

TAMPERE
UNIVERSITY OF
TECHNOLOGY



Proceedings of The Sixth International Conference on Electronic Business

Tampere, Finland
28 November – 2 December 2006
ISSN: 1683-0040





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Proceedings of The Sixth International Conference on Electronic Business

"Frontiers of E-Business Research"

Edited by

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ICEB 2006

28 November – 2 December 2006
Tampere, Finland

ISSN: 1683-0040

Reference to this book should be made as follows: Maula, M., Hannula, M., Seppä, M., Tommila, J., Eds. (2006). *Proceedings of the 6th International Conference on Electronic Business* (ISSN:1683-0040). ICEB+eBRF, Tampere, Finland, November 28- December 2, 549 pages.

Welcome to the ICEB + eBRF 2006 Conference in Tampere!

In 2006 two conferences join forces to create a discussion forum for researchers, practitioners and policymakers all over the world around the main theme “Global Conference on Emergent Business Phenomena in the Digital Economy”. **ICEB** (The International Conference on Electronic Business) is an Asian based conference that has been organized in Hong Kong (twice), Taipei, Singapore and Beijing. Behind the ICEB conference is an organization called the International Consortium for Electronic Business (ICEB), which was founded in 2001. The ICEB conference has been established as an important forum for both researchers and business people in the field of e-business. In 2005 the conference received 180 camera-ready papers and welcomed 140 participants. The **eBRF** (Research Forum to Understand Business in Knowledge Society) was also launched in 2001 and has since been organized annually in Tampere, Finland. Every year the eBRF has attracted over 200 participants to Tampere, produced altogether over 230 reviewed research papers and established itself as a leading business conference in Finland. The eBRF has been organized by the eBRC (e-Business Research Center), which was a joint venture between University of Tampere and Tampere University of Technology and belonged to the eTampere knowledge society program.

The idea of a joint conference **ICEB + eBRF** emerged some years ago. The ICEB board wanted to internationalize the conference by taking it outside the Asian countries and the board of the eBRF wanted to welcome this stronger international dimension. The goal in 2006 is to inspire discussion among the participants of both conferences and to open up new insights on emerging phenomena that are relevant for researchers and actors in the digital economy.

The main theme is divided into three areas: (1) Digitization of Business and its Global Infrastructure - Private and Public Challenges, (2) Creation and Management of Information and Knowledge, and (3) Building Business in the Network Economy. The conference received a total of 113 submitted abstracts and full papers that went through a double-blind review process. The abstracts/papers were reviewed by a constructive, international group of senior scholars representing the themes at hand. An accepted abstract/paper was followed by the submission of a camera-ready final paper. Presentation of an accepted paper in the

conference will lead to its publication in the conference proceedings. A total number of 87 research and keynote presentations from 23 countries will be given at the conference.

ICEB + eBRF 2006 is organized by the Institute of Business Information Management at the Tampere University of Technology. Co-organizers include the following universities: Tsinghua University (China), The National University of Singapore, National Chiao Tung University, (Taiwan), National Chengchi University, (Taiwan), The Chinese University of Hong Kong, Macquarie Graduate School of Management, (Australia), California Polytechnic State University, (USA), California State University, Sacramento, (USA) and the University of Tampere (Finland). Because of the scale and breadth of the organizing committee and the joint nature of the conference, the International Program Committee is likewise exceptionally extensive. I warmly thank the keynote speakers and researchers presenting their papers, as well as all who participated in the conference process as reviewers, session chairs, and in other roles. I would like to say a special thank you to Professor Eldon Y. Li, executive director of ICEB for his contribution to the joint conference.

Without the contribution of dedicated stakeholder groups this historic conference would have not been possible. I wish to thank the Academy of Finland, the Foundation for Economic Education and the ICEB + eBRF 2006 Conference partners: IBM, Metso Automation, Nokia, OpusCapita, PriceWaterhouseCoopers, Tampere Chamber of Commerce, Tampere International Business Office and Technology Centre Hermia for their co-operation and sponsorship.

Last but not least, I would like to thank the local organizing committee members Prof. Mika Hannula and Senior Researcher Marko Seppä (Chair), as well as the chief coordinator of ICEB + eBRF 2006 Johanna Tommila for their dedication and excellent co-operation. On behalf of the organizing committee, let me warmly welcome you to the ICEB + eBRF 2006 conference. We hope that you will enjoy your sojourn in Tampere.

Marjatta Maula
Conference Chair

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A Framework for Utilizing Group Support Systems in Scenario Process

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Abstract — In modern day business, managing environmental change has become a vital part of building success. Changes in technology or business conditions can have a drastic effect on the business in the long run. One of the more potent tools proposed to avert this problem is scenario planning. It has been noticed in multiple occasions that traditional forecasting is vulnerable to sudden changes; scenario planning aims to work around the problems of forecasting by mapping the possibilities of the future with a wider perspective. The purpose of this study is to test whether the scenario process can be facilitated with a group support system (GSS) and whether it presents positive gains to the scenario process. According to the two case studies processed in this paper, it seems that GSS indeed holds potential for facilitating the scenario process. On average, people participating in GSS supported sessions have found that GSS enhances group work in the scenario process and that the concept of creating satisfactory scenario with GSS support is feasible.

Keywords — Scenario planning, Scenario process, Group Support System, GSS

I. INTRODUCTION

A. Background

In modern day business, managing environmental change has become a vital part of building success. The increasing speed of changes in the field of business and the shortening product life cycles are discussed right up to a point where these concepts threaten to become clichés [1][2][3]. The problem of uncertain operating conditions boils down to the question of; how a business can develop reasonable strategies for steering the company in the long run [4].

Strategic planning is seen as an important part of modern corporate management. Traditional techniques and tools have been criticized for being too rigid in the perspective of managing change in the environment [1][5][6]. In many instances the analysis that fuels development of corporate strategies is a snapshot of the surrounding world and does not perceive possible anomalies in the development of future situations.

In the traditional sense management is all about knowing the relevant decision parameters and forecasting the result of each decision. In contrast, in recent literature e.g. [1][2] scenario planning has gained attention as a structured method for interfacing strategic planning with evolving operating conditions. The main advantages of scenario planning, when compared to other methods for preparing

for the future, are the following: scenarios are not a single point prediction of a defined time-space in some point of future, and multiple scenarios are conventionally used to map the borders of plausible futures [6][7]. The central idea in this approach is to avoid problems that arise if, against all probability, a carefully conducted forecast of future business proves to be faulty [5].

B. The scope and issues of this study

The aim of this study is to develop a conceptual framework for utilizing a group support system (GSS) in the scenario process. In scenario planning, the main focus is the process involved in the planning and the challenges it presents to managing knowledge in the process. In a successful scenario process the principal concerns, in knowledge management terms, are extracting private information and tacit knowledge from the participants, diffusing it between the people in the group, and recombining and filtering it to form explicit knowledge in the final scenarios. Or in other words, the aim is in mapping the development of the environment [8][9][10]. The purpose of this study is to test whether a GSS can be used to facilitate the process and whether it will add value to conducting the process.

The principal issues in this study can be further reduced to following questions:

- What are the preferred qualities in scenarios and the characteristic elements of a successful scenario process?
- What challenges does the scenario process present to group work and knowledge creation?
- Can the scenario process be facilitated using a GSS and can use of the GSS add value to the scenario process?

The first task is to establish the makings of a good scenario and to determine a generic scenario process. The second major task is to seek proper methods for utilization of GSS in scenario planning, using the formulated generic process as a junction. The third main event in the scope of this study is a series of empirical experiments, where an experimental scenario process is executed in laboratory conditions.

C. Methodology

The study follows the constructive research methodology described by Kasanen et al. [11]. The constructive approach

follows the path from the definition of the research problem, through constructing a solution to the presented problem, to the testing of the construction and the assessment of generalizability and validity of the results [11].

In terms of research methods, a descriptive literary study is used to determine the conditions for successful scenario planning and the challenges that the scenario process presents to the use of a GSS, i.e. to form the construction for the research problem.

In the empirical phase the construction is put to test in a GDSS laboratory, or a decision room type, face-to-face, GSS-setting at Lappeenranta University of Technology. The method is a multiple case study. Even though Yin proposes single case study in testing theory propositions [12], multiple cases are used for two major reasons; to alleviate the effect of the researchers' action and to raise the external validity of the results. The presented framework is used in scenario sessions and the sessions are evaluated with a questionnaire presented to the participants. The observations and interview results are processed with qualitative and quantitative methods.

The questionnaire results are processed quantitatively, to get an overview of the results of the experiments and to evaluate the weak and strong points of the tested process. On the basis of these results, a series of interviews is conducted to further disseminate the causalities behind the results. By these means the authors investigate how the empirical findings correlate with the presented framework and to wish to achieve increased understanding of the usability of the GSS.

II. SCENARIO PROCESS

A. *Origins and background*

The dawn of scenario planning dates back to the 1960's. The credit of being the *primus motor* has been given to Herman Kahn, who at the time worked with the RAND Corporation [7][13]. At first scenario planning was mostly used for military purposes. The breakthrough in business was at the 1970's when Pierre Wack, being familiar with Kahn's work, started to experiment with scenario planning in Royal Dutch/Shell.

The field of scenario planning is rather scattered, e.g. Bradfield et al. describe the situation as being a methodological chaos [13]. The reason for this is that every practitioner has different emphasis and views. The two main schools are Kahn's American school and Wack's French or *La Prospective* –school. Inside these camps the methodologies can be further divided to Intuitive-logical, *La Prospective* and Probability –models. However, in this study the aim is in the scenario process rather than nuances of conduct, as it can be seen as the key in utilizing a GSS in scenario work.

B. *Definitions*

As stated above, scenario planning differs from traditional forecasting methods in some important aspects. It has been claimed that compared to other methods of managing change, scenario planning has some advantages as discussed above. Traditional trend analysis is essentially an extrapolation of past development and as such ignores the abrupt changes in development. On one hand, contingency planning does not include information about the path of development, and on the other expert opinions are inherently guesses, although mostly educated ones. [2][6]

Starting from the very beginning, Kahn and Wiener [14] define scenarios as "Hypothetical sequences of events constructed for the purpose of focusing attention to causal processes and decision points" with the addition that the development of each situation is mapped step by step and each actor's decision options are considered along the way. Schwartz [7] describes scenarios as plots that tie together the driving forces and key actors of the environment. Ogilwy expresses this more poetically; his view is that, like in a proper tragedy, a scenario should have a beginning, middle, and an end [15]. Schoemaker writes that scenarios simplify the infinitely complex reality to a finite number of logical states. In Schoemaker's view scenarios as realistic stories might focus the attention to perspectives that might otherwise end up as overlooked [6]. Furthermore, Coyle and Chermack argue that scenarios and the process involved sensitize people to consider changes in the environment better [2][3].

From the above definitions, it can be derived that scenarios are a set of separate, logical paths of development, which lead from the present to a defined state in the future. Furthermore, it can be deduced that scenarios are not descriptions of a certain situation some time in the future, nor are they a simple extrapolation of past and present trends.

C. *Preferred qualities in scenarios*

Now that a definition of scenarios is established, the next step is to discuss what qualities should be achieved in the scenario process. Keeping the process in mind, it can be useful to stop for a moment, to think what the preferred outputs are.

According to definition, scenarios are sequences of events. Many writers also stress that this chain must be detailed enough, in order to give ground to interpreting which scenario(s) is about to materialize [6][14][15].

The Bermuda triangle of scenario planning is formed of three overlapping challenges: sufficient detail, relevance to the user, and length. Although a good scenario is detailed, the volume of information should be kept on a manageable level. Business managers are after all notorious for

TABLE 1
DIFFERENT SCENARIO PROCESSES, ADAPTED FROM BERGMAN [9]

Key elements	Intuitive approach	Heuristic approaches		Statistic approach
	Schwartz [7]	van der Heijden et al. [16]	Schoemaker [6][17]	Godet [18]
Defining the problem and scope	1. Exploration of a strategic issue	1. Structuring of the scenario process	1. Framing the scope 2. Identification of actors & stakeholders	1. Delimitation of the context 2. Identification of the key variables
Analyzing the key elements of scenarios	2. Identification of key external forces 3. Exploring the past trends 4. Evaluation of the environmental forces	2. Exploring the context of the issue	3. Exploring the predetermined elements 4. Identification of uncertainties	3. Analysis of past trends and actors 4. Analysis of the interaction of actors & the environment
Constructing the scenarios	5. Creation of the logic of initial scenarios 6. Creation of final scenarios	3. Developing the scenarios 4. Stakeholder analysis 5. System check, evaluation	5. Construction of initial scenarios 6. Assessment of initial scenarios 7. Creation of the final learning scenarios 8. Evaluation of stakeholders	5. Creation of the environmental scenarios 6. Building the final scenarios
Implications	7. Implications for the decision-making 8. Follow-up research	6. Action planning	9. Action planning 10. Reassessment of the scenarios and decision-making	7. Identification of strategic options 8. Action planning

ignoring too long written documents. A relating point is keeping the scenarios relevant to the decision making. There is little use for totally unrelated information and it may frustrate the reader.

The next important challenge is the coherence of the scenarios. Schoemaker [6] defines three basic tests for consistence: 1) Are the trends compatible with the chosen time frame 2) Do the scenarios combine the effect of compatible drivers, and 3) Are the major stakeholders positioned in places that are realistic?

One qualitative factor is the number of scenarios. Walsh [1] suggests that 2-4 would be optimal, although Schwartz [7] is certain that above three would be waste. A reasonable approach has been introduced by Schoemaker [6], who suggests developing 7-9 preliminary scenarios, and then choosing or combining the necessary number of final scenarios out of them.

Another major concern is preserving the nuances of expert opinions and innovativeness in the final scenarios. An innovative atmosphere in the process helps thinking outside the box, and the nuances give depth to the story, which may help in reflecting which of the scenarios is about to unravel in the near future.

Lastly, Selin [8] reminds that trust is what makes or breaks the final results. The process and communicating the results must gain the subjective trust of the decision makers; otherwise scenario planning will not be implemented in the actual management culture.

D. Scenario Process

Despite the aforementioned colorful collection of practices, there are identifiable universal elements in the different proposed processes. Table 1 describes some of the more cited models, as presented by Bergman [9]. Starting from the first column from the left, Schwartz exemplifies the intuitive approach, which largely relies on logical thinking in constructing scenarios. In the middle there are two examples of heuristics methods which are more structured than the intuitive, but less so than the statistic ones. On the right is the statistic approach by Godet, which is built on modeling the environment and estimating the development on mathematical grounds. Extremes in

methods are often considered risky; on one hand, in the intuitive approach the results or the process may seem too creative in order to win trust, and on the other hand, the statistic approach tends to be mechanical and does not encourage innovativeness. However in this context, the mission is not to disseminate the methods, but rather the process.

Despite the obvious differences in the approaches, there are common elements across the field of scenario planning. These characteristic elements are: 1) Definition of the problem, 2) Recognizing key drivers of change and uncertainties, 3) Developing (preliminary) scenarios, 4) Evaluating results and revision, 5) Creating final scenarios, and 6) Implementing the scenarios in the decision making.

III. KNOWLEDGE CREATION IN SCENARIO PROCESS

As stated in the introduction, one angle to the scenario process is that its purpose is to create actionable knowledge from the private knowledge assets of participants in the explicit form of scenario stories. The challenges this presents can be derived from the desired qualities of the scenarios and the process itself, as described above.

Viewing the scenario process in terms of Nonaka et al., it can be seen as a process where individuals' knowledge assets are Socialized, Externalized, Combined and Internalized again (the SECI process) [10]. In these terms the final scenarios can be viewed as a knowledge vision, and to achieve this goal knowledge assets and the space to utilize these premises have to be present in order to create fruitful SECI. Furthermore, the knowledge assets can be seen as held by the participants and *Ba* is analogous to the mental and physical state of being. This proposition is reinforced by Chermack's notion that the mechanism which results in the benefits of scenarios is lowering information barriers and reforming mental models in organizations. [3]

A. Knowledge management challenges in scenario process

Keeping the definition and qualitative aspects in mind, the challenges of managing the scenario process can be mapped. Firstly, Stähle and Grönroos state that information sharing is conceptually unnatural for people and that trust is

necessary for people to share knowledge [19]. This translates so that the participants not only have to have a media through which they can communicate, but also a will to do so.

One definition of knowledge is that information can be transcended to knowledge by giving it context so that everyone within the language or social barrier can understand the contextual meaning [19]. In the context of the scenario process, relevant information about the future is largely in public domain, but also buried in experts' tacit knowledge. The question of making it actionable is how to organize the available information as logical and coherent scenarios, which are relevant to the decision-makers of the firm.

In scenario literature, some guidelines have been established on the selection of the people who to include in the scenario work. The general view on this subject has been that the managers of the firm concerned may have too one sided views on the environment [2]. This can be also explained with the notion that an individual is able to learn new and filter the most valuable knowledge from fields he/she has prior knowledge of, thus creating some amount of path dependency [20]. Also, in the supposedly emerging, more networked knowledge economy the influence of extra-organizational interest groups is said to be greater than before, thus perhaps raising the demand to include these groups in strategic considerations [21]. Translating this to scenario process means that path dependence creates a challenge of how to inspire people to see beyond their usual horizons and also how to single out the most important factors despite of possibly lacking absorptive capacity.

The question of trust is also present in another form, in order to create trustworthy scenarios; the process needs to fill the participants' methodological criteria to gain trust.

Concluding about the challenges of managing knowledge in the scenario process, it can be suggested that the main problems would be encouraging the participants to articulate their knowledge assets and communicate them within the group, create an atmosphere or a place where everyone can and will participate, and connect the fruits of the process to satisfactory scenarios that effectively mirror the collective understanding of the group.

B. Managing the process with a group support system

In some instances, e.g. according to Ståhle and Grönroos [19], the field of knowledge management has been divided into two parts; the so called Scandinavian school stresses that knowledge creation happens primarily as a social process, whereas the other school, dubbed as North-American, focuses on technical means of managing knowledge. In some sense this would indicate that electronically mediated work methods may not be ideal for

knowledge creation. On the other hand, there are also contradicting views claiming that, due to effective information sharing and consensus creation, the use of a GSS would in fact be beneficial to learning or knowledge creation in a group [22][23]. Little has been written directly on the subject of mediating the scenario process with electronic means, perhaps the best known example is Blanning and Reinig's method, which has been described in multiple instances, e.g. [24].

By definition, group support systems are a collection of applications aimed to facilitate group work and communication [25][26][27]. In the general hierarchy of decision support systems (DSS), GSS is placed in the branch of communication driven DSS [28]. Without going into too much detail, GSS implementations generally feature tools for idea generation, prioritization, commenting and discussion, packaged into a software suite [26].

Generally GSS tools are perceived as an effective way to mediate meetings, share information and achieve consensus on decisions concerning un- or semi structured problems [25]-[28]. In recent studies it has been suggested that the GSS would particularly enhance "exchange of unshared information" [23] which could be interpreted so that the GSS facilitates communicating also tacit knowledge.

One of the more celebrated features of the GSS is the ability to work around constrictions of location and time; with computer mediation, meetings can be conducted so that the attendants are conventionally 1) in the same place at the same time, 2) in different places at the same time, 3) in the same place at different times, or 4) in different places at different times [26][31]. The advantages of asynchronous and/or decentralized sessions are not indisputable, but there are propositions that with asynchronous setting the substance of interaction gains depth, as people are more able to reflect the theme and the input of others, resulting in better decisions [32]. Similarly the question of decentralized participation arises with the above discussed demand for including external interest groups and experts in the scenario process; it would seem feasible to have an efficient virtual or decentralized session with GSS mediation, the main concern being the motivation and team cohesions of the participants [33]. In addition, on the basis of the above, a hypothesis could be set that the GSS would lower the transaction costs in acquiring knowledge, i.e. in the form of lessened time consuming and travel expenses. However, as intriguing as these considerations of 'advanced' GSS settings might be, at this stage the main concern is the traditional face-to-face synchronous setting.

The GSS methods have also received critique from researchers. One great drawback, also concerning the scenario process, is that some nuances of human communication are lost in electronic communication,

TABLE 2
BENEFITS AND CHALLENGES OF USING GSS, ADAPTED FROM [26]-[29]

GSS features	Description and advantages	Outcome, Benefit	Challenges
Process structuring	Keeps the group on track and helps them avoid diversions: <i>- clear structure of the meeting; improved topic focus; systematical handling of meeting items</i>	Shorter meetings	
Goal oriented process	Aids a group to reach its goals effectively: <i>- process support facilitates completing the tasks; discussion seen to be concluded; electronic display makes the commitments public</i>	Improved quality of results Greater commitment Immediate actions	Learning through commitment and collaboration
Parallelism	Enables many people to communicate at the same time: <i>- more input in less time; reduces dominance by the few; opportunity for equal and more active participation; participation and contribution at one's own level of ability and interest; electronic display distributes data immediately</i>	Shorter meetings Improved quality of results	Sufficient amount of detail
Group size	Allows larger group sizes: <i>- makes it possible to use tools for the effective facilitation of a larger group; enhances the sharing of knowledge</i>	Greater commitment	Relevant and coherent scenarios
Group memory	Automatically records ideas, comments and votes: <i>- instantly available meeting records; records of past meetings available; complete and immediate meeting minutes</i>	Better documentation Immediate actions	Implementation to decision making
Anonymity	Members' ideas, comments and votes not identified by others: <i>- a more open communication; free anonymous input and votes when appropriate; less individual inhibitions; focus on the content rather than the contributor; enhanced group ownership of ideas</i>	More/better ideas Greater commitment	Better trustworthiness of scenarios and process
Access to external information	Can easily incorporate external electronic data and files: <i>- integration with other data systems; effective sharing of needed information</i>	Easier to justify the acquisition of the system	
Data analysis	The automated analysis of electronic voting: <i>- voting results focus the discussion; software calculates e.g. the average and standard deviation of the voting results</i>	Shorter meetings Better documentation	Efficient communication for knowledge creation
Different time and place meetings	Enables members to collaborate from different places and at different times: <i>offers means for remote teamwork</i>	Reduced travel costs Time savings	

although this can be at least partly averted by including verbal communication when appropriate. Another major consideration is the effectiveness of the input compared to traditional means of communication. The magnitude of this issue depends largely from the people participating in the session, the factors being habituation in electronic expression and development of suitable mental models [33].

The benefits of using a GSS are listed along with the challenges of the scenario process in table 2. Considering the challenges in the scenario process compared to gains in using a GSS, seems that the research findings support the possibility of facilitating the scenario process effectively by means of a GSS. Weighting the benefits and challenges, GSS mediation has clearly plausible benefits. In many instances a GSS has been deemed effective in facilitating communication and, to some extent, improving group cohesion and idea generation, e.g. [33][34]. Also idea generation is more efficient and, as an important feature, the process outcomes can be recalled and printed from the system for further use. Although one could criticize written communication compared to oral, with GSS the original input is retrievable unaltered, as opposed to traditional methods. Other benefits might be commitment and consensus creation through anonymity and information sharing; when the participants' roles outside the session are not present with the input seen by the group, the focus would turn to the substance more than in traditional face-to-face situations.

Furthermore, there are even suggestions that a GSS could

indeed add value to the scenarios. Among others Kwok and Khalifa [22] claim that a GSS enhances group learning through active participation and cooperative working. In scenario literature, it is sometimes claimed that in fact the major benefit of the scenario process is the process itself, in the sense that it helps the decision makers to consider the effects of change, also in ways that are not written down in the actual scenarios[3][6][9]. In this perspective, it would be feasible that a GSS could add value to both the process and the final scenarios.

IV. EMPIRICAL TESTING

As an important part of this study, some empirical experiments were conducted in order to test and validate the constructed theoretical framework. The testing was conducted in a decision room with a GSS, at Lappeenranta University of Technology (LUT).

The decision room is used for teaching and research in the field of group decision support processes and systems. The decision room has been designed to support up to ten-person electronic meetings, and there is a possibility for remote use from within the University. The main group support software of the decision room is the GroupSystems developed by the University of Arizona and Ventana Corporation. The GroupSystems contains all the general characteristics of GSS software. The facilities are specifically constructed for supporting the use of the GSS, including a big horseshoe-shaped table that faces a large screen and a PC with an adequate display for each participant in the decision room.

A. Test settings

The first three experiments, henceforth called case I, were carried out as a series on 16.-17. February 2006 and the second series on 22. May and 19. June 2006. The participants in the first series were 3rd – 5th year, or post graduate, students who took part in a course concentrating in the use of decision support systems. Case II, respectively, consisted of a fourth setting, in which participants were random staff members of the Department of Industrial Engineering at LUT, and a fifth one where the participants were researchers and administrative personnel from a variety of different departments of LUT.

In both cases the place was the same; the decision room, or GDSS-laboratory, of LUT. The tested groups had the same objective of creating scenarios concerning changes that LUT will face over the next ten years. The subject was chosen so that the participants would have comparable interest and background information on the subject. In both cases the same facilitator acted as the chairman, presented the task and set up the GSS-application.

The main differences in Case I and II are the selection of the test subjects and differences in scenario methodology. The actual methods are described in further detail below. Method in case I represents a more intuitive-logical method, whereas the method in case II is a more mechanical approach. The process outlines are presented in table 3, with the appropriate GroupSystems tool in brackets. In addition to test setting the research objectives of the cases differ in the sense that where case I is more mechanical concept testing, case II is intended to validate and explain prior results and focuses more on qualitative methods.

TABLE 3
GSS MEDIATED SCENARIO PROCESSES

Case I	Case II
Session time 1h 45min	Session time 3h 45min
Problem setting, (15min)	Problem setting (15min)
Key Drivers of Change (30min) (<i>Categorizer</i>)	Key Drivers of Change (30min) (<i>Categorizer</i>)
	Identifying Future Events (45min) (<i>Categorizer</i>)
Preliminary Scenarios (30min) (<i>Voter</i>)	Priorization of Events (45min) (<i>Categorizer</i>)
	Creating Scenarios (45min) (<i>Alternative Analysis</i>)
Evaluation and final scenarios (30min) (<i>Categorizer</i>)	Evaluation (45min) (<i>Categorizer</i>)

B. Case I

The session followed a modification of the generic process described in table 3 above. The first step, definition of the problem, was made by the facilitator, who presented the group with a summary of the exercise and a paper version of PESTEL analysis considering LUT. The PESTEL, in fact originally just PEST, acronym stands for the Political, Economical, Social, Environmental and

Legislative or Regulatory factors in the sense how they affect the organizations concerned. It presents a framework for analyzing the organization's macro environment, or acts as a checklist when different actors are evaluated. [4]

The reason for introducing PESTEL in this process is that it opens up a wider perspective on the drivers of change, compared to a situation where the group is just asked to brainstorm drivers without any framework or general theme.

Then the work progressed to the next phase where the group brainstormed the key drivers of change and the uncertainties. Brainstorming was followed by discussion where unclear items were clarified within the group and overlapping items were removed or merged. After the discussion the drivers were prioritized by voting. A ten-point scale was used in all the voting through GroupSystems, as it allows accurate weighing and does not have a neutral point, so the participants are forced to take either a negative or a positive posture.

Of the prioritized drivers, ten of the most important were chosen. The drivers were positioned in a matrix so that two of the most important and independent drivers were first given the four possible combinations of realization/not realization. These four combinations also formed the four scenarios created in the session. Then the rest of the chosen drivers were placed in the matrix below the first drivers and the state of realization was logically derived from the previous by the group. Lastly the formed scenarios were evaluated.

This approach relies much on the logic of the participants in the forming of scenarios and it might be described as an intuitive-logical or borderline heuristic process. The weak point is the formulation of scenarios, where, also depending on the drivers, distinctions of the scenarios can be very small, thus bringing the scenarios closer to forecasting. Also, when the drivers were voted with the question setting "When A happens and B does not, would C materialize, or not?" the frequencies of Yes and No –answers were in many occasions almost equal, which of course undermines the validity of the vote results.

C. Case II

In case II the approach was somewhat different from case I. The session started with definition of the problem and proceeded to defining the major drivers of change, as in case I. The drivers were discussed in a similar fashion as in case II.

The difference is in the part where the participants were presented with the prioritized list of drivers and were asked to identify concrete events that are consequent on the identified drivers. These events were once again discussed and commented on, and overlapping events were merged or removed.

The events were then subjected to voting in two dimensions with the alternative analysis tool; first the impact of the event and then probability. The ten-point scale was interpreted here so that in probability vote 10 was read as 100% and 1 as 10%. Votes for impact factor were interpreted in a similar manner: vote 10 was read as "extremely positive/favorable" incident and 1 "highly

negative” The scenarios were formed on the basis of voting, so that events that had the highest probability were grouped in a “realistic” scenario and events with average to high probability and the most negative or positive impact were grouped in negative and positive scenarios respectively.

In the final stage the events forming each scenario were subjected to discussion in order to ensure that the scenario sets were logical and coherent, and the events were also grouped in approximate chronological order.

This process was intended to be more structured than case I, although it can be criticized for being too mechanical to capture the innovativeness and nuances of the session. In fact case II uses large parts of Blanning and Reinig’s framework for scenario creation [24], with some modifications. As described in their paper, Blanning and Reinig tend to go straight to brainstorming events in the future, with headlines such as ‘optimistic’ ‘negative’ and ‘realistic’ events. In contrast many scenario practitioners explicitly warn about such an approach [2]. The point of the criticism is that the three categories steer the process too much, resulting in un inventive thinking. It can also be suggested that the present or likely the future can not be simply forged into pessimistic or optimistic scenarios with a good conscience. Case II might be called a hybrid process, which synthesizes elements from the intuitive and the mechanical approach, to alleviate the problems of the “triangular” view, at the same time preserving the clean structure it provides for the process.

D. Description of research material

In both cases all the participating subjects reviewed the session with an anonymous questionnaire. The questions were derived from the theoretical framework, particularly from the challenges of the scenario process and characteristics of GSS. A 5-point Likert scale was chosen instead of a 10 point one, because in all cases the participants were more familiar with performance grading in a 5-point scale.

To further explore the scenario experience, the participants in case II were interviewed personally. The interviews were conducted in the usual working environment of the subject, during office hours. The interviews were semi-structured or focused, that is, the questions were prepared but answer options were open. All the interviews were recorded and transcribed prior to further evaluation.

E. Quantitative analysis

Table 4 below shows the questions in the survey form, and gives an overview of the results. In case I the separate grading from the three sessions with $n_{tot}=29$ was processed with Kruskal-Wallis 2-tailed variance analysis with margin of error $p=0.05$. The analysis showed that the results can be handled as a unified sample of the population. As for Case II with $n_{tot}=14$, variance analysis was an excluded possibility in terms of good practice. For the purposes of validating the results, some key figures are also provided. The confidence intervals are also calculated with the standard margin of error $p=0.05$. A More detailed account of the results is presented in appendix A

The table shows that the overall scores are high, especially considering that the common verbal key is 1 ‘tolerable’, 3 ‘good’ and 5 ‘excellent’. Notable figures are the confidence interval and standard error in case I; the deviation in the group is within a quarter of a point. On average the scores are good or even very good, but the trustworthiness is lacking. Judging from the open critique given, the reason for low regards in this respect is that the sessions were carried out as assignments, participated solely by students, although the process received some critique of its own. The point was the actual creation of scenarios where the drivers of change were positioned in the matrix and given yes/no-states. This was considered a confusing and incoherent practice.

TABLE 4
QUESTIONNAIRE RESULTS

Question	Case I			
	Avg	Std. Dev.	$D(x)$	+/-x
1. Do you have previous experience with scenario planning?				
a) I'm familiar with scenario planning	2.64	1.10	0.20	0.42
2. Scenario process				
a) The objectives of the session were clear	3.86	0.92	0.17	0.35
b) The objectives were reached	3.31	0.85	0.16	0.32
c) Do you feel that the process used produces useful results	3.62	0.78	0.14	0.29
d) Do you feel that the key drivers of change were identified	3.31	1.07	0.20	0.41
e) Are the results, in Your opinion, relevant to the operation of LUT	2.62	0.68	0.13	0.26
f) Do you feel that the results are trustworthy?	2.31	0.60	0.11	0.23
g) Are the results logical and coherent	2.97	0.68	0.13	0.26
h) How much of the trust depends on the process itself	2.86	1.06	0.20	0.40
3. GSS in the scenario process				
a) GSS fitted naturally with the scenario process	4.14	0.69	0.13	0.26
b) GSS systematized the process	4.28	0.59	0.11	0.22
c) GSS helped in observing different perspectives	3.76	0.74	0.14	0.28
d) GSS helped in committing to the process	3.52	0.99	0.18	0.38
e) GSS helped in creating trustworthy results	2.97	0.78	0.14	0.30

When it comes to the suitability of a GSS in the process, the overall result in the cases is very good. In the light of the ratings, the advantages of the GSS are systematic processing and increased commitment to the process. Compared to theoretical suggestions about the benefits of a GSS presented above, the results can be seen as supportive.

The quantitative results of case I get reinforcement from case II. Overall the scores are closer to very good, although the standard error is somewhat higher than in case I. Of course it is debatable whether the difference is in the group or the different process, and even the reliability of case II might be viewed as questionable. On the other hand, it might be said that the direction is right. What is

encouraging in the results is that in case II the process got better evaluation in most respects, even though it can be assumed that administrators and researchers would be more critical, at least concerning trust, than engineering students. To investigate the dependencies further, Spearman's Correlation factors were calculated for the material of case I (Appendix B), still with $p=0.05$. The most significant correlations were; 1) *GSS helps observing different perspectives* correlates positively with *usefulness and coherence of the results* and *commitment to process* 2) *GSS helps in committing to the process* correlates positively with *identifying the most important drivers of change* and *observing different perspectives*. 3) *The goals of the session were met* correlates positively with *the objectives being clear* and *the trustworthiness of the results*. Interestingly enough there was no statistically significant correlation between the level of prior knowledge about scenario process and the other answers. These correlations could be translated to the notion that the main benefits or added value from GSS is that it improves commitment, which results in deeper substance, and diffuses information between the group, which helps in identifying important pieces of information regarding session goals. A further observation would be that the primary mechanism for improving commitment in the sample is the ability of a GSS to diffuse information. These correlations are consistent with the other data and thus provide further support for the framework.

Summing up the quantitative analysis, it can be said that the empirical results support the formed theoretical concept of supporting the scenario process with a GSS. As can be observed in table 4, the test subjects were fairly unanimous in their answers, so even though the sample is small, the validity of the results can be seen as better than the sample size alone would suggest. Judging from the results the specified process seems to function as intended, even with variation in the actual method of forming the scenarios. The correlation test suggests that the GSS adds value to the process by focusing the group's attention to the task at hand and through supporting commitment in the process. On the basis of these results, it can be suggested that the concept of utilizing a GSS in the scenario process seems feasible.

F. Qualitative analysis

The qualitative processing was based on the interviews mentioned above, which were conducted amongst the subjects of case II. In order to investigate the problems and deepen the understanding of the process, the interviews were carried out as semi-structured with predetermined themes, but without pre-chosen answer options or precisely formulated questions. The themes of the interviews are presented in table 5 below. Themes were formed on the basis of the theory proposition and the weaknesses unveiled by the questionnaire, in order to get knowledge of why the process did not work, and how it could be developed.

TABLE 5
INTERVIEW THEMES

1. How deep was your previous knowledge of scenario planning and how does that compare to the session
- Was there something missing
- Should there have been more structure or intuition
- Was the essence of the scenario process present in session
2. In the survey there were implications that the goals were not clear enough: was the process enough goal-oriented and if not, how would you improve it?
- Were the goals communicated clearly
- Should the goals have been emphasized more during the action
3. There were also implications that the results lacked logic, what induced these problems in your view?
- Was the reason the process, facilitation or the subject
- How would you improve the situation
4. Did the final result meet the spirit of the session?
- If not, where did the process go wrong
- Did you feel that the triangular model (positive-negative-realistic) affected the results
- Were the ideas and tacit knowledge transferred efficiently
5. Did you feel that GSS enhanced communication?
- Was the communication better or worse than verbally
- Do you feel that the meaning of ideas and comments was understood in the group
- Was there something important missing in the written communication
- Was there enough clarifying verbal communication
6. Do you feel that knowledge was diffused and/or transcended in the session?
- What helped or hindered the communication
- Do you feel that you gained something from the session
7. Do you feel that using the results of this process in an actual situation would be feasible?
- If not, why
- Is the trust in the process, participants, GSS or in all of them

The interviews as a whole did not paint as rosy a picture as the numerical evaluation. Interviews were conducted some time after the session, so the novelty of the situation did not affect the results. The interviewees still saw the process as positive, but clear points of critique arose.

On the negative side, the goals of the process or the process itself were somewhat unclear to the participants or were forgotten during the process. The identification of drivers of change was not integrated to the process well enough, or the identified drivers did not connect to the future events properly.

On the other hand the triangular scenario creation did not seem to bother the subjects, one factor being that the actual scenario method was not specified in the session introduction, so that it would not affect the situation.

There are two main reasons for the poor logicality or credibility of the scenarios. Some subjects were downright suspicious of the validity of the scenario sets. The other reason for average rating in the survey appeared to be that the subjects did not want to rate the results too high, when they had not seen but a handful of probable events instead of ready scenario stories.

In the matter of knowledge creation, the material leans towards inconclusive. The statements were mostly vague, although pointing to the direction that some knowledge creation took place. One factor was that the definition of 'knowledge' or knowledge creation is none too familiar with the subjects and the definitions are somewhat equivocal. If any creation happened, it would have been mostly combination of explicit knowledge or systemization

of conceptual knowledge assets.

In the concluding question the subjects generally saw the scenario method as a viable tool for large and important decisions, even with its flaws. When asked, the basis of trust was the whole process, the GSS, and the whole situation, rather than one separate factor.

G. Summary of the results and findings

The quantitative results are altogether positive regarding the feasibility of using a GSS in supporting the scenario process. Another appreciable note is that the results support the formed theoretical framework. Then again the qualitative analysis reveals that there are some setbacks in the actual scenario method.

Summing up the findings, it seems that the concept of utilizing a GSS effectively to facilitate the scenario process and thus create actionable knowledge seems feasible. On the other hand it seems that the execution of the process needs further development to achieve optimal performance and substance from the setting.

V. VALIDITY AND LIMITATIONS

As always, there is justified doubt whether the results are valid or reliable. First the attention turns into the test setting and conducting. The empirical tests were executed in fairly constant conditions, keeping the process and other factors as same as possible between the tests in each series. Also the tests were executed by the same personnel in order to control variance in conditions. By these standards the testing could be deemed reliable.

Then there is the question of sample size, the total amount of test subjects or participants was 43, which is relatively low compared to some other studies in the field, and the population. However, in the testing the results were consistent between cases I and II, and were also supported by the theory proposition.

Another matter is generalizability; the results are automatically valid only in the population consisting of senior students of Industrial Engineering and to some extent the university administrators. The extent to which these results can be extrapolated into general management of public or private organizations and what is the effect, is a question that cannot readily be answered on these grounds.

With these limitations, this study should be considered as an attempt at proofing the concept of supporting the scenario process with a GSS and a conceptual framework. Although the conduction of the process is documented, the results show that there is need for improving the execution and thus the framework should be used warily for actual scenario creation in the present form.

VI. CONCLUSION AND DISCUSSION

In this study the focus was on a framework for supporting the scenario process with a GSS and thereby using a GSS as a means for creating actionable knowledge in the form of scenarios. According to the theory proposition a GSS would be an effective means for managing knowledge in the scenario process. When tested, the framework showed potential in scenario process, but the

actual execution was found lacking in practical terms.

The significance of this study is that now when there is a tried conceptual framework and fairly method-independent process for GSS supported scenario work, there is a starting point for developing more efficient and effective ways to create scenarios to be used in organizations. A manageable and documented process creates possibilities for a repeatable scenario process with reliable results. There is also an implication for research; a common process should improve the validity of comparisons of the scenario process and scenarios between different methods, groups or types of organizations.

During the research numerous interesting issues were raised. Probably the first question that rises is whether there is a significant difference in the substance and validity of scenarios when comparing traditional methods with a GSS supported method. Considering the critique toward the methods used for scenario creation, an interesting issue is the effect of group composition and work methods in credibility and validity of the final results. Generally, two different paths could be derived from this framework. One would be that of developing methods for scenario creation and testing of the effect of different GSS settings on group work and knowledge processing. The other path would be finding ways to further support scenario process in organizations for better efficiency and substance.

Referring back to the issues of this study; the preferred qualities of scenarios and the challenges of the scenario process boil down to condensing and connecting the expert knowledge of the participants in the session to an explicit disquisition, and the effect of introducing a GSS in this equation. According to the empirical evidence gathered in the two cases, it would seem that using a GSS as a tool in the scenario process is a viable option for alleviating some of the problems. The empirical results were encouraging, as a whole the GSS was seen as a good tool for scenario creation. The research material points that a GSS can provide an effective means for communication and diffusing information, but question whether the use of a GSS specifically enhances knowledge creation remains unanswered.

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APPENDIX A: QUESTIONNAIRE RESULTS

Question	Case I								Case II							
	Results			Std. Error		Confidence interval			Results			Std. Error		Confidence interval		
	Avg	Std. Dev.	Md	D(x)	D (Md)	+/-x ⁻	LL	UL	Avg	Std. Dev.	Md	D(x)	D (Md)	+/-x ⁻	LL	UL
1. Do you have previous experience with scenario planning?								3.0								4.0
a) I'm familiar with scenario planning	2.64	1.10	2.00	0.20	0.26	0.42	2.23	6	3.11	1.54	3.00	0.44	0.56	0.91	2.20	2
2. Scenario process																
a) The objectives of the session were clear	3.86	0.92	4.00	0.17	0.21	0.35	3.51	4.2	4.00	0.71	4.00	0.20	0.26	0.42	3.58	4.4
b) The objectives were reached	3.31	0.85	4.00	0.16	0.20	0.32	2.99	3.6	3.89	0.78	4.00	0.23	0.28	0.46	3.43	4.3
c) Do you feel that the process produces useful results	3.62	0.78	4.00	0.14	0.18	0.29	3.33	3.9	4.11	0.33	4.00	0.10	0.12	0.20	3.91	4.3
d) Do you feel that the key drivers of change were identified	3.31	1.07	3.00	0.20	0.25	0.41	2.90	3.7	3.72	0.57	4.00	0.16	0.20	0.33	3.39	4.0
e) Are the results, in Your opinion, relevant to the operation of	2.62	0.68	3.00	0.13	0.16	0.26	2.36	2.8	4.06	0.17	4.00	0.05	0.06	0.10	3.96	4.1
f) Do you feel that the results are trustworthy?	2.31	0.60	2.00	0.11	0.14	0.23	2.08	2.5	4.00	0.71	4.00	0.20	0.26	0.42	3.58	4.4
g) Are the result logical and coherent	2.97	0.68	3.00	0.13	0.16	0.26	2.71	3.2	3.22	0.67	3.00	0.19	0.24	0.39	2.83	3.6
h) How much of the trust depends on the process itself (1 small -5 largest)	2.86	1.06	3.00	0.20	0.25	0.40	2.46	3.2	3.11	0.60	3.00	0.17	0.22	0.36	2.76	3.4
3. GSS in the scenario process																
a) GSS fitted naturally with the scenario process	4.14	0.69	4.00	0.13	0.16	0.26	3.87	4.4	4.00	0.87	4.00	0.25	0.31	0.51	3.49	4.5
b) GSS systematized the process	4.28	0.59	4.00	0.11	0.14	0.22	4.05	4.5	4.56	0.53	5.00	0.15	0.19	0.31	4.24	4.8
c) GSS helped in observing different perspectives	3.76	0.74	4.00	0.14	0.17	0.28	3.48	4.0	3.89	0.60	4.00	0.17	0.22	0.36	3.53	4.2
d) GSS helped to committing to the process	3.52	0.99	4.00	0.18	0.23	0.38	3.14	3.8	4.22	0.83	4.00	0.24	0.30	0.49	3.73	4.7
e) GSS helped in creating trustworthy results	2.97	0.78	3.00	0.14	0.18	0.30	2.67	3.2	3.67	0.71	4.00	0.20	0.26	0.42	3.25	4.0

APPENDIX B: CORRELATION COEFFICIENT TABLE FOR CASE I QUESTIONNAIRE MATERIAL

Statistically significant correlations ($p=0.05$) are marked with bold style. The verbal key for the row and column titles is consistent with the questions in table 4.

		1 a)	2 a)	2 b)	2 c)	2 d)	2 e)	2 f)	2 g)	2 h)	3 a)	3 b)	3 c)	3 d)	3 e)
1 a)	Correlation Coefficient	1	-0.283	-0.188	-0.049	0.22	0.099	-0.171	0.108	0.181	-0.239	-0.145	0.055	0.136	0.026
	Sig. (2-tailed)	.	0.145	0.339	0.805	0.26	0.616	0.384	0.585	0.356	0.221	0.463	0.78	0.49	0.894
2 a)	Correlation Coefficient	-0.283	1	.450	0.083	0.017	0.005	0.175	0.028	0.226	.382	-0.041	-0.17	0.053	0.113
	Sig. (2-tailed)	0.145	.	0.016	0.676	0.931	0.979	0.373	0.888	0.248	0.045	0.834	0.386	0.791	0.567
2 b)	Correlation Coefficient	-0.188	.450	1	0.196	-0.085	-0.027	.498	0.318	0.168	0.203	-0.149	0.22	-0.039	0.154
	Sig. (2-tailed)	0.339	0.016	.	0.317	0.667	0.893	0.007	0.099	0.393	0.301	0.451	0.261	0.843	0.433
2 c)	Correlation Coefficient	-0.049	0.083	0.196	1	.453	-0.079	0.218	0.254	0.058	0.204	-0.13	.550	0.315	0.246
	Sig. (2-tailed)	0.805	0.676	0.317	.	0.015	0.689	0.266	0.193	0.771	0.298	0.509	0.002	0.103	0.206
2 d)	Correlation Coefficient	0.22	0.017	-0.085	.453	1	0.111	0.095	0.044	-0.076	-0.15	0.062	.402	.395	0.373
	Sig. (2-tailed)	0.26	0.931	0.667	0.015	.	0.575	0.629	0.823	0.702	0.447	0.753	0.034	0.037	0.051
2 e)	Correlation Coefficient	0.099	0.005	-0.027	-0.079	0.111	1	.411	0.366	0.326	-0.153	-0.355	-0.053	-0.004	0.295
	Sig. (2-tailed)	0.616	0.979	0.893	0.689	0.575	.	0.03	0.055	0.09	0.436	0.064	0.79	0.982	0.128
2 f)	Correlation Coefficient	-0.171	0.175	.498	0.218	0.095	.411	1	0.146	0.008	-0.135	-0.355	0.264	-0.085	0.291
	Sig. (2-tailed)	0.384	0.373	0.007	0.266	0.629	0.03	.	0.459	0.968	0.494	0.064	0.175	0.669	0.133
2 g)	Correlation Coefficient	0.108	0.028	0.318	0.254	0.044	0.366	0.146	1	0.145	0.094	-0.22	.404	0.261	0.262
	Sig. (2-tailed)	0.585	0.888	0.099	0.193	0.823	0.055	0.459	.	0.462	0.636	0.26	0.033	0.179	0.178
2 h)	Correlation Coefficient	0.181	0.226	0.168	0.058	-0.076	0.326	0.008	0.145	1	0.23	0.068	-0.112	0.23	0.052
	Sig. (2-tailed)	0.356	0.248	0.393	0.771	0.702	0.09	0.968	0.462	.	0.239	0.732	0.57	0.239	0.791
3 a)	Correlation Coefficient	-0.239	.382	0.203	0.204	-0.15	-0.153	-0.135	0.094	0.23	1	-0.015	0.055	0.093	0.223
	Sig. (2-tailed)	0.221	0.045	0.301	0.298	0.447	0.436	0.494	0.636	0.239	.	0.938	0.782	0.637	0.255
3 b)	Correlation Coefficient	-0.145	-0.041	-0.149	-0.13	0.062	-0.355	-0.355	-0.22	0.068	-0.015	1	0.009	0.3	0.131
	Sig. (2-tailed)	0.463	0.834	0.451	0.509	0.753	0.064	0.064	0.26	0.732	0.938	.	0.963	0.121	0.505
3 c)	Correlation Coefficient	0.055	-0.17	0.22	.550	.402	-0.053	0.264	.404	-0.112	0.055	0.009	1	.449	.427
	Sig. (2-tailed)	0.78	0.386	0.261	0.002	0.034	0.79	0.175	0.033	0.57	0.782	0.963	.	0.017	0.024
3 d)	Correlation Coefficient	0.136	0.053	-0.039	0.315	.395	-0.004	-0.085	0.261	0.23	0.093	0.3	.449	1	.421
	Sig. (2-tailed)	0.49	0.791	0.843	0.103	0.037	0.982	0.669	0.179	0.239	0.637	0.121	0.017	.	0.026
3 e)	Correlation Coefficient	0.026	0.113	0.154	0.246	0.373	0.295	0.291	0.262	0.052	0.223	0.131	.427	.421	1
	Sig. (2-tailed)	0.894	0.567	0.433	0.206	0.051	0.128	0.133	0.178	0.791	0.255	0.505	0.024	0.026	.

A holistic method for finding out critical features of industry maintenance services

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Abstract — The purpose of this case study is to create a competitive operative management system for efficiency and quality performance for a company running maintenance service business for globally competitive forest industry production. Furthermore the research aim is to find out and eliminate obstacles affecting efficiency by identifying the factors that can cause problems in the near future in the service process. This evidently means efforts to create and implement new “eWorld suitable sense and respond” methods to measure, follow and improve performance of the service production. The theoretical framework was drawn up to summarize the major findings about up-to-date topics on industrial production related services having high competence and competitiveness requirements, and to act as a guideline for the empirical pilot research. A qualitative research method with multicriteria decision making process was created and utilised in order to collect data through in-depth expert interviews. The performance measurement and improvement system developed has been piloted in two small scale production maintenance service processes with encouraging experiences, and have already been implemented into everyday use.

Keywords — performance management, multicriteria decision making, competitiveness, maintenance, service, process industry, production

I. INTRODUCTION

The purpose of this study is to develop a customer questionnaire process by which the customer satisfaction and the critical factors of the certain maintenance service of case-company can be monitored and evaluated. The results of the customer questionnaire process can be utilized furthermore for example in performance measurement systems. Theory of customer questionnaire process is based on Rautiainen's and Takala's [11] research. The data regarding a service's current situation was collected through interviews with the case-company's employees. The case-company, Stora Enso Saimaa Services Oy (SESS), is an internal service company which provides maintenance and other services for Stora Enso Imatra Mills.

SESS currently has about 800 employees and turnover is approximately EUR 70 million per year.

II. CUSTOMER SATISFACTION AND OPERATIONS STRATEGIES FOR SENSE AND RESPONSE SERVICES

Quality is often considered one of the keys to success. In fact, according to PIMS (Profit Impact of Market Strategy) data base, including information from manufactures and service firms alike, customer perceived quality is found to be of exceedingly great importance to success. The competitive advantage of a firm depends on the quality of the goods and services provided [4], [17].

Service quality is whatever the customers say it is, and the quality of a service is whatever the customer perceives it to be [4], [5]. For service companies the challenge of customer satisfaction is identifying the critical factors that determine customer satisfaction and customer loyalty [7]. Service quality is the discrepancy between customers' expectations and experience. Good perceived quality is obtained when the experienced quality meets the expectations of the customer, that is, the expected quality. [4], [6], [17].

The several key factors shape customers' expectations: what customers hear from other customers, their personal needs, past experiences and external communications. Price can also be a factor which plays an important role in shaping expectations. Knowing what customers expect is the first and possibly most critical step in delivering quality service. Stated simply, providing services that customers perceive as excellent requires that a firm knows what customers expect. Being a little bit wrong about what customers want can mean losing a customer's business when another company hits the target exactly. Being a little bit wrong can mean expending money, time and other resources on things that don't count on customers. Being a little bit wrong can even mean not surviving in a fiercely competitive market [17].

How we actually can sense customers' needs and how to develop new capabilities to respond their needs more effectively. Revolutionary change in information technology enables companies to use “sense and respond” strategies. Rather than competing by forecasting customers' needs, companies are relying on real-time sensors to

continuously discover what customer needs and delivering efficiently value to customers. The intention is to understand customers [3]. In addition to expectations and experiences the competitors and direction of development have a great influence to customer satisfaction. By taking also these things into consideration in the customer questionnaire process, the method will be versatile [12].

Service process analysis provides a normative framework in which the efficiency of different service capabilities can be evaluated in a matrix. In analysing the logistic processes and information systems that provide service capabilities, there are two questions to be answered: [8], [14]. How should organisations and services be represented systematically to allow comparisons of different strategies? And, what is the criterion of efficiency for matching services and channels that helps in selecting the best combinations for a company? The main idea of the service process analysis matrix (Fig. 1) is to evaluate the efficiency of matching the type of service offered with alternative types of delivery channels. The axes of the SPA (service process analysis) matrix represent the type of service and type of channel. [8], [14].

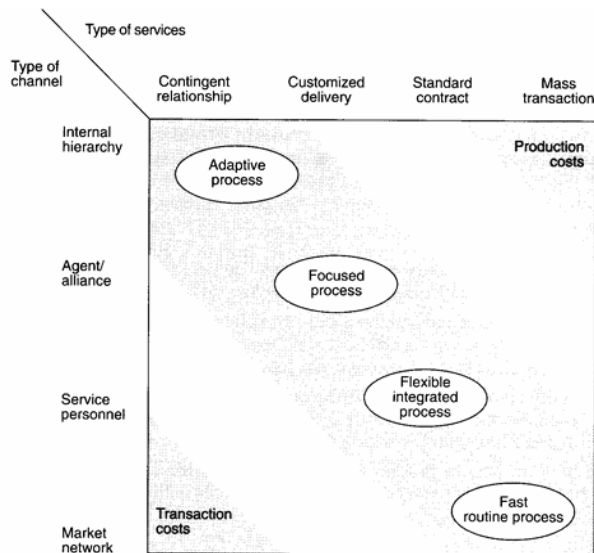


Figure 1. Service Process Analysis matrix [14]

A service process is carried out within a delivery channel that consists of some organisations and the interconnections among them. The channel contains front-line employees and staff members of the service-providing firm. It is important to see customer as a one part of entire service channel and re-examine the justification of current organisational boundaries. We can define four types of services: [8], [14].

- Mass transactions.
- Standard contracts.
- Customised delivery.
- Contingent relationship.

Contingent relationship deals with complex problems and contingencies requiring intensive communication. This type of service is described by risk sharing requiring close relationships. [8], [14]. In cross points of service types and

channels we can define also four efficient service processes: [8], [14]

- Fast routine processes.
- Flexible integrated processes
- Focused processes.
- Adaptive processes.

To get best possible advantage in the market and increase value of customers companies has to make right choices both service and channel type. We can define three points to be taken into consideration making right conclusions:

What is the company's position right now. What is the desired direction of the company? And, how fast the desired target will be reached?

SESS evidently would like to collaborate by focused processes and customized deliveries with its customer Stora Enso. However, in practice the customer needs all the types of service processes from fast routine processes to adaptive processes from SESS.

III. BUILDING THE METHOD

When measuring and evaluating customer satisfaction the first steps is to study the company's service process. The study must be focused to the process operations which produce different attributes of service. The connection between process operations and the attributes of services is really important because attributes arose in operations. In this way it is easier to improve customer satisfaction on the basis of the customer feedback [11]. Fig. 2 emphasizes the importance of the connection.

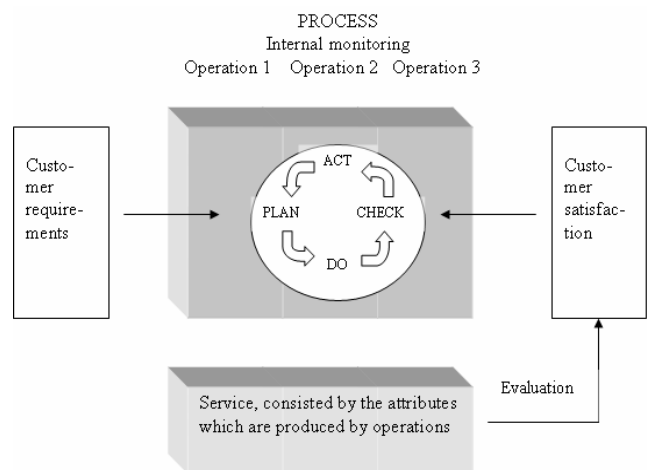


Figure 2. Continuous improvement of customer satisfaction linked to process operations [11]

When the service is divided into operations, each of which produces attributes for the service, it is possible to monitor the improvement of customer satisfaction in both internally and externally. This is a vital thing to achieve improvements.

After studying the company's service process is possible to establish customer opinions and feelings. In study of Rautiainen & Takala information collected from customers with questionnaire. It was measured attributes taking customers' expectations and experiences, impressions of competitors and direction of development into account. To remain the reliability and validity high the questionnaire was short, clear and easy to answer. The more comfortable the questionnaire is to answer the more reliable and valid the answer is. And addition to that more answers are given. Rautiainen & Takala used a simple numerical estimation-scale from 1 to 10. The wide scale makes it easy to find differences between attributes [15]. The questionnaire measures expectations, experiences, performance proportioned to competitors and direction of development [11]. Figure 3 introduces the way how information was gathered.

	Expectation (1-10)	Experiences (1-10)	Compared with competitors			Direction of development		
			Worse	Same	Better	Worse	Same	Better
ATTRIBUTE 1			<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
ATTRIBUTE 2			<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

Figure 3. Model of questionnaire [11].

Rautiainen & Takala analyzed answers so that in the beginning were calculated standard deviations, averages and making some distributions. The standard deviations and averages were calculated on the grounds of evaluations of certain attribute. The distributions were formed of the numbers of the answers compared to all the numbers of the answers [11]. Table 1 introduces an example what the preliminary analysis produced.

Table 1. Preliminary analysis [11].

	Average of the Expectation	Standard deviation of the Expectation	Average of the Experience	Standard deviation of the Experience	Compared with competitors			Direction of development		
					Worse%	Same%	Better%	Worse%	Same%	Better%
ATTRIBUTE 1	8,43	1,36	8,75	0,9	3,1	59,4	37,5	6,5	77,4	16,1
ATTRIBUTE 2	8,55	1,15	8,63	1,4	16,1	58,1	25,8	10	73,3	16,7

After preliminary analysis Rautiainen & Takala used three different tools to identify the most important development subjects of the service. All the tools used the numbers and distributions which were calculated during the preliminary analysis [11]. Gap analysis was used to compare differences between customers' expectations and experiences. With this basic tool can identify those attributes where the experiences were more insignificant than expectations. This kind of attributes can be chosen for development subjects. Nevertheless if too many attributes has gap between experiences and expectations, more tools have to be utilized [11]. Implementation index (IMPL) measures importance and pressure to improve. To increase the sensitivity of the deviation in competitive priorities the standard deviation has been developed into implementation index by dividing the standard deviation by the value of corresponding competitive priority (importance) in order to

improve the possibility to compare different attributes with each other. The smaller value is the bigger possibility to develop [13]. Emphasized Implementation Index measures also importance and pressure to improve. As noted above competitors and direction of development have also an effect on customer satisfaction and customer loyalty. This IMPL is emphasized by the competitor index and the direction of development index. The implementation index uses distributions which are counted from the answers which applied competitors and direction of development. The smaller value is the bigger need to improve the attribute [11]. Equations are showed in Figure 4.

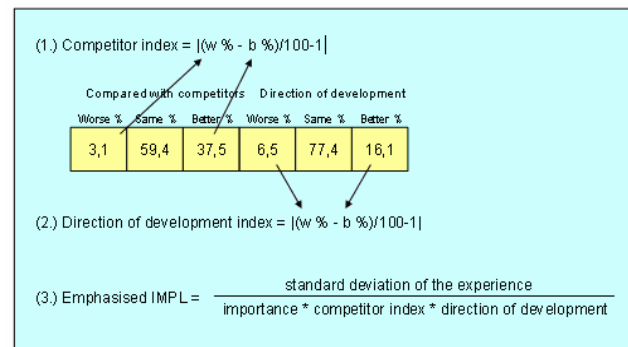


Figure 4. Equations [11].

Developed customer questionnaire process bases on study of Rautiainen and Takala [11]. Some parts and analyzing methods have been added and modified for this case. Developed customer questionnaire process is a 3-phase method:

1. Phase: Current State Analysis.

Tools: Personnel interviews, in-depth interviews, observing.

2. Phase: Identify factors and attributes which affect quality and success of service. Questions have to be in line with strategy of the company so that all the customer groups are represented in the right proportions.

Tools: Information from the first phase, business process descriptions, service descriptions. The company's vision, -mission, -values, -strategy.

3. Phase: Analysis of the questionnaire, observations and conclusions.

Tools: Customer questionnaire results analyzing tools.

As Rautiainen and Takala noted, first step is get acquainted to the company's service process. This can happen with interviews and observing. After this it is possible to move on the second phase and build the questionnaire. In third phase the results will be analysed and after that it is possible to make conclusions. The preliminary analysis was produced just as in study of Rautiainen and Takala. If too many attributes have gaps between experiences and expectations more analyzing tools will be needed. The main goal is to find critical factors of service. Emphasized implementation index is a workable tool for this purpose, but it requires that customers can compare case-company to competitors. However, we assume that the customers of

case-company can't do this kind of comparing because in practice the case-company is the only service provider and that's why new analyzing tool will be needed.

Direction of development index of Rautiainen and Takala formed for this new analyzing tool so that variables of separation change the place among. Moreover results of gap analysis and importance of attributes formed such form that using of those come possible. In this case importance of attribute is same as average of expectations because customers have long-term experiences of the case-company's services and customers process is established. Gap index, Direction of development index and Importance index are introduced in Figure 5.

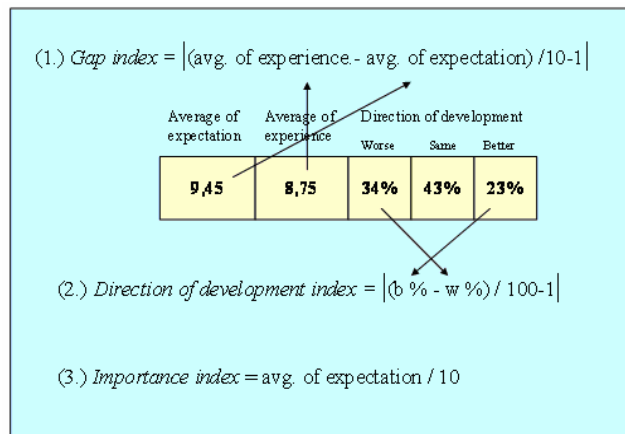


Figure 5. New equations.

Value 1 in Direction of development index means that performance has remained on the same level. Value under 1 means that it has developed and over 1 means that it has decreased. Respectively in Gap index value 1 means that there is no gap, value over 1 means that experiences are lower than expectations and value under 1 means conversely. In Importance index the bigger value means a more important expectation of the attribute.

Critical factors index (CFI) was developed for the case-company. By this tool it is possible to find out critical factors of the service. The smaller value corresponds to a more critical factor.

$$CFI = \frac{\text{standard deviation of expectation} * \text{standard deviation of experience}}{\text{Importance index} * \text{Gap index} * \text{Direction of development index}} \quad (1)$$

CFI is a more comprehensive and practical method than Emphasized Implementation Index because it observes also standard deviation of expectations and gap between customer experiences and expectations. In addition to it is possible to add Competitor index to denominator of CFI if determination of Competitor index is possible. Results of Critical factors index can be multiplied by 10 or 100 to make it easier to monitor the values.

IV. RESULTS

The developed customer questionnaire process was tested in the case-company. It was carried out for a certain maintenance service. Firstly the researchers learned the service's features and current state with interviews and observing. After this the researchers and service providers established the questionnaire. 20 attributes were measured taking customers' expectations and experiences, impressions of competitors and direction of development into account. The period under review in direction of development section was two years because the case-company's maintenance services had re-organized one and a half year ago. Compared with competitors section was in questionnaire first for testing purposes because we assumed that the customers of the case-company could not do this kind of comparing. The quantitative analysis of the results compared with the competitors wasn't possible. The customers were requested to evaluate among others: professional skills of service makers, service minded of service makers, timing of service, price-quality ratio of service and how well service makers take care of safety and environmental factors, see Appendix A.

The respondents were selected so that all the customer groups would be represented uniformly. Questionnaire delivered for 31 customer and 17 of them answered (55 %). On the basis of the response rate, the questionnaire implemented seems to be very successful because the response rate of earlier customer questionnaire in case-company has been only about 35 %. Our questionnaire was delivered personally to the customers and this might have positive influence to the response rate. Table 2 shows the preliminary results analysed by the methods introduced in this study.

Table 2. Preliminary analysis.

	Average of the Expectation	Standard deviation of the Expectation	Average of the Experiences	Standard Deviation of the Experiences	Direction of development		
					Worse %	Same %	Better %
ATTRIBUTE 1	9.65	0.61	8.82	1.38	12.50	68.75	18.75
ATTRIBUTE 2	9.47	0.87	9.12	0.86	0.00	87.50	12.50
ATTRIBUTE 3	9.24	0.75	8.59	0.71	0.00	80.00	20.00
ATTRIBUTE 4	8.53	1.12	8.29	1.05	0.00	73.33	26.67
ATTRIBUTE 5	9.53	0.80	7.82	1.07	25.00	68.75	6.25
ATTRIBUTE 6	9.38	0.81	7.88	1.09	21.43	64.29	14.29
ATTRIBUTE 7	9.24	0.97	8.53	1.12	0.00	100.00	0.00
ATTRIBUTE 8	9.29	0.77	8.53	0.80	0.00	100.00	0.00
ATTRIBUTE 9	9.38	0.72	8.50	0.97	7.14	85.71	7.14
ATTRIBUTE 10	9.47	0.80	8.65	0.86	0.00	86.67	13.33
ATTRIBUTE 11	9.18	1.01	8.65	1.37	0.00	86.67	13.33
ATTRIBUTE 12	9.56	0.81	8.06	1.27	7.14	78.57	14.29
ATTRIBUTE 13	9.29	0.85	7.76	1.44	0.00	92.86	7.14
ATTRIBUTE 14	9.00	1.13	7.23	2.06	0.00	37.50	62.50
ATTRIBUTE 15	8.40	1.52	6.20	2.49	33.33	33.33	33.33
ATTRIBUTE 16	8.94	1.20	8.12	1.11	7.14	78.57	14.29
ATTRIBUTE 17	9.56	0.89	8.81	0.66	0.00	92.86	7.14
ATTRIBUTE 18	9.25	0.88	8.38	1.26	0.00	92.86	7.14
ATTRIBUTE 19	9.50	1.20	7.88	1.36	12.50	62.50	25.00
ATTRIBUTE 20	9.17	0.98	7.83	1.17	0.00	83.33	16.67

In the preliminary analysis it is worth of noticing the high values of expectations and also that every attribute has gap between experiences and expectations. Because of the many gaps more analyzing tools had to be utilized. Direction of development index was determined next. Gap index was also determined for Critical factors index (CFI); see Tables 3 and 4, and Figure 6.

Table 3. Direction of development index and Gap index.

	Direction of development index	Gap index
ATTRIBUTE 1	0,94	1,08
ATTRIBUTE 2	0,88	1,04
ATTRIBUTE 3	0,8	1,06
ATTRIBUTE 4	0,73	1,02
ATTRIBUTE 5	1,19	1,17
ATTRIBUTE 6	<u>1,07</u>	1,15
ATTRIBUTE 7	1	1,07
ATTRIBUTE 8	1	1,08
ATTRIBUTE 9	1	1,09
ATTRIBUTE 10	0,87	1,08
ATTRIBUTE 11	0,87	1,05
ATTRIBUTE 12	0,93	1,15
ATTRIBUTE 13	0,93	1,15
ATTRIBUTE 14	0,38	<u>1,17</u>
ATTRIBUTE 15	1	1,22
ATTRIBUTE 16	0,93	1,08
ATTRIBUTE 17	0,93	1,08
ATTRIBUTE 18	0,93	1,09
ATTRIBUTE 19	0,88	1,16
ATTRIBUTE 20	0,83	1,13

Only two performance attributes had deteriorated on the basis of Direction of development index (Attributes 5 and 6). Other performance attributes had remained on same level or improved. Especially noteworthy is remarkably positive development of Attribute 14 because recently the case-company had put efforts for developing of it. The research objective was to find out and identify service strengths and weaknesses and above all the most critical factors of the service. Finally, these aims was tried to be achieved by Critical factors index.

Table 4. Results of Critical factors index.

ATTRIBUTE 1	0,86	ATTRIBUTE 11	1,65
ATTRIBUTE 2	0,86	ATTRIBUTE 12	1,40
ATTRIBUTE 3	0,68	ATTRIBUTE 13	1,23
ATTRIBUTE 4	1,85	ATTRIBUTE 14	5,82
ATTRIBUTE 5	0,65	ATTRIBUTE 15	3,69
ATTRIBUTE 6	0,76	ATTRIBUTE 16	1,49
ATTRIBUTE 7	1,10	ATTRIBUTE 17	0,61
ATTRIBUTE 8	0,61	ATTRIBUTE 18	1,18
ATTRIBUTE 9	0,68	ATTRIBUTE 19	1,68
ATTRIBUTE 10	0,78	ATTRIBUTE 20	1,33

With Critical factors index (CFI) the most critical factors of service were identified (Attributes 3, 5, 8, 9 and 17). So, attention has to be paid e.g. to professional skills of service makers, timing of service, efficiency of service's completion and how well service providers take care of safety.

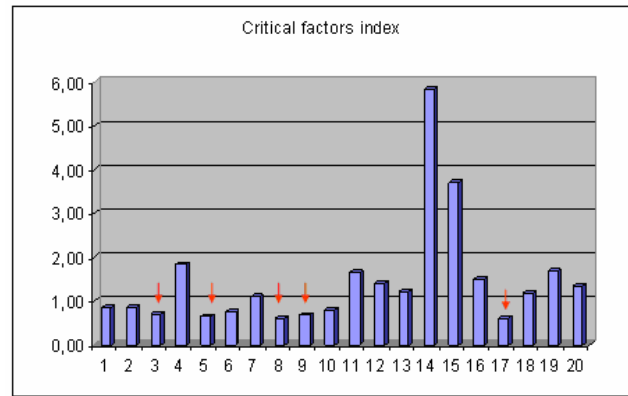


Figure 6. Results of Critical factors index.

V. UTILIZATION AND EVALUATION OF THE RESULTS

Within this case study research, a constructive method for finding out critical features of industry maintenance services was developed and tested by weak market test. The method helped the company to identify the strengths, weaknesses and critical factors of the service. This identifying based on recognition of service attributes, clarification of customers opinions and systematic analysis of these gathered information. The standard deviations, Critical factors index and the weak market test verified the validity and the reliability of this survey.

Current state analysis, customer questionnaire and analysis of it succeeded according to targets. With thorough current state analysis all essential questions for questionnaire was founded. After this questionnaire was delivered for all customer groups and answers were received enough for analysis.

With analysis was observed that customers expect extremely high level of service performance. It was also observed that every attribute has gap between experiences and expectations and that's why more analysis tools were needed. With Direction of development index it was find out what attributes have developed and which had deteriorated. This is really important information because for example it indicates that customers have noticed the development activity of the case-company.

With Critical factors index the most important attributes were identified. On the basis of the index attention has to be paid especially to professional skills of service providers, timing of service, efficiency of service's completion and how well service providers take care of safety. However low value of Critical factors index doesn't necessarily mean that the performance of the attribute is on a low level. Low value of the index can also be courtesy of customer unanimous opinions about expectations and experiences. That's why it's really important that results of customer questionnaire process will be evaluated holistically. In that case it's possible to plan and implement the right further actions: intensive improving or deliberate improving.

Results of the customer questionnaire process have to be examined in depth with service providers. The results are a highly qualified feedback of the service. And that's why it's extremely valuable information for the service providers.

In the case-company information and results of the customer questionnaire process was utilized also in developing process of measurement system in work group level. Customer questionnaire process gave valuable information about customer opinions and results of Critical factors index showing directly which attributes have to be measured. Consequently customer questionnaire process was associated to developing process of measurement system.

Experiences from the customer questionnaire process are still preliminary. However, some general conclusions and conclusions about just this individual customer questionnaire process be proposed.

In this study customer questionnaire process gave important information from the service examined. With it strengths, weaknesses and critical factors of the service were identified. This all based on customer satisfaction survey. With this process it's also possible to take into account opportunities and threats of the service but this requires that customers can compare case-company's service to competitors. In that case Competitor index may add on to denominator of Critical factors index. Customer questionnaire process was also significant part of developing process of measurement systems. Overall customer satisfaction measurements, analyses and proposals for actions can be systemized by using the method developed.

Highly reliable evaluations aren't possible until the method has utilized few years in case-company. Customer questionnaire process have to be repeated couple of times and in this way it will be possible to find out if it is possible to recognize changes of internal and external business environment with this method. Especially the method should sense changes in the attribute criticality. Besides, it should be able to discover that what causes these criticality changes: customer expectations, development of internal factors, deterioration of internal factors, competitive environment.

VI. FURTHER DEVELOPMENTS AND MANAGERIAL IMPLICATIONS

Because we always have to focus to a small amount, let's say e.g. to 4, of priorities in even multifocused business strategies, that the business strategy is under reliable control. Some actions have already been carried out and some are under implementation in the case business. In a long run the effects can not yet be considered. And what might be the "higher level" performance measurements for that? Should we use productivity, profitability, market shares or growth rates of the business? In the long run we have to repeat the customer satisfaction measurement and development actions to follow and make some conclusions

from the effects to the higher level business performance. This is a challenge in a dynamic and complex service business where e.g. the amount of reclamations does not necessarily mean anything in customer satisfaction. Therefore, we can conclude that there is still a tremendous need for developing a simple and holistic customer satisfaction measurement and a higher level business performance measurement related to it. What might this mean in practice?

We have to always first find out the priorities of the customer satisfaction for the dynamic business conditions, and secondly and based to that performance pyramid, to follow the micro mechanism how this affects the higher level business performance. This is really a continuous research and development process when keeping the service business competitive. The holistic customer satisfaction system is all the time changing; some arguments are going up and some down. This fact may cause serious problems because the flexibility, i.e. the life cycle of the customer satisfaction arguments should high be enough, to prevent us from taking all the time new dimensions in the customer satisfaction measurement. Therefore, when searching for a quality information system we should really be very careful just to have the right, that is flexible (long life cycle) enough, customer satisfaction arguments, to make sure continuous and reliable business development. This fact evidently requires dynamic, hermeneutic and for the mostly qualitative studies, to all the time ensure the right understanding of the customer quality behaviour and its effects to business management. This case study illustrates difficulties and problems in decision making especially in huge companies. For example service operations can't be categorised unambiguously in Service-Channel matrix because service operates quite widely in almost all the service types. In some cases this might look like chaos but closer look illustrates that it is only a way to keep customer satisfied in this special business area [14]. These Service Process Analyses obviously mean great challenges for the further developments of the maintenance service.

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APPENDIX

Customer questionnaire

	Expectations	Experiences	Compared with competitors			Direction of development		
	(1-10)	(1-10)	Worse	Same	Better	Worse	Same	Better
X.) Quickness of service.	[]	[]	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
X.) Professional skills of workers.	[]	[]	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
X.) Professional skills of foremen.	[]	[]	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
X.) Timing of service.	[]	[]	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
X.) Accessibility.	[]	[]	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
X.) Efficiency of service's completion.	[]	[]	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
X.) Service makers take care about safety.	[]	[]	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
X.) Service makers take care about environmental factors.	[]	[]	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
X.) Service makers take care about tidiness of working environment.	[]	[]	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
X.) Price/quality ratio of service.	[]	[]	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
X.) Service minded of workers.	[]	[]	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
X.) Service minded of foreman.	[]	[]	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
X.) Reliability of service.	[]	[]	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
X.) Service providers understand the needs of customer.	[]	[]	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
X.) Internal cooperation of service providers working.	[]	[]	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
X.) Service providers inform customer during the service.	[]	[]	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
X.) Correctness of billing.	[]	[]	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
X.) Service providers of area A can operate in area B.	[]	[]	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
X.) Service providers of area B can operate in area A.	[]	[]	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
X.) Prioritization ability of foreman.	[]	[]	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

A model for controlling the patient care process – the challenges and opportunities of electronization

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Abstract — Hospitals are in a great pressure between cost savings and a growing need for patient care. This pressure makes it essential to measure, follow up and develop the processes in order to make them more efficient. This kind of development requires new managerial tools and also new ways of storing the data in hospitals. This study evaluates the opportunities and challenges of electronization in hospitals from the managerial point of view. These opportunities and challenges rise from developing a model for measuring the costs, quality and time of the patient care process in one case hospital. As a result we conclude that if benefits from managerial innovations are to be achieved, electronization of hospitals databases is required.

Keywords — patient care process, process control, health care, electronization

I. INTRODUCTION

A. Background

The primary goals of health care are to give good treatment and heal the patients. When the resources of health care are used cost efficiently, it ensures good patient care for more patients than earlier. The activities of health care must be made more effective in order to keep the total budget of social and health care services on reasonable level. The ageing population and also the medical development, new treatments and the growing expectations of the population increase the costs.

Special health care can meet these challenges only by increasing productivity. The best way to increase the productivity of patient care is to develop efficiency of activities. In health care this means changing over from measuring the results to managing the activities.

There is also need for the electronization of patient care data in order to make the patient care more efficient and improve its quality. With electronization the patients' security could improve, the information would be more real-time, the care process could be shortened, the number of overlapping activities would decrease and the activities would become more efficient, which means more patients

with less costs. The problems related to the electronization include resistance to change and also concern about data security.

B. Objectives

This study introduces a model developed for measuring the costs, quality and time of the patient care process in one case hospital. On the basis of this modelling process, the opportunities and challenges of electronization in hospitals are evaluated.

In this research paper the information needed for the modelling and the need for electronization are discussed. Also the benefits of the electronization of patient information and modelling the patient care processes are considered. These include the visibility of time and cost information and the efficiency achieved through electronization.

II. LITERATURE REVIEW

Botta-Genoulaz and Millet [4] have researched the use of ERP (Enterprise Resource Planning) systems in the service sector. Their aim is to get an insight into how services approach ERP implementation. In their study there are six cases, of which one is a hospital. The problems related to the implementation of ERP in hospitals include country-specific factors, such as reimbursement systems and patient care systems, where practices vary from country to country. In the service sector, the human factors are considered more important than in other industries. Despite the difficulties, the overall ERP experience was considered as a success. The ERP systems accelerated the transition to activity-based costing and increased the level of data standardization within the hospitals. The management also received information on the use of resource, which was not available previously. The benefits received included the following:

- better organization of processes
 - more rigorous software in comparison with manual information processing
 - more satisfied users
 - ability to trace information in the whole system
- Jansen-Vullers and Reijers [8] have studied the potential

contribution of Business Process Redesign to the society's demand for decreasing the costs of healthcare. They focus on the reduction of throughput times and service times by improving the tasks, routing structure and resources of the business process. They present a case of the intake process of mental healthcare. After mapping the intake process they introduce seven different scenarios for decreasing the throughput time: post, periodic meetings, social-medical worker, medical file, notice recording, registration cards and treatment plan. Four of the seven redesign scenarios resulted in the improvement of throughput time. This method enabled the mental healthcare institute to come up with new ideas, which actually improved their intake procedure. Even though this case study cannot be generalised for all processes in healthcare, the intake procedure is rather common and this kind of approach can be used for other processes as well.

Staccini & al. [10] have proposed an object data model of a process and its components and programmed a web-based tool in an object-oriented environment. This tool makes it possible to extract the data dictionary of a given process from the description of its elements and to locate documents according to each activity or role. They point out that clinical information systems must satisfy two kinds of clients. They have to provide the end-users with full event traceability, real-time data entry and retrieval features, context-based decision supply and measurement of activity performance. They must also reassure patients that everything is being done. Staccini & al. [10] also point out the usefulness of process mapping in clinical pathway management. Process mapping can be used for reducing the waiting time, improving quality, measuring patient satisfaction and reducing costs. They also conclude that the model has to be simple, transparent and as understandable as possible. The model must not be too theoretical for the healthcare professionals in order to enhance their collaborative participation in the development process.

Seila [9] has introduced some lessons learned in modelling projects at medium size hospitals. These rules are presented from the perspective of the modeller.

- Health care managers are not interested in modelling methodology
- Data is a limiting factor
- You must understand the health care system
- You should model the health care work processes
- The model should include a financial component
- The model should include data management processes
- The model must be built quickly

Aktas & al. [1] have proposed a management-oriented decision support model to assist health system managers in improving the efficiency of their systems. In their study the efficiency is measured by the total time spent in the system. This reflects the fact that the quality of service and the desire to not wait in queues are of critical importance for the users of health services.

Takeda and Endoh [11] introduce three major goals identified in a 2013 prognosis paper:

- patient-centred recording and use of medical data for

cooperative care

- process-integrated decision support for health care professionals

- comprehensive use of patient data for clinical and epidemiological research and for health care reporting

They also point out that it must be clearly understood that ICT must be implemented according to three basic principles: (1) information can not be meaningful when it is not efficiently used; (2) it is important to think from the standpoint of the recipients of services; and (3) the safety of information must be secured.

Chalmers & al. [5] point out the importance of reliable terminology. They argue that this problem will not be resolved by mere digitization, but on the contrary, will tend to get worse as the volume of electronic medical communication increases. The lack of precisely defined medical terminology makes it impossible to create data sets which can be interpreted between researchers.

Eggli & al. [6] propose a conceptual framework which is universal and based on descriptors of six entities: general population, people with poor health, patients, services, resources and effects. They suggest twelve indicators for the surveillance of the ambulatory care system, almost all based on routinely available data: morbidity, accessibility, relevancy, adequacy, productivity, efficacy, effectiveness, efficiency, health services coverage and financing. They argue that comparable data should be available allowing for benchmarking or performance modelling. They also point out that these indicators can be achieved without threatening privacy protection, using modern cryptographic techniques.

Alden & al. [2] have drawn theories from business and health to develop an integrated model featuring antecedents to and consequences of reproductive health-care client satisfaction. They point out that in many studies the client satisfaction is measured either indirectly, using waiting times, or directly by asking about the client satisfaction. Their own results show that the most important things affecting client satisfaction were the doctor's responsiveness and empathy, and the doctor's expertise and access, viewed primarily as "waiting time".

III. CASE: MODELLING THE PATIENT CARE PROCESS

A. The modelling process

In this study, a model developed as a part of a larger project for controlling the patient care process is introduced [7]. The caring process of lung cancer patients is used as data in the modelling process. The model has been tested with 22 lung cancer patient cases. With the help of this data, we can make conclusions on the information needed for the modelling and also of the benefits of electronizing patient care systems.

The building of the model started by defining the optimal treatment process of a lung cancer patient and the tests needed in diagnosing and defining the disease. This process mapping was the basis when designing the optimal diagnosis process, which is presented in figure 1. The

diagnosis process means the time elapsed from receiving the referral to starting the treatment, and its ideal throughput time was defined less than 36 days. Certain delays between operations are allowed, for example the referral has to be handled right away but the patient's first appointment has to be within a week, due to the practicalities. Spontaneous cure of lung cancer is not possible, which means that the waiting time during the diagnosis process is negative for the patient all the time. During the treatment process some waiting time can be positive for the patient, for example while waiting for the effects of the cytostatic treatment.

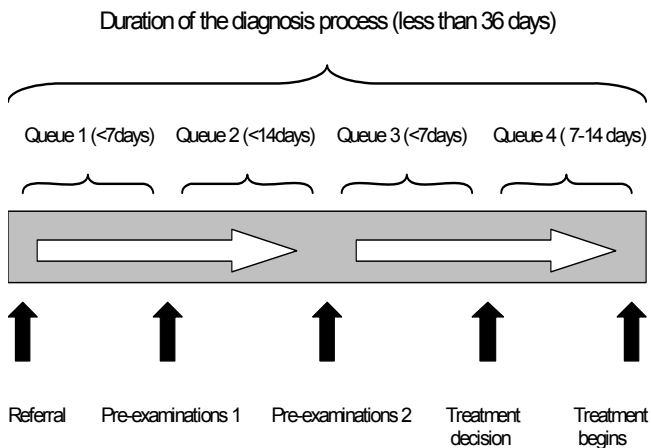


Figure 1. The optimal diagnosis process of a lung cancer patient and its throughput time

The model was developed with a spreadsheet. The model needs information about the patient's occupation, the date of the referral, the tests made for the patient, the time spent at bed rest in hospital, the date of the treatment decision and the date of starting the treatment or ending the tests. As a result the model gives the cost information of each patient and the graphics of cost accumulation. The model also calculates various key ratios. The main key ratios are the time ratio, cost ratio and diagnosis quality. Finally the model calculates a total grade, which is determined on the basis of the main key ratios. This total grade tells about the success of the diagnosis process in a very short form, and with this grade the processes of different patients can be compared with each other. Using the model requires the definition of an optimal patient care process. In order to do an analysis of the process and its costs and time, the results are compared to the optimal process. Appendix 1 clarifies the structure of the model.

B. Results

With the help of the developed model, the costs and time elapsed for the process become more visible than earlier. The model can be used as a tool in managing the activities of the patient care process. The model also makes the costs for the society visible by taking into account the time costs. The time costs are here defined separately for working people, the unemployed, the retired and students. The time costs are calculated based on the average monthly income.

As an output the model gives a cost accumulation graph

and some key ratios. The cost accumulation graph for the optimal diagnosis process is presented in figure 2. The costs of the bed rest in a hospital and the costs of the tests can be seen in this graph as a clear growth of costs at the point when these costs are realized. Time costs are accumulated evenly during the whole process.

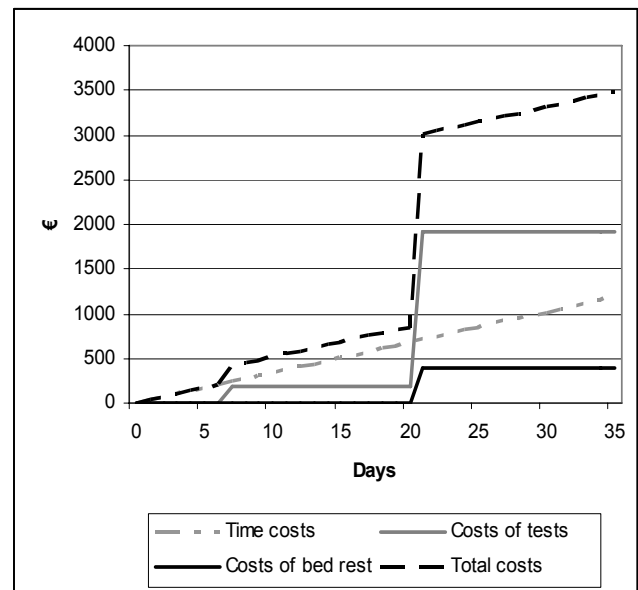


Figure 2. Cost accumulation graph of the optimal diagnosis process

Table 1 presents the key ratios and total grades of the diagnosis process of a lung cancer patient. The time ratio presents how much longer or shorter the duration of the diagnosis process is compared to the duration of the optimal process (36 days). The cost ratio presents the relation between the actual costs and target costs. The diagnosis quality is estimated with the fulfilled tests and the duration of the diagnosis process and comparing these to the optimal situation. The structure of the model and the key ratios are presented in appendix 1. When these ratios are smaller or equal to 100%, the process has reached the targets.

TABLE 1. THE KEY RATIOS OF THE DIAGNOSIS PROCESS OF A LUNG CANCER PATIENT

Patients	Working=W, Retired=R	Time Ratio(%)	Cost Ratio(%)	Diagnosis quality(%)	Total Grade(%)	Assessment
1	R	83	63	57	68	excellent
2	W	386	533	114	344	poor
3	R	149	210	71	143	satisfying
4	R	229	216	86	177	tolerable
5	R	723	940	200	621	poor
6	R	143	296	100	180	tolerable
7	R	140	81	43	88	good
8	R	166	174	57	132	satisfying
9	R	103	59	57	73	excellent
10	R	154	149	29	111	good
11	W	80	169	57	102	good
12	R	231	201	57	163	tolerable
13	R	474	474	143	364	poor
14	R	129	106	71	102	good
15	R	200	299	71	190	tolerable
16	R	223	209	71	168	tolerable
17	R	134	178	86	133	satisfying
18	W	177	155	100	144	satisfying
19	R	46	88	100	78	excellent
20	R	300	155	114	190	tolerable
21	R	66	94	114	91	good
22	R	140	190	100	143	satisfying
Average		203	229	86	173	tolerable
Target		<100	<100	<100	<100	

From these key ratios it can be concluded that:

- The duration of the diagnosis process and the days spent in bed rest in a hospital are the main factors influencing the total costs and the total grade calculated. The number of tests made for the patient is not important.
- To achieve the total grade 'excellent', the diagnosis process should be short and not include many days in bed rest in a hospital. From the point of view of total costs it is more reasonable to make even more tests as long as the duration of the treatment process is short.
- The data shows that the most significant cost drivers are long bed rest periods in a hospital during the diagnosis process. For some patients this means a more severe disease, but part of the patients are taken in a hospital because it guarantees quicker access to different tests. This clearly reflects poor process planning and it should be taken into account as soon as possible.

IV. OPPORTUNITIES AND CHALLENGES OF ELECTRONIZATION

A. Challenges

Here the opportunities and challenges of electronization that we found out during the case study are discussed. In this context electronization does not only mean a paper-free office, but it contains the idea about processing the information into a usable form for the decision makers. Our focus is merely on the findings related to the managerial point of view and not so much on the technological. For example the main concern related to health care information systems is confidentiality, but we will not raise

that up here because we consider that it is mainly technological issue.

During the modelling process there were some difficulties due to lack of data. We discovered that although much information is gathered in hospitals, this data is hard to get and there really is a growing need for electronization. The patient data system that this hospital has acquired contains much data, but using the data is difficult. For example, crucial information in this case is the date of the treatment decision. This date is in the information system but it is hard to find, and collecting information based on this date is nearly impossible (compare [11]). The date of the treatment decision can also be marked unclearly and in these cases finding the accurate information requires knowledge about the treatment process (compare [5]).

From the technological point of view the major challenge is the compatibility with other information systems, which may harm also the managerial use of the information systems. There are not many ERP-type systems for hospitals, and due to the nature of public organizations, the acquisition of computer systems is done in pieces, and so compatibility may cause real problems in the future. At the moment some information is already in the electronic form but some is not. For example the x-ray pictures of lungs are partly in electronic form and partly not. The doctors still need to wait for some information on paper, and some of the benefits of electronization disappear. This case hospital has acquired a new electronic patient data system, but using it for managerial purposes might be problematic. So it would be beneficial to clarify if there are any modules that can be added to the system in order to use it more broadly in controlling the activities of the hospital.

The challenge in enhancing process management is more in people than in information systems. Although all data were available, modelling the processes requires competent staff who are familiar with the medical aspects (compare [9]). The one most difficult challenge related to new information systems and also to new managerial systems is the change of organizational culture. Most of the medical staff do not realize that better process management would help in their daily work.

B. Opportunities

If the patient records and other data in hospitals were in an electronic form, it would help in finding the right data when needed. Statistics and reports would be easy to make and these could be used in managing the hospitals. The challenges in this kind of reporting include the fact that if reports are made, the information should be spread all over the organization. If reports are made only for the management, most of the benefits disappear. Also the results and ratios received from the reports should be understood correctly in order to use them for managerial purposes.

The modelling makes the processes transparent, so it becomes easier to see where the delays come from, in this case what causes the delays in the diagnosis process. When the process is known, redesigning the activities would make it possible to cut the delays (compare [8]). If the

information was available on time, the throughput time would be shortened, which would lower the costs and also improve the quality that the patient experiences (compare [1], [2], [10]).

Electronization will help in making statistics and reports but it can also help the organization in process management (compare [4]). In this study, the electronization of databases would have helped the modelling of the patient care process. It would be an ideal situation if the modelling process did not suffer from hard data collection but the modelling process was a fluent process and all the needed data were available. This way there would not be a need for compromises in the models.

The challenges and opportunities discussed above are mainly from the managerial point of view. If electronization was used in bettering the management, the results could be very good. If the information gathered would be used instead of just collecting it, the efficiency of health care organizations could be remarkably better than it has been. As showed in this study and also other studies [3], [7] the management tools used in industrial companies fit also to the health care sector with some adjustments.

V. CONCLUSIONS

With the help of the results of this study, the processes of patient care can be modified and made more streamlined. The modelling makes the processes and costs more visible, so it is easier to manage the processes if there are problems. This visibility and possibility to enhance the processes should lead to more efficient patient care.

The model introduced in this study suits at least the caring process control of lung cancer patients. The model requires information about the patient and the optimal caring process as benchmark. Electronization of the patient database would be beneficial. Now the information needed for the model was poorly available. Developing the model further requires more testing with other groups of patients. With some adjustments the model could also be used in comparing the results of different hospitals. The model measures quality with time and the number of tests made. Additionally it would be beneficial if the effects of the treatment could be evaluated, especially if the model is to be used to compare different clinics. The comparison could create healthy competition, which could increase the motivation to enhance the operations (compare [6]).

The information systems used in health care are not designed to produce information for controlling the activities. The information included in the systems is hard to get and also often defective. The future challenge is to create a system which enables diverse information collection and handling across organizations. The model introduced in this study could be part of this kind of information system or the model could get the information directly from this kind of patient database. The modelling, collecting the information and using the information to manage the operations could lead the health care sector towards better process management.

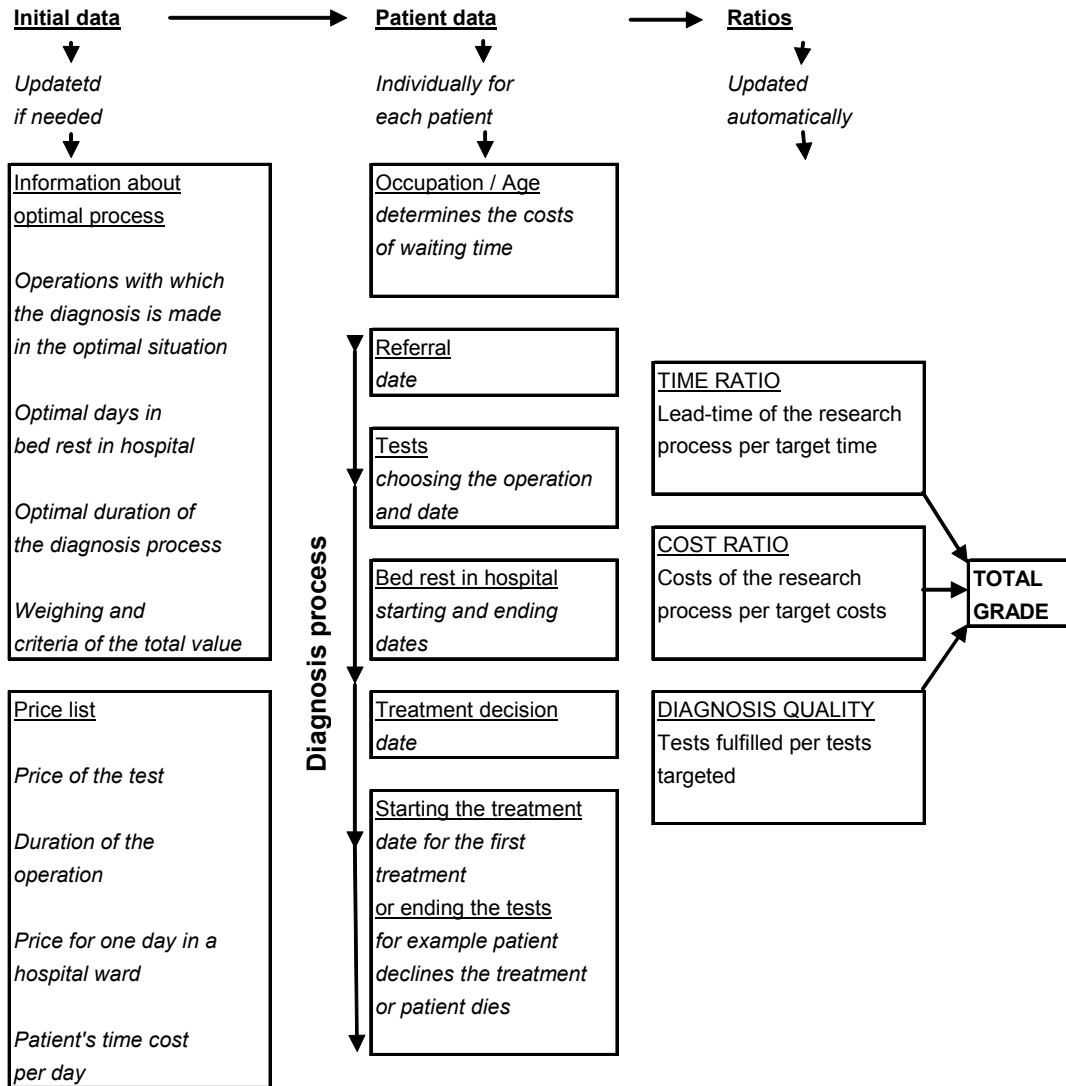
ACKNOWLEDGEMENTS

We are thankful to M.D., Ph.D., Chief of the Department of Respiratory Diseases Jouni Hedman for cooperation.

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APPENDIX 1. STRUCTURE OF THE MODEL MEASURING THE PATIENT CARE PROCESS OF A LUNG CANCER PATIENT

**Additional information**Time information

Active research time per whole lead-time (%)

Waiting time per whole lead-time (%)

Time elapsed from the treatment decision to starting the treatment compared to the target (%)

Time elapsed from the treatment decision to starting the treatment (days)

Whole lead-time

Cost information

Costs of the operation

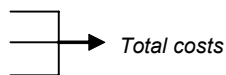
Costs of the bed rest

Time cost of patient

Cost accumulation graph

Diagnosis quality

Duration of the research process



A Multidisciplinary Framework for Concept Evolution: A Research Tool for Developing Business Models

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Abstract — The paper describes a new framework for multidisciplinary concept evolution (MCE). The impetus for systematizing the research concepts was a practical need to facilitate successful communication between different disciplines. The main benefit of the framework is that it aids the complex and dynamic process of conceptualization by highlighting abstraction, generalization, and ontology engineering as practical methods to implement concept evolution. One application of the framework is in solving complex business-related problems. The MCE framework can be utilized not only by researchers but also by other community stakeholders. Applying the framework to scientific disciplines may bring additional value to research as well as benefits to practical development endeavors.

Keywords — Business models, multidisciplinary research, concept evolution, semantic interoperability.

I. INTRODUCTION

A. General

The broad success of the Internet has led to the emergence of eBusiness (eB). Although eB has opened new possibilities for enterprises (especially for SMEs), its spreading popularity has partially influenced the tightening of competition in the global market environment. Facing limited resources, companies have tried to achieve economies of scale by establishing closer relationships with other companies in the form of business or enterprise networks. By networking, companies wish to save costs and achieve synergy effects in business-to-business (B2B) operations. This can be achieved, for instance, by using integrated information systems. These systems, which enable the distribution of network resources, are based on process thinking. This process view calls for a new “business thinking”, which utilizes cross-organizational chains of business processes. This increases demands for mutual understanding and trust, which are prerequisites for implementing these cross-organizational business operations. Following jointly agreed procedures and contracts is one way of enforcing mutual and multilateral

co-operation. However, the difficulties in combining different views and opinions still remain as a considerable obstacle in finding an agreement – even within a single company.

B. Background: Project Description

The demands of the modern business environment described above form the basis of work carried out in a research project focusing on integrating enterprise networks. The project, which embraces the interrelated research areas of business models, systems integration, and information security, seeks to analyse and model information, material and financial flows in the enterprise network, in an effort to combine all the individual results in a general model of integrated enterprise network.

Although they are all part of the common research problem, the focal points of these research areas are slightly divergent, yet complementary. Business models research aims to develop a new business network model which integrates processes in small and medium-sized enterprises (SMEs). The need to integrate the business processes has increased with the digitalization of B2B operations. The goal of systems integration research is to define an electronic business process collaboration prototype model. The developed business process integration model can then be used as a basis for service concepts and for a class of architectures offering a solution to B2B integration. Information security in this context is needed to implement business process integration safely.

C. Research Setting

The development of business-related models is in the scope of design sciences, as stated in March and Smith (1995). Design science attempts to create things that serve human purposes, whereas natural science tries to understand observable reality. Business models clearly serve human purposes. March and Smith (1995) continue with the four types of design science products: constructs, models, methods and implementations. They argue that as in natural science, there is a need for a basic language of concepts (i.e. constructs). These concepts make it possible to characterize

phenomena. March and Smith state that these constructs could be combined into higher level constructions (models) which are used to describe tasks, situations, or artefacts.

In accordance with the design science view, constructive research (CR) was chosen as the main research methodology, largely for practical reasons. CR is generally seen as a case-study method which aims to find solutions (constructions) to predetermined problems. If viewed as an applied research method, the essential feature of CR is the generation of new knowledge of the target area. According to Kasanen, Siitonen and Lukka (1993), finding a practically relevant research problem, obtaining a general and comprehensive understanding of the topic, and innovating and constructing a theoretically grounded solution are crucial steps in the constructive research approach (CRA). Although a relevant research problem can be discovered from a purely theoretical basis, it is more common to find actual research issues from premises of existing real-world business demands (Labro and Tuomela, 2003). In the final stages of the CRA, the developed construction should be evaluated and tested through an examination of its applicability and an illustration of its theoretical connections and research contribution (Kasanen et al., 1993).

Following the CRA stages from the standpoint of design science and surveying the existing theories and concepts, it became evident that there are severe distinctions in the conceptualizations between each research area. It was seen a necessity among researchers to find a ground-level consensus of at least the essential concepts like: business process, business modelling, electronic commerce, B2B integration, trust etc. Additionally, the complexities in selecting the concepts in the scope of the research and the challenges in communicating the definitions thereof between the different parts of the research, acted as a driving force for developing a formal framework for multidisciplinary conceptualization.

D. Structure of the Paper

The next section explains how the challenges introduced by complex cross-disciplinary concept semantics led to the idea to develop a generic framework for multidisciplinary concept evolution (MCE). After this, the practical methods of concept evolution and the notion of emergence of meaning are briefly illustrated. Building on these findings, a proposal for how the framework can be utilized in solving complex business-related problems is then described, followed by a concluding discussion about the usefulness of the developed model.

II. CHALLENGES OF MULTIDISCIPLINARY CONCEPTUALIZATION

The above issue of concept diversity experienced in the project can be illustrated, for example, by using terminology adapted from the well-known methodology of

formal concept analysis (Wille, 1982), which uses a mathematical notion of lattices to represent the relation between concepts (or objects) and their properties (or attributes). The philosophical background of formal concept analysis (FCA) lies in the definition of *concept* (of a given context) as a unit of thoughts consisting of two parts, the *extension* and the *intension*. The extension covers all objects belonging to this concept and the intension comprises all attributes valid for all those objects (Wagner, 1973). In relation to business network research, the initial assumption of a shared concept context can now be formulated using the practical guideline for FCA (Wolff, 1993): the extent of the topmost concept, i.e. the most general super-concept of the combined research domain, should always be the set of all concepts; its intent does not contain any properties (in the mentioned context of the project's research domain). However, the added complexity of the domain of the discourse, caused mainly by the projects multidisciplinary approach and the diverging views in each research area about details of the concepts of each domain, required a more sophisticated treatment of concept semantics.

Additionally, the overlapping nature of the concept descriptions is exemplified in how the three research areas had in many cases inconsistent concept definitions: on the one hand, there were concepts that had a uniform (or nearly identical) name but they still referred to a completely different (real-world) entity, or they had a contradictory meaning between research views; and on the other hand, some concepts with unrelated names appeared to be identical in their definitions or referred to the same underlying entity.

In the context of the initial project's collective research area, these findings about the complex interplay of closely interconnected and at the same time divergent views of three overlapping domain concepts (business models, information security and systems integration) prompted us to discover an intrinsic layered structure of concept composition, which is illustrated in Figure 1. Three overlapping areas of concepts can thus be distinguished: (S) a single-topic layer; the concepts appearing in only one research domain, (D) a dual-composite layer; concepts that fall within the intersection of two research domains, and (M) a multi-composite layer; a set of concepts that fall within the intersection of all research domains.

By means of generalization, an extension of the described model is also depicted on the right side of the diagram. Here it can be seen that the overlapping nature of cross-disciplinary conceptualizations presents itself as a multi-layered structure, where each layer contains a certain set of domain concepts (originating from one or several domains) according to their interconnectedness (that could present itself as a similarity or as relevance, but also as dissimilarity or even as being conflicting) with the other domain's perception of the entity represented. Using this kind of

semi-analytical abstract modelling in each research area individually (or in collaboration), the domain concepts can be categorized and related not only according to their “internal” properties but also along their “external” relations to other research views.

extent that metamodelling can be used as an informal description that is robust enough to present the essential building blocks of the proposed practical research framework.

Even in its present informal state, this cross-domain

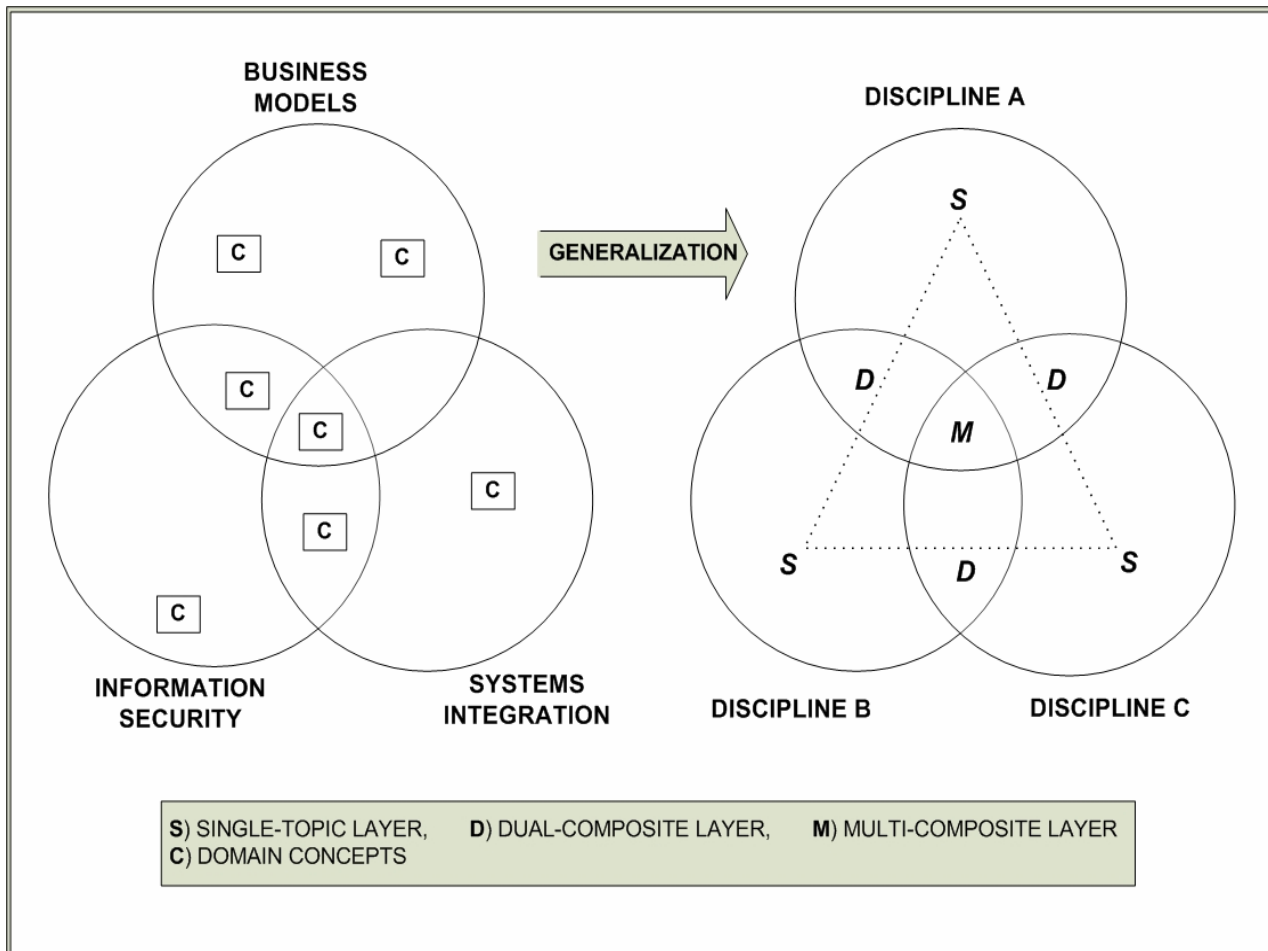


Figure 1: Layered composition of domain concepts

It can be claimed that this way of thinking differs from the more traditional conventions used in multidisciplinary research, which have shown a tendency to only try to connect, combine or converge the already existing concept models of different disciplines in an attempt to build a coherent representation of the whole.

An additional discovery was made when it was realized that formalizing and further developing this kind of a representation could serve as a metamodel. As such, the developed framework can be seen as an explicit model of constructs and rules needed to build specific models within a domain of interest. Thus, the described conceptualization schema could further be developed in accordance with the practices of metamodelling as, for example, in the specifications under the Model Driven Architecture (MDA) by the Object Management Group (OMG; Model Driven Architecture). The following sections focus on advancing the construct in the direction of metamodelling only to the

conceptualization schema could already be used in the initial research project in combining and harmonizing the whole concept domain in such a way that the different concept definitions and descriptions are also conserved.

III. CONCEPT EVOLUTION AND THE EMERGENCE OF MEANING

This section describes the essential constructs and practices that need to be incorporated into the previously described preliminary metamodel for it to be useful in actual research. The main goal here is to present the building blocks of a framework for multidisciplinary concept evolution (MCE).

The fundamental functional requirement of a practical design tool in this context is that researchers should be able to use it to generate a coherent, formally expressive and mutually accepted representation of strongly interconnected research domain concept semantics. This kind of compilation of knowledge is here called *the general and shared body of meaning*. In accordance with the dictionary definition (Oxford English Dictionary), the emphasis here is on the emergence of an understanding about the significance, purpose or the underlying truth of the observed and analyzed conceptualizations. The justification for

It is proposed here that mostly the operational requirements can be fulfilled by applying (i) *abstraction*, (ii) *generalization* and (iii) *ontology engineering* (particularly ontology mapping) to enable the emergence of meaning. However, before these methods or operations are detailed, the novel idea of *concept evolution* is defined as the concrete activities performed by the researchers that give rise to a higher-level representation emerging from the initially constructed conceptualization.

As illustrated in Figure 2, all the mentioned metamodel components, the overall description of the listed practical methods and the basic ideas about semantic interoperability,

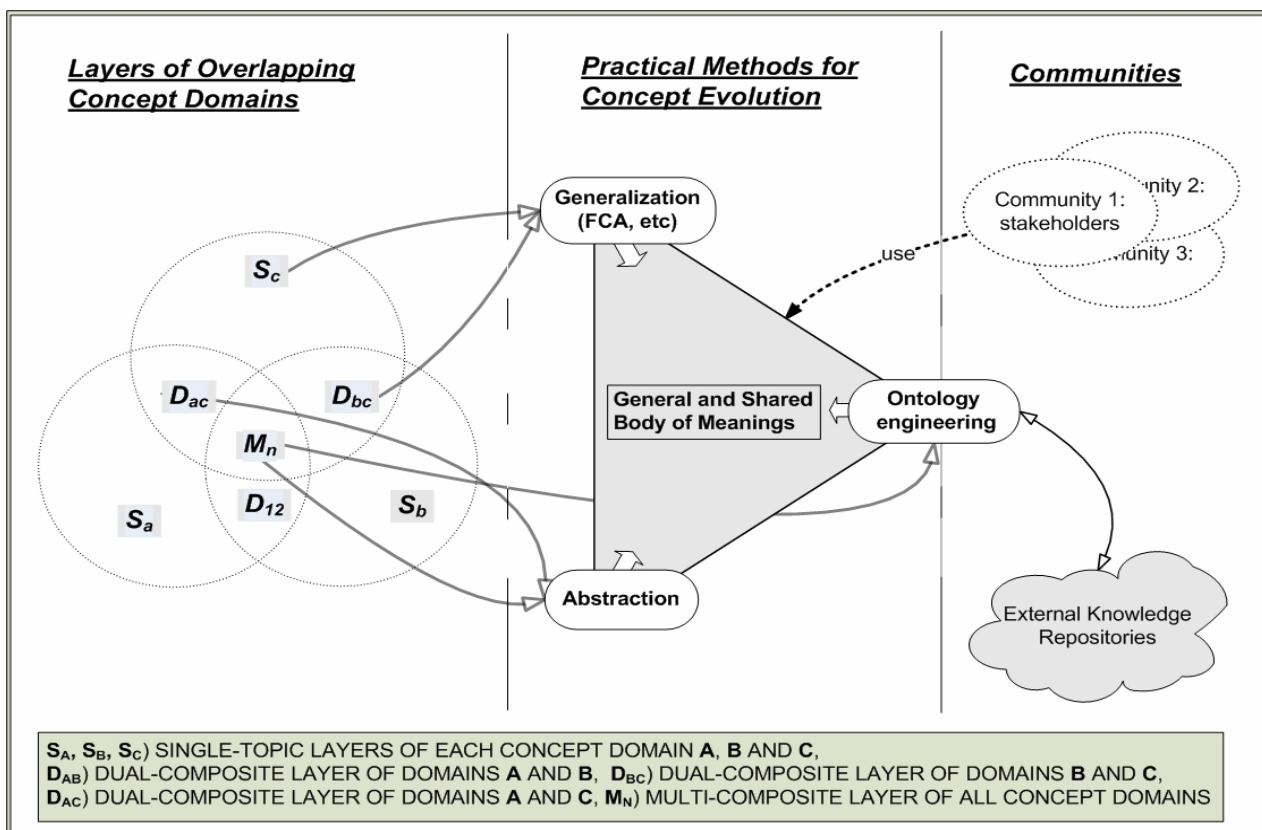


Figure 2: Concept evolution and emerging meaning

introducing meaning to this discussion lies in the insight that it is a valuable notion in tackling autonomy and heterogeneity issues (for example, in the dynamic integration of information systems) and to enable solutions to general problems in social, pragmatic, semantic and syntactic interoperability (Ouksel, 1999, Open Systems Framework for Social Interaction). Also the important community view is included in the framework by recognizing that the quality of the generated repository of meaning is ultimately evaluated by its ability to convey the necessary knowledge in an appropriate form to resolve conflicts, uncertainties and misunderstandings between the *stakeholders* or agents participating in the real-world phenomena being studied.

in combination with the given functional requirements, together constitute the main building blocks of the MCE framework.

As stated before, the MCE framework identifies the following practical methods to aid in the complex and dynamic process of concept evolution:

- generalization*: used here in the same sense as in the well-known object-modelling and set-theory paradigms: inheritance (is-a relation), subsume/supersume, object attribute relations and associations; for example, Formal Concept Analysis (FCA).

- ii. *abstraction*: seen here as a creative cognitive process, during which subjective interpretations are made (with the participation of domain specialists and experts, in addition to researchers) about the phenomena being researched and the initial concepts used. Abstraction (as the common-sense meaning suggests) can help the emergence of novel concepts by reducing the level of detail and by enabling higher-level representations.
- iii. *ontology engineering*: based on the definition of *ontology* as appropriate for the Semantic Web initiative and as specified in the OWL specification by the World Wide Web Consortium (W3C; Web Ontology Language). Ontology mapping (Kalfoglou and Schorlemmer, 2005) is an especially useful practice here mainly in providing formal descriptions and tools to glue research-originated conceptualizations together. Additionally, it can also be used to relate or link evolving concepts and meanings to various *external knowledge repositories*. These repositories lie outside the actual research domain proper and may include things like: related existing ontologies, knowledge repositories, vocabularies, dictionary definitions, taxonomies, standards and enabling technology recommendations, generally accepted naming conventions, code lists, etc.

More formally these operations (i.e. the practical means of concept evolution) can now be expressed as a mapping (or a function), the domain of which consists of the sets (S_i , $D_{i,j}$, ..., $M_{i,j,k}, \dots$) of overlapping domain area conceptualizations (not the individual concepts), and whose range is the constituents and the representations of meaning (m_i).

Summing up the benefits of using the framework, researchers are able to identify and analyse concepts from all relevant research areas and to categorize them into different classes. The framework also makes it possible to generate hierarchical concept schemas and to classify varying concept descriptions and definitions. Additionally, from the perspective of information system design, the framework is useful in providing at least a semi-formal (i.e. possibly machine processable) model of the domain of interest. It must be noted, however, that the practical use of the MCE framework in a variety of research situations still requires, for one thing, the specification of a formal method of utilizing the basic ideas and constructs discussed here.

IV. MCE FRAMEWORK IN THE CONTEXT OF NEW BUSINESS MODELS

When applying the MCE framework to a business context, an examined business-related phenomenon forms a starting point for utilization. When it is examined from the viewpoints of different business stakeholders and researchers, the outcome is a collection of different concept

domains, which paradoxically are not compatible with each other. This diversity of concept domains has traditionally led to deviating views on research issues, because the target phenomena is interpreted and described in subjective conventions. The MCE framework makes it possible to achieve general and shared meanings for concepts of focused phenomenon. These meanings can be adopted by all the research areas in question, and can further be used to form subjective constructs that share their conceptual definitions. This is a crucial aspect in designing or formulating new business models. Business phenomena are typically complex, involving features from different disciplinary backgrounds.

In this research project the specific business-driven phenomenon is an integration of business processes, which is expected to lead to a new business model (integrated enterprise network). As Figure 3 illustrates, by processing the initial concepts "business process", "integration" and "business network" in the MCE framework, a common set of meanings is attained. This collection is then used in the next (construction building) phase of the CRA as a valuable resource to aid in the creation of new solutions (constructs) for the described research problem. Developed constructs can further be combined into new business models. For example, a secure integration of business processes in an integrated business network demands a combination of constructs from different research areas. A prerequisite for this is that there exists general, shared meanings for the concepts of all related research areas.

One of the important consequences of applying the MCE framework to business process integration research issues is the insight that the study of information security should at least now be accepted as an important area of modern business. Because of the fact that information security is a business issue, not a technical issue (adapted: von Solms, 1999), a failure in designing and implementing it has evident effects on the ability of enterprises and networks to function. A severe information security incident can lead to growing insecurity and erosion of trust, which dissolves a network's capability to function. Information security is more than a technical issue: it is also an organizational issue. Additionally, systems integration research should also be added to the list of business issues (Anderson, Longley, Kwok, 1994), and should thus be investigated in parallel to other research areas. A modern business relies heavily on information systems, which can be interconnected by the means of systems integration. IT is also one of the key enabling forces in networking development, because it enables a cost-effective way for enterprise interoperability. In contrast, as a standalone research approach, systems integration mainly provides the functional service view as an infrastructure for implementing business operations at the organizational level.

These distinct conceptualizations inflict difficulties in communication between different stakeholders. However,

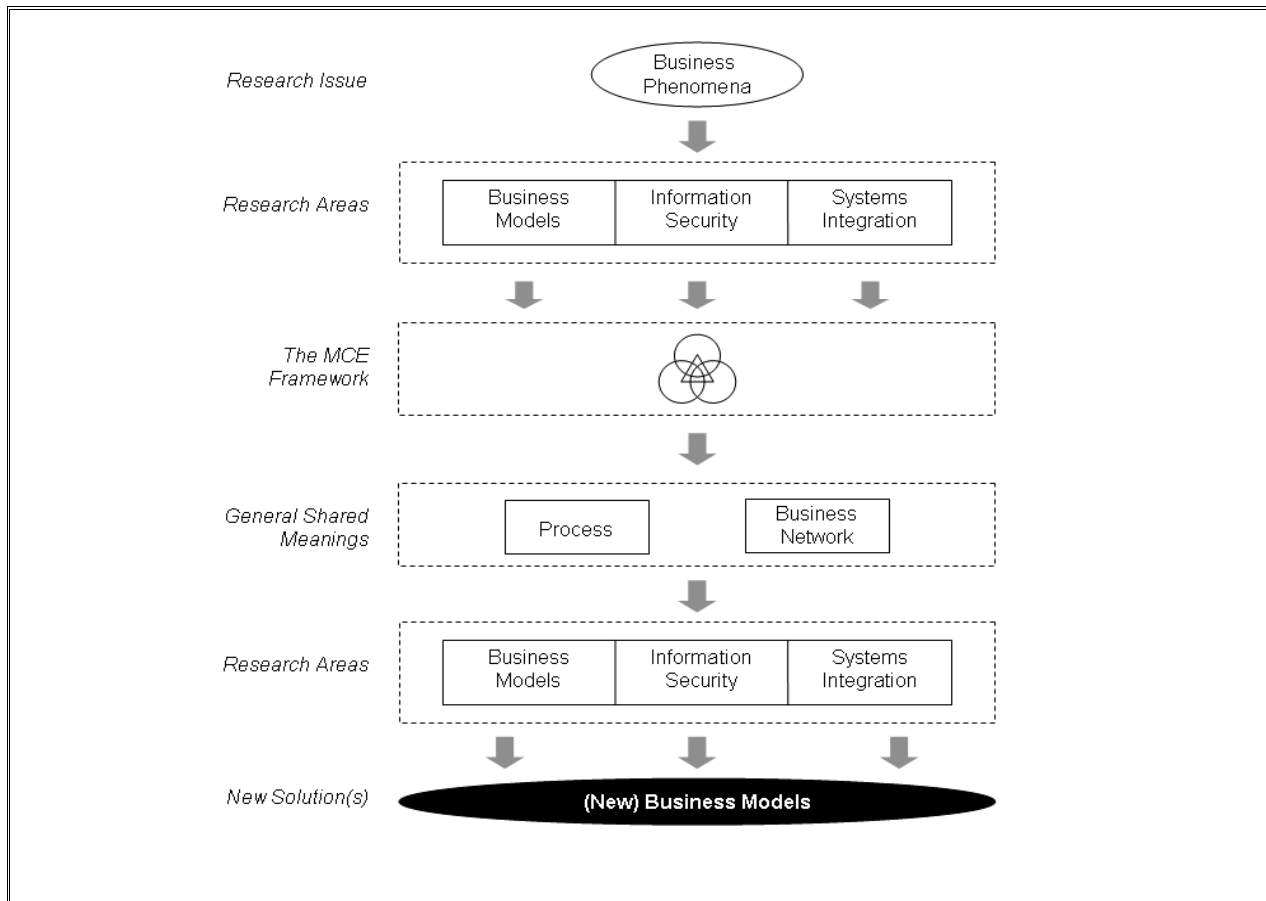


Figure 3: MCE framework used in business models related context

the issue of understanding is actually very pragmatic. For instance, in a real-world business context it is apparent that a company's IT director and marketing director understand each other - especially if they aim to build a new solution for the company's sales system. They might use the same words, which could actually mean completely different things. The issue of understanding becomes even more important when dealing with network of organizations (companies). When communicating between enterprises, it is more difficult to repair misunderstandings due to less face-to-face communication. Also, it is common knowledge that conceptual differences are greater between organizations than within one particular organization. Of course, these organizational-level conceptual differences are manifested through its employees and can often be experienced in B2B negotiating situations. The MCE framework can be applied to this kind of situation also. Then the issue is not to pool meanings from different disciplines, but to harmonize meanings from different viewpoints.

It is important to note that, once created, the MCE framework can be utilized not only by researchers but also by other (business) stakeholders, who view it from their own perspectives. They can pick only those concepts and

meanings from the created collection that serve their own purposes. Even in the case of a single enterprise, there are multiple shareholder positions – for instance, management, shareholders, employees, creditors etc. And as a pragmatic example, it is in the interest of a company's management to ensure the information they communicate to other stakeholders is understood properly. If shared definitions of concepts and meanings are used, then it is more likely that the information is decoded and conveyed in the way it was intended.

V.CONCLUSIONS

The development of the MCE framework prompted a research project aimed to develop new business models. It was discovered that the project's multidisciplinary research environment brought a need to harmonize concepts of different research areas. This finding encouraged researchers to develop the framework as a research tool that would make it possible to combine and harmonize concept domains. Using the framework, researchers are able to identify and analyze concepts from all relevant research areas and to categorize them into three classes: concepts appearing in only one research domain, concepts that fall within the intersection of two research domains and a set of

concepts that fall within the intersection of all research domains. The framework identifies abstraction, generalization, and ontology engineering as practical methods to implement the process of concept evolution.

The MCE framework is a generic tool that can be used in developing pooled interdisciplinary conceptualizations. As a discipline-neutral tool, it can be applied in several research areas, for instance, in developing new business models. Future research is needed to study the detailed practical value of the framework in other practical disciplinary and non-disciplinary areas. Depending on these results, applying the framework to other research areas may bring additional value to both the research itself and further development of the framework, as well as possible practical benefits.

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A Qualitative Analysis of Consumers' Perceptions of the Trustworthiness of e-Commerce

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Abstract — A lack of consumer trust hinders the development of electronic commerce. Although the importance of consumer trust in e-commerce is recognized and several studies have been done about the phenomenon, there is still confusion among researchers concerning different concepts related to trust. As an example, researchers have confused the concepts of consumer trust and trustworthiness and trust and risk. Furthermore, the lack of empirical studies concerning consumer trust has increased the confusion. This paper contributes by exploring what meanings consumers give to the less studied concept of trustworthiness in the context of e-commerce and by providing building blocks for further research. The findings of our study revealed altogether 11 different attributes of trustworthiness that consumers saw as important with respect to electronic grocery shopping.

Keywords — Trustworthiness, Consumer, Trust, Electronic Grocery Shop

I. INTRODUCTION

In late 1990s e-commerce was expected to expand rapidly and become a part of consumers' everyday life. Nowadays some Internet-related services such as electronic newspapers and information searches are widely used by consumers, but there are only a few commercially successful fields of e-commerce. One of the reasons mentioned for the failure of expectations is consumer trust, or more likely the lack of trust [1].

The phenomenon of consumer e-trust (consumer trust in e-commerce) is discussed widely, and many conceptualisations concerning e-trust have been made [2]–[7]. However, many researchers have confused the concepts of consumer trust in e-commerce and trustworthiness of e-commerce [8]. Because of this there is only a limited number of empirical studies that have concentrated on the less studied concept of trustworthiness, which limits current understanding of the consumer trust-related phenomenon. This paper contributes by exploring different attributes of e-commerce trustworthiness from the consumers' point of view.

The aim of this paper is to *investigate what meanings consumers give to the trustworthiness of e-commerce*. The objective will be achieved through three goals. The first

goal is to discuss the concept of trustworthiness and describe its three major dimensions. The second goal is to empirically investigate what meanings consumers give to the trustworthiness of an electronic grocery shop. The third goal is to provide theoretical building blocks for further research based on our findings and current literature.

The current paper is divided into four sections. *Three Dimensions of Trustworthiness* presents a definition of trustworthiness and its three major dimensions (competence, benevolence, and integrity). The distinction between the concepts of consumer trust and trustworthiness of e-commerce is also addressed. *Method, Data Collection, and Analytical Approach* provides a specific demonstration of the method used (semi-structured theme interview) to gather and analyze the empirical material. *Findings* introduces the major findings of our study. In the *Conclusions* section, conclusions of our study are drawn and theoretical building blocks for further research are offered.

II. DIMENSIONS OF TRUSTWORTHINESS

As mentioned earlier, the concept of trustworthiness is often confused with the concept of consumer trust [8]. Mayer, Davis and Schoorman (1995, 712) define trust as “the willingness of a party to be vulnerable to the actions of another party based on the expectation that the other will perform a particular action important to the trustor, irrespective of the ability to monitor or control that other party”. In contrast, trustworthiness is a characteristic of a trustee, and by evaluating the trustworthiness of the trustee, the trustor can decide whether the trustee will be more or less trusted [9], [10].

Trustworthiness is seen as a multidimensional construct. The literature offers several dimensions, like honesty [11], consistency, openness [12], and competence [13]. However, recent literature concerning the trustworthiness of e-commerce suggests that three dimensions are the most relevant, namely competence, benevolence, and integrity (see Table 1.)

TABLE 1.
DIMENSIONS OF TRUSTWORTHINESS IN E-COMMERCE LITERATURE

Author(s)	Competence	Benevolence	Integrity	Some Other
Bhattacharjee (2002)	x	x	x	
Garbarino & Lee (2003)	x	x		
Gummerus, Liljander, Pura & van Riel (2004)	x	x	x	
Lee & Turban (2001)	x	x	x	
McKnight, Choudhury & Kacmar (2002)	x	x	x	
Nöteberg, Christiaanse & Wallage (2003)			x	
Roy, Dewit & Aubert (2001)	x	x	x	
Serva, Benamati & Fuller (2005)	x	x	x	
Tan & Sutherland (2004)	x	x	x	x

Competence means that someone can believe that the other party has the ability to do what is agreed [6], [13]. In the context of e-commerce this means, for example, that the consumer can be sure that the e-vendor has all the products available that are offered on their web site. *Benevolence* means that someone believes the other party will notice his/her interest [6], for example, the consumer can assume that the e-vendor will deliver ordered products in the most convenient way for the consumer. The third important dimension of trustworthiness in the context of e-commerce is *integrity* [4]. Integrity means that someone can believe the other party acts ethically, does not tell lies, and keeps promises. For example, the consumer can assume that the e-vendor does not overcharge or misuse his/her credit card [14].

III. METHOD, DATA COLLECTION, AND ANALYTICAL APPROACH

The purpose of our empirical study is to explore what meanings consumers give to the trustworthiness of e-commerce. Due to the unexplored nature of the phenomenon, we decided to adopt a qualitative method, because we assumed that it would give us richer data than, for example, a survey. In other words, a qualitative method offers the possibility to reveal some attributes of trustworthiness that have not been introduced in earlier studies and to broaden our understanding of the phenomenon. Another reason for choosing a qualitative method was that there are only a few studies in literature that concentrate on the trustworthiness of an e-vendor, and those studies would not have offered us a sensible starting point for conducting a quantitative study.

In order to acquire an understanding of the researched phenomenon, we decided to interview the users of an electronic grocery shop (EGS). The reason for choosing an EGS as the domain for our empirical study was that we assumed the users of an EGS would experience issues related to trustworthiness as being more important than would, for example, the users of electronic newspapers. In other words, we considered that interviews done in the context of an EGS would ensure us a richer description of the phenomenon.

To get into contact with possible interviewees, we worked with an EGS that put an advertisement on their web site with a link to the questionnaire concerning our study. The reason for putting an advertisement on the EGS's web site was the difficulty of finding actual users of EGS in some other way. We also offered a gift token worth 20 euros to all the respondents who were selected for the actual interviews.

The questionnaire contained some questions concerning consumers' personal values. Based on the answers given to the questionnaire, we selected possible interviewees for the interviews. At the end, 156 respondents answered the questionnaire. From them we selected 10 interviewees. All the interviewees had at least some experience in using an EGS, and most of them were frequent users. Five of the interviewees were men and five were women. One was under 30 years old, eight were between 30–50 years, and one was over 50.

The empirical material was collected during the summer of 2004. The method used to gather the empirical material was a semi-structured theme interview. The themes in the interviews dealt with the three dimensions of trustworthiness (competence, benevolence, and integrity). As an example, we asked the informants if the amount of information concerning the e-vendor on the EGS's web site was adequate. By asking that we tried to find out the interviewees' views on the integrity of the EGS. The final interview guide contained several questions concerning all three dimensions of trustworthiness.

Before the actual interviews, two test interviews were held in order to test the functionality of the interview guide. The first test interview revealed that there were some difficulties with the logic of the interview guide. Thus, the interview guide was modified before the second test interview. No problems arose in the second test interview, and the actual interviews took place. After the interviews the material was fully transcribed and analyzed.

The analysis of the empirical material was conducted as follows. Firstly, the interview material was read several times. Secondly, the transcriptions were sorted according to the themes of the interviews. Thirdly, issues that arose from the interviews based on our analysis were written in memos

and read again in order to make sure the idea of the informants was captured. Lastly, the narratives concerning the different themes were sent via e-mail to the informants in order to confirm that we had interpreted their thoughts correctly. Next, the findings of our study are presented.

IV. FINDINGS

Our findings indicate that most of the issues concerning trustworthiness of an EGS appear in the *competence* dimension. Altogether eight different competence-related issues appeared in the interviews. Two of them were sufficient payment methods and home delivery of the groceries. The interviewees were satisfied because they felt the EGS was competent enough in offering different ways to pay for the groceries. The following quote illustrates sufficient paying methods. The interviewee does not even remember which payment methods the EGS offers, because he was satisfied with the one he used.

“Researcher: Do you consider the (payment) systems adequate?”

“Interviewee: Yes, there were also some other systems, but I don’t remember them...”

Also the home delivery of products manifested the EGS’s competence, because the way the groceries were delivered was considered efficient among the interviewees. They did not want to consider any other way of delivery because, for example, they liked the way the groceries were put directly in their fridge, as the following quote illustrates.

“Interviewee: During the summer time I prefer to order from the EGS because the groceries are refrigerated while they are delivered and they place the groceries directly into my fridge when they arrive...”

Furthermore, the interviewees considered the appearance of the product deliverer and the opportunity to cancel or change the delivery as features of a competent EGS. The next quote demonstrates one interviewee’s view on a competent product deliverer.

“Interviewee: The product deliverer should be customer service-minded.. I mean to be kind and normal and he should also do what is agreed.. you know, hold to the delivery time and so on.. well, those are the things which effect most.. whether it is pizza or anything else that is delivered home, it depends on what the person is like.. whether he is kind or not...”

Furthermore, the interviewees perceived the opportunity to cancel or change the delivery as a feature of a competent EGS:

“Researcher: Do you expect to be able to cancel the delivery?”

“Interviewee: Well, yes..because it does not.. well, of course if the deliverer is behind your door then it is naturally unfair.. but the consumer protection law says that you can cancel the order within seven.. or was it 14 days, so of course I should have the opportunity to cancel it...”

In contrast, changing the product order without the consumer’s permission annoyed the interviewees, because the EGS they use sometimes changed the product and did not inform the interviewees about the change. Therefore, the EGS was considered a bit incompetent.

“Researcher: Has anything unexpected happened with the EGS?”

“Interviewee: Some products have.. some products have been replaced without notification.. they have only informed me about the change in an invoice...”

“Researcher: What do you think about that?”

“Interviewee: Well, of course they could call if they change something.. But actually, they have been good products and it has not irritated me much.. But if they can’t deliver even the replacement, then they should call and inform me...”

Also the quality of perishable goods and the accuracy of delivery time were something the interviewees did not consider positive regarding the EGS’s competence. Especially the quality of perishable goods made the interviewees suspicious and they did not want to order those.

“Interviewee: If I were to order fresh products I would be very cautious.. I would feel a bit suspicious about the quality of the products, because you can’t see the fresh products like vegetables or meat...”

Also the accuracy of the delivery time offered by the EGS did not please the interviewees:

“Interviewee: I would like to know the exact time when the products will be delivered.. you know, so that I know with at least 30 minute accuracy when the deliverer will deliver the products...”

“Researcher: I think at this moment they can promise you two hours’ accuracy...”

“Interviewee: I think I could accept that.. but it would be more nice if they could offer me one hour accuracy..”

One competence-related issue was considered either positive or negative among the interviewees. That was the price level of the products. Some of the interviewees considered the prices of the products competent. On the contrary, some said the price level is too high and therefore they considered the EGS incompetent.

“Interviewee: Well, compared to traditional grocery shops.. yes, the prices are higher but, naturally, you have to pay for the service, and if you consider our needs.. we order a big amount of food twice a week, so the delivery fee isn’t so high anymore.. if you think that some of us would go shop with our own car and buy food.. well, it would be more expensive”

One issue emerged in the *benevolence* dimension that emphasizes the trustworthiness of the EGS; the response to feedback. The interviewees stressed that if some problems occurred and they needed to give feedback to the EGS, they wanted a fast response in order to solve the problem. That reflects the benevolence of the electronic grocery shop. If a response to the interviewees’ feedback was given immediately, the interviewees felt the EGS is really thinking about their best. In contrast, the EGS was considered untrustworthy if the interviewees did not get any response at all, or if it took a lot of time to answer their question. Some of the interviewees also said they would not use services provided by such a company again. The next quote illustrates the issue.

“Researcher: If you give feedback to a service provider.. so what kind of reaction would you expect from them?”

“Interviewee: Well, I think it’s always positive if you are contacted personally, either via e-mail or telephone.. you know, nowadays everyone is quite busy like I am too, so perhaps I would prefer e-mail.. Then I would like to have an answer explaining what they are going to do with my problem and when and how they are going to fix it.. Of course, if they can not fix the problem I would like to have an explanation of why the problem can’t be fixed..”

The *Integrity* dimension revealed two issues concerning the trustworthiness of an EGS. The interviewees mentioned that they need some explanations about how their personal information is used. If no explanations were offered, the interviewees did not consider the EGS trustworthy, or did not use the service, because they were not sure who is

going to get access to their personal information and where or how it is going to be used. This refers directly to the integrity of an EGS.

“Researcher: What do you think about services that require registration?”

“Interviewee: Uuum.. I think they are ok, if there is a clear explanation of how they are going to use my personal information.. I mean.. they have to tell me if my personal information is going to be used in some other registers, too..”

Another issue that appeared in the integrity dimension was information about the service provider, products and prices. Information about the service provider was mentioned by many interviewees. They also said they search for information actively. Actually it seems that information about the service provider is a basic requirement that the interviewees wanted to find on the service provider’s web site. Some of the interviewees also emphasized the reliability of the information, namely that the prices and the quality of the products was as promised on the EGS’s web site. The following quote illustrates the importance of information from one interviewee’s point of view.

“Researcher: Well, what do you consider as important features of an EGS’s web site?”

“Interviewee: Uum.. important features.. Well, you know.. basic reliability.. that is important. Then of course.. if they say a product costs X euros and the delivery fee is X euros, then there should be the same amount on the invoice, too.. And quality is also important..”

This section presented the findings of our study. Next, the conclusions and limitations of our study are discussed.

V. CONCLUSIONS AND LIMITATIONS

In the current paper we discussed what meanings consumers give to the trustworthiness of e-commerce. According to our findings, we found eight competence, one benevolence and two integrity-related attributes of trustworthiness.

Compared to other studies concentrated on the trustworthiness of e-commerce (e.g. [3]), our findings revealed several new attributes of trustworthiness (e.g. sufficient payment methods, opportunity to cancel or change a delivery, response to feedback, etc.) that can be used in further research. Although our study was conducted in the context of electronic grocery shopping, our findings can be used, at least to some extent, in other contexts of e-commerce, too. For example, the opportunity to cancel or change a delivery, response to feedback, and the use of

personal information are examples of attributes that are usable in other contexts.

An interesting finding is that the competence dimension included eight attributes, but the other two dimensions altogether only three. Our findings raise a question: Are these three dimensions of trustworthiness, which are quite well accepted among e-commerce researchers, the most important ones? As mentioned earlier, literature regarding contexts other than e-commerce includes several other dimensions of trustworthiness, but only competence, benevolence, and integrity are adopted in e-commerce literature. However, our findings indicate that at least benevolence does not seem to be a very important dimension of trustworthiness from the consumers' point of view. Therefore, we can ask why cannot consistency and openness [12], for example, also be dimensions of trustworthiness in the context of e-commerce? We argue that also an e-vendor can be consistent and open, which could increase or decrease consumers' perception of trustworthiness.

Based on the preceding discussion, we argue that understanding the phenomenon of trustworthiness in e-commerce needs more attention, and especially more empirical research. The lack of empirical research makes the adoption of only these three dimensions somewhat vague. At least our study indicates that consumers are more interested in the e-vendor's competence than in benevolence and integrity. This generates a need to study the importance of these dimensions more deeply, but also to add other dimensions of trustworthiness suggested by earlier literature in the context of e-commerce, too.

The current study also has some limitations. Firstly, the number of interviewees is relatively low. However, the nature of a qualitative study is not to make generalizations, but to reveal new phenomena. The use of a qualitative study is well justified especially when there is a limited amount of empirical research concerning the phenomenon, as was the case in the current study, and the low number of interviewees, at least to some extent, can be excused.

Secondly, the current study concentrated only on the three dimensions of trustworthiness and ignored other factors that might have influence on consumers' perception of the trustworthiness of e-commerce. For example, consumers' past experiences in using e-commerce [19], [20], demographics like age and gender [21], and the service provider's web site (for example, the logic or usability of the web site) [5] were ignored in the current study, despite the fact that they are seen to have effect on consumers' behavior and trust in e-commerce. Therefore, it could be assumed that these issues might have an effect on the evaluations concerning the trustworthiness of e-commerce.

Our findings also have a practical contribution, because they brought up issues that consumers view as attributes of

trustworthiness or untrustworthiness. For example, an e-vendor can provide sufficient payment methods for consumers or provide an opportunity to cancel or change a delivery. Based on our findings, it could be argued that consumers' perceptions concerning the trustworthiness of an e-vendor are very important, because some of the interviewees mentioned that they simply do not use an e-shop that they perceive to be untrustworthy. So, our findings affirm that trust-related issues are very important, especially in e-commerce, as mentioned by many researchers (e.g. [1]).

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A Study of the Deployment of Open Source Software – Finnish Experiences from Public and Private Sector

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Abstract — The software development has become even more complicated for IT-companies and users of software. The rising popularity of open source in all areas of software development and usage is resulting in a need to evaluate more options in software procurement than before. This paper highlights some of the recent international and domestic research on open source deployment and gives some recommendations as to what official stand Finland should take.

Keywords — open source, deployment, public and private sector

I INTRODUCTION

The software development has become even more complicated for IT-companies and users of software. In addition to normal business decisions, they have to decide nowadays whether all or parts of the development work should be done in-house, or outsourced, or off-shored or open-sourced.

By now, most technology executives realize that the open source paradigm shift is something that has to be taken seriously [1]. Until now, the most common strategy has been to deny that open source software exists, or one insists it is somehow inferior to the commercial offerings. Growing popularity of open source forces the companies to accept that open source is here to stay and look where it fits in organizations' strategy as it is proving to be a viable option for commercial development [2, 3].

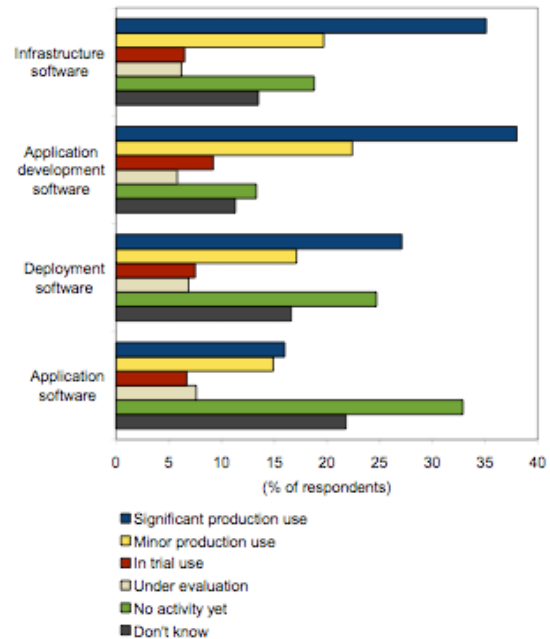


Figure 1. Current level of Open Source Software Adoption. (Adopted from IDC, 2006) (16)

The recent study by IDC illustrates this well going as far as stating that open source will hit all the parties in the value chain, makers, vendors and users of software [16]. The study analyzed over 5000 developers in 116 countries and found that developers worldwide are increasing their use of open source. Reading news and reports daily about how new companies are being formed and funded embracing the open source approach this is relatively easy to accept. However, for instance the largest pure open source vendor RedHat Inc. only counts its revenues in hundreds of millions rather than billions that many of its proprietary software vendors do.

So far open source has been making ways into infrastructure and developers who need tools to build their own applications have been happy to use the tools found in open source. Surprisingly, the data from IDC (

Figure 1) notes that even on the application side, which were supposed to be hard for open source to reach roughly fifteen percent out of 5000 developers worldwide saw open source in significant production use.

The trend has been noted also among the software users. Especially the public sector has been quick to endorse open source as a way to get equal or better productivity with less money. The proprietary software model is therefore under severe distress. An example of how traditional software companies are trying to cope with this change:

At LinuxWorld 2006, Scott Handy (Vice President of Open Source at IBM) said that: "IBM will begin to invest more heavily in open source client-side middleware, development tools, Web application servers, data servers, systems management, open hardware architecture, grid computing and technology services businesses. We plan a major expansion beyond Linux into open source. It's poised to be a more disruptive force in the industry in the next three years than Linux has been in the last 15 years. With open source beyond Linux, we'll be as aggressive and leapfrog right to the injection stage."

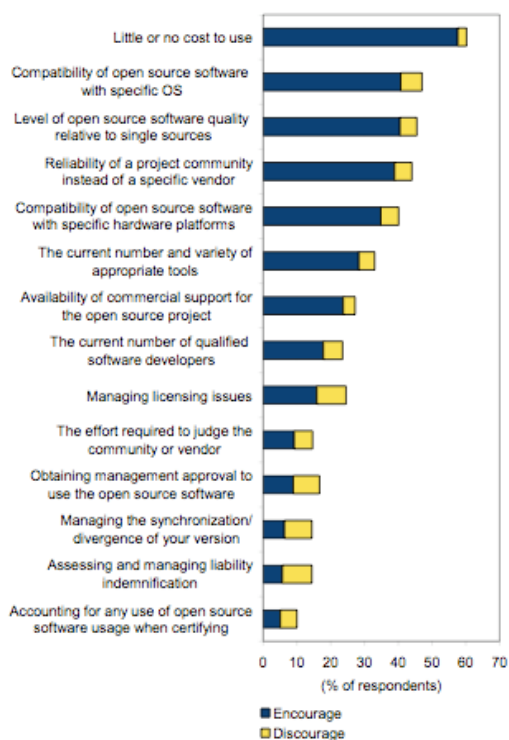


Figure 2. Factors encouraging/discouraging the adoption of open source software among worldwide developers. (Adopted from IDC, 2006)

Interestingly nowadays you can find mentions and even aggressive push towards open source from most companies in the software industry, including e.g. Nokia, Oracle Sun Microsystems and HP.

This is also increasingly true in Finland, which has been trailing the rest of the world after the glorious start with Linux. To date the Finnish Center for Open Source Software, COSS has attracted about hundred annual due paying members ranging from large multinationals to small enterprises and universities. Some young companies offering integration services, such as Movial, Nomovok and Reaktor Innovations have even managed to grow quickly to

50+ employee companies on natural growth without outside funding.

II OBJECTIVE AND METHOD

The objective of the paper is two-fold. Firstly, we clarify what is the official opinion of utilization of open source software in Finnish business environment. We explore what is the current situation in Finnish IT-environment regarding open source business, and estimates based on official reports and analyses what may (and also may not) be happening in the near future. The data utilized is official reports, descriptions, and statements of the representatives of government, municipalities and companies of private sector. Secondly, we compare the empirical results to existing theories about technology adoption. Pertaining to the public sector, we utilize also the economic theory of regulation. For private sector we will use the technology adoption lifecycle theory [4].

III ROLE OF THE PUBLIC SECTOR IN OPEN SOURCE IT PRACTICES IN FINLAND

The interest in open source and open standards has sharply risen during the last year in the Finnish public sector. So far the discourse has not happened on political level but instead among the IT-decision makers. However there is some anecdotal evidence that the politicians are also paying increasingly attention to the theme. The main apparent reason is the examples from abroad and especially the promising estimates of cost savings. For example, the Danish parliament has decided that Denmark will only use open standards:

"Parliament imposes on the government a duty to ensure that the public sector's use of IT, including use of software, is based on open standards."

The Government should adopt and maintain a set of open standards by January 2008, or as soon as technically possible, which can serve as an inspiration for the rest of the public sector. Open standards should be part of public IT and software procurement with the object of promoting competition.

The Government should ensure that all digital information and data that the public sector exchanges with citizens, companies and institutions, are available in open standards based formats." [5]

In addition, there is some research in Denmark that strongly backs the move. In so called Rambøll-report the estimated savings were up to 550 million kroner if the government moves to Open Office. The report included three possible scenarios:

"1. A transition to the Office Open XML documentation standard in the existing Microsoft Office versions would, in itself, result in the cost of approximately DKK 105 million. If it is assumed that the central government follows its current practice and, over a period of five years, updates its current Microsoft Office licenses (primarily Microsoft Office XP and 2003)

to the new 2007 version, the total costs would amount to approximately DKK 380 million.

2. *The costs of implementing the ODF standard while simultaneously switching office packages OpenOffice.org are evaluated as involving costs of approximately DKK 255 million.*

3. *The costs of implementing the ODF standard in the Microsoft Office packages are estimated as being marginally higher than the costs of scenario 1 (primarily due to greater conversion and support costs)."* [6]

In Finland the Ministry of Finance has been studying the use of open source and it is also involved in some EU projects to support open source but there are not concrete results. Moreover, the Ministry of Justice completed an evaluation, where it compared its software expenses [6]. By conducting a remarkable shift from proprietary desktop software toward open source, its software expenses would lessen sixty percent. The governmental IT development plan does not address open source directly but instead supports open standards and open interfaces.[7] Julkisen hallinnon neuvotteluryhmä (JUHTA; Public sector's IT-negotiation group) has also decided that it will cease developing its own XML-based document format and instead rely on ODF. [8]

It should be also noted that there have been some large-scale adoptions, which have not been really publicized, especially in Ministry of Labor and Finnish Meteorological Institute. Also, the Finnish army is using open source products in its IT-infrastructure but the exact details are (not surprisingly) public.

The National Technology Agency has taken a more proactive position [9]. They are proposing a R&D development program for the years 2006-2010, with a 120 million Euros budget with one of the key areas being the development of open-source based technologies and products. The explaining factors are here most likely the success of Finnish OS-startups (e.g. MySQL, Innobase and Emic Networks) and also Nokia's increased interest in open source.

Municipalities are another large consumer of IT in the public sector, with annual purchases of IT, services and hardware of 600 Million Euros. They lack centralized IT-strategy, which means in practice that the IT-structures vary widely. A specific working group (KuntaIT) has been created to tackle that problem. It is unlikely that the group will address directly open source but instead approach the theme using similar open standards-approach as the government has done.

The study conducted in the winter of 2004-2005 about usage of open source in the municipal sector in Finland notes that the municipalities have mostly practical approach to open source e.g. it is used similarly (albeit less) as proprietary software. The biggest obstacle by far for wider adoption was the lack of support from vendors [5].

The most well-known case in Finland is the city of Turku Linux project in which Linux-based desktop package was tested in 2001. Functionality of Finnish version of

OpenOffice and interoperability was tested against Microsoft Office. In the final report after test usage it was recommended that migration to Linux and OpenOffice should be made but the question got politicized in the city council and finally the decided against the recommendation. [11]

While analyzing the situation, we rely on public choice theory. The term public choice theory is a bit misleading because there is no single theory but instead of a wide range of approaches, which aim to use different tools from economics to model the decision-making of the public bodies. The strongest common factor between the approaches is that the different actors (politicians, bureaucrats, voters, lobbyists etc.) are being seen as rational homo economicus, which aim to maximize their own welfare. As a consequence the governmental decision-making is as prone to failures as markets are.

In this case in the most relevant sub-theory is public rent seeking:

"Rent seeking consists of legitimate, non-voting actions that are intended to change laws or administration of laws such that one individual and/or group gains at the same or greater expense to another individual or group."[12]

The theory predicts that companies, which benefit from extensive profits made with closed solutions, should lobby aggressively against any move towards open solutions. Unfortunately, we cannot present any direct evidence of this. Still, this could explain why Microsoft has been hiring politicians from high level positions to work as lobbyist (e.g. Mikael Junger, who used to be advisor the prime minister and Max Mickelson, who was the general secretary of the parliamentary group of the Coalition Party).

On the other hand, the companies, which have an interest in favoring open solutions, should counter-lobby Microsoft and others. Again, we cannot present any direct evidence of this.

Finally, also civil servants may have personal interest, which is not aligned with the public interest. For example, they may have made personal investments for learning certain architectures and a change would require additional work. In this kind of situation a civil servant might try to prevent the change unless there are some benefits, which counter the added personal costs.

IV ROLE OF THE PRIVATE SECTOR IN OPEN SOURCE IT PRACTICES IN FINLAND

The Research Institute of the Finnish Economy surveyed the usage of open source among Finnish software companies [8]. Companies using open source replied that 50% of their revenues is based on open source (32% in 2003 and 16% in 2000). The top three reasons for using open source were:

- 1) Independence from large IT-companies licensing and pricing policies,
- 2) Possibility for a small company to stay innovative, and
- 3) The use of open source lowers production costs in new products.

The survey concluded that the importance of open source has undoubtedly increased among Finnish software companies but as to what potential economic impact that has on the Finnish software industry is impossible to tell.

The size of Finnish software product business is still relatively small being 1.19 billion Euros in 2004 [9]. Representatives from this group claim that open source could destroy this potential industry segment in Finland [10]. Open source movement is challenging the license-based product business that many large incumbents (mostly US-based) have based their business on. Another well-known example of recent developments open source software area in Finland is Maemo.org. In the last year, Nokia launched a community to support the platform development for its tablet pc, Nokia 770. The platform is explained to be meant for developers with personal or commercial interests in developing software for handhelds. It is composed of open source software components which are deployed in the Linux desktop distributions. Various open source and creative commons licenses are used in distributing; however there are extensions which contain the non-free software [11].

V DISCUSSION AND CONCLUSION

While Finland had a glorious start into the world of open source with Linux, the adoption of Linux and other open source software has followed similar adoption patterns as with most new technology. Fifteen years has passed since the introduction of Linux and it is only now becoming a serious contender for business among conservative buyers who require not only technology, but also turnkey solutions with large companies providing support [4].

Open source utilization development both in public and private sector can be described as increasing enthusiasm. Enthusiasm has also transformed to concrete action in both sides, as above examples illustrate. When considering different areas of software industry, we may propose that these areas are positioned very differently in the S-curve of maturity (Figure 2).

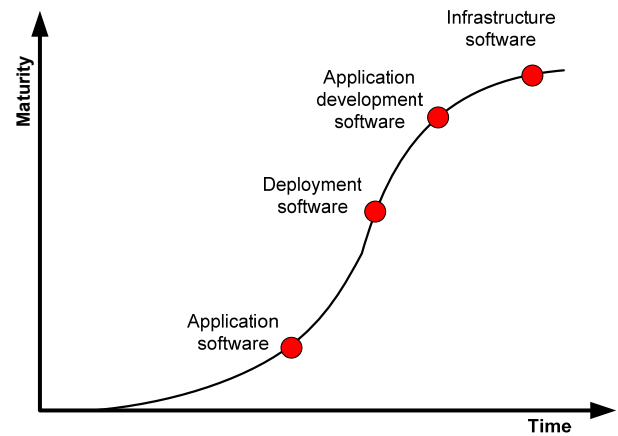


Figure 3. Levels of software adoption.

Looking at Finland's experience with open source from public (government and municipalities) and private sector view we may suggest the following:

- 1) Public debate is similar to what is taking place internationally.
- 2) Open source is growing in importance in Finland's private sector as companies' are increasingly basing their business on it.
- 3) Finland seems to be taking an aggressive approach into building new open source based businesses through new government grants and training programs in 2006, even as there are still only early indications as to how sustainable and profitable open source businesses will be as there are only few companies that have managed to find and execute profitable business models in open source.
- 4) Finland's public sector has so far tried open source desktop applications in small scale, that the impact and potential cost issues of larger deployment can only be estimated.
- 5) Finland's public sector is reluctant to test new software environments as a user until conclusive evidence about its benefits can be seen elsewhere.
- 6) While open source has gained a lot of ground in the public sector on the server side, desktop applications still have long way to go to reach popularity that would threaten the popularity of applications of Microsoft's etc.

As a comparison, the United States has defined its defense organization (DoD) to take in a way a selfish approach to software acquisition; firstly they look after their own interests and secondly at the interests of the U.S. domestic software industry.

U.S. National Interest

DoD has two competing interests:

- 1) Provide for the defense of the U.S., and;
- 2) Support and grow the U.S. industrial base, which provides materiel and systems so that DoD can accomplish its mission.

These trade-offs are well understood for physical goods and services, but not as well understood for digital ones. DoD can easily calculate the cost difference between developing or acquiring a physical good or service by simply comparing make or buy costs. There is however a fundamental difference between physical and digital products. Digital goods (software code, music, movies, etc.) once created can be copied perfectly with relative ease: limiting distribution enforces scarcity, but that scarcity is arbitrary and negotiated, rather than an innate property of the product. Software's ability to be replicated also means it can be incorporated into other software systems without "using up" the original component, as one would with physical components.

The business model of purchasing physical goods and services has served DoD well in the past; but it falls short when applied to software acquisition. By treating DoD-developed software code as a physical good, DoD is limiting and restricting the ability of the market to compete for the provision of new and innovative solutions and capabilities. By enabling industry to leverage an open code development model, DoD would provide the market incentives to increase the agility and competitiveness of the industrial base.

Currently within DoD, there is no internal distribution policy or mechanism for DoD developed and paid for software code. By not enabling internal distribution, DoD creates an arbitrary scarcity of its own software code, which increases the development and maintenance costs of information technology across the Department. Other negative consequences include lock-in to obsolete proprietary technologies, the inability to extend existing capabilities in months vs. years, and snarls of interoperability that stem from the opacity and stove-piping of information systems.

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A study of the uptake of Information Security Policies by small and medium sized businesses in Wales

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Abstract — Over the last few years the risks that threaten Internet connected computer systems and the business critical information stored on them have been widely publicised. To address these threats many companies have implemented security measures, to protect themselves.

Current research indicates that use of an information security policy alongside the actual implemented security measures can greatly minimise such threats. However implementation of such a policy can be expensive and not feasible for Small businesses.

This paper presents a study of Small businesses in South Wales that use a mixture of Internet connected standalone computers and Local Areas Networks (LANs). It looks at the security measures they have in place and whether or not they have an information security policy. Findings show that most Small Medium sized businesses do not have such a policy document, but many are using components that would normally form part of such policy, within their staff employment manuals. This is a much cheaper and less time consuming way of using the more important and relevant components that usually make up such a policy.

Keywords — Information Security Policy, Internet Usage Policies, eMail Use Policies, Password Policies and employment manual and staff manuals

I. INTRODUCTION

An Information Security Policy is a document that is used to provide direction and support for a company's information security in accordance with a business's requirements and relevant laws and regulations [1]. In addition, it covers a series of rules, guidelines and policies that staff must abide by in order that security measures already implemented are as effective as they can be.

The main purpose of such a policy is to inform users, staff and managers of their obligatory requirements to protect technology and information assets. The policy should

specify the mechanisms through which these requirements are to be met.

Current research indicates that use of a formally defined and documented Information Security Policy alongside a company's or organisation's actual implemented security measures can greatly minimise potential security threats [2]. Unfortunately, many Small businesses fail to implement such a policy and so suffer the consequences of a security breach brought about by these threats. Often companies could have avoided such breaches if they had an Information Security Policy document in place.

Research conducted by the Department of Trade and Industry (DTI) showed that only 34% of Small businesses (1-49 employees) and 45% of Medium sizes businesses (50-249 employees) in the UK had a formulated, defined and documented Information Security policy [3].

In Wales, Small Medium sized Enterprises (SMEs), made up more than 99% of all businesses [4] in 2005. SMEs are defined as companies with less than 250 employees and less than €50turnover. These provide approximately 60% of all private sector employment and more than 40% of turnover [5]. Increasing Information and Communications Technology (ICT) and electronic commerce (eCommerce) use by SMEs in Wales is expected to be an important driver of economic growth and productivity of these companies.

Research conducted by the DTI in 1999 revealed that Wales had the lowest use of Web sites and eMail in the UK [6]. This led to the creation of the Opportunity Wales (OW) programme in 2000 to address this problem. The purpose of this programme has been to help Welsh SMEs

increase their use of eCommerce and in turn help Welsh businesses catch up with their UK counterparts.

More recent statistics also reveal Welsh SMEs having a lower usage of the Internet and associated eCommerce activities than the UK average. Research conducted by OW [7] showed that Small and Medium sized companies in Wales generally had a lower uptake of Internet access when compared to the UK average [8] as shown in Table 1 taken from the ONS (Office of National Statistics) study. It is interesting to note that the average uptake of Internet access by Micro sized companies of 1-9 employees (Micros) was actually higher in Wales than the UK.

Table 1 Comparison of Welsh and UK SMES with Internet access

SME size	ONS 2004 UK [8]	OW 2006 Wales [7]
Micro (1-9 employees)	61.6%	66.1%
Small (10-49 employees)	82.6%	72.4%
Medium (50-249 employees)	97.3%	71.4%

By comparing the DTI's "Business In The Information Age International Benchmarking Study 2004" [9] report figures for SMEs in the UK with a Web site, against figures for Wales gleaned from the State of the Nation Report 2005/2006" [7] report, it can be seen that less Welsh SMEs have a Web site than those on average in the UK [Table 2].

Table 2 Comparison of Welsh and UK SMEs with a Web site

SME size	DTI 2004 UK [9]	OW 2006 Wales [7]
Micro (1-9 employees)	51%	57%
Small (10-49 employees)	77%	68.4%
Medium (50-249 employees)	89%	72.7%

The comparison of UK and Welsh studies showed that SMEs in Wales have a lower use of eCommerce than the rest of the UK. Those that do use eCommerce need to have good security policies in place to help protect their Internet connected IT systems from the risks that threaten them. Due to Welsh SMEs having a lower use of eCommerce compared to the UK average it has been assumed that Welsh SMEs would also be less inclined to use such policies.

Companies not using such policies are less well protected leaving their IT systems more at risk to security breaches.

Examples of security breaches include viruses, hackers and staff misuse. This increases the likelihood of IT systems facing down time which, in effect, threatens their day-to-day eCommerce capability.

In 2004 the DTI produced UK average figures showing the numbers of Small and Medium sized businesses that have Information Security policy documents [3]. Unfortunately the results were not split into regional areas and hence no figures exist for Wales.

Extensive searches were conducted across the Internet for reports, conference papers and journal papers, detailing the numbers of Welsh SMEs with a formal Information Security Policy document. Unfortunately, it was not possible to determine any figures detailing this information. Hence, one of the main objectives of this study has been to find out these figures and also to find out what barriers might be preventing businesses developing such policy documents.

II. RESEARCH METHOD

The main goal of the study was to investigate whether Welsh businesses are adopting Information Security Policy documents at a slower rate than other regions of the UK. The study also aimed to find out to what extent Welsh SMEs were using Information Security Policy documents or alternatives. The study also looked into how Welsh SMEs were implementing the various IT usage policy components usually found in Information Security Policy documents.

Research was conducted by contacting 500 SMEs residing in Wales. Details of suitable SMEs were supplied by OW.

To answer the question of whether Welsh SMEs were less likely to have an Information Security Policy document than those on average in the UK, we used figures attained from the DTI Information security breaches survey 2004 to acquire the UK statistics and carried out a two staged survey for the Welsh statistics.

For the purpose of this research into how Welsh businesses are using Information Security Policy documents, our survey examined only one category, defined as a SME. However, unfortunately, the DTI's UK figures were split up into two categories of Small and Medium sized businesses in order to make a comparative study a weighted average of the two DTI categories was determined. This weighted average was then used to compare the results with the proposed Welsh average from the proposed study.

To determine the content and prevalence of Information Security Policy document usage amongst Welsh SMEs the study was broken into two phases:

Phase one

A total of 30 companies were initially selected from the list of 500 SMEs supplied by OW. In March 2006 a letter requesting an interview was sent to each, followed up by a telephone call requesting an interview. A total of fifteen SMEs agreed to be interviewed at their own premises, conducted using a preset questionnaire. Phase one was conducted as a pilot study. The questions asked concentrated on finding out the security measures that the SMEs had in place and whether or not they were using Information Policies and their components.

Phase two

Based on the answers given by SMEs in the pilot phase, a more detailed questionnaire was devised. This questionnaire used more specific questions than previously used in phase one as it was now known to what extent Welsh SMEs were using an Information Security Policy.

The resulting questionnaire was then used to carry out the research for phase two by means of a self administered postal survey to the remaining 470 SMEs in July 2006. The main aim of the survey was to gain a much larger sample of answers from SMEs across Wales and their usage Information Security Policies.

The survey enquired whether the companies used traditional constituents of an Information Security Policy e.g. an Internet usage policy, and whether these were documented within an Information Security Policy, an Employee/Staff manual or some other source, and whether these also contained specific user responsibilities. It also enquired about barriers that might be holding them back from formulating these constituent policies and how these policies were enforced if they did use them.

III. RESULTS

The data from phase two of the research was analysed in August 2006. The response rate to the postal survey sent out to 470 OW clients was 15.5%. The respondents were a mix of sole traders, Micro, Small and Medium sized companies representing a broad spectrum of all industry sectors from tourism to manufacturing.

The results, as were predicted, show that Welsh SMEs do indeed lag behind the rest of the UK in terms of using Information Security Policy documents. The weighted average of the DTI survey conducted in 2004 for Small and Medium companies in the UK with an Information Security Policy document was 34.1%. The comparable Welsh SME figure from phase two study was considerably lower at 5.5% as shown in Table 3.

IT usage policies are component policies that usually form the contents of an Information Security Policy document. Our results show that a large proportion of Welsh SMEs do not actually have any IT usage policies (53.4%) and those

that do, favour documenting them within a staff/employee manual (12.3%) rather than an Information Security Policy document (5.5%) [Table 3].

The phase one pilot research also found that those SMEs that documented their IT usage policies used them as part of an Employee/staff manual much more frequently than they did in a full Information Security Policy document.

Table 3 How Welsh SMEs document their IT usage policies

Response	% of Businesses
Have an Information Security Policy document	5.5%
Staff/Employee Manual	12.3%
Other	2.7%
Not documented	35.7%
Do not use any IT usage policies	53.4%

Just under half the SMEs that responded to the survey stated that they used IT usage policies to help protect their IT systems from security breaches 46.6% [Table 4].

Table 4 Welsh SMEs that use the sort of IT usage policies that are likely to form part of an Information Security Policy document

Response	% of Businesses
Use constituents	46.6%
Do not use constituents	53.4%

Research results show that 64.7% of Welsh SMEs that use IT usage policies within their businesses do not have these documented in any way [Table 5]. The most usual way of documenting these policies appears to be within a Staff/Employee manual (29.4 %) with only 11.7% keeping them within an Information Security Policy document [Table 5]. Many of the companies who did not document the IT usage policies that they use within the company stated that their staff are made aware of the policies orally via management and colleagues.

Table 5 How companies using IT usage policies usually found in an Information Security Policy document keep a record of them.

Response	% of businesses
Information Security Policy document	11.7%
Staff/Employee manual	29.4%
Other	5.9%
Not documented	64.7%

The most popular IT usage policy used by Welsh SMEs are Password policies. It was found that 79.4% have a Password policy [Table 6]. It is encouraging to see that so many Welsh SMEs are taking on board the importance of a Password policy, as passwords are the computer system's front line defence against being breached by an intruder. This is why it is important to have a Password policy that specifies that staff use adequately secure Passwords.

Other popular policies used by Welsh SMEs are for Computer equipment usage (52.9%), eMail usage (50%)

and Internet usage (50%) [Table 6]. Rather worryingly though are the low numbers of companies using Instant Messaging policies, especially in recent times when virus writers, hackers and phishing scammers have targeted users of these services.

More than 15% of respondents stipulated that they used other sorts of policies within their companies. These included:

- Data protection policies;
- Equal opportunities policies;
- Environmental policies;
- Staff sickness policies;
- Disciplinary policies;
- Grievance policies;
- Fire safety policies;
- Health and safety policies.

Table 6 Constituent IT usage policies usually found in an Information Security Policy that Welsh SMEs are using

Response	% of businesses using IT usage policies
eMail usage policy	50%
Internet usage policy	50%
Instant Messaging usage policy	20.5%
Password policy	79.4%
Intellectual property rights policy	32.3%
Computer equipment usage policy	52.9%
Other	15.2%

Results for the survey question asking how SMEs make staff to adhere to their IT usage policies, were gathered in our survey through an open question. In this qualitative data gathering exercise respondents were requested to give their own answers rather than choose from a selection of pre-written answers.

Research results show that the most popular ways for Welsh SMEs to enforce their IT usage policies on their staff is through staff training (38.2%) and trust (38.2%) [Table 7].

Table 7 How SMEs get staff to adhere to their IT usage policies

Response	% of businesses
Surveillance	8.8%
Supervision	8.8%
Staff Training	38.2%
Trust	38.2%
No answer	17.6%

Over 25% of respondents said that as they were a sole trader they had no need for an Information Security Policy document or IT usage policies. The main reason for this is because they had no staff on which to enforce such policies. [Table 8].

Many SMEs also thought that such policies were not needed within their businesses because they were too small (2.6%) or were family run (10.3%) [Table 8]. Many family-run businesses may feel they do not need to use IT

usage policies as they expect family members to be trustworthy. It is not always about trustworthiness; it is often about staff having the knowledge to know how to use Internet connected computer systems in such a way that they avoid making the possibility of computer breaches more likely. That is why it is still important to have some IT usage policies in place even if you do not enforce them. The same applies to the 2.6% of respondents that thought their businesses were too small to warrant using IT usage policies.

Just over one fifth of respondents put the barriers down to a lack of time (20.5%) but only 2.6% cost [Table 8].

One respondent to our survey who did not have an Information Security Policy or any IT usage policies documented quoted the following:

“If we were sent a standard small business policy document we would probably adopt it but have not time to sit and think something like this through at present.”

Table 8 Barriers stopping Welsh SME developing an Information Security Policy document or IT usage policies that normally form constituents of such a policy document.

Response	% of businesses
Family run	10.3%
Business too small	2.6%
Lack of time knowledge	20.5%
Sole trader	25.6%
Cost	2.6%
No business benefit	7.7%
No answer	25.6%
No need	13%

Half of SMEs [9] that took part in the survey who were using either an Information Security Policy document or Employee/staff manual had incorporated compliance within employee contracts.

Table 9 SMEs using an Information Security Policy document and/or a staff manual that have incorporated compliance to these within employee's job descriptions within their contracts.

Response	% of businesses
Yes	50%
No	50%

Half the businesses using Information Security Policy documents or staff/employee manuals include some user responsibilities within these documents. Examples of these responsibilities provided by SMEs taking part in the survey include:

- “To backup data once a month this will change to once a day from 1st of September and for Anti-virus software to be updated every four weeks;”
- “The need for vigilance in all aspects of Internet use;”
- “Backup and Security awareness;”

- “Varies depending on the role of the Person in the organization;”
- “Responsibility for downloads, content. Virus and backup protection;”
- “General rules on Running of Anti-virus and Spyware software.”

Table 10 SMEs that include user responsibilities in their Information Security Policy document or staff manual.

Response	% of businesses
Yes	50%
No	50%

IV. DISCUSSION

Internet, eMail and computer equipment usage policies all serve the purpose of providing guidelines to company employees on their acceptable and unacceptable usages. If followed, these policies should reduce the likelihood of users falling foul of eCrime e.g. hackers, virus writers, phishing scammers etc. who target users of Internet connected computers. Encouragingly, 50% [Table 4] or more of SMEs in Wales that have IT usage policies actually implement them. This figure needs to be increased over time as they can help play an important part in protecting a company's Internet connected IT systems from the sort of security threats just stated above. One would certainly recommend that SMEs do take the time to develop these policies.

Instant messaging service users are often the target of attack through malicious code and phishing scams, making it important that companies make sure their staff use these services in a way which minimises the potential of security breaches. A good way to do this is by developing an Instant Messaging Policy for staff to follow, outlining how they can and cannot use such services on company computer systems. Unfortunately, as our results show, only 20.5% [Table 4] of Welsh SMEs that use IT usage policies within their businesses have one for Instant messaging services.

Many of the SMES taking part in the survey said that the biggest barriers to them developing and using IT usage policies were “Lack of time and knowledge.” One company even stated “If we were sent a standard Small business policy document we would probably adopt it but have no time to sit and think something like this through at present.” In addition to this and the known importance well written IT usage policies can play within a business as part of an Information Security Policy document or a Staff/Employee manual. It looks like these barriers could easily be removed by SMEs being provided with advice on how to draw up such policies, maybe using a template detailing the likely contents for policies. Thus, allowing them to draw up their own policies and use them in either an Information Security Policy document or as seems more the case in Wales a Staff/Employee manual.

In fact “Business eye” do provide free advice and templates to businesses in the Wales area on such matters to enable SMEs to develop such policies so such barriers should not have less of an impact. More likely it is a lack of knowledge of how important such policies can be to businesses which prevents these businesses developing them

Some of the businesses that took part in our survey said the biggest barrier to them developing IT usage policies was a lack of perceived benefit [Table 6]. However, if they looked at the cost of developing such policies within an Employee/Staff manual or Information Security Policy document compared to the costs suffered by companies that have suffered a security breach, they would see that the cost benefits would fall heavily on the side of developing such a document.

Only 50% [Table 9] of businesses that took part in our survey who have an Information Security Policy document or Employee/staff manual have made sure that compliance is written into staff job descriptions and within their contracts. By doing this if a staff member breaks one of the policies he or she has broken their contract and hence is legally in breach of it. Without doing this the policies carry no weight and cannot be used for any legal purpose or disciplinary procedures.

It is important that companies include user responsibilities - procedures they have to carry out, for example each computer user is responsible for downloading patches for their operating system and backing up their own work files onto a CD-ROM every week. These help protect company IT systems from possible security breaches. Unfortunately, only 50% of those SMEs with such policy documents included such responsibilities.

V. CONCLUSIONS

Welsh SMEs that have IT usage policies tend not to have them documented and those that do appear to favour keeping them within a Staff/Employee manual rather than in an Information Security Policy document. This probably stems from this seeming a more practical place to store these. Especially when you consider that many would already have such a manual containing company non IT usage policies and guidelines, so adding IT usage policies would be a fairly straight forward task. Whereas drawing up an Information Security Policy document from scratch would more than likely seem a much larger task than developing and adding new IT usage policies as and when they are needed to your company's Staff/Employee manual.

Those companies in Wales who currently state that they use IT usage policies but do not document them need to start doing so. It is important that company IT usage

policies are documented so staff are aware of them and adhere to them.

The findings as a whole suggest more work is needed to encourage Welsh SMEs to use Information Security Policies, or as seems more likely from this research, Employee/staff manuals as part of a strategy to address their company's IT security. This could perhaps be achieved by carrying out research looking into the costs endured by SMEs that have previously fallen foul of security breaches, which they would have been protected from if they had a policy document in place. This research could be used to show SMEs in Wales the potential costs of not having such a policy document in place and used in conjunction with business support services to help and encourage businesses in the development of a policy document.

ACKNOWLEDGEMENT

This paper is an output of the Opportunity Wales Advance project (Ref 55255), an Objective 1 programme funded through the Welsh European Funding Office and was produced by members of the eCommerce Innovation Centre research team. The authors wish to acknowledge the financial support given by the Welsh European Funding Office.

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Acquiring skills for virtual multicultural teams through a business game

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Abstract — In our contribution we will analyze typical behavioral factors coming up in virtual multicultural teams, thus in teams working together across geographical boundaries by communicating mainly by the use of electronic media. With the help of an online business game we aim to find innovative ways to train team members and leaders to acquire skills required for efficient virtual multicultural teamwork and communication. Students' data will help in a first step to find out more about the factors influencing virtual multicultural teams and will, as a second step, serve as a basis for creating a virtual team training for business.

Keywords — virtual multicultural teams, virtual team skills, virtual communication, training

I. INTRODUCTION

Along with globalization of business also the way of organizing work and accomplishing tasks has rapidly changed from founding of traditional organizations and teams towards formation of project teams that are loosely coupled and literally distributed around the world. Virtual organisations may one day be built more from outsourced functions or even processes, than from owned or member-determined organisations [1], [2].

Even today, most of larger business organizations, to some extent, employ virtual teams to develop new product, support customers, solve problems, conduct strategies or market their products worldwide [3], [4]. The reasons behind this development are manifold, but obvious: 1) forming of a virtual team takes only minimal time as best experts located in different countries / units can be 'brought' together to work on a common goal immediately without them having to move from one country to another, 2) remarkable savings in travel time and travel expenses are gained as team members utilize modern telecommunication technologies in their intercourse 3) the organization becomes more competitive due to increased flexibility as

reforming and dismantling a team with no established personal ties between the team members is easy [4], [5].

However, working in such a virtual team — i.e. collaborating with partners who are geographically dispersed and thus not only unseen, but more or less unknown, by primarily using electronic media — brings along many challenges compared to "traditional" team work. Examples are not only linked to the mastering of new technologies, but to dealing with virtual communication as such. Furthermore there are challenges related to leadership, power development, information sharing, establishing effective working relationships, creating commitment and feelings of belongingness, but also challenges related to multicultural composition of most virtual teams [4], [6].

These challenges are often underestimated by companies but might end up in disastrous outcomes such as total failures in trying to build well-functioning multicultural teams just by picking up the best experts without securing their compatibility as a team [3], [7]. In international organizations such problems are not new as poor post-acquisition integration and adaptation of personnel is reported to be one of the most typical reasons for the failure of international mergers [8], [9].

There are two parallel schools of research on virtual organizations: the information systems approach that puts the emphasis on the new technology and ICT solutions as the elements of virtual working context and the organizational behavior approach that focuses on the human aspects of working in virtual organization. A vast majority (45-50%) of the recent research on *virtual teams* within organizational and business studies has concentrated on leadership issues, whereas clearly less interest has been devoted on studying virtual working as such (10-15%). Equally low is the number of studies on virtual communication (10-15%), only part of which then is targeted on multicultural communication challenges in a

virtual work context.¹ Not only is there an obvious shortage of theoretical knowledge based on empirical research on virtual multicultural teams [10], [11], but also urgent need for high level training for virtual teams [4].

II. PURPOSE AND DEFINITION

Even though the ICT technology plays an important role in the communication and co-operation within a virtual team as well as in their contacting with other actors e.g. teams and customers, it is not in the focus of this study. Instead this study relates to organization psychology, intercultural studies and leadership theory by putting the emphasis on behavioral and communicational aspects in a virtual team. **Thus, in our contribution we will analyze typical behavioral factors coming up in virtual multicultural teams in order to find innovative ways to train team members and leaders to acquire skills required for efficient virtual multicultural teamwork and communication.**

In this study a virtual team is understood as a group of geographically and/or organizationally, but many times also temporally dispersed knowledge workers that is brought together across time and space by the help of ICT to work on important tasks while physically remaining apart. In such a team networking (i.e. communicating, gathering and sharing information, collaborating and making decisions) primarily takes place without face-to-face contact of the team members [10] - [13].

III. METHOD AND PROCESS

A. Virtual Team Project as a Research and Training Experiment

We present the concept and first insights of a training module for virtual multicultural teams. The idea behind and first step of the project which relates research and practice is a virtual team project among business students at two universities, namely the Johannes Kepler University, Linz (Austria) and the Turku School of Economics (Finland) including an online business game and some training sessions. As a second step these virtual team training and research sessions are carried out in real teams of MNCs. First experimenting and studying the virtual training module with the business student groups gives us a possibility to utilize the experiences gained for developing the training to better meet the needs of real teams in MNCs.

The teams in both the students and the business project are formed around playing RealGame™²— an online business simulation game that involves the participants in continuous real-time decision making on typical business processes in a multinational production company.

RealGame™ includes most important core functions of a business organization out of which each team represents one.

RealGame™ is a training environment for companies in a continuously changing environment. Being real-time processed means that the participants are part of the business processes and, that the company functions are transparent in the game. Everything taking place inside the simulation game company as well as the external business transactions can be seen on the screens of the participants' computers. One of the original purposes of the RealGame™ training has been to give the participants a holistic view on the processes of a MNC — ability needed for integrated corporate thinking. Particular aspects affecting the company performance, such as the delivery problems of ordered goods/payments or time lag in international trade also being faced enlighten the delay between planning and execution.

More importantly, in this particular research experiment, the team members are confronted with challenges stemming from cultural differences and physical distance within and between teams. All of which train the team members to cope with the increased demands for communication, cooperation and teamwork between functions and cultural groups. Doing business in a highly competitive environment makes the participants better prepared to cope with the ever-increasing pressure for better financial results, but also gives us researchers a possibility to study teams' ability to use their full expertise in virtual multicultural context.

In other words, the experiment has value in terms of training and research. During the game, students will not only be confronted with the complexity of processes within a production company but also gain valuable team experience — virtual and multicultural — by playing the game in the small competitive groups.

B. Research Setting and Data Gathering

For comparative purposes four types of teams, each consisting of 3-4 members, are formed: mono-cultural & physically in one location, mono-cultural & physically dispersed, multi-cultural & physically in one location, multi-cultural & physically dispersed. Optimal number of teams in one simulation game is 8, which respectively thus allows a class of 24-28 students. A game setting in which teams communicate and negotiate with other teams (and in dispersed teams also within teams while making decisions) only via electronic media (e.g. e-mail, Skype), makes it possible to study the challenges and limitations of virtual communication.

Teams are observed by the researchers during their playing, and by making ad hoc surveys on the team processes if seen necessary. At different points of time their team work will be evaluated by conducting qualitative interviews on single issues of the process. Further, and even more importantly the participants are asked to write reflective essays where they report about their individual

¹ Figures resulting from article search on business related journals in Ebsco, Emerald and Abi inform databases since the year 2000.

² Developed by PhD Timo Lainema, Senior Researcher, Turku School of Economics

experiences during the game, key issues and critical incidents.

The first step will concentrate on students only but the data gained there will serve as a basis for designing the training setting for the managers. Basically, we see a lot of similarities between those two groups of society although we are aware that there are certain differences between them as well. In the business context, some issues might play a bigger role than among students³: power, for example, is primarily a question of functions, financial resources and organizational structures and only secondly of issues such as better expertise, organizational skills, or personality (as it has been the case in former students groups). Age and gender have more influence in management than among students as in the group of the latter, there are no big age differences and gender equality is more or less executed at universities. Further, roles and functions are somewhat predefined in management teams whereas the self-managed student teams can choose task distribution and roles on their own. Similarly, leaders are most often predetermined and officially nominated in business. The students in our settings can feel free whether to nominate a leader or not.

But despite of those (small) differences, we see a chance for students to gain insight into real business settings, and an opportunity to create management training with relevant and appropriate tasks and issues.

C. Method

Especially the reflective essays but also the qualitative interviews were then analyzed by grounded theory method. Grounded theory provides the possibility to find out more about meanings, explanations, situational as well as contextual factors of social phenomena, and can be regarded as an appropriate method for cross-cultural research. Further, it seems especially helpful for our purpose as it aims at generating rather than testing theory and is an adequate tool for combining theory and practice [14], [15].

The aim of our analysis is to detect different factors contributing to the processes and team dynamics in virtual multicultural teams. Following the suggested process for analysis [14] - [17], we read each paper thoroughly ("line-by-line-coding") and filtered out statements suggesting issues influencing the students' collaboration.

Descriptive key and descriptive key words ("codes") emerged from relevant statements. Examples for those in our study were consensus, dominance, no answer, silent or small talk. Those codes which followed a similar pattern were then grouped into the same category (i.e. broader issues). The long list of upcoming codes was then reduced to categories such as decision making, leadership, communication style, or communication pattern. At the end, the categories allowed a conclusion to factors influencing

the process of virtual multicultural teams. As such communication, negotiation, leadership, power development, or cultural sensitivity came up. These factors were then compared to existing literature in order to find theoretical explanations and backgrounds.

Based on those influences and on challenges known in virtual teams in terms of previous studies and our tentative results, we have developed a VMCC training module in which the team members can acquire and train typical skills required in virtual teams, especially on virtual communication. As already mentioned above, we will take the multicultural composition into account as well, by composing the teams differently (monocultural, highly diverse in cultures, token members in monocultural teams, multicultural but dispersed etc.). Thus, we can also find out more about cultural differences and their impact on virtual team work, both within and between groups.

Role plays, mini-cases, discussions, simulation games as well as theoretical knowledge serve the students/participants to learn and train the abilities in question (e.g. cross-cultural negotiation, leading a virtual multicultural team, cultural sensitivity). In order to use them in practice and to verify their relevance, RealGame™ will be played again after the training session. After this first step, the same procedure will be used for companies who want to provide training to their virtual team members.

In the company context we will additionally use interviews of the key people in the company beforehand in order to identify particular problematic areas of knowledge sharing and cooperation. The VMCC -training module will then not only contain training for typical business skills required in virtual multicultural team work but also for special abilities in virtual and multicultural communication.

IV. TENTATIVE RESULTS

From a preliminary analysis on the first validation round and from former virtual team projects with students we have already some idea about what factors, and how, come up in virtual multicultural teams⁴. By making them visible in the VMCC -training it is possible to enlighten to the virtual team members these factors' role in the functioning and performance of the team. These issues are for example team leadership, decision-making, power distribution, trust, the role of language, technical problems and for sure issues associated with virtual and cross-cultural communication.

³ Former interviews with managers for different projects on multicultural and virtual teams as well as our own practical experience have revealed those issues to be different between managers and students.

⁴ In previous semesters, different virtual team projects have been conducted. In order to guarantee a comparability and a certain variety at once, different schools were involved (e.g. Richard Ivey School of Business, Canada; ESADE, Spain), different tasks had to be completed (e.g. case study, seminar paper, negotiation or creative task), and students were coming from different cultures. What remained the same was the task to write a 3-5 pages reflective essay at the end of the project reporting about critical incidents, experiences, learnings etc. The analysis of all those essays showed exactly the same factors coming up than in the RealGame™ simulation. The students in these virtual team projects came from very different cultures such as Canada, US, Czech Republic, Poland, Spain, France, and for sure Austria and Finland.

Interestingly, in former studies using totally different approaches and methods, exactly these issues have been pointed out as the most important elements for training designs for virtual teams as well [4], [11], [18].

Some statements taken from the students' essays (from both the RealGame™ experience and former virtual team projects) shall provide some insight into the data and upcoming topics:

Concerning the issue of leadership, for example, a Finnish student wrote: *"We did not have a leader because of the fact that none of us had bigger knowledge than the others."* or *"Not having a leader made the game more interesting to play."* What was interesting, are the cultural differences in the wish to have a leader as well as in the role this leader should assume. Whereas Finns strive for equality and do not want someone to have more power than others in case there is no obvious reason for it, such as expertise (compare also to the power distance dimension [19] which is very low for Finland⁵, other cultures rather demanded a leader who is often associated with autocratic decision making and authority. *"The only thing why I participated was that we had an autocratic leader."* or *"There was no real decision making process, there were too many in the group. A leader would be required."*

When it comes to decision making, cultural differences were again reflected in the statements of the students. Whereas the Finnish students strived for democratic and consensus-oriented decision making *"In Finland we prefer democratic decision-making, an idea should be discussed with others."*, *"Democracy is easy to achieve when everybody has equal status in a team."*, the Austrians wanted a *"rational and effective"*. Students from other cultures stated, for example *"The US students decided quickly, the French analyzed much."* or *"There are differences between Eastern and Western Europe: whereas Western cultures decide quickly, easily and in cooperation, the Eastern European countries have difficulty in using their skills."* As decision making is also related to cultural differences [19], [20], the issue becomes more complex in a multicultural context.

In most of the students' teams, power was said to be distributed rather equally. But reading their individual reflections, it came out that power distribution did not occur obviously but rather hidden in form of better linguistic skills *"Being the only native speaker in our group I think that was my advantage in participation. Not only was the game written in English, but I could effectively communicate my ideas, and therefore they were used more often"*, personality *"One male was a bit pushy and arrogant in his statements and decisions. He tried to be a leader without even getting to know others."*, better organizational skills *"As the Canadians were more organized and pushy, and we had*

initially rather loose ideas and more discussion, they always made clear suggestions and decided how to do the work.", information sharing *"She was sitting on her information [...]. She has already written her part and left without having any conversation with the rest of us."*, or role distribution *"The other reason was that I think after some time the guy enjoyed being the "CEO" of the team and therefore he did not want to change anymore."*⁶ The importance of being a native speaker in the common language of the group rather than level of managerial skills as a reason for gaining real power in the team is surely an issue with utmost significance for MNCs.

Whereas role and task distribution has been an issue for almost all students coming from different cultural backgrounds, the Finnish students were again very democratic as reflected in *"It also happened to be easy to divide duties between two, as one took orders and the other handled production with overall control being democratic but also efficient."*

Again it becomes apparent that all of these power issues showed also a cultural influence (Fischlmayr & Glaser, 2004).

Trust was mentioned as an important factor in virtual multicultural teams not only in our essays but also in literature [23] - [27]. *"After we had played a while we started to make decisions more independently"*, *"A big issue plays trust between partners. When we cannot meet face to face we must have trust to people with who we work."* Again, cultural differences in the attitude towards trust are observable. For Finns (see first statement) the fact of being trusted by the own team, and to have a certain autonomy out of this trust seems more important than the question whether one can trust the other business partners, as was the most important question for the students of other cultures *"I personally like to know the people who I negotiate with."*, *"You also do not see your partner you do not see the non-verbal communication which is very important. You do not know if you can trust such a partner."* For Finns being honest is a naive prerequisite for doing business and therefore the other partner's trustworthiness doesn't need to be questioned.

Language has revealed to be a crucial issue in virtual multicultural teams as well. Not only did better linguistic skills influence the participation but also power distribution and as a consequence dominance and leadership. *"The language was one of the reasons why some members did not participate so actively."*, *"Now that I look back I think I should have been more sensitive to other people in our group in regards to their language."* or *"For the first time ever I realized that there is a strong connection between language skills and the distribution of power within a*

⁵ Also [21] have stated that the power distance dimension [19], can be related to the wish of different cultures to have a leader. Countries with high power distance, for example, demand autocratic leaders and authority.

⁶ Literature on power development supports the understanding that exactly these factors contribute to the creation and increase of power of persons or groups [28] - [31].

group.” But also the communication style and the tools used for communicating has shown to be an issue in virtual multicultural teams. *“It is important to speak ‘the same language’. The Finns wanted formal and brief messages [...]”, “The Finnish are supposed not to like talking – email is a good alternative where they do not have to talk.”* Interestingly, the Finnish students preferred e-mail to Skype and were not very happy to talk to the students sitting in Austria. *“We tried Skype but the Finns were not interested. Thus, we had to communicate with them by e-mail, it was much more difficult.”* Maybe this was due to the fact that the Finnish group was composed of ICT students who are associated with being factual, giving short and precise information and disliking small talk. But again, we believe that also culture plays a role in this context.⁷ Among Finnish students the attitude was on fulfilling the tasks, concentrating on the game and skipping personal contact. *“The Finns were not very enthusiastic to have a conversation with me.”* The other students, on the contrary, loved the possibility to talk to people from different cultures, liked the game and enjoyed small talk over Skype. *“Maybe they saw the game more as an important virtual business project than a big chance to have multicultural contact with foreigners to learn something about their business habits and their way of interacting and communication concerning business decisions.”* They were rather surprised by the Finnish students’ behaviour. *“I tried to have some personal contact and bringing fun into the game. But it seemed to that the Finnish student colleagues were a bit confused about my answers and questions.”*, From our observations during the game we could make out that the Austrians questioned themselves what this silence might mean and talked about price dumping, no interest in their particular company, or in doing business at all. This confusion lead to wrong interpretations and perhaps also wrong reactions. The simple fact that Finnish students were not interested in talking, had certain insecurity in talking English with foreigners or were simply shy was only later on taken into account when reflecting about it in the essays. *“So, the stereotype of the silent and calm Finns showed up somehow. I also noticed this stereotype when talking to them. My impression was, that they were rather distant, serious, and not very talkative.”*

Generally, communication has turned out to be one of the most crucial elements in virtual teams. The fact that different cultures try to talk to each other, makes the virtual constellation even more complex. Cultural differences are again seen as influencing teamwork across geographical distances more than anything else, which also became apparent in all the above mentioned points. Thus, cultural awareness, certain knowledge about “the others” in the team

and better understanding turned out to be of utmost importance in virtual multicultural teams. Thus, the training design should first of all concentrate on creating this cultural sensitivity and only secondly on skills such as negotiation or conflict resolution as prior to all these skills, cultural understanding seems to play a role. This conclusion stemming from our preliminary results is also supported by studies, which point out the necessity to concentrate on the multicultural composition of the team members when it comes to offering training modules for virtual teams [4], [11].

For a kind of practical verification of the results, tests and comparisons of our students’ results with those of managers (by the use of qualitative interviews on their virtual team experiences) will be made. But even these results show us clearly what has an influence on the collaboration in virtual multicultural teams and thus, we can use these issues for our first training design.

V. SOME CONSIDERATIONS

Being aware of the possible limitations of using student data in research, we see here no such risk, but instead expect to benefit of it — not only in terms of getting more insightful research data, but also while developing the training modules. Our presumption can be argued by following: 1) Behavioral factors have proved to be similar in both student and business samples in further studies [33]. Furthermore the participants are 2) third year business students that have already participated business courses on an advanced level, 3) at least somewhat trained on intercultural issues and 4) familiar with most important theories and concepts of organizational behavior. Thus, we can use thematic interviews and expect to get more insightful reflection in the guided essays and can utilize this information in composing the training program for the MNCs. Das ist alles vom Abstract und das brauchen wir eigentlich hier nicht.

Further, using a simulation game might put some limitations to the setting. But here we again see no problems but the opposite: in the business game the decision making processes are similar to those in real life which cannot be reached in any other way. This serves as a test for the students’ ability to share expert information and utilize it in group decision making. The RealGame™ training thus prepares them for future business situations.

Summing up, we see those limitations as no limitations in here. Exactly this particular setting will give us the possibility to formulate practical implications, which would not be given with a different framework.

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⁷ View also [32] who point out the main difference between Finns and Austrians respectively other cultures. Whereas the latter are not comfortable with silence, it is exactly the opposite in Finland where people prefer silence and quietude over talking.

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An Analysis of M-Commerce Services in Digital Content Markets: Six Societal Environments Effecting M-Commerce

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Abstract — The research question dealt with ‘whether m-commerce services fulfil the expectations both of customers and of service developers and if market demand is being met’. The methodology of the research was qualitative and findings were based on both the content analysis of m-commerce value-chains and open-ended interviews. The six environments of m-commerce worked as a framework for the questions in an open-ended interview. Two m-commerce value-added services, which presented two different types of business models: a closed operator and a customer centric m-commerce model were chosen. Two types of m-commerce services were described and analysed. The sample of interviewees (n=17) consisted of spokespeople for them and a few experts. Research findings were that m-commerce services differ from traditional and e-commerce services in terms of time, context and location, the value-chains of m-commerce are unclear and consumers are not very aware of existing m-commerce services and of the m-commerce services enabled by existing technology.

Keywords — *m-commerce, society, value-chain, value-added services, case study*

I. INTRODUCTION

In the changing business environment, the status of organisations and companies involved in value-added content markets has changed. Development of mobile technology, creation of m-trust and keeping up m-habits, which are the successors of e-trust and e-habits, are crucial issues in terms of creation of the new digital content market and one organisation is not likely to have different aspects. The content and services on offer from any traditional provider are on the way to m-commerce.

From an organisational point of view, the chance to also provide digital content can be given a bias and is two-fold; on the one hand there are obvious benefits:

- creating new markets for new service portfolios
- searching more specific customer segments through joint marketing
- taking advantage of niche markets
- helping to find the competitive advantage.

II. LITERATURE REVIEW

The literature review handles definitions of m-commerce, the problem of turning the flow of digital information and services into revenues and the customer’s point of view of m-commerce.

2.1. M-Commerce

In this research, the definition of e-commerce follows the definition given by the OECD [1] and it has two criteria:

- automation of transactions, and
- spatial separation of transaction and delivery.

The description of the m-commerce solutions lifecycle has been divided into five phases by Kalakota and Robinson [2]:

1. messaging – m-commerce was in the first phase in 2002 when their division was introduced. Messaging means short message services (SMS)-based m-commerce.
2. info-connectivity – web based m-commerce where the user needs an enhanced device with an xhtml-extension. To some extent, m-commerce has experienced this phase in Finland.
3. transactions – this means an m-commerce strategy for organisations in order to evolve revenue-generating m-commerce. M-commerce has introduced applications that support phase three to some extent, but end-users, either individuals or organisations, have not found them to any great extent.
4. transformation – this means that m-commerce is interconnected and implemented into business processes within and between organisations. The largest gains in terms of business value will be found in this phase.
5. infusion mobility and m-commerce is a normal way to do business – this means a culture change from one, in which technology is occasionally handed over to the other one where technology is an accepted part. During this

phase, the m-commerce industry will undergo strong consolidation.

2.2. M-Commerce Customers

What are customers' opinions and what aspects affect customers' purchasing decisions? The consumer's point of view is important and, because of the nature of the new non-established phenomenon of m-commerce, a lot of questions remain unanswered in the documentation available.

Privacy issues as well as transaction procedures, the reliability and usability of the service and the issues to offer either push or pull services are the most important questions to be addressed when discussing m-trust. Barnes [3] raises the question of privacy and standards.

It is an assumption that the customer will choose to use mobile value-added services to meet a specific need. User-friendliness, low price or added value can be the triggers for a user to get introduced to a new service [4].

The mobile communication system is divided into four categories [ibid.]:

- user, where user segmentation is crucial
- place, where mobile communication takes place at a real location and value-added services should be designed to fit into a different user context
- process, where the component of process is divided into two subsystems: leisure and business processes
- time, where mobile communication is temporally short, cyclic or anti-cyclic.

Customisation of m-commerce portals seems to be more crucial than on the web [5]:

- communication: e.g. voice mail, messaging, SMS and e-mail
- personalised content and alerts: e.g. news, sport, weather, stock prices and betting
- personal information management
- location-specific information: e.g. traffic reports, nearest location of some service or other.

According to Dholakia and Dholakia [6], the key dimensions on which m-commerce will be founded, are:

- user experience for easy communication
- flexible location for use everywhere
- on-the-go flexibility for all mobile use
- geographic positioning for navigation
- third party applications for paying for, buying and selling goods
- enterprise integration for work-related use
- multi-transaction services for scheduled and on demand use

- different terminals covering as wide a range as possible.

2.3. Theoretical Frame

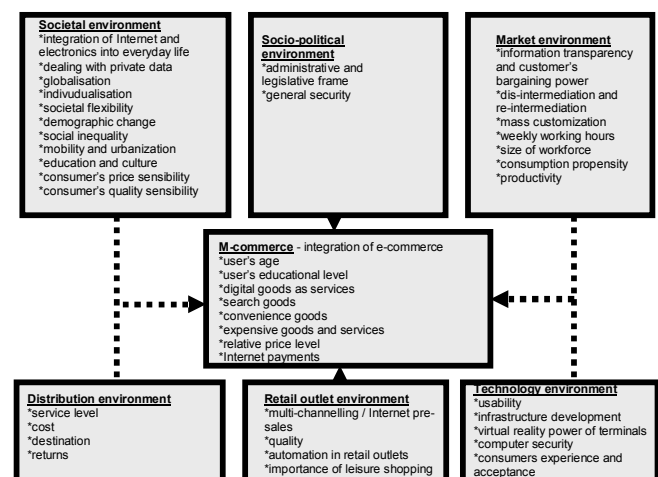
The theoretical frame was set up by Numberger and Rennhak [7] who built a six-phase environment around the concept of e-commerce. The e-commerce and its environments create the whole ecosystem of particles that most likely correlate to each other. The environments concept is the theoretical background to the questionnaire of this survey and is applied to m-commerce.

In this research, m-commerce is considered as a theoretical framework adapted from e-commerce. The main assumption is that although m-commerce is different to e-commerce in some ways, the environmental forces around it remain the same.

Numberger and Rennhak have created an e-commerce environment according to Jürgen Habermas' societal evolution and come up with an e-commerce context with six environments [ibid.]:

- societal environment
- socio-political environment
- market environment
- technology environment
- retail outlet environment, and
- distribution environment.

Each of these has factors that affect the m-commerce value-chain either from the individual level or from the surroundings. M-commerce is at the heart of the model, containing the demographic, goods-related, subjective views of pricing and everyday life indicators. All of the environments are connected to each other [ibid.].

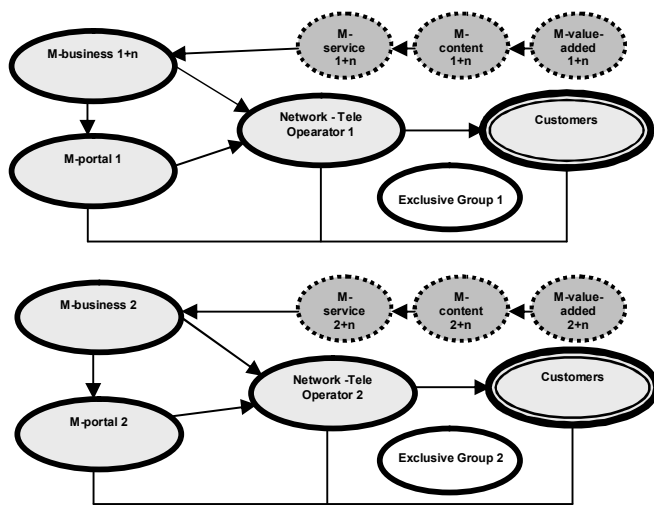


Picture 1: M-commerce and its six environments according to Numberger and Rennhak [7].

III VALUE-CHAIN MODELS

Recreation of the value-chain is obvious in order to position the different stages of digital media developers and creators. Barnes [8, 9] has analysed the m-commerce value-chain and differentiates content on the one hand and infrastructure and services on the other. Barnes [5] has derived two new m-commerce models from this.

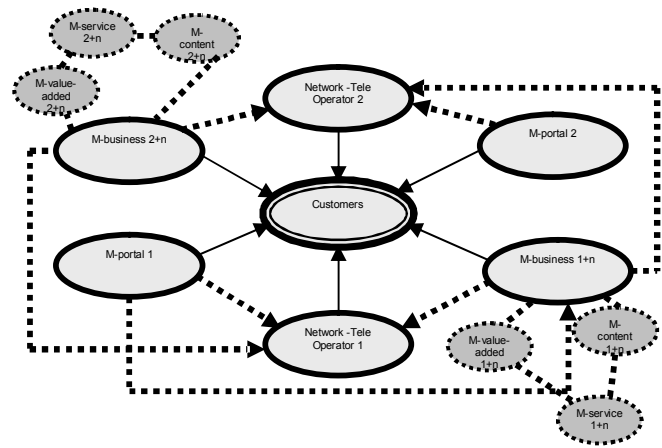
One is a closed operator model and the other is a customer centric model. In the first model, the closed operator model, m-business participants, information and service providers create m-portals, which are distributed by operators to their customers. In this model, there are two gatekeepers: the portal owner and the operator. The first case analysed in the open-ended interview presents this kind of model and is called Armas m-commerce service in the Hämeenlinna district of Finland.



Picture 2: Closed operator m-commerce model [5].

In the second model, the customer centric model, both the m-business and m-portals interact directly with the customer. The m-business and m-portal also create alliances, but they are not visible and do not act as gatekeepers for customers. [ibids.] The other m-commerce case presents this kind of model, Trescape, a mobile web browser application detailing the history of Tampere, Finland, together with a multimedia message enhancement for the short orientation tour.

There is a group of companies called 'enablers', who bridge the gap between services, including content providers [10]. It can be argued if the customer centric model is enough to generate m-services for everyday user needs.



Picture 3: Customer centric m-commerce model [5].

IV METHODOLOGY

In this qualitative research, m-commerce was studied critically by analysing two of the m-commerce services' value-chains and those involved in them. This was done by case-based [11] open-ended interview research revolving around the theoretical framework based on six aspects to cover the e-markets and the societal-political aspects of society by Numberger and Rennhak. The framework was applied to m-commerce accordingly.

V RESEARCH QUESTION

The research question was to define the crucial points for creating new markets for digital value-added products, comparing customer and company perspectives on the matter, consider the problem of supply and demand and ask:

- what are the crucial points to consider when creating new markets for new, not yet existing mobile value-added products, especially within m-commerce in Finland?
- what actions does an organisation need to take to be able to survive in the changing markets of m-commerce content and service products, if willing to do so?

The research covered Finnish digital markets, but it will be reflected on European and global markets as part of the documentation review. This was simply because of the nature of digital content development:

- digital content and services in general have been considered to be easily localisable products which can be seen as an independent piece of art in the culture
- global markets have been considered to be an opportunity
- media convergence has been obvious

- media examples (TV, music, cinema) have been good examples of homogenous mass customer-based thinking.

The research concluded by defining the short-term and long-term effects on the markets. Different product segment research of m-commerce was also analysed, in particular B2B and B2C. The C2B and C2C approaches are mainly new phenomena in e-commerce and m-commerce and there has not been very much research into this as yet.

VI QUESTIONNAIRE

The research was structured in the following way: two m-commerce service value-chains and their representatives were analysed together with a few expert interviews [ibid.] The questionnaire included nine straightforward questions and some further aspects in order to refresh the discussion and was made available to interviewees in advance.

The first question covered the interviewee's basic information (role within the company, number of years in the industry) and included a short description of the interviewee's company. The company description was included because the interviewee and the company or organisation represented should be suited to the value chain definition.

The civic environment was defined purely as an everyday instrument for customers in m-commerce. The question was an introduction to more complicated and more company-sensitive aspects.

The question about the socio-political environment aspect highlighted governmental and social influence on m-commerce. Is there a socio-political push for companies, or do they feel that they are flagships for m-commerce?

There were two questions about the market environment aspect due to the topic of this research. The first lets the interviewee define the concept of 'a customer' and the next question is about demand for m-commerce products. The latter question is about m-commerce markets and how to penetrate them.

The question about the technology environment aspect questioned the barriers and advantages from a technological point of view.

M-commerce was discussed more closely in two of the questions. Interviewees were asked whether there are advantages in using m-commerce rather than traditional means of buying and selling. What kind of advantages were there? The next question covered interaction with the customer. How does a customer (as defined earlier) feel about m-commerce as a distribution channel for the service that the company provides?

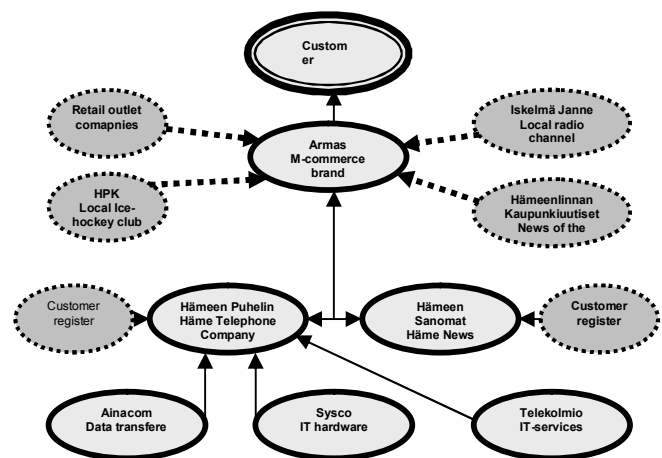
The last question returned to focus on the problems involved and discussed m-commerce and its future in more detail.

VII CASES

In this research two cases were looked in-depth. The most remarkable difference was the m-commerce business model and a different customer approach in both of them.

7.1. Closed Operator M-Commerce Model

Armas connection is the local content service for mobile users in Hämeenlinna, Finland. Its basis is a mobile operator connection managed by Aina Group Ltd., which is a group made up of companies within the area. The value chain consisted of the companies involved.



Picture 4: Closed operator m-commerce model Armas.

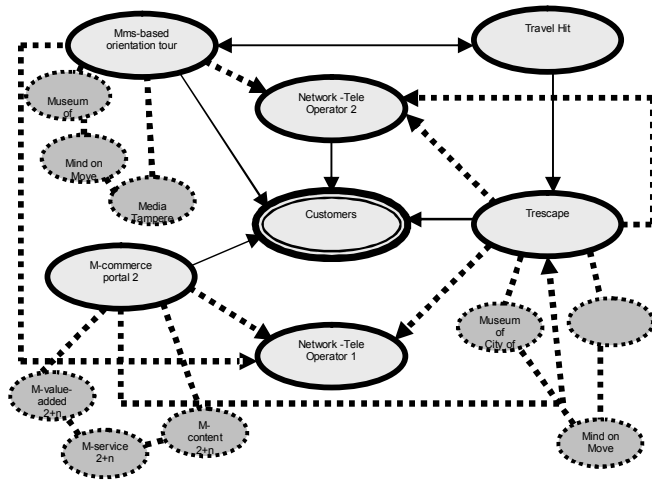
The service concept is as follows. While a person has an Armas connection, by showing their mobile number, which indicates and identifies the connection, the owner is eligible for discounts in shops. The service can be described as a standby service and is considered to be a closed operator m-commerce model [5, 9].

7.2. Customer Centric M-Commerce Model

These are mobile services customised for tourists. According to Tribe [12] the field of tourism is built from aspects of non-business-related tourism and tourism business studies. Knowledge of tourism is created between society and analysed aspects of it and tourism itself. The area is remarkable for digital content services too, because they are related to the environments. Again development of a business area is affected by other aspects too.

Based on the idea of multimedia messaging and routes around town, Trescape and another non-location data-based

service, Racing the amazing Nokia, were introduced. The concept is about having an adventure by sending an SMS with an answer and the user then receives an MMS with a question or clue. The concept is further developed by tourism SMEs and one organisation. The service is a customer centric m-commerce model [5, 9].



Picture 5: Customer centric m-commerce model Trescape.

VIII DISCUSSION

The discussion addresses the disincentives of m-commerce which have remarkable power in m-commerce culture by affecting everyday use and habits.

Influence. The benefit of m-commerce services for everyday life was highly spoken about, but its influence was considered to be minimal. The use of mobile phones mainly focuses on voice and short messages, as a study in Finland shows that they generate 98% of the turnover of telephone operators [13]. Of course this has led to a situation where speed, m-trust and accessibility have been mentioned as being features of the mobile society. The work-related use of mobile phones was not uncovered, but influence was seen on an individual level. It seems that people tend to use harmless m-commerce services to a greater extent, such as ordering ringtones and logos, while all the more meaningful or complicated services are ignored.

Laggards. Technological development is a fact and people have adopted the use of digital devices amazingly: although there are many laggards who are neither willing nor able to cope with the information society. Political programmes will not help them.

Customer base. Who is using your m-commerce product and why? It is important to create and identify the motive for use: if the customer register is kept up-to-date, the customer base does not have to be large, in order to

generate profit. There is enough marketing information, if the company is receiving logs from Mobile Internet service providers (MISP) and has access to the customer register.

Division of revenue. The long value chain also does not encourage m-commerce service providers, with the cost to a customer after telephone operators and other partners have taken their cut being minimal. Therefore, companies and organisations should consider mobile services merely as being more about marketing than about earning revenue. The customer centric m-commerce model case, tourism services of Trescape, clearly shows this phenomenon.

Trust. M-trust is an issue, because a mobile is a very personal device, almost like a wallet in this respect. A person is easier to reach by SMS than by email, because of spam which disturbs email correspondence. SMS is also a trusted way of communication.

Information content. While talking about information, there is no constant solution to the problem of m-commerce information products requiring user loyalty. It is worth noting that typical use of mobile media services is occasional. The advantage is that mobile media is quickly available when needed. Mobile devices are also good feedback devices. Another problem of mobile information is that it cannot be taken out of context. In other words, local and time information for travellers would be very appropriate. Mobile devices are also on their own within corresponding numeric and short notices.

Needs. From a customer's point of view, a company should know about the customer and identify their needs. There should be variety in services in general and one choice could involve m-commerce. I think that potential users would like to reflect their identity by using and showing off mobile value-added services.

To recap, attitudes towards value-added m-commerce services are sceptical because of high expectations of complicated services that have failed.

IX CONCLUSIONS

Value-added m-commerce services still present phase 2 as per Kalakota's and Robinson's [2] structuring though there are expectations to go forward. This research found some of the reasons for that:

M-commerce culture. Organisations wishing to attend to m-commerce should start at the beginning when finding proper m-commerce services either for a work-related solution or individual customer-related solutions.

Government guidance. The technological 'digital divide' can be recognised while innovators and early adapters are compared with laggards who adopt technology last. The cost of the newest technology can be one thing, but the

changing challenges resulting from use of the newest possibility are certainly big (Demoussis and Giannakopoulos, 2006).

Telephone operators' role. The cost of m-commerce value added services was considered as an obstacle to get through before supplying them. In other words, two independent respondents from the same public sector organisations announced that with so many users among the customer segments in a large Finnish town, mass customisation of m-commerce and mass distribution is too expensive. The benefits would be unquestionable, but the data transfer cost is too high.

Simple solutions. Individual customers would appreciate easy-to-use, beneficial mobile services to help them to cope with everyday pressures and problems. The resources that can be saved in working life and process-oriented solutions are used constantly without exception and as new tools. Business users are perhaps the most conservative users of mobile phones, relying on speech, although marketing of m-commerce value-added services has been heavily targeted towards them.

Free samples. The reason for non-existing mobile services can be seen within complicated business models that try to generate revenue from m-commerce services by:

- individual users
- services that are not properly targeted
- within a complicated value-chain
- at particularly low cost
- with a kind of 'nice to have' service aimed at teenagers.

As a result, the combination of well-functioning and useful m-commerce products should be a workable project.

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An Integrated Service-Oriented Development Platform for Realization of e-Business Systems

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Keywords—Service-Oriented Architecture, Web Service, Semantic Web, Business Process

I. INTRODUCTION

SOA (Service-Oriented Architecture) is becoming a leading paradigm for the development of information systems and application integration. Web services [1] and Semantic Web [2] are emerging technologies that promote service-oriented architecture and service-oriented e-business systems. With open and standard application interfaces and technologies, Web services implement SOA's features to support loosely coupled applications and their integration. They are expected to transform the Web into a distributed business computation network. SOA bridges the gap between business and information technologies by providing an approach for reengineering business processes with service-oriented approaches and design enterprise information systems with business-centric approaches. A number of IT companies, such as Microsoft, Sun, BEA, HP and IBM have formed working groups to develop Web services' standards and technologies. IBM and HP proposed "business on demand" and "adaptive enterprises", models that are based on the service-oriented paradigm, infrastructure and a number of Web services technologies.

A major obstacle in developing enterprise-level Web services and transactional applications is that the current platforms, such as those that conform to J2EE and .NET, are based on object-oriented component models. Services are developed as objects and common services derived from the object-oriented frameworks. Service-oriented architectures and protocols are implemented based on the above the object model. As a result, the service-oriented functional granularity cannot be realized to meet loosely

coupled and dynamic business processes. These Web services applications have performance limitations in discovery, communication, execution, transaction and security, which restrict SOA's development for large-scale applications. The issue lies in the absence of a service-oriented framework that provides architecture and resources for Web services development, deployment and runtime environments. For example, XML based transportation and process is insufficient without Web services oriented communication and its related resources.

A generic meta-model is central to service-oriented software engineering and framework. By comparing with UML based software engineering for object-oriented applications and AUML based software engineering for agent-oriented applications, service-oriented software engineering is critical to rapid development of Web services applications. The service-oriented software engineering should facilitate service modelling and description, enable service-oriented business planning (top-down) and application development (bottom-up), provide technologies for common semantics and meta-model for service-oriented development methodologies, and specify technologies to enable interoperability between the service-oriented tools and platforms.

Leading IT enterprises are evolving from software vendors to system integration and consultation providers, in order to improve their competency. This strategic migration has created challenges for their capabilities for integration and consultation. The IT enterprises need to be aware of both technical and business requirements of their customers in order to provide services. Based on research on service meta-model, we propose and implement, in this work, a business-centric, multi-model driven and collaborative development platform for service-oriented e-Business systems. The platform has applied a service-oriented framework and model-driven architecture to support service-oriented software engineering. Intelligent Web

services model, BPEL4WS based process model, and business-specific model have been used to support rapid e-Business development and intelligent business process integration.

The platform is intended for business consultants and technical consultants to collaborate in rapid service-oriented e-Business planning and integration, process reengineering and application development. A business consultant models the business by communicating with customers to collect business requirements, define business objects and their relationships, including services and service providers, and plan business processes through a business view and a set of visualized tools. A technical consultant (engineer) improves the business model and employs his/her service-oriented knowledge and IT language to reengineer business processes and implement Web service based applications through a process view and a service view. The collaboration activities are distributed and real-time, which can improve the communication between the participating IT and businesses engineers, and dramatically reduce the design problems and accelerate e-Business development.

The rest of the paper is organized as follows. Section II presents the objectives and related works. Section III describes the architecture and design of the proposed platform. Section VI gives a brief introduction of a case study. Section V concludes the paper.

II. OBJECTIVES AND RELATED WORKS

E-Business systems have become critical for businesses due to the emergence of dynamic market behaviors and rapid changes of customers' requirements. These systems are required to be responsive in real time, flexible in cost structure, and resilient around the world in order to satisfy the needs in the marketplace and the changes in the technology landscape. Enterprises use such systems to streamline their processes, integrate separate business functions, keep processes sufficiently flexible, and reach their customers quickly. The business integration solutions are the key enabler to make on demand business a reality and deliver business values to the customers. Therefore, it is important to have a set of appropriate integration technologies, e.g., SOA/Web services to support the on demand businesses. In this work, we consider, from an implementation point of view, how the on demand business can be implemented efficiently and effectively in order to meet the needs of the customers.

To implement an e-Business system, developers need to capture business requirements and incorporate them into IT systems. Two roles are usually involved in e-Business planning, design and implementation, i.e., business consultants and technical consultants. Business consultants communicate with customers and identify business requirements. Technical consultants have knowledge of information technologies and approaches to support the businesses. The problems with the incorrect and imprecise

communication and understanding among consultants exist due to the fact that they express their views in different languages. A unified and collaborative platform is therefore valuable, especially in implementing service-oriented business systems. SOA is aimed at bridging the gap between business and IT.

Based on the above observations, we have proposed and implemented a multi-model driven collaborative development platform for service-oriented e-Business systems. It supports top-down business planning and bottom-up service-oriented development. The platform supports service-oriented software engineering and application development. The proposed platform is, in itself, driven by three models, i.e., service meta model, process model and business model. In addition to these three models, a service model is designed to support semantic service description and operations, a process model supports the consistency between business process and Business Process Execution Language for Web services (BPEL4WS), and a business model considers services, providers, adapters and their relationships for specified businesses.

In the research of SOA/Web services, academic groups and industries emphasize different aspects of Web service according to their different views on the value chain of Web services. Gartner focused on standard interfaces and loose-coupling of Web services. Microsoft is interested in the integration of Web services, XML, Web and component-oriented technologies. IBM emphasizes service-oriented architecture and composition and Web services' integration capabilities. SUN promotes the employment of Web services' intelligence in order to support customized service, business intelligence, and custom relationship management. In its latest version of SOA specification, W3C enforces Web services' open standards and highlights Web services' capabilities of cross-platform, machine recognizable, and semantic processing. In the previous works [2, 3], we have proposed a semantic service meta model to promote service-oriented software engineering.

Large-scale and rapid applications of Web services need a secure, reliable, and efficient framework for service-oriented application and software engineering. The framework should provide a generic software model and common infrastructure for development and runtime environments. Currently, the existing key frameworks supporting Web services include J2EE and .NET. Based on these two frameworks, the major application vendors, such as SAP, Oracle, Microsoft and IBM, have provided SOA business platforms [4-7]. Many businesses have published Web services and have decided to develop their information systems using SOA. Web services have seen several successful cases in commercial applications, e.g. Amazon and Google, which provide the developers with Web services to customize their own online book stores and search tools. The proposed platform in this paper, however,

is intended to support business process planning, composition and integration.

In the area of business process modelling, there have been a number of object-oriented attempts [8]. Some of them have tried to design a single model to represent the whole business process [9] [10]. It is, however, not an easy task to find a tradeoff between intuitiveness and reliability. Some divided a whole business process model into several sub-models. For instance, FIDO [11] divided a business process model into four sub-models, each corresponding to one aspect of the business. BRADES [12] divided a business process model into three sub-models according to its lifecycle. It is also difficult to determine what business details should be included in a sub-model. Tosi et al [13] tried to build on-demand information systems using KBCS (Knowledge-Based Customization System). Business processes and business objects are standardized and packaged into components with object technologies. All components are deployed independently to one another using the object-oriented modelling methodology. Users can generically and rapidly customize their enterprise applications to fit the business process flow of the enterprise by configuring those required components. Liang [14] presented an object modelling approach to help bridge the gap between business systems and OOIS (Object-Oriented Information System) by building a business system model for an organization and generating an object model from it. The above methods share a common ground in that they are

all based on an object-oriented modelling method. Our platform is service-oriented in process analysis, modelling and implementation. We further provide the ability to transforming from business requirement to IT implementation.

Huang et al. [15] introduced a solution template-based approach for business process integration and management. A solution template is defined as a platform-independent model for business process integration and management solutions where a template is represented through a composition of a set of solution artifacts with an explicit description of the interrelationships among the solution artifacts. The proposed platform takes advantage of this concept along with BPEL4WS to model business processes. Müller et al. [16] described a platform independent model based on the UML2, and mapped it to a platform dependent model based on BPEL4WS. It also demonstrated how the MDA paradigm can be employed at agent-enabled business process architecture. In this work, the process view is similar to Müller's platform specific model (PSM) [17] in that the business processes are described in BPEL4WS. However, the business view of this work is different from Müller's platform independent model (PIM). PIM in UML2 is a high level abstraction of PSM while the platform's business view is not an abstraction of process view. Our proposed method is more concerned with modeling business services and their relationship.

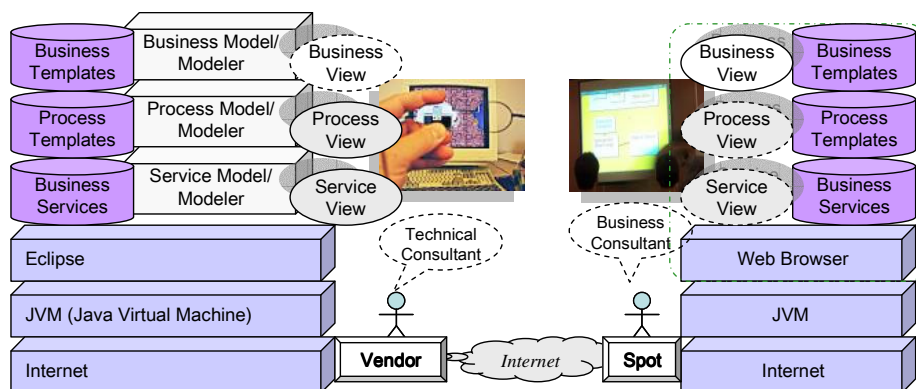


Figure 1. Architecture of the multi-model driven collaborative platform

III. MULTI-MODEL DRIVEN DEVELOPMENT PLATFORM

A. Collaborative and integrated architecture

The architecture of the multi-model driven collaborative platform is shown in Figure 1. The platform supports the service-oriented software engineering and application developments. It employs three views, i.e., business view, process view, and service view to support business and technical consultants' collaborative operations. The

business consultants focus on the use of business view and process view whereas the technical consultants are interested in the use of process view and service view. Consultants can collaborate from distributed sites of, e.g., customers' sites (on the spot) and IT vendors to provide service-oriented e-Business planning and integration, process reengineering and application development. A business consultant models the business by communicating with customers to collect business requirements, define business objects and their relationships, including services

and service providers, and plan business processes through a business view and a set of visualized tools. A technical consultant (engineer) improves the business model and uses his/her service-oriented knowledge and IT language to reengineer business processes, provide necessary information about the internal processes, and implement Web services through the facilities provided by the process view and the service view.

The platform is built on an open source platform, e.g., Eclipse, below which is Java Virtual Machine (JVM). Business consultants use a Web-based user interface. Through Internet the distributed sites are connected. The tools and views are transferred from the platform on the vendor sites to the consultants' Web browsers. In the three views of the platform are three modelers based on the three models. The business modeler is used to capture business requirements, the process modeler is to design detailed process, and a service modeler is to design services. Within the multi-model driven platform, a number of templates are collected from best practices and organized as a set of examples. The business, process and service templates are all individual artifacts, which can be used to compose a business solution for a given business, on demand [18].

B. Three views to design: business, process and service

As shown in Figure 2 and Figure 3, the platform has three views for the consultants to plan and develop e-Business solutions. In order to maintain their consistency, we have developed a set of rules to automatically transform the e-Business subjects among the three views. Consultants interact through the facilities provided by these views to design. To create an e-business solution, a business

consultant starts with the business view and identifies the involved business services, IT services, service providers and their relationships based on the customers' requirements. He/She can choose a business template to assist in modeling, if there is any appropriate business template existing. He/She can transfer the product of the process view to define the business properties of the selected processes (As illustrated by Figure 3).

On the other side, technical consultants with service-oriented implementation knowledge enter into the process view to define execution properties of the selected processes. Based on a selected process, technical consultants can search service directory to check the involved services, if the services are found. Otherwise, the consultant has to transfer the product of service view to create the required services by customizing the existing templates from a library. Otherwise, a new service on the Web services workspace of the service view (As illustrated by Figure 2 on the left) can be created. Another way is to search other sources to find the services that are available, reliable and qualified in the given business. The above operations are repeatable and the consultants can navigate these views to collaborate with each other to complete a business solution design. Based on the identification of businesses, processes and services, description files are generated for the e-Business solutions. There is a compiler, a BPEL4WS compliant engine, provided by the proposed platform to organize, program, compile and deploy these files. A solution can be refined through rounds of definition adaptation and debugging.

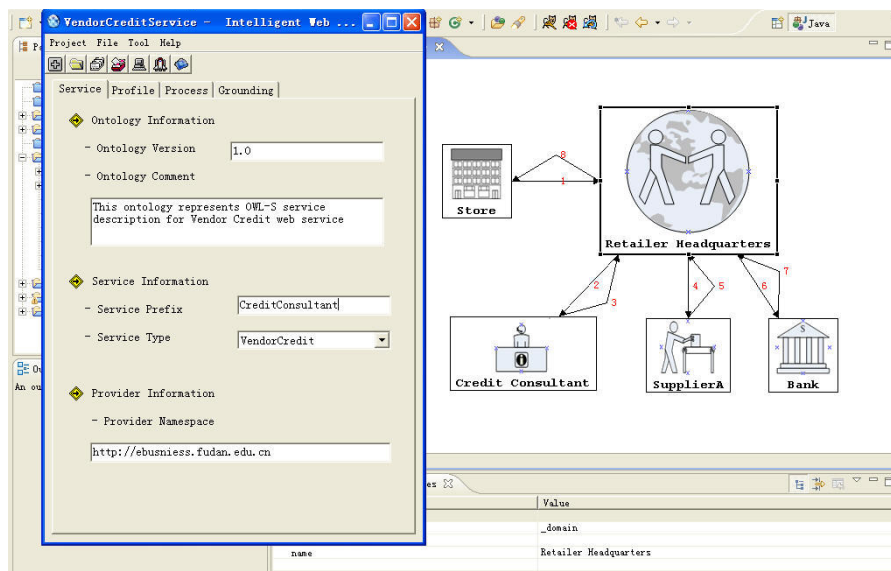


Figure 2. Multi-model driven integrated development platform for e-Businesses

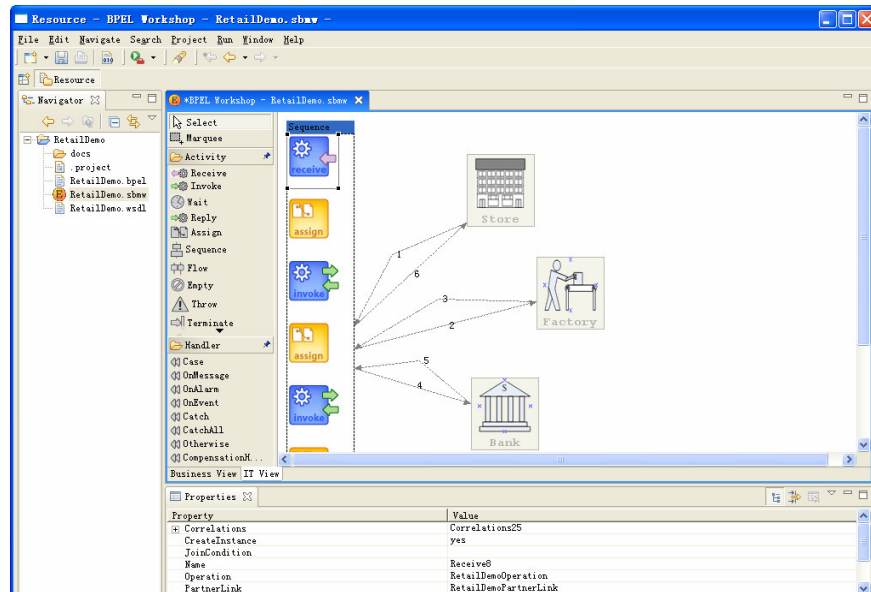


Figure 3. Service model driven development view

The model associated with the solution can be transformed into templates by removing business-specific properties and storing them separately as business, process and services templates. These templates become reusable components. The template-based method is more cost effective than the traditional solution development and it makes business more responsive. Moreover, during the process of using the views and design, a top-down methodology is illustrated through service-oriented business and process planning. A bottom-up methodology is illustrated through the system development based on service composition and process integration.

C. Service-oriented business and process integration

Service-oriented businesses and their processes are implemented through Web services and their interactions. Web services interactions can be distributed across applications and enterprises. An e-Business solution therefore requires the platform to support service interaction by providing a number of common integration services. The business model describes both the pattern and protocol of messages exchanging between the services. Each message may contain one or more types of information required by the services during the interaction. Some of these services can be found at service providers, while others need to be developed by in house.

The platform supports five types of Web services, i.e., business services, platform services and integration services. Integration services are provided to enable template-based integration and collaboration in e-Businesses. They are: (i) coordination and cooperation:

such as adapter services and process-flow-like composition services (ii) ontology and semantic integration (iii) platform services, such as messaging (iv) security services, such as authentication and authorization (v) wrapping services, to name a number of them.

When e-Businesses providers have all service components for e-business systems, they define business templates to compose those services into business processes and applications. Templates describe how services work with each other and how business processes are to be executed. In the platform, business services provide business functions. Common services and platform services provide facilities required by every application. Integration services facilitate interaction between business services by providing agreed interfaces. Coordination services integrate all the services to form process templates and e-business system.

IV. CASE STUDY AND EVALUATION

In a typical retail supply chain, there are consumers, retailers (stores, distribution centers, logistics), transportation providers (carriers), credit authorities, and possibly independent warehouse operators. An inventory tracking department checks shelves and inventory in the retail stores. Once the product stock level is below a specified point, the tracking department requests the distribution center to supply. The distribution center checks the repository in the distribution center. If the stock in the repository is sufficient, the shipment and transportation are arranged. Or, the retailers' distribution center can choose third-party transportation providers and warehouse

operators to deliver the products, if the requested items are insufficient in the repository. In this case, the distribution center requests the logistic department to purchase. The logistics checks the relating suppliers and make inquiries about prices and their credits. The orders will be placed, if the requirements are satisfied. The supplier accepts quotation and replies with prices and terms. The logistics department process purchase orders and arrange shipment, if the prices and terms are acceptable. Once a deal has been decided the headquarter service initiates a request to a trusted bank to make payment to the suppliers. Within this process when the suppliers are determined, the supply chain structure is determined. The business integration solution needs to be developed to support the operations of the above supply chain scenario. In this case, the retailer wants to develop an Inventory Tracking Solution to keep track of the goods movement from its location to the selling floors of the Retailer itself. Figure 2 and Figure 3 are snapshots of implementing a retail supply chain.

To develop such solution, a business process is modeled to describe the actual business operations. The process description provides the details of relating activities and their data flow. The developers through the use of the proposed platform identify the required business and IT services for the solution. The services that can meet the required functions are discovered by searching through service directories. The aforementioned business templates facilitate the search process since it contains pre-identified required services. The associated application, data and B2B adapters are also implemented to form a complete solution. The Inventory Tracking Solution is generated quickly through the use of business templates and intelligent Web services. In this instance, the templates are similar to the Retailer's solutions have already existed in the library. The intelligent Web services identify and mould them to meet the requirements.

The above business has been implemented through the proposed platform. Through this example, the proposed platform and its supporting facilities such as business view, process view and service view has demonstrated that it is functional, feasible, and flexible enough to facilitate collaboration and business-centric and service-oriented solution development.

V. CONCLUSIONS

Enterprises need to be responsive to meet dynamic businesses and requirements. Service-oriented architecture can improve e-Business applications in integration and flexibility. Therefore, service-oriented architecture has been envisioned as an appropriate computational paradigm for e-business applications. This paper proposes a multi-model driven collaborative development platform for building service-oriented e-Business systems. The platform supports service-oriented software engineering and application developments. It employs three views, i.e., business view,

process view, and service view to support business and technical consultants' operations. Consultants can collaborate from distributed sites of, e.g., clients and IT vendors to provide their clients' with rapid system development and demonstration. The proposed platform is service-oriented and driven by three models, i.e., service meta-model, process model and business model. All of these three models are supported by a semantic reasoning engine to facilitate intelligent service discovery, process execution and business-business integration. A simple example has been used to demonstrate its functionality.

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Analysing Multi-voiced Strategising and Firm-stakeholder Interaction in Open Source Software Communities

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Abstract—This paper discusses how to analyse the firm-stakeholder interaction in open source software (OSS) communities by looking at the process from a multi-voiced strategy perspective. We argue that current business models are built on a single-voiced understanding of strategising and interaction. This means that different stakeholders in the OSS communities are left without a voice in firms' strategy processes. As different actors involved in the OSS communities have sometimes very contradictory intentions and expectations, it is important to discover ways that will help us to better understand the nature of interaction in these communities and to create new ways of strategising that will take into account the different stakeholder perspectives.

Keywords—open source software, communities, multi-voiced strategizing, interaction

I. INTRODUCTION

The utilisation of open source software (OSS) has increased remarkably in the recent years (Meyers & Oberndorf 2001). Researching OSS networks and communities has received a lot of attention from scholars in the fields of organisation and innovation, too. At the same time as OSS has become a serious alternative for the utilisation of proprietary software as well in the office as in personal use (Helander & Rissanen 2006), it challenges our conventional understanding regarding the role of firms, intellectual property rights, and organisational forms (Dahlander & Magnusson 2005). Given that open source communities themselves are networks mixed up by individual developers and firms participating in the community, OSS is an interesting research context from the stakeholder viewpoint. There are largely over 100,000 open

source projects in the world. These projects, and the OSS communities created by them, are usually in some way linked to each other. Thus, it is not a surprise that OSS communities have been in the interest of quite a few network researchers as well (e.g. Kidane & Gloor 2005, Ye & Kishna 2003, Lakhani & von Hippel 2003, Lee & Cole 2003, Nakakoji et al. 2002).

However, the number of studies that specifically take into account the role of firms in these OSS communities or emphasise the firm-stakeholder interaction is still rather limited (for exceptions, see Goldman & Gabriel 2005, Dahlander & Magnusson 2005). One of the most remarkable features of OSS is that the knowledge to create the product is not in the hands of firms, but resides within different actors around the firm (Dahlander & Magnusson 2005). As actors involved in the OSS communities have sometimes very contradictory intentions and expectations, we find it important to seek ways of strategising that will take into account the perspectives of different parties by analysing the nature of firm-stakeholder interaction in the OSS communities.

The purpose of this paper is to discuss how we can analyse the firm-stakeholder interaction in OSS communities by looking at the process from a multi-voiced strategy perspective. Multi-voicedness is defined as a company's understanding of multiple stakeholder interests. The paper starts by discussing what it takes to formulate a multi-voiced strategy process that incorporates varying or even contradictory stakeholder views. As a result of the discussion build on stakeholder thinking, we present a way to look at strategy making from a multi-voiced stakeholder perspective.

After that, we take a look at OSS communities and relations between OSS firms as well as other actors in the networks by assessing the elements of multi-voiced strategising in OSS communities. Finally, based on these elements, we discuss how multi-voiced strategising and firm-stakeholder interaction in OSS communities can be analysed at the empirical level. The paper is part of a larger research project, which aims to study the various business

opportunities and business models provided by the open source software.

II. FROM SINGLE-VOICED TO MULTI-VOICED STRATEGISING

The idea of multi-voiced strategising builds on the basic assumption of the stakeholder approach that an organisation's purpose, be it public or private, is continuously constructed from multiple stakeholder views that often contradict each other. The purpose of the stakeholder organisation stems from the goals of its stakeholders and becomes identified by engaging in dialogue with different stakeholders. (See e.g. Evan & Freeman 1988, Wheeler & Sillanpää 1997.) This means that corporations and their managers have obligations to a large set of different stakeholders, not just stockholders or owners. Effective strategising in such an organisation needs practices that celebrate the multi-voiced nature of the operations. However, it seems that current strategic theories and practical models do not support strategising in multi-voiced business settings. Rather, they promote single-voiced strategy processes (Eriksson & Lehtimäki 2001).

The single-voicedness of strategic thinking refers to the deterministic manner of prevalent strategy making discourse in determining, who are strategically important actors and who are not (Knights & Morgan 1990). In current strategy making practices, it is natural to view top managers, strategy consultants and large institutional stakeholders as legitimate participants in the strategy processes. It is as natural to neglect the role of, for instance, employees or all less influential stakeholders, such as activist groups and other NGOs, citizens and members of local communities or even raw material or component suppliers, in strategy making processes (Lehtimäki 2000).

The core of the multi-voiced strategy process lies in the criticism of the conventions of strategy making which define other than the focal organisation's understandings of its purpose and goals as less valuable, opinionated or even worthless information. A multi-voiced business setting calls for a multi-voiced strategy process that allows for different opinions and understandings to be heard in strategy making. In Table 1, single-voiced and multi-voiced strategising have been illustrated by paying attention to three dimensions: strategic actors, strategic activities and strategic actions (c.f. Lehtimäki & Kujala 2005).

SINGLE-VOICED AND MULTI-VOICED STRATEGISING (ADAPTED FROM LEHTIMÄKI & KUJALA 2005)

	Single-voiced strategising	Multi-voiced strategising
<i>Strategic actors</i>	Rational and opportunistic actors	Willingness to listen and respect for others
<i>Strategic activities</i>	Hierarchical Instrumental	Relational Networked
<i>Strategic actions</i>	Unified strategic vision Rational planning	Open strategising Stakeholder inclusion

Concerning strategic actors, multi-voiced strategising is a way to break away from predominant actor categories that limit open dialogue. The presumption in multi-voiced strategising is to allow for participants to be heard and treated as knowledgeable in their own terms. Thus, multi-voiced strategising requires that actors are willing to listen and respect for others instead of rational and opportunistic actor view of single-voiced strategising. (Lehtimäki 2000.)

In multi-voiced strategising, the strategy process is embedded in a broad range of stakeholder networks. This means that strategic activities are seen as relational and networked compared to hierarchical and instrumental activities of single-voiced strategising. Of course, power issues are always present whether we talk about hierarchical and instrumental or relational and networked activities. But, instead of brushing them away, they need to be taken into account. Strategic management meets a challenge in trying to piece together all the goals of different stakeholders. One should keep in mind that all actors are actively seeking to accomplish their own purposes, but these purposes can be negotiated and discussed. (Lehtimäki & Kujala 2005.) Ideally, taking the multitude of goals and purposes as the starting point leads to deeper level interaction and allows an open dialogue between different actors. Only then we can talk about genuine relational and networked strategic activities.

Finally, in multi-voiced strategic actions, single-voiced strategising with unified strategic vision and rational planning is replaced with open strategising and stakeholder inclusion. This means, for example, that strategy practices are changed from closed and tightly scheduled expert and management meetings to listening to different stakeholder viewpoints, analysing the argumentation behind the viewpoints, and building an understanding of the value structure guiding different agendas under discussion (Kujala et al. 2005). Furthermore, strategising becomes understood as an ongoing process rather than a sequential process that begins with planning and ends in published strategy documents to be implemented in the organisation. Multi-voiced strategising brings stakeholder dialogue into

TABLE 1

the strategic focus. Visions, purposes and other ways of strategic actions become formulated in the continuous process of stakeholder inclusion.

III. MULTI-VOICED STRATEGISING IN OPEN SOURCE SOFTWARE COMMUNITIES

Previous literature on OSS communities has discussed the different actor roles that the individual developers have in the networks. For example, Nakakoji et al. (2002) and Ye and Kishida (2003) have modelled the roles of the actors by their involvement in the OSS project. They have identified in total eight roles: project leaders, core members, active developers, peripheral developers, bug fixers, bug reporters, readers and passive users. Although not all OSS networks have all these participants, these eight roles can serve as a starting point for the empirical analysis of actors in the OSS communities.

Another important point is to consider what kinds of firms and firm roles can be found in the OSS communities. Räsänen (2004) has identified an OSS value chain, starting from OSS developer communities and ending to the potential utilisers, for example different industry segments and public or private organisations, for the open source software. However, these potential utilisers rarely interact directly with the developer communities. This creates a need for intermediators between the utilisers and the developer community. In the OSS value chain model, Räsänen (2004) identified several different kinds of intermediators. Some firms operate almost entirely in the open source software business, either as software developers, integrators, service providers or pure consultants, whereas some other firms represent the more traditional, proprietary-based software business, but are producing software products and systems that are used in OSS environments.

When we extend our analysis to the interaction and relationships between the actors, we can utilise the four basic elements of relationships identified by Easton (1992): mutuality, interdependence, different power relations, and investments made in the relationship. OSS macro networks, meaning the network consisted of several OSS communities, are characterised by three elements: mutuality, interdependence and different power relations. However, these elements may vary a lot between different OSS communities. The dependencies between communities can be two-way, leading towards mutuality and usually more balanced power relations between the two communities. However, one-way dependencies are also common, which means that one OSS community is dependent on another OSS community but not vice versa. This usually leads to unbalanced power relations between the two communities, as only one of the parties of the dyad is dependent on the other. Different kinds of power positions can be present just within one open source community. In fact, it is common that the heart of the

community consists of central developers that have more power in the community than, for example, the fringe developers have. Central actors with a lot of power can influence the future directions of the developed system, work allocation and other important strategic decisions made within the community.

Literature concerning OSS communities does not tell us much about the strategic actions dimension of multi-voiced strategising. However, we know some examples of OSS firms that are trying to bring new issues to strategic focus by placing their employees in everyday interaction with other actors of the communities. From multi-voiced strategy perspective, such actions can promote the dialogue between different stakeholders and engage new ideas and viewpoints to a company's strategy process. Table 2 summarises the above-discussed elements of multi-voiced strategising in OSS communities.

TABLE II
ELEMENTS OF MULTI-VOICED STRATEGISING IN OSS COMMUNITIES

<i>Strategic actors</i>	Individuals: project leaders, core members, active developers, peripheral developers, bug fixers, bug reporters, readers and passive users Organisations: Developer communities, intermediators, utilisers
<i>Strategic activities</i>	Mutuality, Interdependency, Different power relations, Investments made in the relationship
<i>Strategic actions</i>	Interaction between different stakeholders

IV. ANALYSING MULTI-VOICED STRATEGISING IN OSS COMMUNITIES

In order to analyse the multi-voiced strategising in OSS communities at the empirical level we must develop a research instrument that is able to capture the multi-dimensional nature of the everyday management and strategising. We believe that it is important to gather data from different parties of the communities as well as from different levels of organisations to ensure that we get a rich and versatile description of the OSS communities. In empirical data gathering, we follow the advice of Denzin and Lincoln (2000), who recommend qualitative methods when researchers aim at capturing an individual's own experiences and point of view and wish to secure rich descriptions of the social world explored. To collect the qualitative data, we use personal interviews, as the researched phenomenon is relatively new and unexplored (Hirsijärvi et al. 2005). Based on our theoretical premises of single-voiced and multi-voiced strategising presented in Table 1 and the elements of multi-voiced strategising in OSS communities presented in Table 2, we have developed a suggestion for the empirical research instrument for each

of the three dimensions of strategising (Table 3).

TABLE III
EMPIRICAL RESEARCH INSTRUMENT FOR ANALYSING MULTI-VOICED STRATEGISING IN OSS COMMUNITIES

	Questions presented to the interviewees
<i>Strategic actors</i>	Which actors are thought to have strategic importance in the OSS communities?
<i>Strategic activities</i>	What are the relations between different actors like?
<i>Strategic actions</i>	How are different stakeholders incorporated as part of the strategic actions of the focal firm?

In the interviews, the dimension of strategic actors is suggested to be researched with a question: Which actors are thought to have strategic importance in the OSS communities? This question stands for the interest in different individual and organisational actors in the OSS communities. In the analysis of the interviews, we can further pay attention to which actors are presented as active parties of strategising or who are thought to have power in terms of how the communities are developed.

The dimension of strategic activities is proposed to be researched with the following question: What are the relations between different actors like? This question represents the concern for the quality of the relations between different parties of the OSS communities. When analysing the responses, we can consider what kinds of expectations different actors have toward each other, and pay attention to the taken-for-granted basis of actors' relations.

Finally, the dimension of strategic actions can be researched with a question: How are different stakeholders incorporated as part of the strategic actions of the focal firm? This question reveals the characteristics of the strategy process and its outcomes. In the interview analysis, we can pay attention to whether the strategy statements, such as visions or strategic goals, of the focal firm include the views of different stakeholders.

In addition to personal interviews, some other data gathering methods might also be suitable for analysing multi-voiced strategising and firm-stakeholder interaction in OSS communities. For example, by looking at the printed strategy documents or the web pages of the companies, we could find out many things about the strategic actions dimension. A thorough case study of a OSS community could also reveal many interesting viewpoints. But, as a starting point for studying the novel and rapidly developing OSS phenomenon, the interview based qualitative research is believed to serve best. The next step is to move on with testing, and if needed further

developing, the empirical research instrument presented above, and after that start the empirical data gathering.

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Analyzing the Internet-based Changes in the Finnish Residential Real Estate Market.

Case: Igglo.

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Abstract — This paper is about real estate industry in Finland, and the Internet-based changes that have turned a collection of static pictures and text into a more interactive search and decision making tool for home hunters. The novel e-services and marketing model of Igglo, a newcomer to the Finnish real estate industry, are described in detail. In addition, several US exemplars of innovative ways of offering real estate services are presented. Finally, different ways of providing real estate services are compared in order to judge whether the Internet is now ready to fulfill its promise of more efficient and nearly friction-free markets.

Keywords: Residential real-estate agency, e-services, business model, marketing strategy

I. INTRODUCTION

In 2004, there were 1366 companies in Finland operating in the real-estate brokerage business, employing nearly 3 700 people and producing an aggregated turnover of € 444 million [1]. Real estate agency belongs to the service industry, which is the biggest source of GDP in Finland, amounting to nearly 65 % of the GDP [2]. As many other service industries, the real estate agency has also undergone profound changes after the commercialization of the Internet a decade ago. However, the main motive for writing this paper was a recent newcomer to the real estate agency market, and the buzz that was caused by its innovative business model and web-services offered. In addition, surprisingly few studies have been conducted on the real estate agency business in Finland, a gap that this paper aims at filling from the point of view of electronic services.

There are only few industries where the whole supply chain has been moved to the digital environment. Most service industries complement their traditional personal service with an electronic service (so-called bricks-and-clicks approach). This is the case also in the real estate business. According to Rowley [3], the reasons why the Internet functions better as a complement than as a substitute for the traditional estate agency, are the following:

- i) House purchase is a *significant commitment*, and purchasers are concerned to work with reliable intermediaries who bring experience and expertise to the process of purchase and sale of properties.

- ii) Property-sellers often *need advice on selling their house*, and are prepared to pay for someone to manage the sale of their house including interacting with and negotiating with potential purchasers, organizing viewing, and liaising with or fulfilling the function of solicitors.

- iii) Purchasers *need to view a property*, and both buyers and sellers need a localized support network to support this viewing process. [3]

Real estate agency is essentially an information-based intermediary role that focuses on bringing the sellers of property and buyers together [3]. Porter [4] has argued that the Internet presence should increase the power of both buyers and suppliers in an industry. However, even though the large Finnish residential real estate chains are already well-established on the Internet, this change has not been visible in the amount of commissions that the real-estate agents charge from their customers. The case company of this paper, Igglo, entered the market with a mission to bring sellers and buyers together in an unforeseen way, and by doing so, decrease the level of commissions charged from the customers.

The well-known service attributes – *intangibility, heterogeneity, simultaneous production and consumption, and perishability* – were defined twenty years ago [5]. Lately, the definition of services has, however, aroused new interest and fresh interpretations. Among others Vargo and Lush [6] questioned the viability of the service attributes and claimed that, instead, any economic exchange is fundamentally about service provision. According to their definition, services are the application of specialized competences (skills and knowledge) through deeds, processes and performances for the benefit of another entity or the entity itself (self-service) [6].

Electronic services (also called digital or online services) are defined as a benefit-providing object of transaction that can be characterized as an intangible process that is, at least partially, produced, marketed and consumed in a simultaneous interaction through electronic networks [7]. According to Grönroos et al. [8], e-services consist of the *content* of the service that can be divided into core, facilitating and supporting services, and of the *medium* of the service through which the consumer is in contact with

the service provider.

The goal of this paper is twofold. First, we analyze the Internet-based changes in the real-estate business, emphasizing the situation in Finland. We do that by comparing the e-services offered by the newcomer, Igglo, and by the main agency chains. Moreover, we present novel technology-enabled ways of helping buyers and sellers of real estate (especially apartments) to find each other. Our second goal is to analyze the traditional, the newly emerged, and also the envisaged future ways of delivering the service to the customers in the real estate market.

The data of this paper consist of a review of scientific journal and contemporary magazine articles, website analysis and an interview. This paper concentrates on the Finnish real estate industry sector, and in particular, in the Helsinki metropolitan area, complemented with a few exemplars of innovative foreign services.

The remainder of this paper is structured as follows. Section two presents a brief literature review on research in the real-estate industry and the Internet. In addition, the main features of the Finnish real-estate market are described and analyzed. In the third section, the case company, its website, and its marketing model are presented. Section four concentrates on analyzing the different ways of delivering the service to end-customers in the real estate market, taking a future perspective. Finally, section five concludes the paper and gives suggestions for further research.

II. RESIDENTIAL REAL- ESTATE MARKET AND THE INTERNET

A. Previous research

According to Gwin [9], the previous literature on real estate brokerage and the Internet can be divided into two streams: research on the *direct benefits and costs* of the new technology and the Internet to agents, and research on the potential *indirect costs* of broker disintermediation. Among others Rowley [3] has studied the advantages of the Internet in real-estate agency. She lists these to be the following:

- i) *Global, national and regional reach* which makes Internet particularly attractive for matching properties and customers in certain property categories or geographic areas.
- ii) Customers can potentially access *a wide range of properties*, being sold by numerous estate agents, by consulting one of the websites that is supported by a consortium of real estate agencies (for example, www.asuntoverkko.com), or thought portals (e.g., www.oikotie.fi or www.etuovi.com in Finland).
- iii) Potential for the *elimination of some or all of the significant costs* associated with real estate agents service delivery through offices (e.g., reductions in the number of telephone and personal enquiries received,

reduction in the need to publish brochures, reduction in advertisements in print media, and ultimately the sale of some offices, leading to the release of capital and the elimination of the office running costs).

iv) Potential for innovative approaches to *depicting properties online*, using digital photography and virtual reality coupled with other high technology tools. Especially Google Earth has widened possibilities to show the environment of the property in a new way.

v) Potential for offering a range of *additional information and advice online*, and marketing related services, thereby acting as a one stop shop for all services associated with moving house. [3]

Moore [10] has stated: "*A better informed customer leads to a more productive agent which can save time and money for the real estate company.*" However, if the potential buyer attempts to locate and purchase the property on his/her own, the broker is removed from the equation. Guttery et al. [11] as well as Tse and Webb [12] raised the question about the Internet's potential for enabling information sharing, and for bypassing the traditional broker. It is thus important to examine the buyer's search costs - if the costs are lower than the brokerage fee, it is likely that buyers will conduct the search themselves and will have no need for a broker. [9]

Zumpano et al. [13] found in their empirical study that the use of the Internet as a search tool reduces search costs even though broker intermediation is involved in finalizing the sale. Because the Internet increases the search intensity, buyers are able to inspect more homes without extending search duration. This is beneficial also to the agents, since they can concentrate on showing homes that have the highest probability of meeting their buyer's needs. Zumpano et al. [13] advise brokers to expand their web presence in order to insure their survival as an intermediary in real estate transactions. Gwin [9] developed a model to determine how much information brokers should supply on a website. The model examines the buyer's tradeoffs between hiring a broker and gathering information on his or her own; as the buyer's search costs increase, the real estate broker can provide more information on the Internet while still avoiding disintermediation.

There are conflicting views on what the ultimate effect of new technologies will be on the real estate field, some predict that they will lead to lower costs per transaction and need for fewer brokers [14], [15]; others argue that new technologies will increase the agents' revenue and net income. [16]. According to Miles [17], the Internet is prone to cut out middlemen and reduce margins, but Stanfill [18] states, nevertheless, that the best way to beat the Internet is to join it. Thus, it is widely agreed that despite the possible threats, the Internet presence is a necessity for real estate agents.

B. The Finnish Real-Estate Agency Industry

Year 2005 set a record for the real estate agents in

Finland, as measured by the amount and value of real-estate deals closed [19]. When analyzing the market with Porter's five forces framework [4], the *bargaining power of suppliers*, i.e. the sellers of property, has increased compared with the *power of buyers* due to the rising price levels and lack of properties for sale. The *substitute* for using brokers' services is that consumers sell and buy apartments on their own, or live on rent, which is difficult due to the insufficient supply of rental apartments. The *entry barriers* to the industry are low, and in addition to the few large agency chains, there are numerous small firms in the residential apartment broker business. Thus, the market is fragmented. All these factors should have contributed to lower commissions according to the five forces framework [4], but instead, the common fee charged from customers has stayed as high as 4,88 % even after the Internet has entered the field. According to Böös of Osuuspankkikeskus [20], the actual average fees charged are between three to four percent.

The main large real-estate agent chains in Finland are Huoneistokeskus and SKV (that announced their plans to merge in August 2006), Kiinteistömaailma and OP Kiinteistökeskus (OPKK), which all provide Internet services for home sellers and buyers. In addition, SKVL, the Finnish Real-Estate Agents Association represents over 400 small and medium-sized agents, and provides a common web service (www.asuntoverkko.com) for over 100 companies belonging to the association. More detailed information on these companies is provided in Appendix 1. There are also two portals, www.etuovi.com that shows the offering of over 1 300 real estate companies, and www.oikotie.fi that is a platform for sale by owner (FSBO) and broker advertisements. The large real estate agent chains have historically been tightly coupled with some banking group – this might be the reason why these chains do not belong to SKVL, and there is no association that represents the whole real estate field.

When the web services of the portals and the biggest real estate agents are analyzed using the e-service framework of Grönroos et al. [8], the following observations can be made. The *medium*, i.e. the user interface has a professional look, and the structure of the services is quite similar on different websites. Even though a well-functioning user interface is a necessity for a satisfying user experience, it does not provide a sustainable competitive advantage for the agency since the user interface is so easy to copy by competitors.

The *core service* of real estate brokers is to act as intermediaries between home sellers and home seekers, e.g. by posting for sale announcements in different media. Thus, an important determinant of their offering is the amount and quality of the announcements. *Facilitating services* are necessary for making the service accessible. Accordingly, good search engines and versatile search criteria are the most important facilitating features. Different ways of searching in the main real estate

websites, and other service elements are listed in Appendix 2. The basic search criteria on most sites are the number of rooms, price range, size of the property, building year, property type, condition, special features and the like. Map search, possibility to have “my own site”, and searching with a house code are also common service elements. Search for foreign property, mobile service integrated to web services, or services in different languages are much rarer elements.

Supporting services are value-adding components that are used to distinguish the service from competitors' offerings [8]. In real estate settings the sites can offer articles on housing price trends, hints on interior design, stories on agents' work etc. All analyzed websites offer supporting services to some extent, and two of them provide a link to affiliated sites, the content of which consist of purely supporting services (e.g. www.kotikissa.info).

In Finland, there are small and medium-sized real estate agents who still function as pure brick-and-mortar companies, but most agents use either the parallel or the synergy strategy [21] of the bricks-and-clicks approaches. The parallel strategy means that both channels work independently of each other, and thus the Internet channel is explicitly separate from and unrelated to the physical channels. The synergy strategy is a mixture of virtual and physical channels, explicitly linking the virtual and physical presence, and deploying the strengths and benefits of both channels. [21]. Since the real estate brokerage is “people business” [3], there have been no serious attempts to move the whole real estate process to the virtual world. However, the newcomer to the Finnish market has developed novel services and moved new phases of the real estate process to the Internet, in order to facilitate the finding of right buyers and sellers. We will describe this development next.

III. CASE DESCRIPTION

In this research we follow the case study method [22]. Our interest lies in technology-enabled changes in the real estate process. A company is analyzed in depth, and other technology-savvy real estate companies are presented with less detail. The study can be described more as an exploratory [22] than confirmatory study since confirmatory study would need detailed analysis on more companies. The data of this paper consist of a review of scientific journal and contemporary magazine articles, analysis of company websites, discussion forums and blogs, and of an interview.

The case company, Igglo, is owned by Taivas Group, a marketing conglomerate that owns several companies in Finland. The resources of the mother and sister companies were used to plan and implement Igglo's website and marketing campaign. The web service was launched in February 2006, and by August 2006 Igglo claimed that it

was the third largest real-estate agent in the metropolitan area [23]. The new elements of the web service were made possible by a proprietary database of nearly 40 000 pictures of houses (excluding detached houses) in the Helsinki area. The marketing catchphrase is “Your home is already at Igglo”. The launching of the website with new service elements triggered complaints from the competitors who felt that Igglo’s activities were breaking, if not the law, at least the established, good practices in the field. The Competition Ombudsman ruled that there is nothing illegal with the way Igglo was conducting its business. In the following, Igglo’s service elements – push turning into pull, information on the site (supporting services), user involvement, and versatile search functionalities (facilitating services) – are described in more detail.

A. Igglo’s Internet service elements

As already mentioned, the large database of pictures is a prerequisite for the new service elements, the most novel of which is the push marketing turning into pull.

From push to pull

According to various sources [20], [24] the finding of home sellers, who are the paying parties in the real-estate contracts, can take up to two thirds of the agents’ work time. In most real estate sites, the potential sellers are only offered an e-mail address of the agency to express the sale interest. Agents are usually the first callers if the owner places a for-sale-advertisement in the newspaper or on a website, and potential sellers have had no tool to test the demand for their apartment – until now.

With the *silent sale* service, prospective sellers can test the demand for their apartment, and the previously agent initiated contact (push) turns into a pull mode whereby the customer is the initiator of the sale. If there is demand for the apartment the customer service personnel contacts the prospective seller to see if s/he is serious about the sale. The other real-estate agents claim that they have offered similar service to their customers for years by providing the seller with potential buyers from their own data base. However, the visibility of interest is far greater in a website. During the first six months there were 3 800 silent sale announcements on Igglo’s website [23].

With another service element – *earmarking* – the prospective buyer marks those streets, houses or apartments that s/he is interested in, and s/he will be notified if the apartment comes to the market for sale. The main difference with the traditional system is that the interest is transparent, all the users of the web service are aware of the interest, not just the agent. The whole web service concept was born with the idea of earmarking – the process was first tried out in an offline environment, (with letters left to the owners of the houses that were of interest to the prospective buyer) and was then implemented digitally. During the first six months there were 15 000 earmarkings on Igglo’s website [23].

If the buyer and seller find each other based on the silent

sale and earmarking services, the commission charged by Igglo is 1,85 %. According to a survey conducted in May 2006 [25], most of the sellers expected to learn about the interest towards their apartment (64 % of 300 respondents), and the market-value of their apartment (13 %) when they use silent sale announcement. When asked about the likelihood of having Igglo to broker the transaction, 48 % of the respondents (N = 347) answered that it is very likely or likely that they would sell with the help of Igglo. [25]

When asked about earmarking, 42 % of the respondents (N = 340) expected to be notified when the earmarked target came for sale. When asked whether the respondents (N = 417) would buy the earmarked apartment if the seller had a contract with Igglo, 44 % of respondents answered that it was very likely or likely that they would use Igglo as an agent [25]. According to Igglo’s managing director, Mr. Ranin, 90 % of their deals were struck with the 1,85 % commission by August 2006 [26]. Thus supply and demand seem to meet, even though many competitors have labeled silent sale and earmarking as nothing more than just marketing gimmicks.

Information on the website

One of the most important pieces of information that both sellers and buyers are interested in is the price level of apartments. It is possible for buyers and sellers to follow the price requests from the newspaper and website advertisements. This has been made easier by Igglo that has collected ask prices of apartments to the website. In addition, there is also a graph of the average price level of the area (data provided by the Statistics Finland). The actual bid prices are submitted by different real estate agents to the Statistics Finland, and released six months after that deals have taken place. Real estate agents are thus owners of very important information that is only partially revealed in the form of price requests in sale advertisements.

Pictures are one of the most important features that add value to customers on a real estate agent website. In addition to pictures taken from apartments, there are also pictures taken outside the houses and above from the air to give an overview of the area. On the website, there are also links to the town planning office to make it easy to check what changes are to be expected in the area. In addition, links to nearby houses can be found. Originally, there were also additional descriptions that were based on Mosaic’s geo-demographic profiles but they were removed because of complaints from some users [27]. Other supporting services include frequently asked questions, presentations, and information on how to conduct a housing deal.

User involvement

The web service encourages the registered users to take part in the content creation by asking them to supply stories about the houses and the area, to enrich the descriptions of the houses and to submit pictures of the houses. The service is implemented so that the users can choose from pre-determined attributes to describe the apartment, house and

area. It is also possible to ask questions from the prospective seller or the landlord. The user involvement feature has earned the case company the name “the first Finnish web 2.0 company”. Even though one of the basic characteristics of services is the interaction between the service provider and the customer (and in e-services this interaction is implemented electronically), the traditional roles are modified in Igglo’s service since more power is in the hands of the customers. Although there is a disclaimer on the user submitted content, opening the service requires trust between Igglo and the users. In August 2006, the user generated content was scarce on the website, less than what the company had expected [27].

Search functionality

Igglo provides several ways of searching on its website, but the competitors offer versatile functions as well, as can be seen in Appendix 2. The original idea of the site was for the search engine to interpret free-format text-fields, however, it proved to be problematic [27], and at the moment the advanced search is implemented with predetermined attributes of apartments and houses.

The more traditional search attributes implemented on the website are: town, area or the name of the street, price range, number of rooms, condition of the apartment, construction year, and type of the property. Recently, new search categories were added to the service: the most wanted (in nr. of earmarking), the most visited, the most offered (in nr. of silent sales), the most expensive, the least expensive, the most expensive per square meter, the least expensive by square meter, best ads (based on the ratings of Igglo’s site visitors), and the most pictures and questions answered. In addition, a map-based search is possible.

Figure 1 summarizes the main elements of Igglo’s website. When the user inputs, for example, a street address on the website, the service presents pictures of the houses on the street. When the user chooses a house, the house specific information is presented, i.e. information on recent price requests of the apartments in the house and in the area, supply (sale or silent sale), demand (earmarking), and interest in apartments for rent.

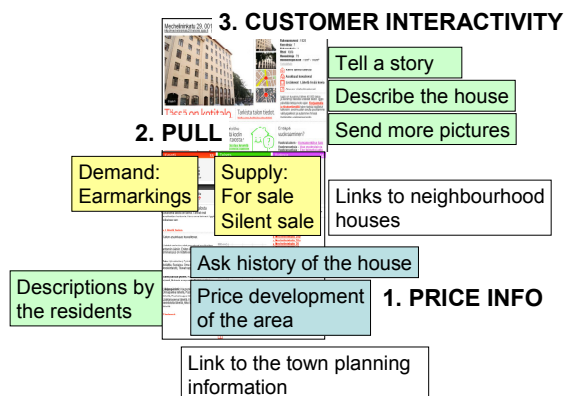


Figure 1: Case company web-service.

B. Analysis of Igglo’s Marketing Model

In general, a business model refers to the ways of creating value for customers, and to the ways a business turns market opportunities into profit through sets of actors, activities and collaboration [28]. Timmers [29] describes a business model as an architecture for product, service and information flows including the description of business actors and their roles, potential benefits for business actors, and the sources of revenues. The combination of a business model and marketing strategy is called the marketing model [29]. Igglo’s marketing model elements are discussed next.

Igglo’s *value proposition* can be summarized in three main points: lower commissions, more transparent information, and finding the right buyer and thereby the best price for each seller. Its *revenue model* is based on commissions paid by the seller of the apartment. The commission is 1,85 % + the costs of documentation for the *basic service*, in case both the seller and buyer connect through the web service. The *efficient marketing service* charges a 2,85 % commission, including advertisements in newspapers and brochures. The most comprehensive service, the *value service* costs 3,85 % and it includes staging and cleaning of the apartment. The service offering is thus differentiated to meet the varied needs of the customer base.

Igglo’s *competitive advantage* is based on the picture database that has made the new services - silent sale and earmarking - possible. The real estate process is clearly divided into the self-service phase and into a traditional agent’s role. Because the previous push model of finding sellers has been transformed, at least partly, into a pull model, there is time and cost savings that the case company has chosen to pass on partly to the customers in the form of lower commissions. A customer satisfaction survey conducted among Igglo’s customers in spring 2006 [25] found that the company was perceived as above expectations by 33 %, the same as expected by 53 % and below expectations by 14 % of the respondents (N = 858). 15 % of the respondents were very satisfied with the service and 44% were fairly satisfied. However, there were only 72 deal concluded by May 2006 when the survey was conducted, thus the respondents most likely answered to the question: “Are you satisfied with the Igglo’s web services” when they were asked about their overall satisfaction with Igglo. Dabholkar and Overby [30] examined the concept of service quality linking it more to the service process, whereas customer satisfaction is more dependent on the outcome of the service encounter. The outcome of the real estate process, i.e. success in selling or buying a suitable apartment is likely to be more important than the process of how the sale is conducted [31]. Igglo will face a further test of the viability of its business model when a well-functioning web service is combined with the traditional real estate process in a larger scale as the company expands geographically.

Igglo is an unusual real estate company in the sense that its roots are in the marketing field (Taivas Group). The launching of the web service was a text-book case of how to attract attention. The first press release came out only after the site was already up and running. Competitors' angry reactions made reporters write even more on the new service. Three months after the launch of the service, 55 % of Southern Finns recognized Igglo's name either spontaneously or when helped [25]. According to Igglo's managing director, Mr. Ranin, their services are a prime example of Rogers' [32] innovation diffusion; Igglo's name is already familiar to the *early adopters*, and the next group of users will be the *early majority*. Igglo is thus claiming that it has successfully jumped over the "death valley". The *brand awareness* is based on the fame of the founders and their previous successful innovations of other companies belonging to the Taivas group (most notably Sulake and Habbo Hotel).

Igglo's Internet service is being developed constantly, which is possible since the service is coded in-house. In addition, in order to gain photos of the next areas of expansion (cities of Turku, Tampere and Lahti) there is a photograph competition titled "the best and the most horrible picture of my living quarters". Pictures of the capital region, and some other cities are also objects in the competition. Igglo aims at starting a new program with a commercial TV-channel in which the sellers committing themselves into signing a contract will have their homes staged for sale. Moreover, Igglo has joined a group headed by MIT that studies the real-estate industry.

In financial terms, during Igglo's first six months there were 1 000 brokerage deals signed, 400 deals concluded, 3 800 silent sale announcements, and 15 000 earmarkings. There were over 1 500 000 visitors to the website, and almost 50 agents hired in the capital region and six in Turku [23].

IV. REAL ESTATE AGENT PROCESSES

According to Wofford and Clauretie [33], the real estate agent's work includes five process phases: *listing the property*, *prospecting for buyers*, *servicing*, *negotiation and agreement*, and *closing*. Since finding the paying customer, i.e. the seller, is so crucial, we add a new phase – *prospecting for sellers* as the commencing phase. In this section, these six process phases are deliberated as we compare the traditional way and Igglo's novel way of conducting the real estate business. In addition, we present some future scenarios.

A. Traditional Way

Traditional real estate agents spend a lot of time in advertising and keeping a close eye on FSBO advertisements in order to *prospect for sellers* that would be willing to sign a contract with them. Thus, in relation to the sellers, the agents are commonly the ones taking initiative and pushing their offering to sellers. After the

seller and the agent have signed a contract for the sale of the apartment, the agent uses different channels to *list the property*: the agent's website, portal websites, newspapers and direct mail.

Prospecting potential buyers, on the other hand, is less work for agents since buyers are active seekers of information in the traditional mode, too. Efficient search tools, good-quality pictures, virtual tours and information on the neighborhood (schools, parks, shops) increase the value of the agents' website. In the *service* phase, a broker tour in the apartment is arranged in order to make high-touch evaluation [31] possible, and the necessary documentation is provided. In the *negotiation* phase, the help of the agents is needed especially in gaining price information on the area, and in conducting negotiations on behalf of the customers. In the *closing* stage, the official deal is signed, and the agent is often present providing the necessary legal documentation.

B. Igglo's Way

Igglo's service elements were already examined in detail in the previous section. The four most important differences when compared to the traditional way of doing business are: push turned into the pull mode (*prospecting for sellers*), versatile offering of information on the site (*listing*), users as content-creators, and more search options (*prospecting for buyers*). When the supply and demand meet, Igglo's customer service personnel contact the silent seller to inform her/him that there is an interest in the market. After that, the three last phases of the real-estate process do not differ greatly from the traditional way of conducting business. However, new services are introduced, e.g. house value calculator and different levels of brokerage commissions with different levels of services. The trend of providing other than just the basic service, thus customizing the offering for the needs of the customers, is likely to increase in the future.

C. Technology Enabled Future Way

In the future, *prospecting sellers* with the pull mode is likely to become more common. An indication of the fact that the pull mode concept might be universally appealing is that www.redfin.com, an online Seattle brokerage is interested in applying for an U.S. patent of taking photos of houses in Seattle region [34]. User involvement in planning and implementing services is increasingly important. Since, especially the younger generations are used to sharing their photos, favorite links, music, films and thoughts (e.g. www.flickr.com, <http://del.icio.us>) it is likely that this customer base is willing to be more involved in customer processes, including the content creation in websites. There are few technological and human prerequisites for this development: a broadband connection, and proliferation of digital cameras. The user-generated content is used when *listing* the information of the apartment on websites.

In the future, it is likely that buyers will be offered better

and more versatile search engines and options. Especially in the United States various searches that combine information from different databases (so-called mashups) are increasingly common. For example, www.propertyshark.com combines census information with maps and allows searching among others with the following criteria: single men availability, toxic sites, or recent sales. Google Earth is often used as the map platform (for example www.earthpoint.us), but other map information is also used (for example www.geniusrealty.com) on which other applications are built on. Thus both the *listing* and the *prospecting for buyers*- phases are influenced by these developments. Buyers have been active previously, but an even more active role of buyers is encouraged by e.g. www.reply.com that offers a possibility for a prospective buyer to scan houses in the US market, and to send an offer to prospective sellers through reply.com that charges a fee for the service. Reply.com expects a response rate of 20 to 25 % from the sellers. Redfin.com, on the other hand, will implement a similar service in Seattle and San Francisco by the end of the 2006 but their response rate expectations are closer to 5 % [35]. Reply.com has implemented its service without pictures of actual houses (using air photos), but redfin.com is likely to use photograph of actual houses.

The traditional task for the real estate agent's *servicing phase* - showing a round in the apartment - is already divided into the online and offline elements. Usually the preliminary screening is done on the Internet, and only those apartments that fulfill the buyers' specifications will be seen on the spot. Various 3D-model and virtual reality presentations might someday improve these phases even further, although it seems difficult to believe that the home buyers would be willing to buy an apartment without seeing it first in person. Even a more agile and flexible way of serving customers is to operate from a van like the agents of www.geniusrealty.com in Boise, Idaho do. The company has equipped its van with a high-speed Internet access, wireless communication, and faxing, copying and printing capabilities. When a customer calls with a request to see a house, the agents try to be at the house for sale within minutes with all the necessary information to strike a deal. The company also offers other technology-enabled service features on its website, e.g. Internet live chat and push to talk. In addition, the valuation of homes in monetary terms is a vital feature in real estate sites even though calculators are often accused of lack of accuracy. However, in the US market, using the valuation calculator on www.zillow.com site, to "zestimate", has made the site the eighth most popular real estate site according to ComScore Networks [36].

Regarding the *negotiation phase*, the price request of an apartment is naturally an important reference point, but often even more important are the actual bid prices of apartments in the neighborhood. At the moment in Finland, the public information is only average price information

based on zip-codes. However, the Housing Fund of Finland is planning to host a free service that offers apartment bid prices of the 15 biggest cities for the general public. The service will be implemented as a map application with mean price information on the street level [37]. This transparency will improve the position of the buyer, and help sellers to set their price requests at a more realistic level. Realistic price information is important, especially during swings in economy since changes in economic activity is reflected in housing prices very quickly [37].

In the future, efficiency could be added to the negotiation phase if tools that already exist, e.g. web-based video and audio conferencing, were used. When examining the international development, we found that www.redfin.com has added a possibility to make an offer electronically for an apartment even though the customer had not previously seen the apartment [38]. The method might be suitable for buying a holiday home or an apartment on the other side of the country.

In Finland, the *closing* phase could be implemented electronically thanks to the country's advanced e-banking infrastructure. An apartment sale is a stock trade, and it could thus be carried out with the help of digital signatures, and electronic bank transfers. The Finnish Ministry of Justice has made plans to build an electronic system to enable the closing of property deals, which are legally even more complicated than apartment deals. The driving force behind this plan is the considerable cost savings accrued [39].

Based on the above discussion, Figure 2 sums up the three ways of conducting real-estate agency business - the traditional way, the way launched by Igglo, and the possible future way.

	1. PROSPECTING FOR SELLERS	2. LISTING	3. PROSPECTING FOR BUYERS
Traditional way	2/3 of agent's time	Website & newspaper ads, brochures	Search functionality
Igglo's way	Silent sale PUSH -> PULL	Website ads, (newspaper ads, brochures)	Earmarking Search functionality
Possible future way	Pull	User involvement	Advanced search, mashups
	4. SERVICING	5. NEGOTIATION, AGREEMENT	6. CLOSING
Traditional = Igglo's way	On-site showing	Personal service, (advice about price offers, counteroffers etc.)	Advice, official documents
Possible future way	Virtual reality, 3D, bid price, info, differentiated services, calculators	Chat, web cameras, web conferencing	Electronic closing

Figure 2: Three ways of conducting real-estate business.

V. CONCLUSIONS

The focus of this paper has been in the real estate industry in Finland, and the Internet-based changes that have turned a collection of static pictures and text into a

more interactive search and decision-making tool for home hunters. The novel e-services and marketing model of Igglo, a newcomer to the Finnish real estate industry, were described in detail. In addition, several US exemplars of innovative ways of offering real estate services were presented.

It seems that, at least in Finland and US, the Internet is about to change the processes of real estate business. The real estate industry is an information-rich service industry – and the information that was previously owned by agents is now openly presented in websites. Additionally, the amount of information on the websites is manifold; a good example of this is Igglo's proprietary picture database that has made services like silent sale and earmarking possible. The silent sale service presents a clear change in thought – the sellers that have previously stayed passive have now a possibility to initiate the selling process by silently “test-selling” their apartments. This means that the push mode has turned into pull. Other innovations include that the users serve as content creators, they are offered more search options and more versatile price and other information on the websites. The innovative real estate agents emphasize lower commissions and well functioning web services in their marketing campaigns. At the same time, they also provide customers with traditional services in order to offer something for everybody – and usually at a lower price than traditional brokers.

Real estate sector is a “hot” at the moment in Finland – economy is growing, interest rates are low, and apartment prices have risen for years – and new entrepreneurs have untapped the possibilities of the Internet. The Internet has brought efficiency gains since agents can concentrate on the productive phases of broker's role. However, the Internet might also present threats if sites that combine map applications and other databases to FSBO-housing information (e.g. www.housingmaps.com) become common also in Finland. Self-confident sellers will cut out the middlemen and sell their homes by themselves. Another example of an innovative service that gives sellers and buyers an option to act on their own is www.reply.com. Reply.com is being paid to deliver bids to the owners of apartments by potential buyers, but the company is not involved in the actual broking of apartments itself. In general, although a customer decided to employ a real estate agent, there is pressure towards lower commissions since customers carry out activities that previously belonged to the agent, and start questioning what the agent is doing for his / her fee.

In the real estate industry the service can be divided into online and offline phases. Online services focus on providing comprehensive and rich information to the customers with easy to use and attractive user interface. The purpose of offline services is to offer elements that are lacking online, most importantly on-site viewings (thereby providing high-touch information to aid buyers in their decision-making), personal advice on price negotiation and

help in arranging e.g. a staging or pre-sale home inspection. Since changes in online services impact offline services, future research could include examination on how the service quality and customer satisfaction are, on one hand, linked to service process and outcome, and on the other hand, to online and offline services. It would be managerially important to find out which aspects of the real estate services, online or offline, influence the customers' perceived value and satisfaction, and how.

It is somewhat difficult to draw straight parallels from real estate industry to the popular e-service industries because of the particularities in each industry. Electronic banking and stock trading have a virtual delivery mode, and in auctions (like eBay) the value of the purchase is rarely as high as the value of an apartment. However, some generalizations can be made.

User involvement in planning and implementing services will be increasingly important. It is also likely that the advertising revenues from the website will increasingly supplement commission revenues. In addition, new revenue models will be created, or old ones employed again – there might be an ample supply of good ideas to draw from in the archives of previous dot.com companies. Internet might now be able to deliver the promise that was made in the dot.com years: “*Internet-based electronic markets leverage information technology to match buyers and sellers with increased effectiveness and lower transactions costs,*” and therefore lead to “*more efficient, 'friction-free' markets*” [44].

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APPENDIX 1: FINANCIAL INFORMATION ON THE MAIN COMPETITORS

	Total sales	Growth-%	Employees	Nr of deals	Bank affiliation
Huoneistokeskus	65,5 mln	14 %	580	13.800	Nordea bank
Kiinteistömaailma	53,5 mln	20 %	650	14.000	Sampo bank
SKV	29,6 mln	21 %	310	10.000	
OP-Kiinteistökeskus	N/A	20 %	450	16.000	local cooperative banks

- Huoneistokeskus was founded in 1953. It has concentrated on big cities and expensive houses and property deals. Approximately 600 professionals work for Huoneistokeskus in more than 70 offices throughout Finland. In addition to buying and selling property and residences, they also broker rental flats and provide a premises evaluation service. Sponsor capital and Nordea are the main owners.
- Kiinteistömaailma was established in 1990. According to Kiinteistömaailma, it is the fastest expanding real estate agency in Finland. Kiinteistömaailma has sales outlets in 52 regions in Finland and personnel of over 600 professionals. Kiinteistömaailma functions on a franchise principle, and the sales outlets are owned by local, independent entrepreneurs. Sampo Bank owns the central office of the whole chain.
- Op-kiinteistökeskus is a fairly traditional real estate agency that is owned by the local cooperative banks. It functions in cities, but has been especially successful in the countryside and in smaller cities.
- SKV used to be owned by savings banks. Sponsor capital is nowadays the main owner. In August 2006, SKV and Huoneistokeskus announced their plans to merge.
- SKVL was founded in 1946 and the members are 400 SME's that are responsible for about 40 % of the real-estate deals.

APPENDIX 2: SEARCH ELEMENTS OF THE MAIN REAL ESTATE COMPANIES

Search and service elements	Huoneisto-keskus	SKV	Kiinteistö- maailma	OPKK	Asunto- verkko	Etuovi	Oikotie	Igglo
Map search	x	x	x	x	x			x
Seller information							x (in some cases)	
Type of property	x	x	x	x	x	x	x	x
Ownership structure		x			x	x	x	x
Number of rooms	x	x	x	x	x	x	x	x
Price range	x	x	x	x	x	x	x	x
Size	x	x	x	x	x	x	x	x
Building year	x	x	x	x	x	x		x
Characteristics of apartment or house	x	x	x	x	x	x		x
Condition		x			x	x		
Availability		x			x	x		
Extra conditions	x	x	x	x	x	x	x	x
Save search	x	x		x		x		x
Search with a code	x	x	x	x	x	x	x	
Search by showing day	x	x	x	x	x	x		
"My own site"(registration)	x	x	x			x		x
Country						x		
Region	x	x	x	x	x	x	x	x
Region in detail	x	x	x	x	x	x	x	x
Other search criteria	x	x	x	x	x			x
Availability					x	x		
Mobile service			x				x	
Several language	x							
Number of all property	4 000	3454	6583	7430	2582	50 800	40 261	1500 (incl. houses)
Number of apartments	3 269	1619	4 333	4454	1 696	30 598	23 594	350 (for sale)

Source: Real estate websites as of 10 September 2006

Applying Absorptive Capacity Construct to Customer-related Knowledge Processing

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Abstract

The importance of customer-related knowledge as a source of competitive advantage has been addressed by several researchers during the last decade. However, only a little is known about the processes through which firms learn to know their customers organization-wide. In this article we propose that one possibility to study how firms process customer-related knowledge, and thus learn about and from their customers organization-wide, is to apply absorptive capacity construct originally developed in the context of innovation activities. By building on previous literature on absorptive capacity, customer knowledge management and relationship marketing, we introduce a conceptual framework of customer-related absorptive capacity, and discuss the external and internal antecedents to the construct. We propose that customer relationship performance could at least partly be explained by the capability of the supplier firm to acquire, assimilate, transform and exploit customer-related knowledge.

Keywords

Absorptive capacity, customer knowledge, customer relationships.

1. INTRODUCTION

The absorptive capacity concept suggests that the ability of an organizational unit to link its knowledge to innovativeness and learn from the external knowledge source depends on the degree of its absorptive capacity [1]-[3]. Although the absorptive capacity construct has been applied in several streams of research, for example in organizational learning, knowledge management, strategic alliances and innovation management [4], it has been less popular among marketing academics. In the marketing literature academics have studied market-based organizational learning [5], but the marketing literature still remains rather silent on the organization-wide learning about specific customers [6]. An increased understanding from this perspective would however be of great managerial interest for example to practitioners struggling with the high number of unsuccessful customer relationship management (CRM) implementations [7]. Moreover, it is suggested by several researchers that customer-specific

learning can create competitive advantage for firms as it helps firms not only to understand their customers better, but also to learn what their customers know [8]-[9]. By improving the level of customer-related knowledge, firms are able to provide and develop products that include added value to the customer. The development of customer-related knowledge also enhances the ability of the firm to gain competitive advantage, as customer-related knowledge is invisible, and thus, hard for competitors to imitate [10].

This paper is conceptual in nature and examines the applicability of the absorptive capacity construct in the context of customer-related knowledge processing. The paper investigates how the four dimensions of a firm's absorptive capacity: acquisition, assimilation, transformation and exploitation conceptualized by Zahra and George [11] can be applied to examine organization-wide learning about specific customers from the perspective of a supplier firm.

Based on the previous research on absorptive capacity, customer relationships, and customer knowledge management, the paper introduces a framework depicting the elements of customer-related absorptive capacity. We propose that firms can gain great synergies if they have capabilities for acquiring, assimilating and transforming customer-related knowledge organization-wide and also capabilities for exploiting the knowledge in their customer value creation processes. Thus, the better the firm is able to leverage its customer-related knowledge assets; that is the knowledge about and from their customers, the better it is able to provide added value to the customer, and thus, more likely to achieve competitive advantage. We propose therefore that customer-related absorptive capacity may at least partly explain customer relationship performance. However, in accordance to the conceptualization by Zahra and George [11] we recognize that the capabilities of firms to leverage their knowledge bases differ, and thus also the ratio between potential and realized absorptive capacity differs.

2. ABSORPTIVE CAPACITY - LITERATURE REVIEW

The concept of absorptive capacity was introduced by Cohen and Levinthal [1] in the context of innovation activities and R & D. They defined it as the "ability to

recognize the value of new information, assimilate it, and apply it to commercial ends". The absorptive capacity of the firm is a path-dependent construct, which builds on its prior knowledge base and the intensity of effort, thus determining the ability of the firm to acquire new knowledge [1,12-13]. Absorptive capacity has been proposed as a critical factor in innovation process of the firm [1,3], and therefore as a potential source of competitive advantage in the dynamic markets [14]. Since the seminal work by Cohen and Levinthal [1] also other definitions for absorptive capacity have been provided. Kim [15] has referred to absorptive capacity as the capacity to learn and solve problems. Zahra and George [11] on the other hand have proposed that absorptive capacity is a four-dimensional construct consisting of acquisition, assimilation, transformation and exploitation of knowledge. They also distinguish between potential and realized absorptive capacities, and state that realized absorptive capacity is the primary source of performance improvements. Another categorization of the construct by Lane, Salk and Lyles [12] divides it into the ability to understand, assimilate and apply external knowledge. Compared to Zahra and George [11] above, this categorization does not open the processes inside the organization in as much detail, and does not accentuate the active role of the organization in acquiring the knowledge.

Originally in the absorptive capacity stream of research, the unit of analysis has been the 'innovating unit', be it the firm or a subsidiary. For example, Cohen and Levinthal [1] have focused on the firm level but yet, acknowledged that there is also a need to focus on the communication among the sub-units in order to fully understand the absorptive capacity construct. The original operationalization of the concept was in the form of R & D intensity (also used by e.g. Stock, Greis and Fischer [16]), but since the birth of the concept, it has also been operationalized and used as a dyad-level construct, *relative absorptive capacity*, in the context of interorganizational learning [17].

During the last decade absorptive capacity has become a widely used concept among academicians. It has been applied for example in studies related to technology transfer [18-19], international expansion of a firm [20], new product development [16], and customer relationship management (CRM) [21]. For the purposes of this paper, the studies done in the context of acquisition, transfer and exploitation of knowledge are especially interesting. Absorptive capacity has become a widely used construct for example in studies related to knowledge transfer within multinational corporations [2-3, 22-24]. In these studies the positive linkage between absorptive capacity and knowledge transfer has become well established [2, 25], but it has however been found that the organizational units may also differ in their ability to manage potential and realized absorptive capacity [26, 11]. Although it has been generally acknowledged that the competitive advantage of a multinational firm derives from its ability to create and transfer knowledge internally [27], these studies indicate that the transfer of best-practices or knowledge does not

happen automatically, as the different units within multinational corporations have different kind of abilities for learning from other units. Moreover, knowledge has also been characterized as "sticky" meaning that it is difficult to transfer across organizational units [25].

Absorptive capacity has also been studied in inter-organizational interface focusing on international joint ventures [17, 12, 28]. In this stream of research Lyles and Salk [28] found that the more the company learns knowledge from the foreign partner, the better the performance of the joint venture. Moreover, it is proposed by Lane, Salk and Lyles [12] that inter-organizational trust has an important role in the absorptive capacity because it drives the 'teacher firm' to help the 'student firm' to understand the knowledge that it is offering to the student. In studies from inter-organizational perspectives it is thus recognized that the counter-part in the dyad may either inhibit or impede the absorptive capacity of the knowledge absorbing party.

3. A CONCEPTUAL FRAMEWORK OF CUSTOMER-RELATED ABSORPTIVE CAPACITY

Based on the previous literature on customer knowledge management [6, 8-9] we assume that there is a positive relationship between customer-related knowledge processing and customer relationship performance. However, in order to examine more deeply how firms process customer-related knowledge, and how they learn to know their customers organization-wide, a systematic description of the intra-organizational learning processes is needed. By building on the absorptive capacity conceptualization by Zahra and George [11] we propose a conceptual framework (figure 1) where customer-related absorptive capacity consists of a capability of the firm to acquire knowledge from and about the customer via multiple channels (acquisition), a capability to interpret the knowledge based on the previous customer-related knowledge structures (assimilation), a capability to integrate the knowledge within the firm so that new value creating offerings to the customer can be developed (transformation), and finally, a capability to develop own internal competencies based on the new customer-related knowledge and capability to provide added value to the customer (exploitation). In accordance to Zahra and George [11] it is also suggested that the customer-related absorptive capacity can be characterized either as 'potential' or 'realized'. In the context of customer relationship management this could imply that many firms are good at generating customer-related knowledge but few have competence to make use of it as argued by Campbell [6]. Customer relationship performance in our study refers to customer profitability, customer satisfaction and increase in customer-specific sales. Before proceeding to the main dimensions of customer-related absorptive capacity, we firstly discuss the antecedents to the customer-related absorptive capacity in the following section.

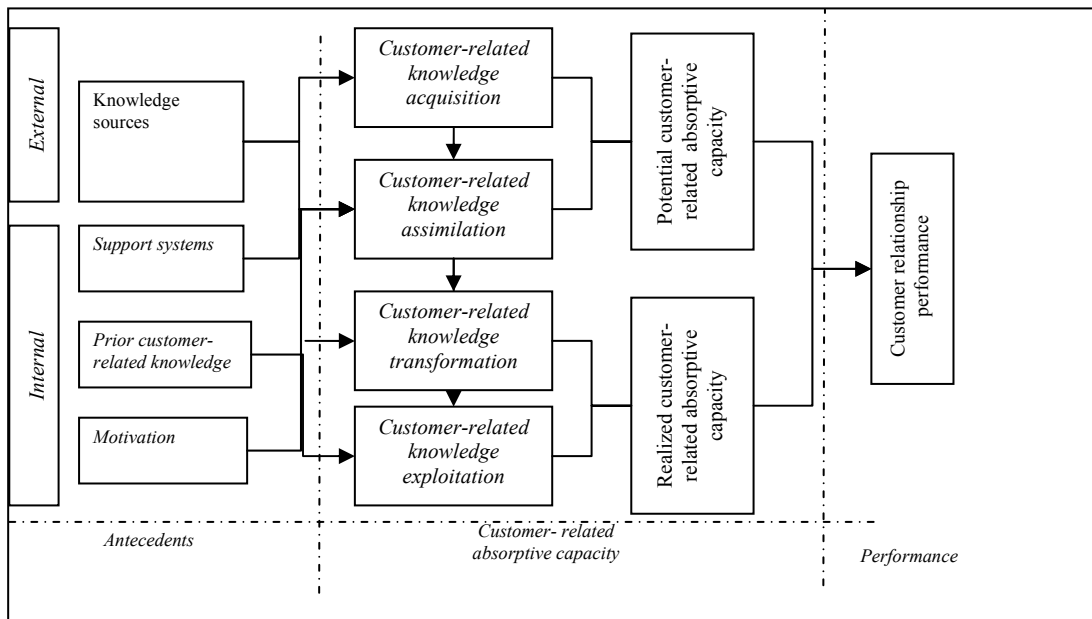


Figure 1. A framework of customer-related absorptive capacity

3.1. Antecedents to customer-related absorptive capacity

Despite the vast amount of literature on absorptive capacity in different streams of academic research, the focus in research has only recently started to shift from studying the impact of absorptive capacity on knowledge transfer to the factors that drive the development of the absorptive capacity in the first place. Based on a recent literature we propose that the antecedents to customer-related absorptive capacity are either internal or external to the focal firm. The external antecedents refer to the sources of knowledge. The internal antecedents refer firstly, to the past experience as proposed by Zahra and George [11], secondly, to the motivation of employees to absorb new knowledge as proposed by Minbaeva et al. [24], and thirdly, to the support systems implemented to improve customer-related knowledge processing. In the following, the relevancy of each antecedent for the customer-related absorptive capacity is each separately discussed.

3.1.1. External antecedents

Knowledge sources

The external knowledge sources reflect the degree to which the firm is exposed to new knowledge. It is suggested by Zahra and George [11] that the diversity of the knowledge exposure, and the degree of complementarity between the firm's existing knowledge and knowledge from the external source, both have a positive effect on the development of the absorptive capacity. Moreover, as 'customer-related' means that we are discussing specific customers, the customer itself has an effect on the absorptive capacity of the supplying unit. Therefore, in accordance to the findings by Lane, Salk and

Lyles [12], it is suggested that the counter-party, in this case the customer, can either impede or enhance the absorptive capacity of the supplier firm. Moreover, Gupta and Govindarajan [2] argue that the similarity of personal characteristics, social characteristics and language between the knowledge source and the receiver has a positive impact on the development of absorptive capacity. These propositions imply that a pure exposure to diverse external knowledge may not yet guarantee a development of absorptive capacity. The knowledge from the external source must be related to the existing knowledge base of the firm.

Firms can become exposed to customer-related knowledge through several sources. These sources can be either indirect, such as competitors and other interest groups other than the customer itself, or direct, the customer. Furthermore, direct customer knowledge can be acquired from transactions or from interactions with the customer [8]. It is argued by García-Murillo and Annabi [8] that interactions produce knowledge that is richer in content compared to transactional knowledge, which concerns for example customer preferences and purchasing activity of the customer. Customer interactions provide much higher quality knowledge because through these interactions it is possible for the firm to gain knowledge on what the customer knows [9]. The more complex the customer relationships, and thus the more contact points between the buyer and the seller, the more knowledge sources there are through which the customer-related knowledge can be absorbed.

3.1.2. *Internal antecedents*

Prior knowledge structures

As new knowledge builds on the existing knowledge structures, it would not be possible to identify relevant new knowledge without prior related knowledge [29]. If the prior knowledge base is limited, the firm may end up at distributing widely every little piece of new information [5], thus easily leading to an information over-load. Moreover, the path-dependent nature of the absorptive capacity [1] implies how firms end up in following different paths and developing their competencies into a certain direction, possibly ending up in a competency trap.

In general however, prior customer-related knowledge structures, and previous experience of the relationship help firms to recognize the relevant new customer-related knowledge. Prior customer-related knowledge thus provides the basis for future value creation opportunities for the customer.

Motivation of the employees

As the absorptive capacity of an organization or organizational unit consists of the absorptive capacities of its individual members [1], the absorptive capacity can be developed by enhancing the absorptive capacities of each individual employees. According to Minbaeva et al. [24], employees can be motivated to absorb knowledge more effectively. This could happen by investing in human resource management (HRM) practices, such as employee training or performance-bound incentives, that support the ability and motivation of the employees to absorb knowledge, and by creating an environment that enhances frequent communication and knowledge sharing [26, 23]. In this sense traditional functional organization structures have been found inefficient because they tend to increase specialization, and thus, create barriers for internal communication [14].

Following the arguments by Minbaeva [24], we suggest that the development of customer-related absorptive capacity depends on the motivation of each individual involved in the management of the relationship to absorb customer-related knowledge. The motivation to absorb customer-related knowledge is closely related to the organisational culture and top-management support that further affect the way employees regard customer relationships [10], and the way they desire to learn about specific customers [30]. Front-line salespersons have an important role in the absorption of customer-related knowledge because they have the access to customer interactions. They have thus an access to the knowledge that the customer holds, and thus their motivation should be the number one interest for the managers.

Support systems

Capabilities of a firm to absorb customer-related knowledge are also driven by the organizational support systems such as (CRM) -software. CRM software enhances the development of the customer-related absorptive capacity because it extends the amount of customer -related

knowledge sources the firm is able to handle. The software also functions as a knowledge repository or "memory" where the customer-related knowledge can easily be stored for further analysis. CRM-software can be used to analyze, process and integrate customer-related knowledge from various sources, either secondary or primary. Although many firms have failed in implementing CRM effectively, recent research findings by Mithas, Krishnan and Fornell [31] show that CRM software can also have positive effect on performance if the customer is willing to share information.

3.2. *Dimensions of customer-related absorptive capacity*

In the following section we discuss the main dimensions of customer-related absorptive capacity and illustrate the difference between realized customer-related absorptive capacity and potential customer-related absorptive capacity.

Acquisition of customer-related knowledge

For the marketing academics, the externally generated knowledge critical to operations may refer either to the knowledge about the markets (that is customer, competitors, industry), or knowledge about the specific customers, when the aim is to develop and enhance specific customer relationships. In the marketing literature, the acquisition of knowledge has been traditionally referred to as an important function in a market-oriented company [32-33], and a positive relation between the intelligence generation and customer value has been proposed [33]. It has also been identified as an essential input in new product development [34]. Along with the shift from transactional orientation of marketing to relational orientation, the emphasis has shifted towards knowledge generation for the purposes of enhancing specific customer relationships [10, 35]. The acquisition of customer knowledge for purposes of relationship marketing differs from the traditional market information processes conceptualized by Kohli and Jaworski [32] as the purpose of relationship marketing is to develop specific customer relationships and "*create loyal customer so that a stable mutually profitable and long-term relationship is enhanced*" [36]. Thus, instead of gathering information of a "faceless market", relationship marketing aims at learning about specific customers [37].

Customer-related knowledge is typically acquired through multiple channels, be it IT solutions or personal contacts between the sales persons and representatives of the customer [35]. When operating in an international environment, customer-related knowledge must also be acquired in a number of different geographical locations, thus adding a contextual nature to the customer-related knowledge. The quicker the company is able to acquire customer-related knowledge through the multiple channels and multiple markets, the quicker the firm is able to answer to customer-specific needs.

Assimilation of customer-related knowledge

Zahra and George [11] define assimilation as "*firm's routines and processes that allow it to analyze, process, interpret, and understand the information obtained from external sources*". Information technologies such as CRM systems are effective tools in analyzing and processing customer-related knowledge. Interpretation and understanding are however always human activities that can be improved for example by increasing the number of informal meetings and communication between the personnel involved in the management of customer relationships. This implies that true customer knowledge competence cannot be achieved by relying completely on information processing technologies as suggested by Campbell [6].

Assimilation of the new knowledge is important because without it, the knowledge cannot be disseminated to other parts in the organization and existing knowledge bases cannot be renewed. Thus, assimilation capabilities are required to make sense of the externally acquired customer-related knowledge and to integrate this knowledge so that consistent value-adding strategies can be developed for the customer [6]. Assimilation capabilities are extremely important when customer relationships are geographically extensive and involve multiple contact points between the customer and the supplier. In such case, assimilation capabilities are needed to avoid contradictory service offerings to the same customer. As there is an increasing tendency of customers to demand coordinated service from their suppliers [38], we propose that the better the capabilities of the firm to analyze, process, interpret and understand the customer-related knowledge, the better the customer relationship performance.

Transformation of customer-related knowledge

Transformation dimension of absorptive capacity refers to the capabilities that facilitate the renewing of existing knowledge bases based on the new acquired and assimilated knowledge. Thus, as a result of transformation, firms may be able to see important matters in a different light, and they may have to change their dominant perceptions. As Zahra and George [11] put it: "*it yields new insights, facilitates the recognition of opportunities, and, at the same time, alters the way the firm sees itself and its competitive landscape*". Transformation capabilities allow organizational renewal, and are thus closely connected to strategy development processes. At the customer level this means that transformation capabilities help firms for example to recognize new value creation opportunities to the customer, and to develop value-adding customer relationship strategies, to define new possibilities for increasing customer integration, and to discover improvement areas in own day-to-day customer service processes.

Exploitation of customer-related knowledge

According to Jayachandran et al. [35] the major impetus for companies to generate customer knowledge is to learn about customer needs and behaviors and as a consequence,

to develop customer specific products and services. The ability to create value to the customer may lead to the competitive advantage of the firm [39], and reduction in costs [40] as the customer will most likely to continue buying from the supplier that is capable for providing highest degree of added value. Thus, the last dimension of the customer-related absorptive capacity, exploitation, is perhaps the most important one as it describes the capability of the firm to exploit the customer-related knowledge in the customer value creation for example in terms of new products and services. This is also the dimension that allows the firm to leverage the existing competencies or to develop new competencies. As such, it is also the most challenging stage as many firms have been found to be better at acquiring knowledge than actually utilizing it [6].

Potential and realized customer-related absorptive capacity

Zahra and George [11] suggest that absorptive capacity can be either potential or realized. Potential absorptive capacity consists of acquisition and assimilation capabilities, and realized absorptive capacity consist of transformation and exploitation capabilities. They also suggest that both components of absorptive capacity "*fulfill a necessary but insufficient condition to improve firm performance*". This means that firms are not able to exploit knowledge unless they firstly acquire and assimilate it. On the contrary, acquisition and assimilation of knowledge does not yet guarantee improvement in performance, whereas realized absorptive capacity has been proposed as a primary source of performance improvement [11]. In addition to the path-dependent nature of absorptive capacity emphasized by Cohen and Levinthal [1], the distinction between potential and realized absorptive capacity provides an additional explanation for why some firms are so much better in leveraging their customer-related knowledge bases. It is therefore important for firms to recognize whether their capabilities to absorb customer-related knowledge differ from the competitors, and whether the firm is better at developing potential than realized customer-related absorptive capacity. The degree to which managerial activities should be directed to nurturing the development of potential versus realized absorptive capacity depends also on the competitive environment. For example Jansen, van den Bosch and Volderba [26] have suggested that firms should pay special attention on the nurturing of potential absorptive capacity when the markets are dynamic. This implies that when the markets and customer base is under constant change, firms should remain more receptive to diversity of customer-related knowledge sources.

4. DISCUSSION AND LIMITATIONS

This study depicts a framework which can be applied to studying organization-wide learning about specific customers. It thus increases our understanding on the

capabilities of firms to learn about and from their customers organization-wide. In general, the paper concentrates on the intra-organizational determinants of effective customer knowledge processing, which is a very highly neglected area in marketing research [6]. It is proposed in this study that the performance of customer relationships could be at least partly explained by the capabilities of supplier firms to acquire, assimilate, transform and exploit customer-related knowledge.

In this study absorptive capacity construct has been studied from the perspective of a supplier firm serving specific customers. This means that in our framework the target of knowledge exploitation is a specific customer relationship. It should however be noted that firms may exploit customer-related knowledge for other purposes as well, for example to develop relationships with new potential customers. On the contrary, by acquiring knowledge about and from new customers, firms may be able to sense new opportunities and to apply this knowledge in the development of the existing customer relationships. This means that firms must hold on to knowledge diversity and aim at holistic understanding of the competitive environment. Diversity of knowledge is especially important in the rapidly changing market environment because it increases the probability that new knowledge is related to the prior knowledge the firm has [1]. Moreover, in the rapidly changing markets, the responsibility of customer-related knowledge acquisition should be a decentralized responsibility because one person alone does not have the capacity to keep track on continuous changes. In this sense, an increase in the level of cross-functional cooperation could provide significant advantages.

Although absorptive capacity construct has been developed for studying phenomena in R&D management context, we propose that the construct is applicable also in the context of customer-related knowledge processing. Customer knowledge is after all an external knowledge source the same way than any other knowledge. However, it should be noted that as firms organize their processes and activities for serving customers in a specific manner, depending for example on the size of the customer, the routines and activities through which customer knowledge is processed in the organizations are different from the routines and activities used to process other type of knowledge. This should be taken into consideration when operationalizing the capabilities that constitute customer-related absorptive capacity.

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Barriers to Adoption of Advanced E-business in Welsh Small and Medium Sized Enterprises

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Abstract — *The eCommerce Innovation Centre (eCIC) at Cardiff University has a central role in Opportunity Wales, a programme providing e-business support to over 9000 Small and Medium sized Enterprises (SMEs) during the last five years. Uptake of advanced e-business adoption has been low during the programme as well as throughout Wales in general. This paper reports on the findings of a pilot study that was undertaken in the fifth year (2006) of the programme. The approach taken to identify the key barriers to adoption was through interviews with a cross section of expert delivery partners and a sample of SMEs that advanced e-business was relevant to. The key objectives were to understand the barriers to adoption in respect of the current programme as well to help planning for future support initiatives. In addition, the research would help identify and overcome certain barriers in relation to the objectives of the Lisbon Strategy. The paper concludes that varying definitions of e-business inhibit our understanding of uptake when comparing to other studies or initiatives. Also, the strategic planning of e-business, where relevant, will reduce barriers to advanced e-business adoption, as will the lessons learned from SMEs who have successfully made the transition.*

Keywords — e-business, e-commerce, integration, advanced e-business, wales, smes

I. INTRODUCTION

A key challenge that has arisen within Wales is encouraging Small and Medium sized Enterprises (SMEs) [1] to adopt more advanced e-business applications and for these to integrate better with business processes and applications. In Wales, Opportunity Wales, Opportunity Wales Advance and Opportunity Wales in Objective 2 Areas [2] are co-existing projects that have helped SMEs adopt e-business. Over the last five years the combined projects have provided support to over 9000 SMEs. A Wales wide survey – State of the Nation (SON) [3] is conducted annually by the eCommerce Innovation Centre (eCIC) at Cardiff University and reports on the level of e-business adoption through the same route map used to assess the position of Opportunity Wales clients. SON findings and Opportunity Wales benchmarking data consistently show that the adoption of integration and advanced e-business is low. This appears consistent as the Information Society Benchmarking Report [4] concludes that Europe lags behind in the use of advanced e-business

applications.

Defining advanced e-business is not always straight forward but the integration of e-business processes with internal systems is a significant indicator used in the context of the Opportunity Wales programme. The term e-commerce has been used throughout the programme but e-business is now widely accepted as a more appropriate definition relating to SME uptake. The route map used by Opportunity Wales and the SON report benchmark the level of adoption from stages 0 to 6 with stages 5 and 6 being considered advanced e-business.

Despite the United Kingdom being the highest adopter out of the 26 European countries for both selling and purchasing products/services via the Internet, the linking of sales/purchases with internal systems still remains very low [5]. Also, the Information Society Benchmarking Report discusses how the United States is better at Information Communication Technology (ICT) integration. Although this is only one area of adoption, it describes the synergy of adoption with growth and productivity in comparison to the lesser extent of Europe's adoption. Various contributions to the Lisbon Strategy such as the Impact Assessment [6] acknowledge that in relation to e-business more efforts are needed to improve business processes and fully integrate ICT providing new opportunities to reduce costs and improve performance. The low uptake makes research into this area, particularly the barriers, very important in relation to future progression of e-business in general as well as in Welsh SMEs.

The objective of this study was to identify the key barriers to advanced e-business adoption for Opportunity Wales clients so they can be addressed through this or future regional projects. Interviews with project delivery partners and actual SMEs with differing requirements provided the primary source of data.

The paper reports on the pilot study findings of the barriers to SME adoption through Opportunity Wales, a data set that is a significant representation for Wales. The research will contribute to understanding how Welsh SMEs can achieve certain objectives of the Lisbon Strategy in relation to advancements in e-business adoption.

II. PURPOSE AND METHODOLOGY

The research objectives are to understand the barriers to

advanced e-business adoption for Welsh SMEs based upon the experiences of delivery partners in the Opportunity Wales project, as well as a representative sample of SMEs that integration and advanced e-business is relevant to. The Opportunity Wales Programme consists of three projects all designed to help Welsh SMEs adopt e-business. The projects have trained over a hundred advisers who provide support to SMEs across the Objective 1 and 2 areas of Wales. eCIC has a central role in the project involving adviser training and quality control as well as a multitude of e-business research activities. The route map is a tool that has been used to benchmark clients through the duration of the projects by positioning them at a stage depending upon their e-business activities at the time. Adoption benchmarked for clients and responses through the Wales wide SON survey provide a strong indication of uptake and conclude that the two most advanced stages of the route map remain low throughout the duration of the project. In respect of the Opportunity Wales projects this research is a pilot study and makes up part of a "lessons learned" process for the programme. The findings from other European regional reports and projects are also discussed where appropriate in relation to the findings within Opportunity Wales and the future uptake of SMEs in general.

The approach taken for this pilot study to understand the barriers to uptake further was through the three phases described below:

Phase I – A summary analysis of the Opportunity Wales benchmarking data and SON findings in relation to advanced e-business adoption.

Phase II – Interviews with three Opportunity Wales delivery partners who have supported approximately one third of the Opportunity Wales clients. Their expert views on the barriers of uptake are an important part of the debate in relation to the project.

Phase III – Primary research through case examples of established clients who have been interviewed over time. This includes SMEs that have successfully implemented a level of advanced e-business or have barriers preventing them from doing so.

III. FINDINGS

A. Phase I

In respect of the Opportunity Wales Programme and for discussion in this paper, advanced e-business refers to stages 5 and 6 of the route map:

Stage 5 - This can almost be seen as an internally facing development as Internet technologies are used to extend integration. Everything from the business on-line shopfront through to manufacturing and fulfilment are brought together and it is possible to gather information from all parts of the business. This allows the business to move towards a more integrated internal use of eCommerce.

Stage 6 - This can be considered advanced eCommerce, as developments stand at the present. In a

B2B situation the business could join on-line exchanges, eMarketplaces and related services, using the Internet to connect with business partners, suppliers and customers. B2C companies could offer personalisation to customers, consider affiliate programs or advanced eMail marketing campaigns and customer management systems. [7].

It has been accepted by the management team and the practitioners in the project that this is a guide and not an exact interpretation. Certainly Stage 5 implies that multiple organisational processes need to integrate but in reality if one significant process integrated to a back office system then this would be classified as Stage 5.

The problem of defining advanced e-business is not just an issue existing within the Opportunity Wales programme but is also evident in other projects.

The OECD proposes a definition of e-business as "(automated) business processes (both intra- and inter-firm) over computer mediated networks." Furthermore, according to E-business Watch [8], the OECD definition implicitly indicates that the focus and main objective of electronic business is to be found in business process automation and integration, and the impacts thereof.

The evolving definition of e-commerce and e-business has seen Opportunity Wales use the term e-business more recently, but the OECD definition of e-business with its reference to business process automation is what Opportunity Wales has defined as Stages 5 and 6 of the route map. Another UK regional initiative, ConnectingSW, commissioned the South-West ICT Benchmarking Survey 2005 [9]. This study identifies the areas that Opportunity Wales benchmark in Stages 5 and 6 but as different subsets of business functions which include supply and purchase functions, marketing and sales function and system linkages. A Scottish regional initiative also conducts an annual e-business survey [10] and benchmarks 'integration' independently of any business function but looks at the numbers of processes that are integrated.

The first phase of the Opportunity Wales programme 'Opportunity Wales', had a client base of 5456 after a three year period. Although this figure accumulated as more clients received support, clients were benchmarked at 6 monthly intervals. By the end of the Opportunity Wales project less than 1% of clients were at stages 5 and 6 of the route map. Opportunity Wales Advance is a continuation of Opportunity Wales and like its predecessor covers the Objective 1 areas of Wales. The project is currently 2 ½ years into a 3 year project and out of 4263 clients to date, again less than 1% are at stages 5 and 6 of the route map. Opportunity Wales in Objective 2 areas is a 2 year project running in parallel with Opportunity Wales Advance. After 18 months and currently 1099 clients, the benchmarking data is also concluding that less than 1% are at stages 5 and 6 of the route map.

The SON reports similar findings to the Opportunity Wales benchmarking data and represents a Wales wide sample. Only 3% of SON respondents are Opportunity

Wales clients so the data sample is clearly different. Less than 4% of SON respondents with an Internet connection are at stages 5 and 6 of the route map.

The comparison of how different UK regional studies have benchmarked e-business and advanced e-business adoption has confirmed that the approaches taken are very different. This concludes that not only is making a comparison of adoption difficult in respect of UK studies but the varying definitions and benchmarking approaches taken demonstrate that there is still uncertainty over how e-business should be defined and measured.

B. Phase II

Phase II reports on the findings from interviews with a representation of Opportunity Wales delivery partners who have had direct exposure to e-business adoption in their areas. This was preferred to a questionnaire targeting relevant SMEs due to the very small sample that Phase I identified.

The barriers reported have been classified below:

- Cost was a barrier to uptake but more so uncertainty of cost.
- A lack of understanding of the issues involved in adopting this level of e-business.
- A lack of confidence in supplier solutions.
- A lack of understanding on return on investment.
- Technical capability or internal skills required.
- The level of impact and risk this would have on existing systems.

The qualitative responses did not conclude which barriers were the most significant but it was clear that cost was not always the biggest issue.

Key comments made by interviewees:

- “SMEs need convincing that there is a need or something breaks before they consider investing or reinvesting. If there is a clean investment then maybe the ideal solution will be implemented”
- “In respect of the type of application and the company profile that advance e-business adoption is relevant to: Profile: “Companies with 25 or more employees in the retail sector”, Application: “1. Web site integration to database, 2. Web site catalogue integration to Accounts system, 3. Integration of e-business related Customer Relationship Management (CRM), 4. Supply chain related integration.”
- “Lack of confidence in marketplace and suppliers with testimonials”
- “Barriers to such implementations and the upheaval that the change may bring i.e. the replacement of key systems with new, security concerns of critical elements such as accounts becoming linked to on-line applications, the

impact it could have on a job role when someone has always performed this role manually so why change.”

C. Phase III

The statistical data cited concludes that uptake is very low so to understand the barriers to uptake the first hand experience of relevant SMEs was considered important. Five SMEs with differing situations and requirements were interviewed over a period of time:

1) Company A

A small retail outlet operating predominantly in the traditional retail market but with growing on-line sales.

2) Company B

A small manufacturing company with both a domestic and international customer base that is diversifying in a declining market.

3) Company C

A small automotive retail company operating a simple but successful just-in-time (JIT) system to fulfil customer requirements while remaining efficient within operating capacity.

4) Company D

A small company with an overseas manufacturing operation with end products sold predominantly through B2B sales channels.

5) Company E

A small manufacturing company that now makes significant on-line sales of its finished products.

TABLE 1 – APPLICATIONS IN USE BY COMPANIES INTERVIEWED EXPERIENCING BARRIERS TO ADOPTION

Company	Application
A	An Electronic Point of Sale (EPOS) system is in place for traditional retail sales. A Web site with on-line catalogue and payment facilities is present for the growing on-line market. An e-procurement system is in place with their main supplier. These three applications are not integrated.
B	Current application of e-business is an effectively marketed Web site and use of email. Web site is currently being reworked but a requirement has existed for five years to have an integrated customer support function.
C	Current applications include a Stock Control system and e-procurement system that are not integrated.
D	Currently a new accounts system with a stock management system that needs populating. An overseas manufacturing outlet with basic IT systems that are not integrated with the UK office.
E	A Web site with on-line catalogue with payment facilities and an accounts system that are integrated.

Companies A, B, C and D have looked at integrating some part of their e-business activities with their internal

systems but have clearly stated barriers to doing so whereas Company E has succeeded in integrating part of their e-business functionality to internal systems but experienced barriers in doing so. Table 1 summarises the applications in use.

Company A Barriers

The barriers reported by Company A were both business and technology related. Integrating their on-line catalogue to their EPOS system was seen as desirable but not essential. However, integration would help overcome the problems with linking stock availability to the Web site without worrying whether customers could be ordering items that were unavailable. Also, the time involved in manually checking stock availability against items for sale is further justification for investment. In respect of technology barriers the EPOS system and on-line catalogue are from different suppliers with the reality of integration remaining an uncertainty from both a functionality and cost perspective. The on-line catalogue supplier offers bespoke integration but how costly and feasible this would be has inhibited progress to date. Barriers to integrating e-procurement with their largest supplier are more strategic. If there was a greater commitment to this product range through existing sales channels a fully integrated solution could be provided by this supplier. This also represents a level of risk and uncertainty.

Company B Barriers

Over time important returns on investment have been made by effectively marketing their Web site and securing B2B sales. To reduce the amount of time spent providing customer service the idea of an integrated customer support tool has been evaluated for the last five years. The main barrier to adopting this technology is cost and uncertainty of cost. In addition to this and with a budget in place, reinvestment in a new Web site with associated marketing is a priority.

Company C Barriers

The two main applications in use are an order processing and stock control system as well as Web based e-procurement facilities from selected suppliers. The order processing and stock control system has some capabilities for supply chain automation and the e-procurement system support on-line ordering. The biggest barrier in this operation is business related where automatic reordering at previously fixed prices can affect profit margins in a marketplace that involves significant bartering.

Company D Barriers

For several years the company has talked about better process integration with their overseas manufacturing outlet. Any process or activity involving stock is time consuming and the primary business case for such an investment was time saving and a more fluid operation. The company had previously had a bespoke stock management system that they were heavily reliant upon but felt they did

need to move away from this at the right time. Despite the upheaval the new accounts system is in use with the transition of stock control to happen shortly. When the new stock system is fully operational, partial integration will be possible between both outlets. The primary barriers to this implementation have been a combination of cost and time. It is not the direct cost of the technology needed that is a problem but internal staff resources are limited. Staff time is always prioritised to tasks for maximising outputs so prioritisation has meant that it has taken this length of time to take one step closer to system integration.

Company E Barriers

At first a Web site and On-line catalogue were implemented and were a separate entity to the internal accounts system and order processing. Growth of Web sales were significant and an investment appraisal with the options of employing a new member of staff or investing in an integrated system were considered. Progression with one of the options was deemed critical to manage the workload but the integrated system was the most cost effective solution. It was a coincidence that an integration facility was available for the accounts application and on-line catalogue facility. The business case appeared correct but the main barriers were through implementation as the solution malfunctioned for a long time. Company E concluded that the solution was not completely fit for purpose and cited that cost was not the barrier but it was the unreliability and uncertainty of the supplier solution.

IV. DISCUSSION OF FINDINGS

It has become clear that the ambiguity surrounding the definition of e-business and advanced e-business is a problem that impacts the measurement of adoption, progression and barriers when comparing on a wider scale.

The pilot study (Phase 2) revealed through interviews with Opportunity Wales delivery partners that there were common barriers to adoption. This was important to identify key areas for future work. Phase 2 also identified that adoption of ICT and e-business is not often thought about strategically and this lack of planning adds to the level of uncertainty as well as a multitude of different applications being implemented to achieve short term objectives.

The interviews with SMEs (Phase 3) highlighted the individuality of the barriers. E-business Watch refers to interoperability as "the ability of ICT systems and applications to work seamlessly together, and for diverse information resources to be systematically and consistently accessible to applications." It also refers to "Technical" and "Business" interoperability [11] with the latter being the most complex. Phase 3 identified both technical and business interoperability barriers but these appear more relevant when a company has taken a step closer to adoption. Behind this, but in relation to progress towards adoption, there are early barriers such as lack of understanding of issues involved, lack of skills or lack of understanding of return on investment.

V. CONCLUSIONS

Opportunity Wales has seen thousands of gains from the deployment of e-business by SMEs despite adoption of advanced e-business remaining low. This certainly questions how important advanced e-business is for all SMEs. However, to achieve certain objectives of the Lisbon strategy, greater adoption is needed by those SMEs who would benefit from it but experience barriers from doing so.

This pilot study within Opportunity Wales has concluded that early barriers exist preventing some companies even looking to adopt advanced e-business as well as barriers surrounding the actual implementation.

To increase the uptake of advanced e-business in Welsh SMEs this pilot study concludes that the following future work be considered:

- Clarification of the potential uptake of advanced e-business in Welsh SMEs is needed. This would differentiate SMEs who had a need to adopt but have barriers to doing so from those SMEs that are unlikely to adopt.
- Clarification and consolidation of suppliers that provide advanced e-business products and services. There is a lack of confidence in supplier solutions as well as evidence of uncertainty surrounding the end solution delivery. The gap between customer expectations and supplier delivery needs to be reduced.
- Strategic planning for e-business adoption needs promoting through support service. Proper planning for e-business aligned with business objectives will reduce certain barriers to adoption.
- A cross section of SMEs who have successfully adopted aspects of advanced e-business need exemplifying. However, the issues as well as the benefits need to be drawn out for other potential adopters to learn from.

ACKNOWLEDGEMENTS

This paper is an output of the Opportunity Wales Advance project (Ref 55255), an Objective 1 programme funded through the Welsh European Funding Office and was produced by members of the eCommerce Innovation Centre research team. References are also made to Opportunity Wales (Ref. 52572) and Opportunity Wales II project (Ref 55265) and (Ref 55266). The authors wish to acknowledge the financial support given by the Welsh European Funding Office.

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Beyond V2C: Entrepreneur's Risks and Returns in the Era of Networked and Global Business

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Abstract — V2G model goes beyond V2C model and proposes an entrepreneur's personal view of the risks and returns as compared to that of the firm's risks-return trade-offs. At the growth stages, the partnership of co-entrepreneurs and VC or IPO also means risk sharing for the original entrepreneur or founder. Larger group of founders and early stage actors allow the entrepreneur to consider him or herself differently, even lower the "risk" of his or her job than the traditional entrepreneurs. V2G model combine the best parts of the roles as an entrepreneur (owner) and hired manager. Thus, in this case, it is not any more only "your" firm, but a rapidly-growing enterprise with the corresponding V2G mindset. This V2G mindset avoids negative effect of a single owner. The separation of the roles of the owner and manager will allow the entrepreneur-founder to adequately cope with them. In sum, V2G model points out three proposals: first, it examines risks and returns from entrepreneur's individual viewpoint; secondly it explores risks and ambitions between individual and enterprise; and finally it describes the importance of the ownership development of the enterprise and development of the value of the enterprise.

Keywords — entrepreneurship, growth venture, ownership, governance, Venture-to-Capital, V2C

I. INTRODUCTION

A. Growth Venturing

The rapid rate of globalization and quickening pace of technological innovation expose new venture activity to fresh challenges. It is no longer logical to maintain that firms aspiring to grow focus on domestic growth first and on incremental internationalization later on. The increasing velocity of change in knowledge-intensive societies and firms may have also intensified the need for, and the speed of, growth at home and international markets at the same time. Despite these changes in business and society, the discussion around entrepreneurship has remained associated with niche marketing, limited business outlook, ad-hoc and intuitive strategies, lack of resources and capabilities as well as over-reliance on the owner-manager's own initial competencies. The exceptions to these are the recent theoretical discussions and empirical findings regarding Born Globals and International New Ventures as well as V2C models (Venture-To-Capital) [among others e.g. 1, 2, 3]. This paper will build on the latter research and model-

building tradition by proposing a framework for growth venturing (or Venture-To-Growth – simply V2G) that starts with V2C and focuses on influential issues that impact the rate and pattern of rapid growth. The V2G proposes four families of factors, the shortage of which adversely influence growth. We refer to each shortage as a "Gap" [4] and empirically examine eight in depth case-firms for their implications and insights.

B. The Entrepreneurial Choice

Historically, entrepreneurs have created jobs for themselves and family members, employment for others, and wealth for the family and their regions as a whole gradually. Creation and preservation of family wealth has been the primary objective over time. Etemad [5] suggests that most of the successful firms, which grew to become regional and international, were local family firms at the beginning. This traditional growth path goes back to the local artisans, merchants and traders on the famed Silk Road, dating to 500 to 1000 B.C., that dominated the Far East and Middle East before extending to the Greek and Roman empires.

The examples of successful family firms, such as Medici's, Farnese, Della Rovere' (started in current Italy), Rothschild's (current Germany), Armstrong's, Chippendales and Parsons (current England), Ford, Carnegies and Rockefellers (the US) started from humble beginnings at home and expanded to their respective continent and beyond. The initial patriarchs of these families, similar to a host of others, were entrepreneurs: they aspired to create jobs, income and wealth for themselves, family, and then for others. However, not all family firms go on to become large international companies.

There comes a time that the initial entrepreneurs face the entrepreneurial choice between status quo, maintaining a secure and accomplished family firm in a steady-state, growing even further, or even bowing out. Thus not all family firms become the instrument of growth. Nor do all entrepreneurs become empire builders. In the process of building a firm, family or otherwise, some entrepreneurs grow the family firm and become content with it. Others evolve to adopt entrepreneurship as a way of life or a lifetime challenge and vocation. They go-on to become the builders of many new firms of their own choosing. They may even become serial or "professional" entrepreneurs and co-entrepreneurs at their own volition; and thereby

bring the much-needed wealth of knowledge, experience and social networks to a new start-up firm. In that process, they overcome many of the traditional shortcomings associated with the fresh and young entrepreneurial start-ups. Naturally, they bridge many gaps and chasms on the road to building growing companies at much faster pace, as they do not loose time to mistakes and set-backs.

On the other side of the coin, aspiring ventures also face the choice in the selection of their entrepreneurial team: e.g., between the team that aims for IPO as exist and the one that can help the firm to that rise beyond IPO and aims for V2G. This main objective of this research is to examine a range of such entrepreneurial choices, especially within the proposed V2G framework.

II. NEW CONCEPTUAL FRAMEWORK

A. Gap Reduction Approach

A fundamental assumption underlying the growth venturing (or venturing to growth or V2G) is that actors in, and around the growth venture, including the owner-managers, are committed to growth because of their belief that the growth objectives of the venture are more important than those of the entrepreneur [6]. However, without the entrepreneurial drive, dedication and commitment, which can be viewed analogous to a strong sense of ownership, a start-up would face even greater difficulties. The desire of some (traditional) entrepreneurs, mainly as a “lonely-rider” type or in family-owned and run firms, are to primarily secure personal or family wealth as opposed to growing the wealth of the venture. Thus, not all or majority of the new companies do want to grow fast. It is possible to argue that when there is one entrepreneur, or very few in the entrepreneurial team, both the entrepreneur(s) and the firm grow together. However, the presumed theoretical discordance between their respective objectives may eventually lead to diverging trajectories. Such discordance, if not divergence, in the extant literature suggests that there exists potential shortcoming(s) in both the mindset and the required qualities of the starting entrepreneurs in the beginning for the growth venturing to proceed. This suggests that there exists a combination of *Entrepreneurial-Managerial Gap*. However, the venture may face other shortcomings as well. The venture's ability to grow is undoubtedly dependent on its ability to add sufficient managerial capacity to manage the growth processes [among others e.g. 7, 8, 9]. This suggests that enterprise may face a problem in the delivery of adequate entrepreneurial and managerial services to the firm, both of which are crucial to a venture's sustained long-term growth. It is also assumed that a venture grows faster when it has enough capital resources and capabilities of its own to do so; or it takes steps acquire them in order to narrow its *Resource-Capability Gap*. Naturally, it grows even faster if it has enough information and knowledge [10] or systematically narrows its *Information-Knowledge Gap*.

Mason and Harrison [11] suggest that many ventures are unsuccessful in raising equity finance because they are not ready for receiving such investments. Similarly, Seppä and Näsi [3] state that “it is ironic that there is no shortage of

capital now; but there is a shortage of small-enough doses of it”, which point to the presence of the *Equity Gap*. When the company's stocks are intended for acquiring necessary resources and capabilities for further growth, this intention influences the ownership structure of the company. Stated differently, the founder-manager can utilize their entrepreneurial capital to access to incremental financial and knowledge resources; and thereby reduce both the resource-capability and knowledge-information gaps. Such injection and usage of equity helps the firm to develop quicker for becoming a publicly-traded company. However, the classical story of an entrepreneurial firm suggests that the entire authority over the venture is at the founder's command; or one person has all the authority and makes all the crucial decisions. In such cases, there is bound to be gaps between requirements of the new investors and the owner-entrepreneur. Therefore, the governance principles must be consistently developed to enable faster growth. This *Structure-Governance Gap* can be viewed in more reflective light as “a structure-conduct-governance” paradigm, where the changes in equity capital or ownership *structure* influence the *governance* principles of the enterprise. Ownership also tends to determine the balance of power between shareholders. Such balance reinforce the goals and risks of the shareholders, which in turn influences the nature of decisions and impacts firm's strategies and consequent growth rates [6].

B. Venture-To-Capital (V2C)

Seppä [12] illustrated “the VC spiral” that results in the growth in size of the average venture capitalist (VC) funds raised by a successful VC and in the consequent growth of the minimum amount of investment as well. Thus, the capital gap problem relates to the distance between a prospective venture and an investable venture. As stated earlier, Seppä and Näsi [3] observe that there is a shortage of small-enough doses of capital. Thus, family and personal savings remain the most important source of start-up funding, with venture capital playing a greater role in the early growth phase rather than in the start-up phase [13, 14]. Firms with a relative lack of tangible assets appear to be financed through less formal means, where non-bank financing (loans from individuals unrelated to business) plays a more important role in the capital structure of the start-ups. This emphasizes the importance of network resources in this type of ventures [15].

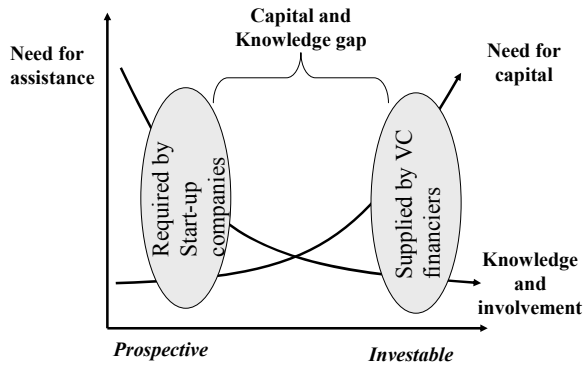


FIGURE 1: THE KNOWLEDGE AND INFORMATION GAP [16]

Rasila, Seppä and Hannula [16], and Rasila [17] introduced the equity gap that suggests the minimum investment limit is too high for young ventures. The reality of the equity gap (see Figure 1) can be seen as a negative phenomenon, as a shortage of adequate financing in the early stages of the life cycle. The equity gap is obvious and problematic for new ventures which seek rather small initial investment. As noted earlier, one strategic management implication of the Penrose effect [7] is that a fast-growing organization tends to stagnate due to managerial limitations (e.g., a part of the Entrepreneurial-Managerial gap). Thus, there is also a shortage of managerial competences, attention and time. This is called knowledge gap here (see Figure 1).

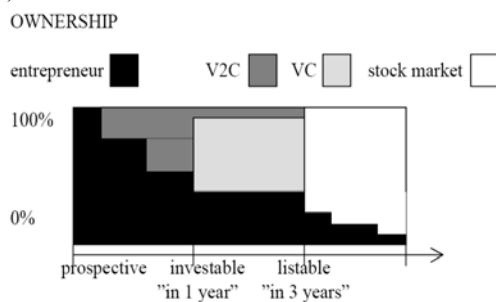


FIGURE 2: V2C MODEL [3]

Seppä and Näsi [3] described a V2C model which is distinguished from playing solo (where the lone entrepreneur owns all the shares) and pushed by VC models. This Venture-To-Capital (or simply V2C) model described the basic orientation of growth venturing, where distribution of ownership is faster than the other two models because ultimately the ownership is widespread anyway (e.g. IPO, MBO and LBO). On the other hand, the width of the “gaps” calls for efforts to create a new professional actor. Figure 2 provides an illustration of the space for V2C to fulfill in the process of accelerating ventures from idea to IPO [3].

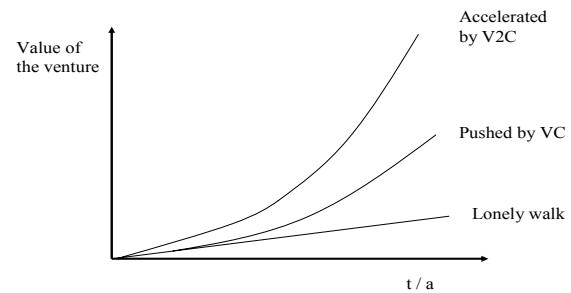


FIGURE 3: THE EXPECTED TRAJECTORIES OF VALUE OF THE FIRM OVER TIME [16]

The role of the entrepreneur is still vital but not as dominant as in the traditional view of growth venturing. In the context of growth venturing, it is assumed that a venture grows faster when it has enough capital of its own to do so. Naturally, the venture is not expected to grow rapidly without additional investments. Therefore, a venture grows even faster if it is also accelerated by V2C (Figure 3), which operates between the inception of a venture and the moment when it becomes attractive to formal venture capital financing. The V2C operative fills especially “the knowledge gap” or, as Penrose [7] called it, “the managerial limitations”.

C. Different Entrepreneurial Risks and Mindsets

Growth venturing is risky business in which stakeholders invest time, knowledge and money. In addition, various players are involved in the venture with different goals and attitudes to risks. For this study, the most interesting actors are, first and foremost, entrepreneurs (including founders), co-entrepreneurs, business angels and venture capitalists. They are deeply involved in the venture investing time, money and knowledge. They also carry the risks, but they reap the anticipated benefits.

For other players, such as banks, there are different tools to manage risks and, therefore, they do not necessarily absorb large risks. For the entrepreneur, the risk means walking away from a secure job and a career path. Although in the modern world, there is no longer such a thing as a career path of secure jobs. In addition, starting up a firm could be the only way to get a job. Personal risk also means that an entrepreneur is taking her or himself and her or his family into an unfamiliar storm of stress and uncertainty. However, for other players, this is just a job or a hobby. For professional stakeholders, risk management is a part of their job and they have a set of tools at their disposal for managing it (e.g. investment criteria, continuous monitoring and portfolio management).

Risk and investment in the venture influence the mindset of the strategy makers. Indeed, non-owner managers need to show their position, which explains their tendency to favor riskier growth strategies than their non-managerial counterparts [18]. On the other hand, an entrepreneur might choose the best for the family and not the best for the venture. In general, investments can be considered as

investment of money and knowledge (time).

Traditionally, there have been main types of entrepreneurs, ranging from life-style entrepreneur to traditional entrepreneur and serial or professional entrepreneurs. As entrepreneurs evolve, they learn how to transfer a part of the undesired risks inherent in entrepreneurial venture to others. For example and as discussed earlier, the entrepreneur in a start-up situation has no choice to bear the entrepreneurial risk personally as the young firm has no capacity to absorb it. A traditional view of the entrepreneur represents this situation, which is depicted in the south east quadrant of Figure 4.

With growth, however, the firm can begin to absorb more risks and the entrepreneur can transfer a part of the entrepreneurial risk to the firm. Life-style firms, where the entrepreneur manages the firm in a stable and steady fashion, bear all the risks. They populate a part of the South-West quadrant in Figure 4. Naturally, growth exposes both the firm and the entrepreneur to additional risks. While professional and serial entrepreneurs manage risks in a comfortable zone (depicted at the centre of Figure 4) and possibly transfer their personal risk exposure to the firm (as in the North-West quadrant of Figure 4), the speculative-type growth may not be able to do so. Growth in this type firms exposes the entrepreneur to large risks (as depicted in the North-East quadrant of Figure 4). Stated differently, entrepreneurs face different family of choice and they conduct themselves differently, which results in placing their respective firms in different positions in Figure 4. We will use this framework to further explore risk-growth-entrepreneurial choice interactions later on.

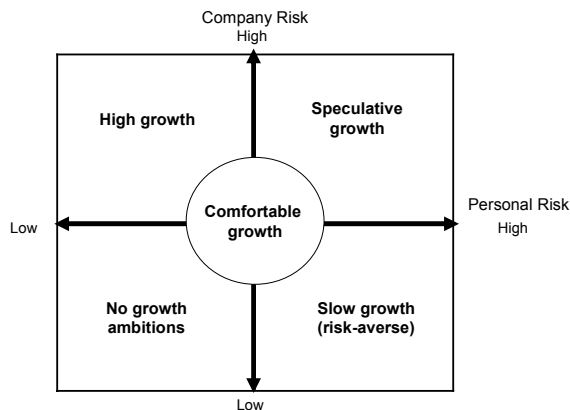


FIGURE 4: A SCHEMATIC REPRESENTATION OF FOUR POSSIBLE STATES OF PERSONAL-COMPANY RISK TRADE-OFFS BASED ON RANGE OF ENTREPRENEURIAL CHOICE.

III. EMPIRICAL RESEARCH AND FINDINGS

A. Methods

The empirical evidence of this research consists of eight in-dept and longitudinal case studies of rapidly growing and internationalizing young enterprises (RIEs) in Canada. These cases are selected from the six annual public lists of the Profit's "Top100 Fastest Growing Enterprises in Canada", spanning over the years 2000 to 2005. These lists are well-known and rank the growth of Canada's

entrepreneurial companies annually, based on the growth in revenue over a five-year period to avoid temporary fluctuations. Firms included in this study have grown very rapidly by any standard. Their average five-year growth rate is over 9800% (or over 150% on annual basis) and median internationalization is over 80% of gross revenue. Although, the inclusion of only publicly-held companies in the study could be viewed as a limitation, we decided in favor of completeness and accuracy of publicly-held information (such as public securities documents and information filed by public companies and investment funds with the Canadian Securities Administrators (CSA) in The System for Electronic Document Analysis and Retrieval filing system) as it enables us to examine and better understand the role of the ownership in the resource-constrained start-ups. The methods include careful criteria for selection of diverse RIEs to ensure broader applicability of findings. The selected vital statistics of each case-firm, based on in-depth and longitudinal development of the cases from the inception, spanning between six to 12 years, are highlighted in Table 1.

TABLE 1
SELECTED CHARACTERISTICS OF THE CASE-FIRMS.

Company Name	Five year growth rate	Revenue 2005 Canadian \$	Foundati on (Pre-seed)	IPO or Listin g
1.AirIQ Inc.	3,014%	\$40 million	1997	2001
2.Carmanah Technologies Inc.	3,669%	\$39 million	1997 (1994)	2001
3.DTI Dental Technology Inc.	2,570%	\$35 million	1996	1999
4.Extreme CCTV Inc.	12,735%	\$24 million	1994	2002
5.Garda World Security Inc.	9,452%	\$259 million	1994	1999
6.Pethealth Inc.	8,306%	\$14 million	1999	1999
7.TLC Vision Inc.	28,938%	\$303 million	1993	1997
8.Western Financial Group Inc.	9,647%	\$64 million	1996	1996

B. The Impact of Electronic business: E-Commerce is "business as usual" for RIEs

The empirical examination of case-firms reveals innovative, yet with theoretically consistent strategies, portraying patterns, which explain the entrepreneurial mindset in these younger rapidly growing firms. Consider the following selective examples. The central common business platform that supports AirIQ's telematic-related services on which the prevailing position of a mobile asset is stored, and from which, that position is reported (or further processed) is web-based or Internet-assisted. This allows mobile clients to access and transfer that information to their mobile devices easily and regardless of their location. Therefore, once the client has become part of the system, the Internet acts as the distribution channel for

machine-to-machine transfer of telematic information.. The Internet-Based Facilities (IBFs) and Technologies (IBTs) have enabled AirIQ to expand beyond the traditional channels for delivering its (telematic) services on real time and continuous basis practically everywhere. The extensive use of the IBFs and IBTs have allowed AirIQ to bridge the time and space that have traditionally acted as barriers, especially to smaller and younger firms for providing services on demand everywhere as such smaller younger firms cannot establish a physical presence earlier-on in their lives.

Pethealth's own IBFs and ITBs enable pet owners to conveniently subscribe to Pethealth services, pay their premiums and register a claim all on-line. Similarly, veterinary clinics can report pet's health status and place an expense claim online and avoid the paper work and waste of time conveniently. In fact, the Internet and customized IBFs and ITBs have at least complemented, and in some cases substituted for, some functions of the distribution channels with little regard for the timing and the location of the pet, pet owner, veterinary clinics and other buyers and suppliers. Pethealth services are available at all times where there is access to the Internet. In that process, they have bridged over time and distance and subsumed the mode of entry discussions by default. Pethealth's information databases that support all of its services can be viewed as its common business platform is also online.

Carmanah uses multiple and parallel channels for communication (e.g., interactive web-site, 1-800 number as well as local agents and distributors) from which a customer can choose depending on his preferences and needs. This is a typical pattern of information dissemination and distribution channel in rapidly-internationalizing firms. In light of e-commerce-enabled and interactive web-sites, the traditional concept of mode of entry has lost their conventional importance. Clients decide as to which channel to use and then the firms IBFs and IBTs assist and augment the process.

Although electronic commerce (E-Commerce) is central to AirIQ's and Pethealth's business models, their own customized IBFs and IBTs also play crucial and complementary roles in their respective E-Commerce platforms. In practically all RIEs in our samples, E-Commerce has become the "business as usual", especially when electronic business is integrated with the legacy systems, especially in the older industries such as guarding (e.g., in case of case-firm Garda). In fact, the role of E-Commerce is even more pronounced when it comes to knowledge-intensive businesses as well as services that can be delivered in digital formats. Once the firm meets the challenge of transforming its business to a digital format and deploys an E-Commerce platforms, it can offer them at all times and everywhere with the help of its own IBTs and IBFs that also enable further customization and adaptation to customer needs. Our in-depth case studies points to presence of E-Commerce platform augmented with each firms' own customized IBTs and IBFs in all of the RIEs in the study.

C. Gap reduction findings

All studied cases went public very early in their life cycle when the firms were relatively small (average revenue under \$4 million and median \$2,4 million). This finding suggests that publicly-raised equity were used to remedy the young firm's constrained resources, which has historically impeded these firms' growth. Consider, for example, that the publicly-raised funds could be used for acquiring productive resource early-on, which implies that the mindset and the governance structures of these companies had evolved beyond a single shareholder in favor of a smaller stake in a growing and larger company. This transformation has three immediate advantages:

i) the firm avails itself for relatively-inexpensive public funds earlier, which allows it to acquire the necessary resources and capabilities earlier and relatively cheaply and thus bridge its *Resource-Capability Gap* sooner and faster than relying on private sources of funds.

ii) The preparation for early IPO puts the firm on different footing regarding its management and governance structure as the entrepreneur or the initial entrepreneurial team prepares to become publicly accountable sooner with a profound positive impact on the firm's governance in the early stages for early listing. And,

iii), this re-orientation is bound to have positive effect on closing the *Structure-Governance Gap* as well. Another potential benefit of earlier listing is that it may influence the founders or co-entrepreneurs to bring experienced people on board earlier. Most of the entrepreneurs and co-entrepreneurs of our case-firms were highly-experienced and successful entrepreneurs and executives in their prior engagements. Most of them had founded their firm by harnessing the social capital of their social network in terms of acquisition of financing, attracting strategic partners and even in engaging key executives. Our Case-firms suggest that this earlier changes help to bridge the *Entrepreneurial-Managerial Gap* sooner and faster. Combined, the closure of the gaps could out the firm on a higher growth trajectory.

The growth path of our case-firms clearly deviates from the trajectory of young firms based the conventional principle of entrepreneurial independence and strongly gravitates towards interdependence, synergy and symbiosis [19]. Consistent with that practice, the case firms have also integrated newly-acquired competences (e.g., their senior owner-executives) with the existing internal capabilities of the firm and thus augmented their combined social capital, further enhanced their social network and the corresponding market knowledge and position as well as their customer base. It also appears that most of these RIEs combine multiple advantages and deploy a few dominant theoretically-sound growth patterns, which are highly information- and learning-intensive and customer-oriented, resulting in much faster reduction of the *Information-Knowledge Gap*. Their overall growth patterns, however, do not easily fit into the extant growth or internationalization theories.

D. Findings #1: Personal view

Our data of RIEs contains 10 primary founders or co-

entrepreneurs with have significant amount of shares and central influence in the development of the firm's rapid growth. Eight were CEO's and two in the executive position such as VP Operations and VP Sales.

The average compensation of Profit Listed companies were \$288,231 in 2001 [20]. According to Statistics Canada, the average salary for senior management personnel in Canada was \$100,950 per year in 2000. In UK the average salary of a director of a small company (up to £5m turnover) was £58 000 (about \$133,000) in 2002 [21]. This information shows that the case companies' top executives (mainly CEO) earn more or less same (average \$132,000 and median \$91,000) than average SME executive in the year before IPO, but much more than managers in an average SMEs after the IPO (i.e., on average \$286,000 vs. \$101,000). Also, the median of salaries (\$195,000) goes above average top executive's salary only one year after IPO. In the fifth year after IPO, or listing, the average annual salary and bonuses are about \$350,000 with the median of \$279,000.

The specific information from case-firms is more revealing. For example, the founder-director of TLC Vision Inc. average returns were about \$850,000 (from year before IPO and for the next six years) versus the average annual income of \$140,000 for typical doctors in most provinces as estimated by the Canadian Federation of Medical Students. Thus, his annual compensation was 5-6 times higher than the average doctor's annual income in Canada after graduation.

The average returns of another founder and CEO (of the TLC Vision inc. with a BBA Certificated Accountant) was about \$450,000 vs. the average salary for CAs with approximately 10 years' experience of \$103,500, according to the latest salary survey [22]. However, the salaried partner drew about \$142,500 in Ontario in 2005 [22]. Hence, on average, the TLC Executive's annual salary and bonus was three times higher than those with his education level.

Consider Garda World Security, which issues new options every year. Ten per cent (10%) of the Common Shares of the capital stock of the Corporation that is outstanding from time to time is reserved for the issuance of stock options pursuant to the stock option plan of the Corporation. Garda's founder-CEO annual salary and bonuses were \$135,000 in third year after listing and \$883,000 in the sixth year. CEO's non-exercised options value at the end of the fiscal year 2005 was \$4 million (300 000 shares). In addition, he still hold 4,9 million shares (19 %). At present his stock value is over \$110 million (evaluated at \$22.50, stock based on the Last Trade At 9/26/2006 3:55pm). The cumulative shareholder's value on \$100 investment in the August 1999 in Garda's common shares was \$3,500 at the end of 2005. These evidences from cases lead us to use the framework of risk-firm-entrepreneurial choice trade-offs of Figure 4 to propose the corresponding one pertaining to the personal view of risks and rewards in the V2G model (see Figure 5). The list of the significant states and their corresponding descriptions are as follows:

- A – Foundation of the growth venture 1 (nascent entrepreneur or serial entrepreneur)
- A' – Foundation of the growth venture 2 (serial entrepreneur)
- B – Comparison level as a director in SME (salary)
- C1 – Failure of the growth venture 1 before IPO
- D1 – Successful IPO of the growth venture 1
- A'' – Foundation of the growth venture 3 (serial entrepreneur)
- C2 – Failure of the growth venture 1 after IPO
- D2 – Successful growth of the company's value (exercised options)
- D3 – Successful partial or full exit (sales all the shares)

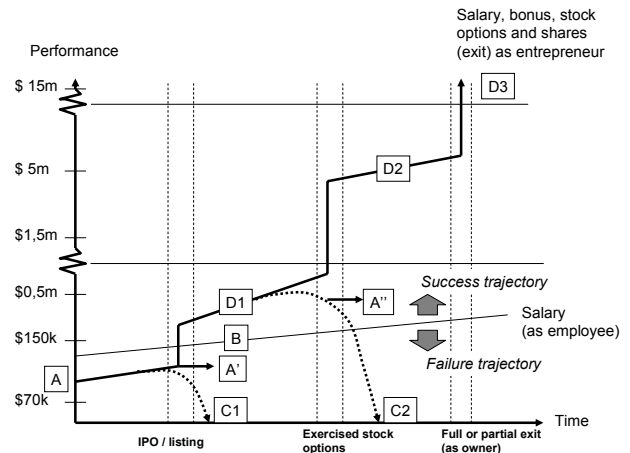


FIGURE 5: ENTREPRENEURS SUCCESS AND FAILURE TRAJECTORIES

E. Findings #2 Risk of the entrepreneur and firm

The highlights of case-firms' growth path can be summarized in the following observation (forming a highly realistic scenario, as follows):

i) The original founder's average ownership share declines from 35% (highest ownership stake is 45%) before listing to 21% in the year of IPO and to less than 14% in five years after IPO with the median of 10% (due the initial founders selling shares to co-entrepreneurs and investors or the corporation issues new shares over time).

ii) As a consequence and at the same time, they lowered their personal risks as well as company risks when they capitalize their "entrepreneurial capital" as venture capital injections helps firms to weather the storm and survive much better than otherwise.

iii) The firm had raised funds from VC or stock market via IPO and private placements as early as possible. VC's role, which was more important in the seed and start-up stages, became less important in the growth stage. At the high growth stage the ventures were able to raise funds from banks as the earlier success worked as collateral. Funds from banks were certainly cheaper than those from VC (for example, 6,5 % interest rate from Royal Bank of Canada than 12 % from VC in the case of AirIQ Inc.).

The important finding, based on the above evidence, is that the serial or "professional entrepreneurs" (e.g., Region A in Figure 6) are exposed to a higher risks, but they do not absorb personal risk. A typical traditional entrepreneur

(e.g., Region B in Figure 6) is assumed to be risk-averse and later raise its commitment. The “life-style entrepreneurs” (e.g., Region D in Figure 6), is practically bearing “no” personal risk as it is transferred to the firm. Consequently, the general presumption regarding an entrepreneur appears to have limited applicability in the context of the framework presented in Figure 4. The findings of this research and discussions supports the risk Trade-off framework presented in Figure 6, with a brief description of the significant states highlighted in the legends below.

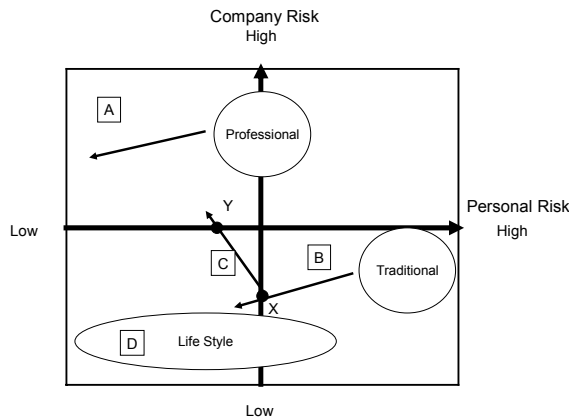


FIGURE 6: THE EXPECTED MOVEMENTS IN PERSONAL-COMPANY RISK TRADE-OFFS MATRIX.

Legends:

- A: Serial or Professional entrepreneur balancing the personal risks in order to involve with riskier growth businesses. Over time, the company risk reduces as along with that of the entrepreneur's.
- B: The risk-averse “traditional” entrepreneur's personal and company risks is decreased systematically and incrementally.
- X: The entrepreneur could get involved in riskier business (C), when the entrepreneur feels sufficiently secure or the trajectory B steadily continues toward position D.
- C: The sense of security could lead the entrepreneur to engage in more risky business (Y).
- D: The life-style entrepreneur is self-employed without high growth ambitions.

F. Findings #3 Towards V2G model

The empirical evidence suggests the rapidly-growing younger firms: (i) expand their ownership base earlier; (ii) they also go public early-on and; (iii) IPO is not the main exit route for entrepreneurs, V2C actors or even venture capitalists (VC). Thus, the shareholders' exits is realized mainly through holding stock that can be traded on the stock exchange incrementally, which run counters to the Solo, VC and V2C models proposed by Seppä & Näsi [3] and Rasila [17]. IPO and listing on stock exchanges seem to be a working mechanism for early stage financing, incremental and partial exit for all stakeholders, incentives for entrepreneurs and V2C actors and a measure of early,

but not the ultimate, success. The V2G model of the ownership development of RIEs is illustrated in Figure 7.

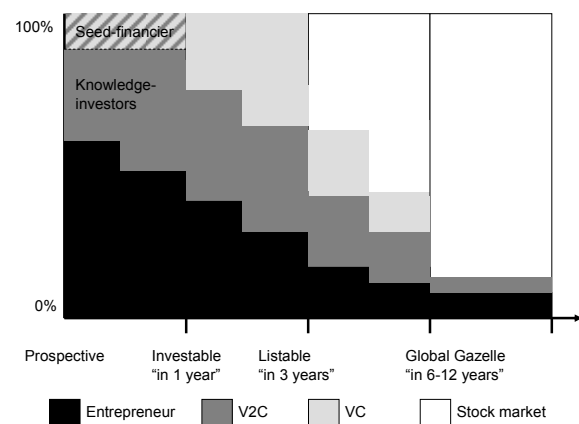


FIGURE 7: V2G MODEL

Our findings suggest that founders reduce their personal risks by exchanging part of their ownership stake for higher salaries (especially after the IPO), stock options and partial exits during the growth (as depicted in Figure 6). Consequently, founders will gradually face similar incentives to those of the co-entrepreneurs as well as the hired managers, which support long-term commitment and the separation of the key roles (manager, director and owner). This evolution is actually required by the formal and institutional investors and it resonates with good governance principles requested by stock exchanges. Thus, the Structure-Governance-Paradigm and the separation of the roles (manager, director and owner) are fundamental elements of the rapid growth ventures beyond V2C. This is the essence of the proposed “Venture-to-Growth”, or V2G for short, based on the in-dept study of RIEs.

IV. DISCUSSION AND CONCLUSIONS

In sum, V2C model's focus is on early success of the new venture so that it can reinforce the continuous growth in the future. The V2C model is developed mainly from the investor's perspective. Overall, this perspective seems to neglect both the entrepreneurs' position and the purpose of the venture to become a real growth company. When V2C actors operate only between the seed stage and the formal venture capital industry, this could lead entrepreneurs, co-entrepreneurs and other stakeholders to attain a short term financial gains and become short term-oriented; with the prospects of longer term gains remaining uncertain. In order to avoid the short-term perspective and gains among the stakeholders, the grand exit should be avoided.

V2C model is probably applicable for most of the growth companies; but for true RIEs or “global gazelles”, it is too narrowly defined as intermediate actors and intermediating stage. Similarly, the formal role of venture capitalist is not convincing in RIE cases, because the traditional exit routes (IPO or trade sale) are not the preferred exists any more as the actual growth can be financed by the financial institutions (e.g., bank loans). Thus, there is more room for

formal and institutional investors (e.g., Small Capital Investment Funds).

V2G model goes beyond V2C model and proposes an entrepreneur's personal view of the risks and returns as compared to that of the firm's risks-return trade-offs. At the growth stages, the partnership of co-entrepreneurs and VC or IPO also means risk sharing for the original entrepreneur or founder. Larger group of founders and early stage actors allow the entrepreneur to consider him or herself differently, even lower the "risk" of his or her job than the traditional entrepreneurs. V2G model combine the best parts of the roles as an entrepreneur (owner) and hired manager. Thus, in this case, it is not any more only "your" firm, but a rapidly-growing enterprise with the corresponding V2G mindset. This V2G mindset avoids negative effect of a single owner. The separation of the roles of the owner and manager will allow the entrepreneur-founder to adequately cope with them. In sum, V2G model points out three proposals: first, it examines risks and returns from entrepreneur's individual viewpoint; secondly it explores risks and ambitions between individual and enterprise; and finally it describes the importance of the ownership development of the enterprise and development of the value of the enterprise as depicted in Figure 7.

The public policy implication should not be lost on those who formulate growth-oriented policies or whose policies impact growth of younger and smaller enterprises. As an example of such policies, formal investors and private individuals should be encouraged to invest in earlier-on IPO than what is advocated by the VC community. Similarly, the environment must allow, if not cover, for early IPO as an instrument of raising public funds for growth as opposed to financial exit for the VC community.

Unfortunately, public policy authorities seem to lag behind what is actually needed and thus neither aspiring firms benefit from public-support program; nor can they leverage such support to create employment and wealth even faster than what they have already achieved. Naturally, the formulation of a family of conducive policies not only can help these V2G enterprises (that we call hasty gazelles). Their rapid growth may also stimulate other similar smaller firms to create employment, innovation and wealth even faster than their larger counterparts and with higher velocities than ever before. Simply stated, the preponderance of a policy environment capable of supporting rapid growth (i.e., an average 9800% in five years) versus normal growth (e.g., 5% to 10% annually to result in 20% to 45% in 5 years) should not be lost (see Figure 8). Similarly, there is strong need for understanding lessons from the pattern of the case firms' processes, practices and strategies [for more details see 5, 23, 24, 25, 26].

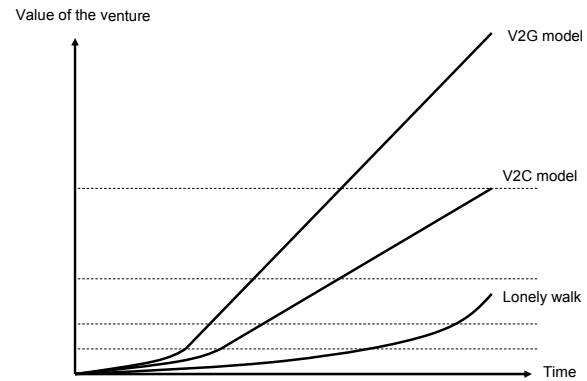


FIGURE 8: A COMPARATIVE TRAJECTORY OF GROWTH FOR V2C, V2G AND LONELY WALK.

ACKNOWLEDGEMENT

We express our gratitude to those institutions that have provided financial support for work, which are the Foundation for Economic Education or Liikesivistysrahasto and Tekes (Finnish Funding Agency of Technology and Innovation).

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Building a Customer Value Model in Mobile Communication Business

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Abstract — Communication services are currently confronted with large changes due to the price erosion of services and entering new service providers. The gap is filled with different services that are hoped to be successful in the near future. The problem, however, is that firms do not necessarily know what their customers value. One solution to the problem is building a customer value model. This paper applies the Delphi method to formulating the customer value model which is implemented by using the Analytic Hierarchy Process. The result is a model for understanding customer value preferences which includes the relative value preferences of the value elements and their attributes, the preference profiles for deeper segmentation of customers, and finally the performance analysis of the case systems.

Keywords — customer value, mobile services, business model, Delphi.

I. INTRODUCTION

A. Background of the study

Mobile communication services can be understood as services and products that enable the information and communication transfer between persons. These kinds of services are currently confronted with large changes due to the price erosion of services and entering new service providers. These new services are often based on Internet technologies such as Voice over IP (VoIP) applications. The gap is filled with different services that are hoped to be successful in the near future. The problem, however, is that firms do not necessarily know what their customers value. This leads to creating services with no users and to even greater problems. On the other hand some of the current business models in communication services are not vital in situations where customers value services above low prices. For example, service operators have adjusted their business to allow low prices by cutting R&D operations down and downsizing the staff. If customers' preferences drift towards services, the operator cannot provide these, firstly because of the ignorance of the changed situation and secondly because of the lack of capability to provide new services. It can be assumed that in the changed situation some other party has the capability to act.

One solution to these problems is building a customer value model with the Customer Value Audit (CVA) [1]

process. The aim of the CVA process is to integrate the customer with the R&D process of the firm. Integrating the customer into the process generates value to the customer, but the real challenge is how the firms can benefit from this as well.

B. Scope of research

The objective and research problem of this study is to build a model for analyzing the customer's values that drive and explain the changes in the business model and on entire value network levels. The overall framework is presented in Figure 1.

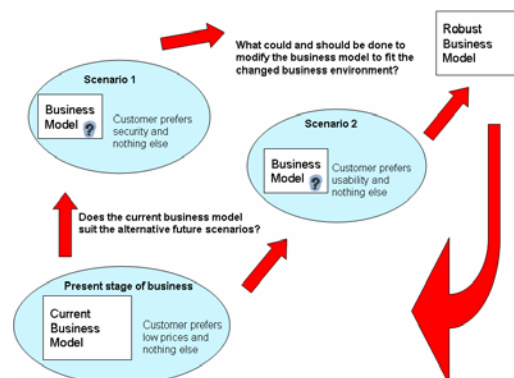


Figure 1. The research framework.

In the framework, the hypothesis is that the dynamics between present and future business model scenarios are driven by the development of different customer profiles. Further, these profiles or segments are comprised of the combination of various customer value attributes. To reveal the real preferences of the customer of mobile services, a case of two mobile communication service systems was established. The following characters of these communication systems were taken into the analysis: voice service, contact information management, status service, file transfer, call screening, and SMS/instant messages.

The aim of the empirical part of the paper is to rate customer values in communication systems and to analyze what communication system best realizes the desirable values. We use the Delphi method to formulate the customer value model. The Delphi is implemented by using the Analytic Hierarchy Process (AHP). The value

evaluation is made by using the pair-wise comparison technique, where each attribute is compared to another to find out the preference order. As a result we provide a model for understanding customer value preferences and their connection to the value creation in networks.

II. CUSTOMER VALUE ANALYSIS

A. Creating value in networks

From the value network perspective, the concept of value creating system has been added in the strategic management literature to illustrate the entire set of activities and companies linked to produce value for both the end-customers and the actors in the system. According to Normann and Ramirez [2], “the focus of strategic analysis is not the company or even the industry but the value-creating system itself, within which different economic actors – suppliers, business partners, allies, customers – work together to produce value.” By this definition, customer preferences are an important element in the value network of actors, since the value is captured from customers [3]. In consequence from the value networks standpoint, customer requirements and preferences are essential in order to understand the changes in value network structures.

A concept that is often related to value networks, and especially describing the firms in them, is business model which is briefly a description of how the firm does business [4]. According to Cartwright and Oliver [5], a business model describes “how and where the firm engages in business, who its customers are, and often, who its major competitors are. Typically, the firm will also describe the major activities that it performs in the course of its business” [5].

The value in the network is ultimately brought in by the customer who purchases the product or service because it has elements that the customer considers valuable. The business model of a firm is in a central role in capturing this value. This is why identifying the elements of value and changes in the preferences of customers are critical for business. The efficiency and flexibility of the business model are essential for maintaining the competitive advantage.

B. Analyzing customer value

The aim of the customer value analysis is to integrate the customer with the R&D process of the firm. Although the idea is originally presented in a business-to-business environment, the basic idea can be transferred to the consumer markets as well [6]. One main view of the connection between the customer and the firm is the study of the customer need assessment [see e.g. 7; 8; 9]. In this view the aim is mainly to recognize the unrecognized needs of customers. The customer need refers to what customer ultimately wants. Customer value, on the other hand refers to what customer wants with certain limitations like money. Another approach for integrating the customer into the firm's processes is the customer value view [1; 6; 10-12].

This view is also linked to the value creation of firms which makes it more suitable for this research.

Integrating the customer with the R&D process certainly generates value to the customer, but to capture the value generated, firms have to reconfigure their business models accordingly [6]. Building a customer value model helps the firm to recognize the customer values and to modify the business model suitable for capturing them.

The customer value model is a data-based representation of the worth (in monetary terms) of the product or service to the customer [10]. Although the value in the customer value model should be addressed in monetary terms, we approach the concept of value from a wider point of view. We use the value definition of Flint and Woodruff [11] who argue that value is either received value or desired value. Received value is the value that the customer actually gets from a certain service. According to Flint and Woodruff [11], the desired value is “the bundle of product attributes and resulting consequences, both positive and negative, and monetary and non-monetary, that the customer wants to happen.” We concentrate on the analysis of the customer-desired value. Flint and Woodruff [12] also point out that the concept of customer-desired value should not be mixed with the concept of personal value: personal values are abstract core beliefs that guide human behavior. Where personal values are generic and fairly stable, customer-desired value is more tied to a service or a product and it faces more changes [12]. The value of some service to the customer is a subjective matter [13], and it depends on the customer's user profile, namely, the way he or she likes to use the service, or is used to using it. In a group of people with similar user profiles, the value of the service is quite comparable.

We use the CVA as a tool for developing a customer value model. The CVA process has three phases: start-up, survey, and strategy formulation [1]. We have modified the process to fit the study of customer desired value in communication services.

III. CREATING A CUSTOMER VALUE MODEL

A. Establishing the case study

Customer studies are usually implemented as surveys, and there are some drawbacks with such an approach. Firstly, the issues of value are profound, and reliable answers require deep thought into which surveys usually do not force respondents. Answers can be unreliable since it is easy to make judgments without reflection. Secondly, it may be hard to get differences in the answers because respondents do not have to pay attention to the consistency of their judgments relative to the other questions in the instrument. We have approached the problem of the customer value study with a model that forces the subject to think. The pair-wise comparison has a built-in feature of choice making. When favoring one attribute of the pair, it means that the other one is not favored. For example, in this study within the pair *security vs. prices*, preferring security means that customer accepts higher prices. This represents

the sacrifice side of the value; when favoring one attribute you have to give up some other attribute. This makes it a more appropriate method for a customer preference analysis than the traditional survey.

To formulate and test the customer value model in practice, we have conducted a case study in mobile communication services. The case systems are specified as Skype Mobile and Smart Phone. Smart Phone is an ordinary phone with high quality data transfer and other advanced features, and it uses the mobile telecommunication network as an access network. The limitation is that this phone does not have a Wireless Local Area Network (WLAN) connection. Skype Mobile is a phone with above-mentioned features and the WLAN connection. This phone also has Skype application integrated into the operation system. Basically, the Skype Mobile can be any kind of VoIP application integrated into the mobile terminal.

We use the AHP decision model where each quality attribute is pair-wise compared with each other to find their relative importance order. The selection of the customer segment is the start point of building a customer value model [10]. We have selected the consumer segment and formed a customer panel of lead users and advanced users of mobile services. According to von Hippel [14], lead users are people who “face needs that will be general in a marketplace, but they face them months or years before the bulk of that marketplace encounters them, and ... are positioned to benefit significantly by obtaining a solution to those needs.” Advanced users are users that are experts on the subject of mobile services through their personal interests or their work.

The customer value model can be opened and analyzed by defining the single attributes of value elements that can be technical, economic, service or social in nature [10]. Garvin [15] has presented eight dimensions of product quality, which are performance, features, reliability, conformance, durability, serviceability, aesthetics, and perceived quality. The studies of service quality were furthermore applied to address the special features of services. For example, Parasuraman et al. [16] have modified and added some intangible attributes in the assessment of services quality. These attributes include tangibility, reliability, responsiveness, assurance, and empathy among others. We have combined and modified these categories to fit the case of assessing services of mobile communication systems. The list of the modified value elements and their attributes is presented in Table 1.

TABLE 1
ATTRIBUTES AND THEIR EXPLANATIONS

Availability of services:	
1. Coverage of the network	The network can be used everywhere or just at some hotspots.
2. Reachability	Call receivers' reachability. Relevant issues are e.g. is the device always on and is it in the network area. Networks available GPRS, UMTS, WLAN, etc.
3. Terminal updating	

Easiness to take new services in use. Availability of device and software updates.

4. Size of network user base
Size of the device or software user base. Possible contacts.

5. Potential new services
Possible new services. The innovativeness of services.

Features and their usability:

6. Using the voice service
Ordinary call. Making the call, speaking, and ending the call.

7. Using the conference call
Telephone call among several people at the same time. Making the call, speaking, and ending the call.

8. Management of contact information
Numbers, names, addresses, etc.

9. Using the status services
Status affects the device's signaling features. E.g. “in meeting” or “not available” have different signal tones. Can also be visible to caller e.g. Skype.

10. File transfer
Sending and receiving photos, text documents, etc.

11. Using the SMS/MMS/instant messages
Writing, sending and receiving messages.

Security:

12. Information security
Protection against eavesdropping. Anonymity. Personal data protection.

13. Call screening
The easiness of defining from whom or which number calls can come.

14. Trusting the service provider
Assurance of the service. Confidentiality of the customer data. Stability of the terms of contract.

15. Independency of the service provider
Possibility to change the subscriber connection and use services provided by other service providers.

Costs:

16. Initial set-up
Affordability of initial set-up. Purchasing the devices and software, setting up the connections.

17. Local calls
Affordability of local calls.

18. International calls
Affordability of long-distance calls.

19. Conference calls
Affordability of conference calls.

20. File transfer
Affordability of data transfer.

21. SMS (MMS)/ instant messages
Affordability of messaging.

The *Availability of services* represents the service and *Features and their usability* the technical value element. The social element is taken into account in the *Security* category and the economy element in the *Costs* category. The attributes that illustrate the product quality dimensions are modified to fit the case services.

B. Methodology and process

We used the Delphi method to formulate the customer value model by structuring communication between groups of people who can provide valuable contributions in order to resolve a complex problem [17]. With the Delphi

technique, participants state their opinions in an anonymous questionnaire [18]. The characteristics of a Delphi study are iteration, anonymity, controlled feedback, and group statistical response [19].

The Delphi iteration rounds were implemented by using the AHP tool. The fundamental principle of the AHP is to decompose a decision problem into a hierarchy of parts. According to Saaty [20], by structuring a system into clusters and subdividing clusters into smaller pieces, it is possible to form a complete picture of the whole system. The hierarchy is formulated by starting from the goal of the decision making and proceeding to objectives and covering objectives. In making the judgments, the elements of the problem are looked at in isolation, one element compared against another with respect to a parent element. A pair-wise comparison is used throughout the hierarchy to derive the priorities of the elements. Finally, the performance of each alternative is evaluated with respect to objectives. One advantage of the AHP is that it provides a rational way to conduct expert opinions by taking into account the inconsistency of judgment. It also harmonizes the comparison between tangible and intangible measures by allowing the usage of the verbal linguistic scale in the assessment.

For the first Delphi round, the model was formed into an anonymous web-based questionnaire where the attributes were placed as pairs so that every attribute was compared to another (see Appendix 1). This evaluation was performed by conducting a customer panel where experts made judgments of their relative preferences of the value attributes. The functionality of the AHP also allowed direct ratings to be made.

The final part of the case study addressed the fit between the value attributes and the selected two communication systems. The aim of this second Delphi round was analyze what communication system best realizes the desirable values. The model was also based on the AHP tool where a group of experts rated the attributes' realization in the case services. The group analyzed and discussed each attribute and decided which system best realized the attribute. The assessment was made on a scale from 1 to 9. Figure 2

presents the AHP model used in comparing the relative importance of the value elements and their attributes.

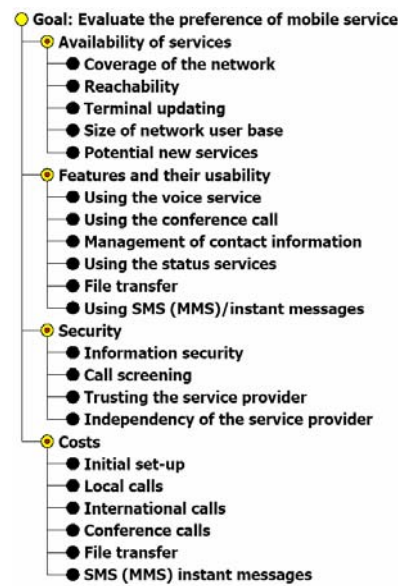


Figure 2. The AHP model of customer value elements.

C. Customer panel data

The model was tested in an expert customer panel consisting of 14 users of communication systems and ICT researchers. The aim was to analyze how different options perform with different attributes.

Table 2 presents the value preferences of the customer expert panelists after AHP supported comparisons of the value attributes. The value preferences in the model present the relative weights of each attribute in the above hierarchy. The values of each of the panelists (p2–p14) have been illustrated in the table. P1 shows the combined values of group judgments. The combined value was calculated by using the mathematical algorithms in the Expert Choice AHP software.

TABLE 2
RELATIVE VALUE PREFERENCES OF ATTRIBUTES IN THE MODEL.

	combined, p1	p2	p3	p4	p5	p6	p7	p8	p9	p10	p11	p12	p13	p14
Availability of services	0,176	0,436	0,153	0,158	0,134	0,120	0,559	0,279	0,068	0,119	0,077	0,054	0,183	0,084
Coverage of the network	0,256	0,411	0,322	0,213	0,294	0,219	0,211	0,099	0,572	0,101	0,195	0,234	0,082	0,167
Reachability	0,395	0,319	0,243	0,475	0,142	0,544	0,604	0,569	0,170	0,160	0,161	0,538	0,507	0,460
Terminal updating	0,127	0,036	0,090	0,193	0,142	0,069	0,104	0,052	0,031	0,347	0,215	0,100	0,292	0,060
Size of network user base	0,123	0,141	0,289	0,035	0,142	0,035	0,053	0,246	0,148	0,045	0,377	0,044	0,032	0,277
Potential new services	0,099	0,092	0,055	0,084	0,280	0,134	0,028	0,035	0,078	0,347	0,052	0,084	0,087	0,036
Features and their usability	0,224	0,282	0,121	0,107	0,232	0,208	0,163	0,082	0,390	0,399	0,215	0,124	0,183	0,195
Using the voice service	0,426	0,419	0,336	0,257	0,266	0,457	0,585	0,461	0,382	0,212	0,416	0,449	0,424	0,479
Using the conference call	0,052	0,043	0,073	0,044	0,056	0,049	0,020	0,021	0,052	0,038	0,078	0,109	0,094	0,025
Management of contact information	0,144	0,260	0,117	0,242	0,144	0,111	0,139	0,116	0,083	0,215	0,149	0,079	0,097	0,098
Using the status services	0,047	0,114	0,028	0,040	0,067	0,046	0,021	0,053	0,024	0,027	0,051	0,031	0,044	0,062
File transfer	0,124	0,084	0,161	0,203	0,201	0,049	0,057	0,262	0,210	0,421	0,027	0,217	0,100	0,024
Using SMS (MMS) /instant messages	0,207	0,080	0,286	0,214	0,266	0,289	0,178	0,087	0,249	0,087	0,278	0,115	0,241	0,313
Security	0,205	0,102	0,291	0,526	0,402	0,069	0,065	0,091	0,390	0,194	0,052	0,517	0,317	0,037
Information security	0,370	0,522	0,275	0,469	0,357	0,193	0,427	0,565	0,552	0,514	0,128	0,388	0,341	0,065
Call screening	0,119	0,078	0,037	0,053	0,172	0,156	0,172	0,047	0,053	0,189	0,335	0,071	0,047	0,325
Trusting the service provider	0,278	0,200	0,202	0,357	0,235	0,550	0,277	0,288	0,210	0,090	0,075	0,355	0,318	0,301
Independency of the service provider	0,233	0,200	0,486	0,121	0,235	0,101	0,123	0,101	0,194	0,206	0,462	0,185	0,294	0,310
Costs	0,396	0,180	0,435	0,210	0,232	0,602	0,212	0,547	0,152	0,287	0,656	0,305	0,317	0,684
Initial set-up	0,125	0,399	0,040	0,067	0,168	0,187	0,335	0,061	0,124	0,049	0,115	0,042	0,185	0,081
Local calls	0,387	0,286	0,295	0,361	0,181	0,371	0,392	0,517	0,249	0,222	0,441	0,485	0,240	0,573
International calls	0,072	0,112	0,066	0,108	0,100	0,062	0,052	0,080	0,055	0,032	0,026	0,030	0,168	0,046
Conference calls	0,040	0,035	0,035	0,044	0,042	0,039	0,019	0,023	0,028	0,026	0,044	0,063	0,052	0,028
File transfer	0,149	0,078	0,282	0,185	0,184	0,031	0,137	0,174	0,240	0,530	0,065	0,226	0,177	0,019
SMS (MMS)/instant messages	0,227	0,090	0,282	0,236	0,325	0,310	0,066	0,145	0,303	0,140	0,309	0,153	0,177	0,253

The data was gathered by conducting a pair-wise comparison between each cluster, for instance, the availability of services, and between single items of the value attributes inside the cluster, for instance, the coverage of the network. The panelists were asked to compare the relative importance of each attribute with respect to case mobile services. After the assessment, the AHP model was used to calculate the weighted preferences for each cluster of service attributes and the single items of the attributes.

IV. TESTING THE MODEL

A. Reliability

Inconsistency indicates the illogicality of the respondent (reliability), and it is automatically calculated by the used Expert Choice software. The inconsistency ratio for judgments ranges from 0 (= consistent) to 1 (= random). In normal conditions, good inconsistency is under 0.1; however, when the assessment is conducted as a survey, we accept a higher inconsistency ratio in the study. The study revealed that comparing the attributes is difficult even for an expert. The security element was the most difficult to piece together. The reason can be the ambiguous nature of the subject. Inconsistency was also the reason for eliminating one answer. Figure 3 shows the combined inconsistencies of the value elements.

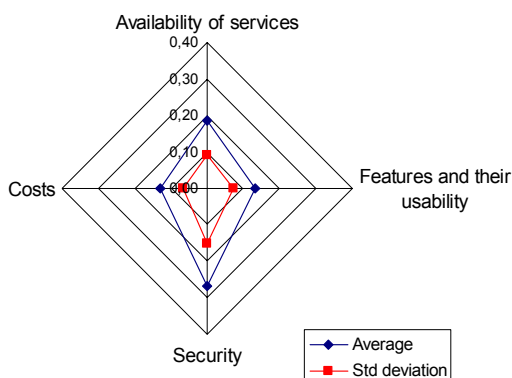


Figure 3. Inconsistencies in the assessment.

B. Customer value preferences

Although the test group was technologically oriented, it valued the affordable cost above the other elements. Security was ranked second, even though, standard deviation was quite high implicating different opinions of the test group on this subject. The average preference weights of value elements are shown in Figure 4.

The average preferences of four main value elements were distributed rather evenly between the elements. Not surprisingly, costs were preferred significantly higher than other elements in the model. This implies the important trend of low-cost services. However, remarkable business potential was related to the relative high level of preference in all the explored value elements. For example, security as a service seems to provide a lot of potential. It should be noted that the prices of mobile services have dropped

significantly in Finland in recent years, which has perhaps increased the relative importance of other value elements.

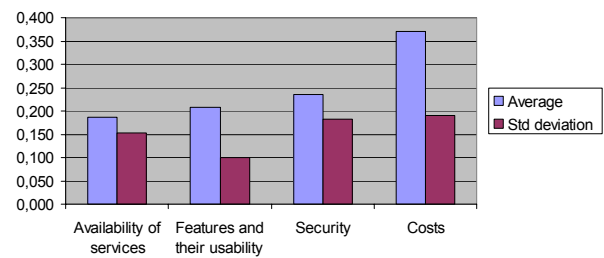


Figure 4. Average preferences and standard deviations of the elements.

Inside the availability of services element the reachability and coverage of the network attributes were preferred. From the business perspective this means that seamless interoperability between networks and applications is critical in order to provide services. On the other hand, the potential new services attribute was not preferred. This can imply that it is hard to imagine the potential of possible new services.

In the features and their usability element, voice services and messaging dominated with over a 60-percent share of the total. This means that the usability and interoperability of these features should be improved. The file transfer had quite high standard deviation. This implies that the preferences are different in different user groups, and there are potential new customer segments that prefer file transfer.

The security element is quite interesting because it was ranked second after costs in the total model. This makes security a very attractive service component. It has the highest inconsistency (illogicality) within the test group, and this could mean insufficient knowledge among customers about the subject. To get benefits from this element some additional marketing and service packaging is needed.

The costs element revealed that the comparison between initial costs and the costs of usage is difficult. This allows firms to benefit from asymmetric information at customers' expense. The inconvenient preference of low costs can be turned into an advantage by bundling the services to create additional value for customers. A harder way is cutting the costs of service production, which is reality in many firms.

C. Customer profiles

Although the sample was small and no statistical evidence could be shown, the study brought up three profiles. These are security, low cost and service profile. It is also reasonable to assume that there is at least a usability profile, but because the customer panel has a technical background the usability issues were not raised.

The results indicate that there are similar preference combinations among different persons, and the customers can be profiled based on the CVA process. The answers tend to form similar patterns according to the similar preferences of the respondents. An example of the profiles is shown in Figure 5. It illustrates the security profile.

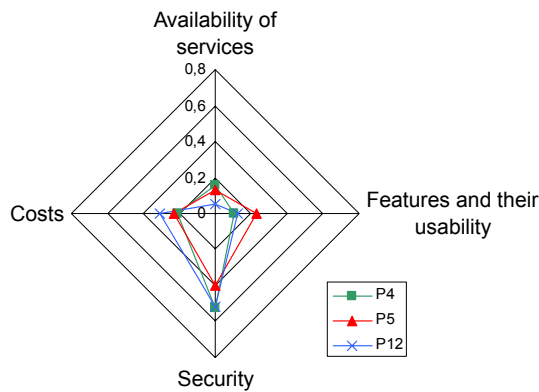


Figure 5. Security profile.

The profiles are based on the relative preference weights of the panelist. If the panelist prefers one quality over others it shows as a peak in the diagram. When similar answers are combined, it forms a group of similar preference combinations. For example, in the security profile security is preferred significantly over other elements of value. The explanation can be the higher awareness of the issue based on, for example, the technical background of these three panelists. The reason can also be the experiences they have gained using the services. Also, the real reasons for the preference patterns in the low cost and service profiles are connected to the usage history and knowledge of the panelists.

Knowing the connecting factors of these answers is the key to form the segments that are connected to the customer values and the firm's business model. The connecting factors can be based on demographic information, among others.

D. Performance of case services

To link the value elements back to the firm's R&D process and furthermore to the business model, we tested the performance of the case communication systems Smart Phone and Skype Mobile against the customer values. The performance of the case systems on each attribute was analyzed. The result was that Skype Mobile performed better than Smart Phone in every element except security. The performance of the case services is shown in Figure 6.

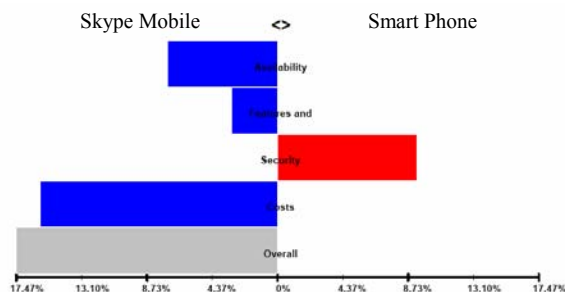


Figure 6. Performance of the case services.

This result has several implications for the firms. First of all, the message from customers is clear: integrating VoIP technology into the mobile phone significantly increases

the customer value. However, this has a downside for operators. The current business model designed for delivering voice through traditional telecom networks is out of date when the voice and data traffic switches to the WLAN, which is usually free of charge and not necessarily controlled by the operators. The situation of mobile device manufacturers is easier. To capture the value from customers, they have to integrate the VoIP and WLAN into the mobile phones and adjust the pricing accordingly. No major changes in the business model are needed. This development has recently started with a leading mobile device manufacturer.

Second, the issue of the security element requires some attention. The reason why the Smart Phone performs better here can be found inside the element. Information security and trusting the service provider are the problems with Skype Mobile. The information security of the internet is not as high as in the telecom networks. Also, the service provider of this case example is new and uses technology that is novel and protected.

Third, the features and their usability element is only slightly better in Skype Mobile. This is due to the fact that the devices compared can be externally almost identical; only the software and technology need to be different. This makes most of the features as easy or difficult to use.

E. Summary of the findings

To summarize the findings, we have combined the main results and important issues mentioned in the literature into a conceptual model that includes four levels: customer, product/service, business model, and value network. The model is introduced in Figure 7.

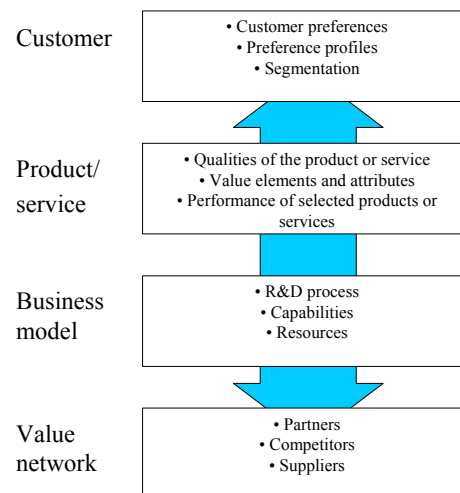


Figure 7. Conceptual model: customer value linked to the value network.

First in the model is the customer level on which finding out the preferences of the customers and also the segmentation of the customers based on preference profiles are essential.

The second level is the product and service level which includes the value elements and attributes connected into the qualities of the product or service. In fact this level

comes first in the research process, but conceptually the product or service combines the business model to the customers. This is because generally the business of the firm is based on some product or service sold to the customer. This means that the firm's customer, product/service and the business model are tied to each other.

The third level is the business model level. The mechanism inside the firm linking the customer to the strategy of the firm is the R&D process. However, the capabilities and resources are in a central role when applying the acquired customer knowledge.

The fourth level is value network. The impact of customer preferences ultimately reaches the whole value network through the business models. This is due to the fact that firms can acquire capabilities and resources from other actors in the value network and even outside it. Also, the threat of competing offerings can cause changes on the network level.

V. CONCLUSIONS AND DISCUSSION

The subject of customer value preferences has been the topic of research interest for years in the industrial management literature. The usage of demographic information (e.g. age, sex, income) in the analysis of customer preferences provides several advantages for recognizing and anticipating the customer needs of different user groups. However, the diffusion of mobile service has revealed that customer segmentation can only partially be based on demographic factors. For example, the diffusion of VoIP services cannot solely be explained by the lead-user theory or demographic information. Instead, an in-depth analysis of customer needs may result in advantageous customer segmentation.

The contribution of this paper is a model for analyzing customer value preferences and their realization in different communication systems. With the data of the customer panel, we have built customer preference profiles based on different styles of using the communication systems and therefore different value preferences. We have also found out the critical user values and the different attributes. The customer value audit revealed three major issues of customer preferences in mobile communication systems:

- The affordable costs are valued above other elements even in the technologically oriented test group.
- The security element is the most difficult one to piece together (highest inconsistency).
- The comparison of initial start-up cost to the costs of usage is difficult.

The presented model for assessing the service quality and customer preferences in mobile services was developed through several iteration rounds within a test group of advanced users and researchers. The selected test group was advanced users in the sense that they had the capability to conduct an AHP assessment from the customer value audit perspective. The AHP analysis is often conducted with a small group of experts who are capable of

performing subjective pair-wise comparisons of decision criteria. The reliability of the assessment is then automatically calculated by the AHP software. This inconsistency ratio calculates the degree of inconsistency in the judgments. We used the inconsistency ratio to improve the reliability of the study and reveal the areas that are the most difficult to perceive. Only one participant had to be dropped from the expert panel due to unacceptable inconsistency. One clear limitation of the study is, however, that the users were, rather homogeneous in their demographic characteristics limiting the variety of customer profiles.

The framework of the AHP model is based on the grounding theoretical frameworks for measuring service quality [e.g. 15] with characteristics of information service attributes. Additionally, the application of the AHP was developed for constructing a hierarchy and assessing the relative preferences of each value attribute. Customer preferences are commonly derived from surveys of several hundreds or thousands of customers, by relying on that large masses are logical in their judgments. This may work well in several cases providing essential information for marketing and R&D. Large samples are, however, not always a prerequisite. For example, in the studies on the lead user method in developing new product concepts [14], it was found that a small number of lead user experts can provide essential information for development purposes. Similar implications have been found in the literature of expert judgments such as the AHP [see: 20] where several methods and applications have been developed to elicit expert knowledge on the studied phenomena. In this study, the Delphi method implemented with AHP has proven to be a powerful and valid method for evaluating complex customer preferences. It has also provided insight into the formulation of different user profiles in mobile services.

In a normal expert assessment situation, there is generally an opportunity to re-evaluate the assessment based on feedback. In this session this was not allowed due to anonymity and time limit restrictions of the study. It is reasonable to argue that many settled judgments would get better after iteration, since the learning and thus the capability to process information on the subject increases.

The analysis shows that mobile services are valued rather differently even within a small test group of mobile users. This implies that heterogeneous market segments exist already within the present mobile service portfolio. Different value creating attributes such as cost and security transfer are valued differently among different user segments, which allows customer preference profiles to be used for the segmentation of end-users.

Future studies on this area should address the role of the business model in capturing value from customers. The capabilities and resources of the firm should be connected to the customer value elements to produce higher customer value. Also, the relations of the business model and value network as enablers for the value creation and capture should be examined.

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APPENDIX 1

Example of the pair-wise comparison questionnaire.

Coverage of the network	4	3	2	1	0	1	2	3	4	Reachability
	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	
Coverage of the network	4	3	2	1	0	1	2	3	4	Terminal updating
	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	
Coverage of the network	4	3	2	1	0	1	2	3	4	Size of network user base
	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	
Coverage of the network	4	3	2	1	0	1	2	3	4	Potential new services
	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	

Business Models for Collaborative Planning in Transportation: an Application to Wood Products

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Abstract — In this paper, we propose a framework to describe collaboration in transportation. Then, we discuss the strategic, tactical, operational and real-time transportation planning decisions and raise issues about implementing collaborative decision processes. Also, we provide a literature review of transport decision-support systems that use collaborative planning in the wood fiber flow chain in forestry. Finally, we propose a typology of different business models associated with collaboration in transport

Keywords — Collaboration, transportation, decision-support system, business model, forest product industry

I. INTRODUCTION

Transportation planning is an important part of the wood fibre flow chain in forestry. Large volumes and relatively long transport distances together with increasing fuel prices and environmental concerns make it more and more urgent to improve transportation planning.

There are often several forest companies operating in the same region. Harvest areas supply the mills that by processing round wood will produce end-products (e.g. lumber, veneer) but also co-products (e.g. chips, sawdust) which will be used to supply other mills. Co-ordination between two or more companies is however rare, even if supply, demand and companies are geographically evenly dispersed in the region. In Figure 1 we illustrate the simplest example of transportation inefficiency due to a low level of interaction between two companies: the total unloaded traveling distance (i.e. broken line) is higher when companies do their truck routing independently (Fig. 1-A) compared to when they are doing them together (Fig. 1-B).

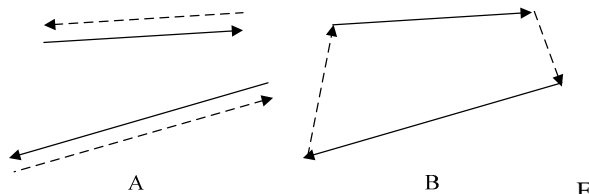


FIGURE 1

IMPROVEMENTS IN UNLOADED DISTANCE (BROKEN LINE) WITH COLLABORATIVE PLANNING

Lately, there has been increased interest in collaborative transportation planning to support the coordination of the wood fibre flow as the potential savings are large. In many of the case studies the collaborative transportation work is compared with the actual transportation work carried out. It is then possible to compute the savings with collaborative transportation planning.

In this paper, we propose a framework to describe collaboration in transportation. Then, we discuss the strategic, tactical, operational and real-time transportation planning decisions and raise issues about implementing collaborative decision processes. Also, we provide a literature review of transport decision-support systems that use collaborative planning in the wood fiber flow chain in forestry. Finally, we propose a typology of different business models associated with collaboration in transport.

II. TRANSPORTATION COLLABORATION FRAMEWORK

There are four main actors involved in transportation collaboration and four master processes. The actors are the customer, the carrier, the pickup/delivery site and the transportation planner. The customer, which in the forest industry, could be a saw mill, a pulp and paper mill or a panel mill, expresses transportation needs. Typically, a transportation need would specify a specific volume of a specific goods to be picked-up at a location (i.e. pick-up site) and delivered to another location (i.e. delivery site), within a specific time window. The carrier provides the transportation services. The carrying can be done by trucks with different capacities, equipped or not with a crane for loading and unloading. It can also be done by train or barge as well as by different combinations of these transportation means. The sites also play a role in the transportation problem since they may impose different constraints to the routing problem. Finally, the transportation planner is responsible for proposing a transportation solution that takes into account transportation needs, carrier capacity and logistics constraints coming from the customer, the carrier and the sites.

To effectively execute the transportation activities, four major processes need to be mastered. They are planning, expediting, carrying and receiving. Note that each actor can

be involved in one or many of these processes, which are defined as follows. Planning involves defining the best allocation of transportation needs to carriers and constructing the best routing solution for the carriers. The routes may be composed of one or many pickups and deliveries and need to respect all demand, time window and capacity constraints. The planning process can be defined as (i) intra-organizational, meaning that all actors involved in the planning process belong to the same company; or as (ii) inter-organizational, meaning that actors from different companies are involved in the planning process. The next three processes are associated to execution of the main transportation operations. Expediting refers to the process of making the volume available and ready for pickup. Carrying refers to the transportation of the volume and finally, receiving refers to the reception of a carried volume of products.

III. COLLABORATION ON TRANSPORTATION PLANNING DECISIONS

Collaboration in transportation planning means that a coalition has been defined. This coalition brings together a specific set of actors and involves them in an intra or an inter-organizational planning process. Planning rules have been accepted between the participants of the coalition, permitting a stable collaborating organization where all participants have no incentive to quit the coalition.

In theory, transportation planning provides a great deal of collaboration opportunity. The way the decisions need to be taken will govern the possibility of building the different coalition in time. In some cases, the coalitions may be different for different decisions while in other cases, the coalition needs to remain because of the high interrelation between the decisions to be taken. Collaborative planning on a decision could result in an obligation to future collaborative planning within the same coalition (or a subset of these participants) on shorter term decisions. This "obligation" could come from a common long term agreement and high operational expected returns.

The selection of the participants in the coalition is another fundamental question. In, for instance, a region with many forest companies, if planning is done as though they were a single company, they would obtain the best benefit achievable through collaboration. In practice, there are always some restrictions imposed by one or several participants. These restrictions become additional constraints to be taken into account when planning. By planning with and without these restrictions, it is possible to quantify the financial impact of these business constraints. Some interesting questions are raised such as: *knowing how these constraints impact the benefit of the collaboration, who should be part of the coalition?*

Moreover, the benefit of the collaboration would need to be shared among the participants. How should it be done? [1] suggest using a cost allocation method. They have proposed a series of methods to share the cost that are, partly, based on co-operative game theory. They also illustrated how the different methods can propose different

sharing solutions. This raises the question: *will the participants remain in the coalition if one or the other of these methods is chosen?*

The collaborative plan as well as the sharing solution can provide tools to redesign the coalition, showing which participant is providing more benefit to the coalition and which one is gaining more from it. It may happen that only a sub-set of the initial coalition remains at the end. Moreover, the solution may lead a company to divide its participation into a subset of its supply and demand points in order to integrate different coalitions in order to reach the best possible returns.

This creates a new problem for one company: *for each decision, with which coalition collaborates and on which supply/demand points?* As far as we know, this problem has never been studied.

IV. TRANSPORTATION PLANNING DECISIONS

The problem of transportation planning of the wood fibre flow chain in forestry is definitely not a simple one. Planning such transportation activities involves many decisions which are commonly managed according to four perspectives of time horizon: strategic, tactical, operational and online. In Table 1, we reported these decisions. Several of these are discussed in [2] and [3].

TABLE 1
STRATEGIC, TACTICAL, OPERATIONAL AND REAL-TIME TRANSPORTATION DECISIONS

Strategic (>5 years)	- Road building and maintenance - Deployment of train and heavy load truck systems - Fleet capacity and composition management
Tactical (1/2 to 5 years)	- Road upgrade - Equipment - Train system scheduling
Operational (1 to 180 days)	- Supply allocation to demand points - Truck back-haulage tours - Truck routing
Real-time (< 1 day)	- Truck dispatching

Strategic decisions concern the construction and the maintenance of transportation infrastructures and the transportation fleet management. Decisions on the infrastructures include the layout of the forest road network to access the harvests areas, the location and capacity of storage terminals required for transshipment, the deployment of train and heavy load truck¹ systems as well as potential improvements on the existing forest road network to deploy heavy load truck system. Transportation fleet management deals with the capacity and the composition (i.e., number and type of locomotive, wagon, truck and barge) of the fleet (e.g. private, dedicated, etc) to

¹ Heavy load trucks (HLT) are specialized logging trucks hauling loads of two to more than three times greater than conventional logging trucks but which are limited to travel only on the forest road network. HLT system consists of using them to carry round wood from the harvest areas to a terminal (or directly to the mill if it is reachable by the forest road network) in order to complete the delivery by train or conventional truck.

meet the transportation requirement forecasts. This exercise is realized jointly with the current and potential train and carrier service providers (including the company's private fleet if any) and it spreads out over several years taking into account the economic lifespan of the various equipments in the fleet.

Tactical decisions concern forest road path standard upgrade (e.g., speed increase, accessibility during thawing period or during heavy rains) and equipment. Also, decisions on the scheduling of train systems previously deployed that consist in adjusting the capacity of the train routes (i.e. number of wagons in the train route and the train route frequency) in each train system.

Strategic and tactical transportation related decisions are often planned simultaneously with other decisions related to wood fibre procurement (i.e. forest management and harvest operations) and mill production. Consequently, companies are generally reluctant to engage in collaborative planning on these levels even if collaborative planning can be achieved and provide high expected returns. This is particularly true when the coalition is built to share major infrastructures. Typically in such cases, the infrastructure costs are split among participants and the operating and maintenance costs are charged in terms of usage. When the coalition is stable the logic remains, however, as some participants pull out of the coalition the operating and maintenance costs of the infrastructure can become too high for the remaining participants. The risk associated with strategic level collaboration becomes higher. The "strategic" coalition therefore needs to provide higher potential returns and the participants must be bounded by a high level of trust.

Operational decisions are taken for a short term horizon and deal with specific resources and needs. The first operational decision concerns the allocation of supply points to demand points that consists in the establishment of i) the catchment areas for each mill with a demand in round wood and ii) the suppliers' mills for each mill with a demand in fibre bulk. The decision defines the volume of each catchment area and supplier mills allocated to satisfy mill demand. Another operational decision concerns the design of potential truck back-haulages tours. A back-haulage tour delivers several loads instead of only one in order to reduce empty traveling distance and thus transport cost. The simplest case of a back-haulage tour is illustrated in Figure 1: after carrying a load between a supply and a demand point, the truck doesn't return empty to the supply point as usual but carries another load from/around the demand point to/around the first supply points. Finally, another operational decision deals with truck routing where the whole route of each truck is scheduled.

Real-time decision concerns the scheduling of the route of a specific truck, but instead of making up the schedule in advance (e.g. the day before), the schedule is created in real time with the present situation instead of the predicted situation.

The operational and online transportation activities provide an interesting context for collaboration. In contrast

with the strategic and tactical decisions, the planning of operational and online transportation is less integrated with procurement and production as they are often planned in sequence after procurement and production decisions are made. Price and service level are the key performance indicators associated with the operational decision level.

Transportation activities represent almost 25% of total costs in the wood products industry. In Sweden and Canada, transportation activities represent one third of the total cost of raw material, round wood, for the industry. Furthermore, they are not a core activity for the wood processing mills which reduces the level of risk associated with the collaboration. As explained by [4], these conditions: high return, low risk, non core activity, provide a good environment for building a strong coalition. The next sections present industrial applications supporting collaborative planning.

V. INDUSTRIAL APPLICATIONS

In the next section, we discuss five industrial applications that were developed by university researchers to support collaborative planning in wood fibre transportation. These applications address one or several of the operational decisions (i.e. supply allocation to demand points, truck back-haulage tours and truck routing). These applications can be used in a context without collaboration by a single company but we concentrate on their collaborative potential.

Collaborative planning in transportation raises the need to manage a large set of data coming from different actors involved in the different processes. Information and decision support technologies are therefore necessary to support the collaboration. This section mainly deals with the technical problems and solution approaches while the following section will discuss potential business models that can support such collaborative planning.

A. *FlowOpt*

FlowOpt [3] is an application developed to support strategic and tactical transportation planning for the round wood supply of mills. Taking into account this context of use, the supply allocation decision has been adapted to handle wood fibre exchange between participants. Thus, all the supply and demands points of each participant in the coalition are managed as a common resource. Wood fibre exchange appears when some volume belonging to the supply points of a participant is allocated to satisfy the demand points of another participant.

The exchanges are generally viewed over a period of a year and require a high level of trust between the participants. They aim to reduce the transportation costs of the participants by bringing the supply points closer to the demand points but also in identifying back-haulage tours between the participants when possible. The overall solution approach of FlowOpt is based on column generation. However, the allocation with exchange possibilities is planned with an adaptation of the LP multicommodity transportation problem in order to keep

track of the participant “owner” of the supply, and handle exchange restrictions.

Recently, research in Sweden and in Canada reported study on potential logs and chips exchanges between forest companies, see e.g. [5]. In a case study with two forest companies, barter pulp logs on FlowOpt, [3] report a potential cost reduction estimated at about five percent even if some companies impose restrictions on the collaboration such as limiting the total volume in bartering and allowing no barter for deliveries to specific destinations.

In Figure 2, the potential benefits of wood fibre bartering between two companies is illustrated [3]. Four mills (two mills per company) and a set of supply points are considered in this case. In the left part of the illustration, each company operates by itself. The catchment areas are relatively large as compared to the right part where the companies use all supply points as a common resource. The absence of cross-over flows in the right part indicates a better allocation of the supply between the two companies. Finally, let us mention that to obtain an understandable figure for the benefit, no back-haulage tours were allowed but higher benefit could be achievable when back-haulage tours are allowed.

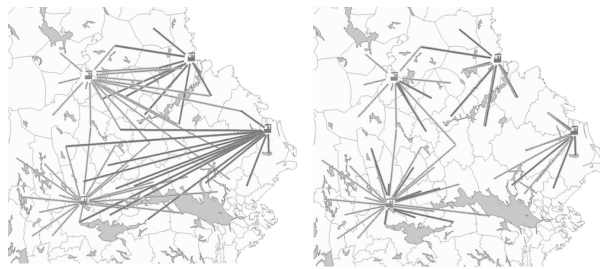


FIGURE 2

ILLUSTRATION OF WOOD BARTERING: IN THE LEFT PART EACH COMPANY OPERATES BY ITSELF AND IN THE RIGHT PART BOTH COMPANIES USE ALL SUPPLY POINTS AS A COMMON RESOURCE.

B. ÅkarWeb

Åkar Web [6] is an application developed to support collaboration in the planning of logging truck routing decisions by transportation planner(s). The application proposes a set of back-haulage tours and the tours which will be used as support for future truck routing. When back-haulage tours are designed, no wood fibre exchanges are allowed. However, all the exclusive allocations of each participant are coordinated together since the set of back-hauling tours must minimize the total transportation cost.

Since 2001, a large forest company has been using the application with its associated carriers and also with a second forest company, but not directly. Indeed, the second forest company pre-assigns its transportation needs to its carrier. At this moment, the allocation decision has already been made and definitive. Some of these carriers send their transportation needs assignment to the large company who uses the application to realize the allocation of its own supply and demand points by considering back-haulage tours with the pre-allocated transportation needs. At this

point, further truck routing planning can be managed in a centralized or a decentralized way but the latter is in use. The large forest company assigns its supply points to its associated carriers with a list of potential back-haulage tours for each and also informs the second forest company carriers of the potential back-haulage tours for each of their transportation needs assignment. This means that back-haulage tours may appear within the carrier assignments or between several including carriers not associated with the same forest company. Given the potential back-haulage tours it is then up to the transportation planners of each carrier to use them to collaborate. Reduction of 15 percent of the empty trucking distance and 6 to 7 percent of the transportation cost was identified with the use of the application.

C. MaxTour

The MaxTour [7] application deals with the design of truck back-haulage tours. Thus, the volume allocation decision is already made and must be respected. In contrast with the two previously applications, MaxTour allows the planning of a back-haulage tour including round wood and bulk fibre deliveries instead of just deliveries of one of them. The use of multi-use truck trailers² makes it possible.

In a case study using MaxTour with round wood and bulk fibre fixed deliveries between many business units, [7] report an annual potential reduction of 8 percent in empty hauling time and a cost-saving of 1.1 percent only related to back-haulage tours with multi-use truck trailers.

The solution approach is an adaptation and an enhancement of the saving heuristic of [8]. Currently, the application is mainly utilized a posteriori with historic transportation data to evaluate potential saving with back-haulage tours and also to support economic study on the viability to add a specific number of multi-use truck trailers to the truck fleet.

D. RuttOpt

RuttOpt is an application developed to schedule a route for each logging truck in a fleet spread throughout a set of depots. Decisions on the supply allocation to demands points are also supported as well as managing driver changeover during the route.

The solution approach is based on a two-phase method. First, the LP multicommodity transportation problem is solved for the supply allocation then subdivision of future route (i.e. a sequence of supply points(s) followed by a demand point) is conducted following heuristic rules. Second, the customized tabu search algorithm of [9] is used to assemble the route subdivisions in order to construct new routes.

E. Virtual Transportation Manager

VTM is an application presently in development to handle the scheduling of routes to satisfy a set of transportation

² Multi-use trailers, currently utilized in few Canadian forestry operations, give the operational flexibility of hauling either round wood or bulk fibre loads, which contrasts with specialized round wood or bulk fibre trailers.

requests with an estimated fleet of trucks spread throughout many territories instead of known depots. The participants send their transportation requests to the application specifying a volume of a specific wood fibre type to be hauled from an origin to a destination site within a specific time window. Routes are scheduled and then a central transportation manager proposes the routes to carriers.

The solution approach is based on a constraint programming resolution with heuristic rules. Currently, the application is tested for a set of regional log suppliers. Tests on a low and a high activity period show a cost reduction of 4,5 and 7,7 percent respectively.

VI. BUSINESS MODELS FOR COLLABORATION

Developing the information technology and solution methods is a first step toward the collaboration. The next step is to design a business model for the coalition. The model aims to build a coalition in which the equilibrium is maintainable, i.e. all participants have no incentive to quit the coalition.

We can identify six theoretical business models:

- A customer leads the coalition
- A carrier leads the coalition (or a third party logistics provider, 3PL)
- A fourth party logistics provider, 4PL, leads the coalition
- Carriers share the leadership of the coalition
- Customers share the leadership of the coalition
- Carrier(s) and customer(s) share the leadership of the coalition

For each model, the following business perspectives will be discussed:

- Who is responsible for conducting the transportation planning and what objective(s) is it following?
- How is added/removed a participant in/of the coalition?

To support the discussion, let denote:

- B^c the benefit of the coalition c
- B_p^c the benefit on the coalition c provide by participant p
- I_p^c the incentive to remain on the coalition c for a participant p
- $W_{p,p'}^c$ the contribution of participant p to the incentive of the participant p' on the coalition c

To obtain B_p^c and $W_{p,p'}^c$, we must plan a coalition c with the participant p to obtain B^c and I_p^c , then plan a coalition c' without the participant p to obtain $B^{c'}$ and $I_p^{c'}$, and, finally, compute:

$$B_p^c = B^c - B^{c'}$$

$$W_{p,p'}^c = I_p^c - I_p^{c'}$$

Also, in the figures, the circle represents a customer, the rhombus the transportation planner and the rectangle a carrier. The broken line represents a transportation needs and the line a route.

A. A customer leads the coalition

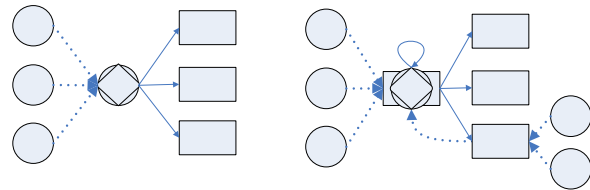


FIGURE 3

BUSINESS MODEL IF A CUSTOMER LEADS THE COALITION: IN THE LEFT PART THE BASIC MODEL AND IN THE RIGHT THE VARIANTS

In the left part of Figure 3, we illustrate the basic business model if a customer leads the coalition. The transportation planner is a customer, TP-customer. It is planning its own transportation needs but also the transportations needs received from other customers. After the planning, the TP-customer allocates the routes to a set of carriers.

The TP-customer objective is the satisfaction of its own transportation needs at the minimum cost.

It is the TP-customer who adds and removes participants in its coalition of customers.

A participant p will be added to the coalition c if:

$$W_{p,p'}^c > 0 \text{ where } p' \text{ is the TP-customer}$$

A participant p will be removed of the coalition c if:

$$B_p^c = 0$$

or

$$B_p^c > 0$$

and

$$W_{p,p'}^c = 0 \text{ where } p' \text{ is the TP-Customer}$$

and

$$I_{p''}^c - W_{p,p''}^c > 0 \text{ for each other participant } p'' \text{ in coalition } c$$

In the right part of Figure 3 some variants of the business model are illustrated. The TP-customer can have its private fleet and use external carrier to complete its needs in transportation capacity. Also, TP-customer can indirectly integrate in its planning the transportation needs of other customers through the carrier of these customers. The last variant is the business model of the application ÅkarWeb in the presented case study.

B. A carrier leads the coalition

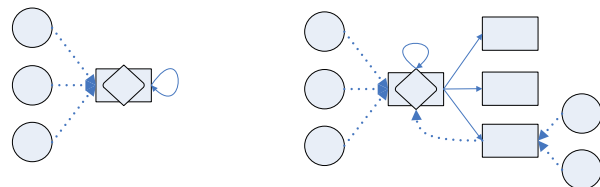


FIGURE 4

BUSINESS MODEL IF A CARRIER LEADS THE COALITION: IN THE LEFT PART THE BASIC MODEL AND IN THE RIGHT THE VARIANTS

In the left part of Figure 4, we illustrate the basic business model if a carrier or a third party logistics provider

leads the coalition. The transportation planner is a carrier, TP-carrier, planning the transportation needs of a set of his own customers in using only its transportation capacity.

The TP-carrier objective is the maximisation of its profit by planning its customers' transportation needs using only its transportation capacity.

It is the TP-carrier who adds and removes participants of its coalition of customers. The TP-carrier follows the same rules, but at its advantage, of the TP-customer to add or remove participants.

In the right part of the Figure 4, we illustrate some variants of the business model. In addition to its transport capacity, the TP-carrier can use external carrier to complete its needs in transport capacity. Also, the TP-carrier can indirectly integrate in its planning the transportation needs of other customers through the carrier of these customers.

C. A fourth party logistics provider leads the coalition

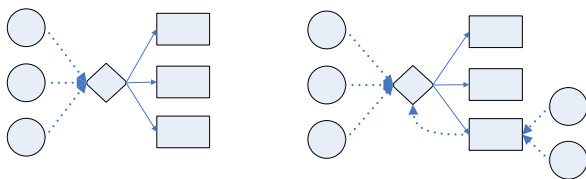


FIGURE 5

BUSINESS MODEL IF A 4PL LEADS THE COALITION: IN THE LEFT PART THE BASIC MODEL AND IN THE RIGHT THE VARIANT

In the left part of Figure 5, we illustrate the basic business model if a fourth party logistics provider leads the coalition. The transportation planner, TP, is neutral in the sense that he isn't a customer or a carrier. It plans the transportation needs of a set of customers under a capacitated set of carriers.

The TP objective is the maximization of its own profit through an optimized match of customers' needs and subcontracted carrying capacity.

It is TP who adds and removes participants in its coalition of customers and carriers. The TP follows the same rules, but at its advantage, of the TP-customer and the TP-carrier to add or remove participants.

In the right part of Figure 5, we illustrate a variant of the business model. The TP can indirectly integrate in its planning the transportation needs of other customers through the carrier of these customers.

D. Carriers share the leadership of the coalition

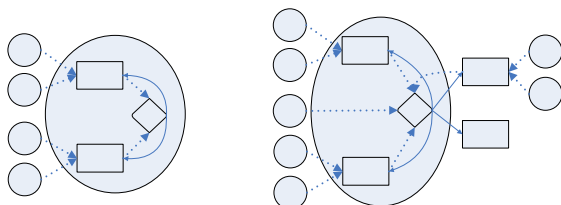


FIGURE 6

BUSINESS MODEL IF CARRIERS SHARE THE LEADERSHIP OF THE COALITION: IN THE LEFT PART THE BASIC MODEL AND IN THE RIGHT THE VARIANTS

In the left part of the Figure 6, we illustrate the basic business model if a set of carriers share the leadership of the coalition. The transportation planner, TP, is named by the carriers' coalition to plan the transportation needs of their respective customers using the transportation capacity of all the carriers. After the planning, the transportation planner allocates the route to the carriers according to their respective transportation capacity.

The TP objective is the minimization of the transportation cost or maximization of the profit of the carriers using their transportation capacities.

Coordinated by the TP, the carriers decide together to add and remove participants in the carriers' coalition.

A participant p will be added to the coalition c if:

$$B_p^c > 0$$

A participant p will be removed from the coalition c if:

$$B_p^c = 0$$

In the right part of Figure 6, we illustrate some variants of the business model. In addition to their own capacity, the coalition can use external carriers to complete their needs in transportation capacity. Also, the TP can integrate in its planning the transportation needs of other customers through the carrier of these customers or directly with the customer.

E. Customers share the leadership of the coalition

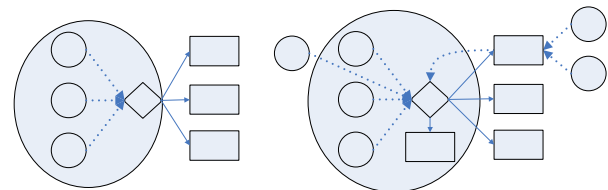


FIGURE 7

BUSINESS MODEL IF CUSTOMERS SHARE THE LEADERSHIP OF THE COALITION: IN THE LEFT PART THE BASIC MODEL AND IN THE RIGHT THE VARIANTS

In the left part of the Figure 7, we illustrate the basic business model if a set of customers share the leadership of the coalition. The transportation planner, TP, is named by the customers' coalition to plan their transportation needs. After the planning, the transportation planner allocates the routes to a set of carriers. This is the business model in the VTM application.

The TP objective is the minimization of the total cost for all the customers.

The building of the coalition can be done in various ways but generally, a customer initiate the coalition by inviting other customers who contribute to its benefit. Coordinated by the TP, the customers decide together to add and remove participants in the customers' coalition by following the same rules of the previous carriers' coalition.

In the right part of the Figure 7, we illustrate some variants of the business model. The customers' coalition can sign contract(s) with carrier(s) to have a dedicated fleet (a carrier could be the private fleet of a customer on the coalition) to use in combination or not with external carrier

to complete the needs in transportation capacity. The TP can integrate in its planning the transportation needs of other customers through the carrier of these customers or directly with the customer.

F. Carriers and customers share the leadership of the coalition

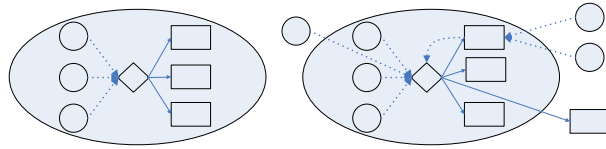


FIGURE 8

BUSINESS MODEL IF CARRIERS AND CUSTOMERS SHARED LEADING COALITION: IN THE LEFT PART THE BASIC MODEL AND IN THE RIGHT THE VARIANTS

In the left part of the Figure 8, we illustrate the basic business model if a set of customers and carriers share the leadership of the coalition. The transportation planner, TP, is named by the customers and the carriers to plan the customers' transportation needs using the carriers' transportation capacity.

The TP objective is the minimization of the transportation costs of the customers using the transportation capacities of the carriers.

Coordinated by the TP, the customers and the carriers decide together to add and remove participants in the coalition by following the same rules of the previous carriers' coalition.

In the right part of the Figure 8, we illustrate some variants of the business model. In addition to the carriers' transportation capacity, the coalition can use external carriers to complete the coalition needs in transportation capacity. Also, the TP can integrate in its planning the transportation needs of other customers through external carrier or directly with the customer.

VII. CONCLUSION

In this paper, we reported some applications which were developed to support collaboration in transportation. We explained their purposes and proposed a series of business models which can permit their implementation in different industrial context.

These contexts are characterized by the composition of the coalition as well as by which actor(s) is assuming the leadership.

Significant cost-savings can be achieved through transportation collaboration. However, the collaboration raises many business challenges and questions. Future work should address those questions and experiment with different cost allocation strategies or benefit sharing strategies in order to provide the means to sustain the different coalitions.

ACKNOWLEDGEMENT

This work was funded by the FOR@C Research Consortium.

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Challenges of Managing a Network Business

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Abstract – This study aims at identifying and analysing the key challenges in managing a network business. The starting point of the paper is the alleged need for new kinds of theoretical frameworks which take into account value creation situations businesses face today. Hence, this paper introduces the value co-production framework as an alternative perspective to the existing approaches built in the industrial era (i.e., value chain thinking). This framework elevates knowledge and relationships in the locus of business and argues for reconfiguration of roles, actions, and interactions among the networked actors.

Based on our study on a network-like, two years old joint venture firm, we demonstrate how the value co-production framework functions in practice. Moreover, we suggest that the future management competence lies in company's ability to manage interactions, not individuals or individual companies. Thus, studying different kinds of network approaches in relation to proposed framework would give a deeper understanding of the ways by which networks and relationships drive value co-production.

Keywords –innovation-based business, value co-production, relationships, knowledge

I. INTRODUCTION

Transformation from manufacturing to service economy, globalization of business, business opportunities brought up by ICT, and a need to partner with companies across industry sectors set new demands for business competence. The frameworks for understanding and managing business built in the industrial era are not anymore applicable to the majority of value creation situations businesses face today [1]. In demand, particularly, are theoretical frameworks that help to better understand the networked nature of value creation in business. Networks support growth and provide innovative capacity [2]. New competence emerges and develops into business opportunities through network relations between organisation's members and non-members, and with the help of their knowledge and competence [3]. Thus, the business opportunities arising from innovations should not only be scrutinised through the traditional and single-minded approaches (e.g., value-chain thinking) [4] but rather through more diverse approaches to business (re)framing. Examining the innovation process with a framework of value co-production [1] [5] [6] or capability

co-creation [3] allows for a deeper understanding of the dynamics of networked business.

The purpose of the paper is to identify and analyze the key challenges in managing a network business. Thus, the research question can be formulated as: "*What are the key challenges in managing a networked business?*" The study aims at generating empirical knowledge for understanding the networked nature of value creation in innovation-based business. The study joins in the line of argument by Normann and Ramirez who call for research on the ways by which economic actors design new offerings, join in innovative co-productive relationships and reconfigure the roles of each co-producer in the process of co-producing value [1].

We present our arguments in four steps. First, we shortly introduce the conceptual framework of value co-production. Second, we describe the research setting and the methodology. Third, we present results of the analysis of the case firm Alfa. We go through seven critical business decisions with a discussion of their related factors. Finally, we conclude by presenting some remarks on the subject matter.

II. INNOVATION-BASED BUSINESS AS CO-PRODUCTION OF VALUE

The industrial view treats innovation activity as a question of linear value production i.e., value chain thinking. It is thought that the actors continuously increase the value by working in the assemblage of sequential operations till the products or services reach the customers [4]. Innovation activity as a process of value co-production highlights the value creation as a synchronic and interactive, not linear and transitive [6]. Thus, the value co-production framework allows for reconsidering the roles, actions, and interactions among economic actors [1].

The framework of co-production does not regard customers as consumers destroying value created by the producers. Instead, customers mutually co-create or co-invent value over time both with their suppliers and their own customers. [1] [7]

The value co-production framework allows for treating the role of customer as a partner in co-production similarly to the role of a supplier or other network partner.

Thirdly, the new logic of value co-production elevates the individual knowledge/competence and relationships between the actors in the locus of business. The dynamic properties of

knowledge/competence needed to bring forth new innovative solutions to the market invites more actors inside as well as outside the organization to be engaged in the co-productive processes. [1] [3]

Figure 1 illustrates Sveiby's idea of value co-production and capability co-creation emerging through the interactions between organization's external relationships, internal relationships, and individual knowledge/competence. In the figure, individual actors use their competence to create value by transferring and converting knowledge externally and internally to the organization they belong to. The external relationships comprise the ongoing and dynamic interactions between the members non-members of an organization. Correspondingly, the internal relationships refer to the internal actions the members take, the way they work and communicate with each other, and the beliefs, values, and stories they share with each other. [3]

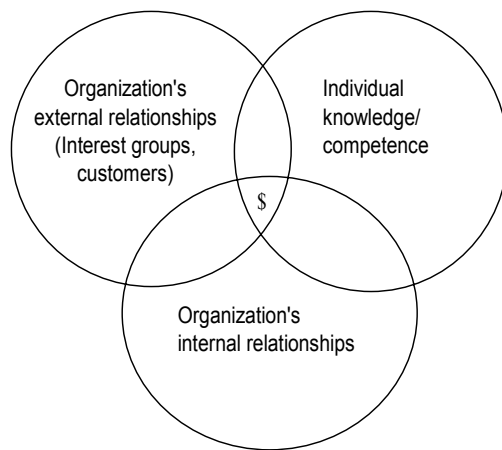


FIGURE 1
CO-PRODUCING VALUE THROUGH RELATIONSHIPS AND
KNOWLEDGE/COMPETENCE [3] (Modified.)

The value co-production framework best describes organizations which, in addition to their own knowledge/competence, utilise the knowledge/competences of the external actors. It is also applicable to organizations which have a vision-based network and a capability to combine resources and competences of different actors into a new and functioning value (co-)production systems. These organizations need to focus on utilising aggregates of different resources and competences on an expanding scale [5]. Therefore, value creation means building a better and better fit between relationships and knowledge [6].

III. RESEARCH SETTING

Research methodology

In this study, we follow the basic ideology of case research [8]. In broader terms, our approach is qualitative [9], focusing on description and analysis of processes taking place in a case company. Thus, our study is an empirical study examining a phenomenon in its real environment.

We adopted a qualitative, case research design [10]. The research material was analysed with a content analysis method. Researcher triangulation was implemented in order to enrich and deepen the analysis of the material [11].

Data collection

Our primary contact during the data collection process was the founder member of the firm called Alfa. All interviewees (total of six persons) were chosen according to his recommendations. The interview data was collected by three different researchers in two separate points of time, spring 2004 and between late autumn 2005 and early spring 2006. All interviews were conducted in Finnish, and they were recorded and transcribed.

Four persons were interviewed both in 2004 and 2006, and two only in 2006. The four persons interviewed twice are the key persons who had been working in the project even before the establishment of Alfa. Also the two persons whom were interviewed only once had been with the company from the beginning. The purpose of repeating interviews among the four key persons was to include also a temporal scope in this study.

The interviews lasted between three quarters and two hours. The interviews focused on the processes of organising, developing, and conducting the company as well as on the challenges it faced during the period of the study. The interviews were conducted as open-ended to bring forth actors' own interpretations of the situation [11].

Data analysis

Interviews were recorded and transcribed word for word. Only those little words such as "um" and "you know" were left untyped. The research material comprises approximately 170 pages of transcript.

The method of content analysis was used [12]-[13]. The analysis proceeded through six phases [14]:

First, we decided that the unit of data analysis would be a statement, which could be a word, a sentence, part of a sentence, or a thought comprising of many words and/or sentences.

Second, we got acquainted with the interview material by reading the typed material through many times and by listening to the tapes before starting to analyse them. This phase took quite long time, because all researchers did not participate in the actual interviews but received only transcribed material afterwards.

Third, we simplified the data by coding those arguments and enunciations that were related to our research problem. Then, all similar codes were grouped together into a same category.

After that, we continued merging categories with the same contents. Interpretation was used in all the phases described above.

Finally, we used researcher triangulation also by assessing the creditability of the data analysis. In other words, two of the researchers analysed the empirical material together and one of the researchers did analysis of the same data independently. Then all researchers discussed and compared the interpretations.

IV. CO-PRODUCTION OF VALUE THROUGH NETWORKS – CASE ALFA

The case firm Alfa was established to bring a technological innovation to the market. The innovation combines know-how from two industries and thus could be described as a hybrid media. Innovation process dates back to 1997, when a product development manager of a company was assigned to study the future scenarios of the industry. The manager worked with researchers from MIT who studied how to operationalise the interaction between people and smart environments, "things that think" [15]. These discussions inspired the product development manager to work the ideas into the possibilities of combining different technologies.

In the next paragraphs, we will present results from our analysis on the interconnectedness of critical decisions in the process of bringing innovation to the market. These decisions and the underlying factors behind them try to demonstrate how value within an innovation-based business is actually co-produced. Table 1 summarises the business decisions and their related factors.

Owning-partners selected based on capabilities

At first, the parent company intended to build a new product line based on the innovation. However, other business reorganization was done at the same time, and also, the parent company did not acquire the knowledge needed for mastering the new product line. Thus, a decision was made to invest in a spin-off with two other partners from two different industries. Moreover, this decision can be seen as giving the grounds for other critical business decisions described in later paragraphs.

Funding actors participate in value-creation

Besides the funding from the three owners, the National Technological Funding Agency played a critical role in financing the setting up the business operations of the new company. Later on new capital investments were negotiated. Through sharing the ownership the parent company was able to do risk-sharing and to bring more financing know-how into setting up a new business.

TABLE 1
THE CRITICAL BUSINESS DECISIONS MADE IN ALFA

Decision	Related Factors
Owning-partners	<ul style="list-style-type: none"> • Broader set of skills
Funding from partners	<ul style="list-style-type: none"> • Risk management • Broader financing know-how
Production through partners	<ul style="list-style-type: none"> • Unwillingness to invest in own manufacturing equipment
Customers as co-producers	<ul style="list-style-type: none"> • Developed technologies attract the large-volume market • Global customers have resources to invest in technology development • Global customers have power to "induce" others to use new technologies • Diffusion of technology inside and through the global customers
Gradual development of technologies	<ul style="list-style-type: none"> • Competitors offer ready-use-solutions
Network of specialists	<ul style="list-style-type: none"> • Need for highly skilled specialists • Important to be close to the partners and customers
Value co-production through network relations	<ul style="list-style-type: none"> • Flexibility, dynamics, and agility of activities • Cost savings through avoiding large investments • Outsourced resources • Focusing on own areas of expertise • Good preparedness to expand business activities • Business concept demands such a broad expertise that cannot be handled within one company

Production through partnering

The first product was launched in 2006, two years after the start-up. The decision was made early in the innovation process not to invest in own manufacturing equipment but to build production through partnering and subcontracting. The product development manager knew actors in the printing industry.

Customers as co-producers

At the time, when the company was set up, it was not clear what exactly will be offered and to which customers. The decision process on whom to target as the main customers was not easy and it took almost a year to determine who the customers are and who they should be. In a network business, there is a fear that profits dissolve into the vast network of partners and subcontractors. Thus, the company paid close attention in determining its position in the network.

After the long internal discussions and negotiations, the company decided to target the globally known customers, i.e., global brand owners. These actors were seen as having the

potential resources to either use the technology in their own operations or develop it further with Alfa. As industry leaders, these actors have also the power to seduce other customers to use it. Moreover, the brand owners were seen as a means to reach brand owners' own customers (i.e., customers-customers) and other important players in the market field.

The challenge with the global brand owners was that they were not, after all, interested in participating in the process of product development. Rather, they wanted ready-to-use solutions. Also, finding the right partners to negotiate with has not been easy, because the brand owners have organised themselves not as hierarchical organisations but as bundles of networking contracts. Thus, connecting to the right networks to bring the innovation forward has not been easy task for the company.

Gradual development of technology

The company sees competitive advantage in engaging its customers in the final phases of the product development. Hence, the company approaches the customer with an unfinished idea of the final solution, and then develops it with the customer. The reason for this has been the fact that the company's competitors are offering ready-to-use solutions to the customers. However, the risk in this approach lies in determining correctly the time to commercialise and more specifically launch the product to the market. The solution must not be too incomplete and yet not too complete for the customer.

In product development, the company has several partners and acts sometimes as a mediator between them. These partners are universities, other public research sites, autonomous firms and customers.

The company is a network of specialists

At first, in 2004, nine people worked in the company. At the end of 2006, there are about twenty people working. The hiring policy has been to recruit highly skilled specialists, no matter where they want to stay. It is thought that not necessary everyone wants to move to the city where the headquarters are. Thus, the organisation itself has become a networked organization. The personnel are located in five cities in Finland and one in Central Europe. Specialists travel frequently to customers as customers participate heavily in the final phases of product development, and they contact frequently their partners for getting more experiments and testing underway.

Value is co-produced through network relations

During its existence, the company has been operating through its network relations. The network comprises both company's internal members (i.e., personnel) and external members (e.g., owners, research centres, consultants, customers, partners and subcontractors). Some relations have been built before the establishment of the company and their existence as well as continuity has been dependant on specific personal contributions. All in all, internal and external members are interacting with each other frequently and there is a drive to deepen the most potential relationships further.

From the start, the company has seen the network as an enabler for running the future business effectively: company needs such a broad expertise that cannot be handled within one company but within the range of multiple actors participating in the technology development as well as in the production and marketing of the products. This, in turn, helps the company to maintain and develop its own superior expertise. Moreover, networking with partners and customers are seen as offering possibilities to expand the business activities further, to stay out of costly investments and to remain its capability to change courses of actions quickly if something unexpected emerges.

However, the challenge the company has recently faced is its ever-increasing internal and external dispersiveness. As the network relations become wider and wider, it is impossible to control the internal (and external) actors and consider whether the connections are utilised properly or not. Networking decisions include decisions on whether wider connections are yet needed or should the company focus on a certain amount of relations and deepen them further.

V. DISCUSSION

This paper has studied key challenges of managing a network business. The aim of this paper was to generate empirical knowledge for understanding the networked nature of value creation in innovation-based business by demonstrating how value co-production occurs in practice. The study is based on ten interviews conducted between 2004 and 2006. The interview material was analysed using a method of content analysis.

The identified seven critical business decisions focuses on traditionally held areas of business such as ownership, investment, production, customers, competitive advantage, organising, and managing network relations [4]. The primary organising principle and driving force of Alfa's activities and operations are internal and external networking. Thus, value co-production occurs in and through several network relations synchronically and interactively [1] [3] [5] [6].

First of all, customers participate in the production of value [1] [6] [7], and thus, customer relations themselves become valuable, as they become close and long-term relations. Moreover, scattered internal and external network connections between members inside the company and between the company and its suppliers as well as between the company and its partners not only enable the role shifts and overlaps between the

actors but also blur the efforts to control the aggregates of different actors [1]. Therefore, the success of management of the company relies on the ability to manage interactions, not individuals or individual companies.

Knowledge capital is argued to be one of the crucial elements and perquisites for surviving in today's innovation-based business [5] [6]. It is generated and maintained through the aggregates of dispersed individual expertise [3] and renewed through external relationships. The company tries to keep its highly skilled specialists by letting them to be loosely tied to company's apron. Thus, both the empowerment of specialists and their self-guidance seem to play important roles.

Financial capital is secured through professional financing organizations. The company gains cost savings through networking because it does not have the heavy load of investment to cover. Moreover, as the company develops its product with the customers, it can acquire some cash flow even before launching the product. However, the company has difficulties in pricing the knowledge/competence based products. The value co-production framework highlights knowledge as the most critical asset of the firm [6], but deciding the market value of knowledge based products and services is a true challenge in the everyday business. Thus, research on the combining of the value co-production framework and the dynamics of appreciation/pricing knowledge seem to be yet needed.

In terms of social capital, the company is able to utilize the specialists' long term relations in the printing, paper and electronics industries. Through strong networking know-how the company can better focus on its' own core competences. However, the value co-production framework seems to ignore how differently networks and relationships between individuals and firms can be conceptualised. Thus, it would be valuable to further analyse the different networks with network research approaches, such as social networks, business networks and entrepreneurial networks. Through such analysis, a deeper understanding of which networks and relationships are actually those that drive the value co-production between the economic actors will be sought for.

As to conclude, this study is part of a larger research programme on networks which focus on actors' interdependences and knowledge formation processes in order to identify, describe, and analyse the emerging business premises and features as well as business models with regard to framing and managing innovation-based business in a network context. This study has cast a light on showing the importance for understanding the value creation situations businesses today face and the need to study it further.

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Community of Practice and Organizational Design

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Abstract — In this paper, we pointed out how the form and management of an organization shapes its levels of knowledge transfer and learning. We document the lessons from an ongoing knowledge management program within a major French banking company at its early beginnings. Basically, the purpose of this program is to understand how knowledge sharing and learning can be supported in professionally-oriented communities to reduce business process and improve organizational performance. Through this business case, we illustrated that promoting management initiatives without taking into account organizational structures is a nonsense. Corporate success in today's economy comes from being able to acquire, codify, and transfer knowledge more effectively within the whole organization. From this point of view, organizational design is about enabling a group of people to combine, coordinate, and control resources and activities in order to produce value *i.e.* organizational knowledge. Too many knowledge initiatives undertaken today are disconnected from organizational design. As a result, many executives are unsure of how to translate the goal of becoming a "learning organization" into strategic course of action. Thus, creating the appropriate organizational design can enhance the organization ability to create and exploit knowledge.

Keywords — community of practice, organizational design, knowledge management, knowledge mapping

I. INTRODUCTION

As competition is becoming tougher, it is increasingly apparent that sponsorship and support of groups such as communities of practice is one strategy to increase the value they create and improve organizational performance. From this point of view, community of practice or professionally-oriented communities are gaining momentum since they are recognized as a glue that binds existing and future activities of the firms. These communities, by definition are composed of knowledge workers, who develop and maintain their professional body of knowledge in close relationship with their colleagues. In this sense, they provide the necessary environment for professionals to develop their skills and share the knowledge and experiences of their professions through the whole organization. Thus, these communities are strategic corporate resources that need to be managed to ensure that their goals are well aligned with business strategy. This approach is consistent with the knowledge-based view of

the firm which suggests that the role of the firm and its unique source of competitive advantage rest in its ability to integrate the knowledge of different individuals into the production process of goods and services. This type of approach involves the deliberate integration of knowledge in business processing functions where critical decisions are being made. In fact, it's not only a question of alignment between the objectives of the community with those of the business strategy, but of integration of the knowledge generated by this community into key processes. The article is divided into four parts: section 2 summarises the contributions found in the academic literature on knowledge management, community of practice and organizational design; section 3 presents the study background and the methodological approach we used; section 4 reports the results of our analysis which is still in progress; the conclusion - section 5 - discusses the preliminary results.

II. ACADEMIC REVIEW

A. Community of Practice (CoP)

The notion of CoP appeared at the beginning of the 90s, with the development of the Internet and its associated new technologies, which brought into question our relationship both with, and to, knowledge. Several authors, such as John Seely Brown [1], Etienne Wenger and Jane Lave [2], have highlighted the role of tacit knowledge in learning mechanisms and revealed the contextual significance of "*situated learning*", and the importance of this in the acquisition by the novice of knowledge and behavior necessary for his professional life. This approach was pursued in parallel by the work of Thomas Davenport and Larry Prusak [3] [4] in the domain of KM. Their research showed that an organization became collectively more intelligent when it was able to connect all the participants in a given action so that they could manage, share, construct and produce information and knowledge jointly to facilitate problem solving. In this perspective the interactions between members of a network play a fundamental role in the creation of knowledge, questioning the idea that learning is purely an individual problem.

According to Wenger [5], "communities of practice are groups of people who share a concern, a set of problems, or a passion about a topic, and who deepen their knowledge and expertise in this area by interacting on an ongoing basis". Wenger promotes the social aspect of learning, which is part of collective practices at the center of CoP.

For Wenger, these practices develop around doing actions, which in both a historical and social dimension produce structure and meaning. This concept of practice includes both an explicit field and a tacit register. All the same contrary to Nonaka [6], Wenger does not consider it useful to put into opposition the tacit and explicit dimension of practices to the extent that he considers these two aspects to be ever present in all forms of knowledge. According to Wenger, three dimensions allow us to characterize the type of relationship, which makes up a shared practice and constitutes the source of coherence among individuals: mutual engagement, joint enterprise and shared repertoire. Over the course of time participation within a CoP will create resources, which will make sense as it were. These resources form a shared repertoire and include physical artifacts like prototypes and models, routines, tools, and procedures that the community has developed or adopted over the course of its existence and which have become little by little an integral part of its nature. Finally, concerning the creation and make up of these communities, Wenger underlines that they develop in a spontaneous and informal manner. Moreover, one cannot set up a CoP simply by putting people, tools and resources together and establishing objectives the way one constitutes a working group or project. Rather, one can only encourage and foster the development of shared activities by willing participants. Wenger insists that too closely supervised communities, an expectation of early results or trying to direct the development of the community towards narrow or pre-established aims, will end in failure. Today, many firms promote and support such communities to develop new products or services [7] and improve their competitiveness [8] by reducing learning curves. Thus, in many organizations these communities are becoming recognized as valuable organizational assets.

B. Knowledge Management and Community of Practice

According to Wenger [9], communities are not born in their final state, but go through a natural cycle of birth, growth, and death. As members build connections, exchange information and experiences, they coalesce and go from one stage to another. So, there must be a series of connections that individuals have with others. In other words, individuals must perceive themselves as part of a community. A sense of trust must be developed across these connections. With a critical mass of community participation, effective structuring and repeated experience, community members will improve the way they acquire knowledge and accomplish tasks. In short, at the first stage, the community is just starting to form having common interests. Professional knowledge and experience is then collected and shared amongst the members. The members of the community have to share a common understanding of issues facing the organization. At the second stage, the core team creates value and standards and the organizational structure is set up. To be sustainable over time, this structure must be recognized and supported by the whole organization to stimulate continued adoption, use, and contribution by a critical mass. Members increasingly communicate and collaborate using a large range of ICT

tools, KM technologies and face-to-face meetings, and new members join the community. At the third stage, the community operates in project mode with a proper structure and processes. The community coordinator, who is a community member, helps the community focus on its domain, strengthening relationships and developing its core knowledge. Critical success factors at this stage are clear and visible community purposes, membership benefit, and governance structures and policies which should be in perfect harmony with the business strategy, which involves managing interactions with other organizational entities or departments. At the fourth stage, the community has reached a stable level and it is important to change the community's rhythm to rejuvenate it. It can be done thanks to face-to-face meetings and others seminars aimed at energized members. The community needs to encourage the members to participate in the discussions, seminars, message exchange, etc. It is also important at this stage to think about what kinds of resources are available to set up the community (both human and technical). Indeed, as the community grows, it may run into technological limits and need to re-evaluate the technology and the mode of communication used. Thus, critical factors in this phase are membership rewards, incentives and scalability issues. Finally, the last stage of the community life cycle deals with the evaluation of the community outputs and the value added in terms of knowledge. One of the major issues at this stage is to evaluate the collective knowledge generated by the community and spread it into the whole organization so that it can be reapplied. For this purpose, it is necessary to set up particular devices allowing knowledge to be extracted from documents, discussions, information exchanges and decisions [10].

C. Community of Practice and Organizational Design

Organizational performance can be seen as the result of interaction of strategy, organizational context, and individual behavior. From this point of view, managers have to choose the right approach according to their markets, create or customize processes to deliver services to those markets and motivate people to act in line with the company's objectives. Due to the competitive nature of the banking industry, these organizations need to leverage knowledge collection and transfer in order to maintain a competitive advantage. In this context, knowledge management means the process, by which an organization creates captures, acquires and uses knowledge to support and improve the performance of the organization.

Regardless of how it is defined, a company that manages its knowledge effectively gets the greatest value from the knowledge it has, whether that value is measured in sales, time-to-market... Thus, organizational design takes into account three critical factors: strategy, organization and motivation. Organizational design interventions deal with modifying elements of an organization's structure, including the division of labour, decision processes, choice of coordinating mechanisms, delineation of organizational boundaries, and networks of informal relationships [11]. The ultimate goal of organizational design is to enable a group of people to combine, coordinate, and control

resources and activities in order to produce value, in all the way appropriate to the environment in which the business compete [12].

CoP have previously been thought of as coming into existence when people interested in a common work-related area feel a need to share what they know and to learn from others. Little empirical evidence has been collected to analyze how a community of practice can be designed and built as part of a specific organizational development project. The organizational design (OD) is a formal, guided process for integrating the people, information and technology of an organization. It is used to match the form of the organization as closely as possible to the purposes the organization seeks to achieve, that is its strategy. However, designing a CoP is very different from most organizational design approaches, which traditionally focused on creating structures, systems, and roles that achieve clear organizational goals and fit well with other structural elements of the organization. According to Wenger [5] the goal of community design is to bring out the community's own internal direction, character, and energy (aliveness). Because a CoP stems from informal processes, designing a CoP can not be understood in the traditional sense of specifying a structure and then implementing it. Basically, the community design elements that are most appropriate depend on the community's stage of development, its environment, member cohesiveness, and the kinds of knowledge it shares. Thus, the ultimate role of design is to catalyze that evolution. In this context, organizational design has to be related to practice. That is, the way community members carry out a set of tasks or activities. In short, the way the work is organized within the community. Indeed, practice evolves with the community as a collective product, becomes integrated into member's work, and organizes knowledge in a way that reflects practitioners' perspectives. From this point of view, successful practice development depends on a balance between the production of outputs (documents, best practices, tools...) and deep learning experiences for community members.

III. STUDY BACKGROUND AND METHODOLOGICAL APPROACH

A. *Study Background*

In short, at the beginning of the year 2005 this company decided to modify its strategy to improve the effectiveness of its processes. It was mainly a question of time-to-market: reducing the time needed to the request handling of loans by the professional customers, on the national market. Prior to the implementation of this new strategy the top executives we met asked us to carry out a preliminary study. In this connection, the objectives of the project were as follows:

- to identify the business know-how impacted by the new strategic plan in order to prepare the new process-oriented organization,
- to analyze business know-how to appreciate their criticality,
- to set up devices of safeguarding and transfer of the

knowledge the most critical.

The last stage is currently under development.

One business-unit has been chosen and was at the core of this project: "Contracts & Guarantees". Our study focussed on the "Loan Servicing Department" within this business unit. This department is in charge with the study and the development of the loan applications for the professional customers. The personnel concerned works mainly in back-office and is responsible for the realization of the requests addressed to the trade agencies. This activity covers, the risk analysis, the establishment of the adequate guarantees according to the amount of the loan and the profile of the customer like secured loans or mortgage loans, the compliance of the loans and agreements with the state and the European laws... Few years ago, this entity has been chosen as a pilot department to test a new work organization which has moved from a bureaucratic one to a process-oriented one. Several employees who worked previously in other departments have been gathered into a professionally-oriented communities in which the main regulation process is based on expertise. At the same time, groupware and workflow tools have been implemented in this business-unit and many training sessions have been proposed to support the work done by these knowledge workers. For technical problems, the company has implemented a sophisticated document management system with direct enquiry and archiving features. With the help of document descriptions and key words, searches and solution entries can be undertaken by all employees.

Within this entity, the employees used to work in two very different ways. One group of employees made up of 10 employees – the oldest employees - was very specialized and the work organization was based on Taylor's principles (sub-group n°1). Each operator is specialized on a particular activity: mortgage loans, risk analysis... This group stems from a reorganization carried out in 2001 following a merger with another national bank. At the same time, groupware and workflow tools (Oxygen) have been implemented in this business-unit and many training sessions have been proposed to support the work done by these knowledge workers. Basically, all these employees were volunteers and have been added to the existing department. The second group was made up of 11 employees and the work organization was much more flexible (sub-group n°2). Each operator was working on a dedicated customer's demand, which covers different type of activities: historical count analysis, business needs, risk analysis, the assembly of the desired type of loan and the associated guarantees. In this case, each operator was dedicated to a specific company which covers the whole activities made by the previous group. In fact, the subgroup n°1 act as an experts group to solve problem faced by subgroup n°2 on specific and technical questions like risk coverage, mortgage rate analysis... Thus, the "Loan Servicing Department" is a big team composed of these two informal subgroups and form a community of practice. Indeed, this community is a group of people who share a concern, a set of problems, and who deepen their knowledge and expertise in this area by interacting on an

ongoing basis.

The project started in November 2005 and is still in progress. All community members are full-time employees, aged between 31 and 54. A senior manager (the sponsor) called Charles A, is the project's representative at the executive level. Charles A then identified two informal leaders for the CoP given their expertise; called Thierry G and Oliver B. These two leaders are the community coordinators responsible for the overall guidance and management of the CoP. They help build and maintain the CoP, encourage participation, help direct attention to important issues and bring in new ideas to energize the CoP if so required. Charles A and the two coordinators interact through e-mail, by phone or at face-to-face meetings on a regular basis, depending upon the ongoing activities of the community. The operators of the communities know each other and had the practice to meet at the time of monthly meetings or to exchange by telephone, email or face to face.

B. The methodological approach

Our research project is based on a qualitative case study design. The major method of data collection is based on in-depth interviews (26). These interviews lasted from one hour to two hours, and were tape-recorded and transcribed. Each time, we used participant checks for validating the accuracy of research findings. This method has been applied both for analyzing the structuring characteristics of the community, and mapping the knowledge domains.

To describe the community we studied, we use the approach defined by Dubé *et al* [13]-[14] for the Virtual CoPs analysis. Indeed, these metrics seem very suitable with our purpose. The CoP in this study is operational, small (24 members), at the coalescing stage. According to Wenger *et al* [3], at this stage, the key domain issue is to establish the value of sharing domain knowledge. This community has been created on a permanent basis with no definite time in mind, through a top-down approach. Thus, the CoP was coded according to the scale proposed by Dubé *et al* [13]-[14]. The final results are presented in the Table I and underline the most representative characteristics of the CoP.

CoP Identity Card	
Demographics	Results
Orientation	Operational
Life Span	Permanent
Age	Young
Organizational context	Results
Creation process	Intentional
Boundary crossing	Low (same business unit)
Environment	Neutral
Organizational slack	Medium
Degree of Institutionalized formalism	Supported
Leadership	Clearly assigned
Membership	Results
Size	Small
Geographic dispersion	Low
Member selection process	Open
Member enrolment	Compulsory
Member's prior community experience	Extensive
Membership stability	Stable
Members' ICT literacy	Medium
Cultural diversity	Homogeneous
Topic relevance	High
Technological environment	Results
Degree of reliance on ICT	Medium
ICT availability	High variety

TABLE I
STRUCTURING CHARACTERISTICS

To go further in the analysis, we also check internal documents (annual reports, strategic plan...) that were useful for understanding the critical components of the organizational design and diagnose organizational problems. This analysis involves the collection of information necessary for making design decisions. Another set of structured interviews has been conducted with the executives (6), focusing on the strategy of the organization, the key tasks being performed and current strengths and weaknesses of the organization.

C. M3C Methodology

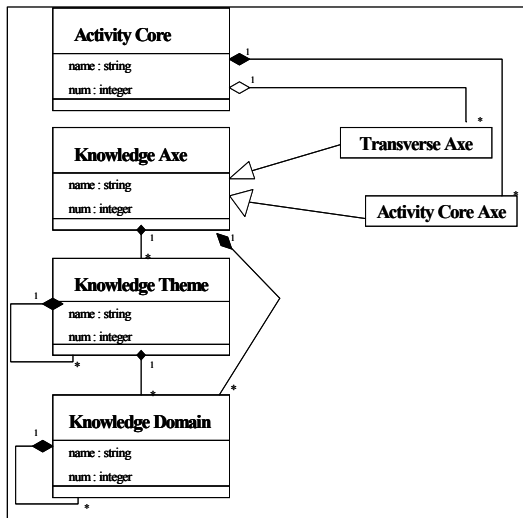
The term "mapping knowledge domains" refers to the process of charting, mining, analyzing, sorting, enabling navigation of, and displaying knowledge. According to Speel *et al* [15]: "knowledge mapping is defined as the process, methods and tools for analyzing knowledge areas in order to discover features or meaning and to visualize them in a comprehensive, transparent form such that the business-relevant features are clearly highlighted". M3C is "domain-oriented" approach [16] [17]. The M3C methodology has been described and illustrated by Ermine *et al* [18]. The cartography and the evaluation of knowledge domains are based on knowledge acquisition from experts. M3C is also a knowledge engineering method which can be used in combination with other methods used for modeling descriptive and operational knowledge of an expert in a particular domain or field of knowledge [19]. M3C is grounded on robust models (formal, graphical and criticality models) we experimented in collaboration with industrial research centers and tested in big firms within different industrial sectors (GTIE group, Schindler, Chrono-Post, PSA Peugeot Citroën, Hydro Quebec...).

1) The formal model of the cartography

The formal model described with UML classes diagram (Table 2), is a hierarchical representation that classifies the knowledge domains of the firm in different levels.

A knowledge domain can be defined as a field of activity related to a specific group or team (community) for whom information and knowledge can be gathered. In short, a knowledge domain is the area of knowledge the community agrees to learn about and advance.

TABLE 2
THE FORMAL MODEL OF THE CARTOGRAPHY



One of the main feature of the cartography is the core activity or “core knowledge” which reflects the strategic knowledge, associated to its fundamental mission. Around this central point, we can find knowledge axes, which define the strategic knowledge domains. Of course, these knowledge domains have to be consider in association with the missions in view within the organization. Finally, the knowledge domains are joined together according to a common objective on the same knowledge theme, along the knowledge axes. For the analysis to be more accurate, both domains and themes can be divided into sub-domains and sub-themes.

2) The graphic model

The knowledge cartography gives a global view of knowledge domain in the firm. Different tools can be used to map these domains. The map below has been realized with Mind Manager (Table 3).

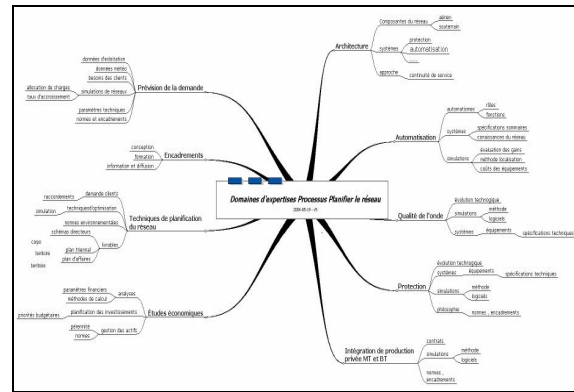


TABLE 3
KNOWLEDGE MAP

3) The criticality model

The criticality of a domain is an evaluation of risks and opportunities associated to this domain. Basically, it looks like a SWOT analysis in strategic management. For example, what will be the consequences of “knowledge drain” within a specific domain ? What type of domain should be developed ? ...However, we have to define what may be “objectively” the criticality of a knowledge domain. For this purpose, we used an analysis tool called CKF(Critical Knowledge Factors) which has been developed in the Knowledge Management Club in France. CKF is an analysis grid which has been performed and validated in many French and Foreign companies. The CKF grid contains 20 criteria gathered in 4 thematic axes (Table 4).

Thematic axes	Criteria
Scarcity	Number and availability of experts Externalization Leadership Originality Confidentiality
Utility	Adequacy with strategic objectives Value creation Emergence Adaptability Use
Difficulty to Capture knowledge	identification of knowledge sources Mobilization of networks Tacit knowledge Importance of tangible knowledge sources Rapidité of obsolescence
Nature of knowledge	Depth Complexity Difficulty of appropriation Importance of past experiences Environment dependency

TABLE 4
THE CRITICAL KNOWLEDGE FACTOR GRID

Each criterion is evaluated according to a scale composed of 4 different levels, representing the degree of realization of each criterion. The rating of a criterion is based on one question. Each level is expressed by a clear and synthetic sentence to avoid interpretation problems. For each knowledge domain of the map, the result of the criticality analysis, using the CKF grid, is visualized with radar diagrams (by criterion and by thematic axe, Table 5).

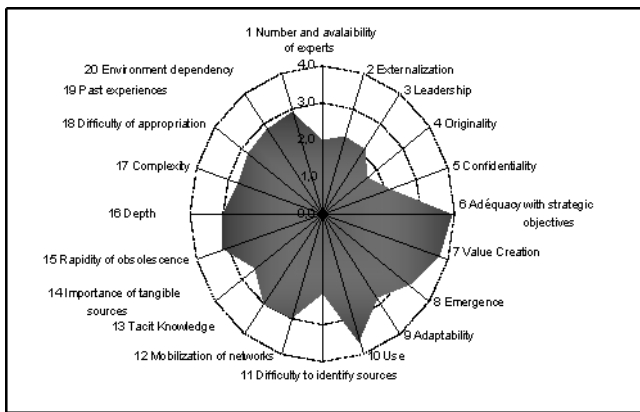


TABLE 5
RADAR DIAGRAM

IV. FINDINGS AND RECOMMENDATIONS

A. Change Work Organisation within the Community

1) “Task-based” Organisation versus. “Business-based” Organisation

In terms of work organisation, there is no such thing as “one best way”. If the “task-based” organisation (sub-group n°1) may suit some individuals, it is however completely unsuitable to others. From an objective standpoint, the ‘business-based’ organisation (sub-group n°2) seems much better suited to a competences development and know-how transfer perspective. This approach enables a closer proximity with the customer, the development of a global view of its activities over time. Moreover, at a cognitive level, this approach helps the operator “make sense” by developing the “*know how*” and the “*know why*”, thus allowing the combination of conceptual knowledge with practical knowledge (competences).

The “task-based” organisation only purports to develop know how, and does not offer the operator an overall view of the operating process. It fits within a logic of specialisation related to productivity improvement projects underway. The manager’s role can be summarised as a simple supervision and control task (direct supervision), with limited involvement (*monitoring costs*). The management of a “business-based” organisation requires more commitment, particularly as far as coordination and communication are concerned (*coordination costs*). A corollary is that a “task-based” organisation limits the development of managerial capabilities.

2) Work Organisation & Related Risks

The “task-based” organisation leads to increased risk in the processing system. The logic of productivity associated to this system leads to the primacy of quantity versus quality. Yet in this respect, the “business-based” organisation contributes to improving “knowledge of the customers”, thus limiting their opportunism, *i.e.* the risk borne by the institution.

3) The individual, the team & the community

In a “task-based” organisation, the individual is isolated within a hierarchical structure that he is incapable of

grasping as a whole. In this context, motivational issues may arise and influence the extent of the operators’ motivation (“parabola of the cathedral builders”). The transfer of knowledge becomes difficult, as the *modus operandi* forces the operator into isolation. Yet the learning process can only be envisaged within an interaction logic (socio-constructivism) with other actors who possess the knowledge and know-how.

The “business-based” organisation appears to be potentially more interesting from an organisational learning perspective. To manage a “business-based” organisation requires a definition of supervisory tasks (job description, name...). If the team-manager has to assume a coordination role on a daily basis, one should also plan a position dedicated to knowledge management (*Chief Knowledge Officer*, or *Knowledge Manager*) within the team and between teams. In this context, the organisation (at operating level) becomes a networked structure with the team as the basic entity. The bringing together of the various teams within a logic of “business” knowledge sharing may thus serve as the basis for the creation of genuine “communities of practices”. Today, these communities make up the foundation of the “cognitive firm”.

Recommendation n°1

A “Task-based” organisation may only serve as a transitional organisational method, prior to the generalization of a “Business-based” organisation that is more conducive to the development of collective know-how.

B. Change Training Processes within the Community

1) Adapting Work Schedules for Tutors

Today, most of the training is delivered by designated tutors, charged with training newly arrived staff within the community. If this approach is fundamentally sound, it remains that tutors need to be given the means to carry out their tutoring. Indeed, no allowance is made today for adapting their work schedule, even though they are requested not only to train new staff but also to carry out their daily processing tasks, without any *quid pro quo*.

Under those circumstances, training becomes a difficult and perilous challenge for the tutor. It is imperative that this anomaly be corrected, especially considering that this is the cornerstone of the training system in the field. In this respect, one should plan to alleviate the tutors’ work-load throughout the training period, so that they may commit themselves fully to their tutoring and coaching mission in favour of new staff.

This form of tutoring *in situ* may be completed by the implementation of a real e-learning solution allowing remote delivery of the training if necessary. In addition, it is necessary to update existing sources of documentation and to promote their usefulness and ease of access by reviewing the nature of existing media (digital format, tutorials, self-evaluation tools, forums...). The training delivered and the educational material used should also be adapted to the reality on the ground and to users’ expectations.

2) *Towards a Recognition of the Tutors' role and status*

As a corollary to the previous point, it is also important to redefine the tutors' role and status in the field. Insofar as they play a fundamental role in the training of business players (the operators), it is important indeed to reconsider their status as trainers and escalate it. This escalation must be concretely reflected in their job description and in clear and specific remuneration formulas that encourage their engagement, especially amongst the more experienced actors who want to share their know-how and experience. In the current environment, involving the unions in this debate might prove worthwhile. It is also important to keep in mind that the tutor's role is not limited to helping new staff acquire knowledge, competences and professional expertise. Through his / her position, he / she also contributes to the welcoming, the support, the information and orientation of those employees who take part in training programmes. To this extent, he / she acts as an extension of the HR Department, and may be able to help the employees develop and implement their professional objective. This dimension is often downplayed or simply ignored by the executives.

3) *Role of the Tutor in the Knowledge Transfer System*

The tutor plays the role of a facilitator in the individual knowledge transfer system. In particular, he can contribute to the expression on implementation of work practices thanks to his / her expertise level and unique knowledge he / she possesses, *i.e.* metacognitive knowledge. Metacognitive knowledge includes the knowledge of general strategies that may be used for various tasks (solution modes) as well as the knowledge of the conditions where such strategies may be used. This knowledge about cognitive tasks helps the operators (learners) to identify the nature of the task and to select a strategy to tackle it. There is a metacognitive dimension in all learning strategies. One may distinguish between three types of strategies:

- Declarative knowledge : to know the "what" of a strategy,
- Procedural knowledge: to know the "how" of a strategy,
- Conditional knowledge : to know the "when" of a strategy.

An employee who would only possess a declarative or procedural type of knowledge about a strategy would not be capable of making a transfer between two similar tasks in different contexts. Let us specify that we mean by transfer the process which enables an individual to use formerly acquired knowledge in a new context. It is a phenomenon whereby progress achieved during the process of learning a certain form of activity triggers an improvement in the practice of that activity, or of a different one which is akin to the main activity.

Recommendation n°2

The status of tutor must be recognized and promoted, and the existing training system must be adapted so as to enable tutors to carry out their missions fully.

C. *Put in place a Knowledge Capitalisation and Transfer System within the Community*

1) *A Knowledge Capitalisation and Transfer System*

As mentioned above, there is today a training system which extensively relies on tutoring. This system must be improved, but remains very pertinent within a logic of individual learning. However, there is presently no system in place for the capitalisation and transfer of knowledge that can link the individual and collective levels. Let us recall that the concept of capitalisation has been in existence for a long time in industrial firms: it is expressed in the form of production manuals, guidebooks, checklists.... Yet with the increase in service activities, a need has appeared to capitalise on know-how that is more intellectual than technical in nature. In general terms, this capitalisation is made necessary by:

- the need to improve productivity in service firms by promoting knowledge capital,
- the retirement within a few years of a large number of experts, which prompts the need to capitalise the knowledge and know-how of those who have them,
- the emergence of new technologies that facilitate the exchange and spreading of knowledge.

Knowledge (both knowledge and know-how) to be capitalised has many angles; it is articulated between tacit and explicit, individual and collective knowledge. Capitalisation consists in promoting implicit individual knowledge so as to transfer it to the collective explicit mode, with the purpose of fostering a collective appropriation (collective implicit). Considering our observations and the results evidenced, it seems necessary to initialize the process, and hence to primarily favour the promotion of implicit individual know-how, resulting from experience, and its transfer to the explicit level. The purpose of capitalisation is to enable the production of explicit documents, describing the action carried out and dealing with practices implemented, so as to enable an appropriation by others: in other words, a transfer. Formalisation is a basis for exchange.

2) Sequencing of the Knowledge Management Process to be put in place

The process described below is iterative and includes several stages, which are necessary steps.

<i>Recommendation n°3</i>			
	Objective	Action	Outcome
Stage n°1 Create	<i>Create the knowledge</i>	Discover the knowledge - Invent the knowledge	- Value added within the business process
Stage n°2 Identify & Capitalise	<i>Identify strategic knowledge</i>	- Collect & document strategic know-how so as to preserve it (capitalise)	- Create memory (capitalisation)
Stage n°3 Spread	<i>Spread strategic knowledge</i>	- Transmit, share and distribute knowledge based on : • its importance • its confidentiality • its degree of urgency • its reliability...	- Puts at the disposal of CoP a common and strategic knowledge base
Stage n°4 Leverage & Create anew	<i>Use of the circulated knowledge</i>	- Use and leverage acquired knowledge - Improve and update existing knowledge	- Value creation at the CoP level and path towards a new stage of creation for new knowledge

The study we carried out has clearly enabled initialization of the first two steps in the knowledge management process. Strategic knowledge areas have been clearly identified. What remains to be done is the gathering and recording of strategic know-how after formalising and explaining it. This stage is not part of our specifications, but we may spell out its outline.

3) Actors and their Role

Capitalisation calls on different actors, with specific roles for each of them. It relies mainly on four essential actors and functions :

- The promoter of capitalisation : This is most often the manager whom the action's project manager reports to. His / her role is to promote and facilitate production of capitalisation. He / she should also ensure the promotion of those who produce.

- The producer of capitalisation : He / she is the action's project manager, as he / she possesses the know-how implemented, which is what is being capitalised.

- The "facilitator" : It is a person that is selected by the producer (tutor), whose job is to help with the expression of practices implemented.

- The "mirror" team : It gets involved at the feedback stage, during organised exchange sessions, to contribute an external viewpoint, act as a future "consumer" of the capitalisation produced, be a catalyst leading to the "de-contextualisation".

The implementation process is currently underway.

V. CONCLUSION

The first part of our study enabled us to identify the knowledge domains, to evaluate the criticality of each domain and finally to locate the problems involved in the

organization of work within the community. The community we studied is still relatively young and rather atypical since it does not use homogeneous operating mode. On this point, it appears clearly that a choice has to be made between "task-based" organization and "business-based" organization. The choice of the right organizational design is very important since it influences the knowledge transfer mode and its effectiveness both inside and outside the community. Basically, it seems that the "task-based" organization is unsuited to the aims in view by the business strategy and especially to the development of new competencies into the community. The preliminary results indicate that the organization design must be adapted or aligned with those of the knowledge management project and by the way, with those of the business strategy. This report is not new and comes to confirm a largely widespread opinion in the academic community: the organisational choices can prove to be harmful with the development of knowledge in the company. In this context, the emergence of a learning organization remains a mirage. The executives we met have well understood this problem however they remain rather reticent with the idea to make modifications likely to influence total productivity of the teams they manage. Indeed, that implies to change the executive's state of mind and to evaluate the community on new basis and new indicators that those who usually prevail in such a business.

The indicators of productivity used to appreciate the performance of a team concentrate on the result and seldom on the process which makes it possible to arrive at the result. For years, managers took as a starting point the Taylor's principles, being unaware of the consequences in term of knowledge management. Consequently, one comes thus at a rather paradoxical situation where one wants to produce something new with archaic and obsolete methods.

Another point deserves to be underlined, it clearly appears that the knowledge mapping method is a powerful tool to study the organisational design within a community. If this method makes it possible to identify knowledge domains and their importance, it also an interesting way to locate organizational problems. Indeed, this approach, while isolated from the knowledge domains makes it possible to identify core competencies [20]-[21] and to better understand the work organization. This method makes it possible to supplement the traditional methods used to study the organizational design. While asking an operator what are the main competences it needs in its daily work and how it uses them , one asks him to clarify the procedures that it use to do his job and solve problems. Thus, knowledge mapping is a way to enter the organizational design, focusing on core competencies. This approach is consistent with the resource-based view of the organization and core competence model. Once more, our approach does not have anything exotic and falls under the line of well-known work in management science. In this context, it seems that knowledge mapping methods could be used to highlight and further illuminate the meaning of core competence within organizations. By identifying knowledge domains it becomes possible to locate core

competencies at the operational level and appreciate their criticality. From this point of view, knowledge mapping methods like M3C make it possible to connect knowledge management and strategic management, and thus formalize and operationalize core competence analysis. Thus, through knowledge mapping methods it is a question of improving inside-in approaches or internal diagnosis in the strategic management field.

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Company Participation in Open Source Software Communities: Measuring Sustainability

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Abstract — A framework for analysing the sustainability of a community in four dimensions – social, cultural, legal and economical – is presented. The framework is further differentiated by taking into account the different types of open source software communities, particularly with regard to their work ethics: voluntary or salary-based. In conclusion, the framework is tentatively applied to two communities, Debian and Eclipse.

Keywords — open source software, communities, sustainability, hackers, work ethic, Debian, Eclipse

I. INTRODUCTION

Most of the contemporary open source software communities are by nature hybrid, consisting of actors with both commercial and non-commercial interests, motivations and backgrounds. The goals of different groups of collaborators, be they hobbyists, volunteers or paid workers, diverge while there is also considerable convergence with regard to the technical goals of a project (see, e.g. [1]). It is therefore good that the old image of a community full of voluntary hackers has ceded for a more realistic approach, which takes into consideration the strongly increasing corporate interest and participation. The work ethic of the corporate world is entering open source communities.

Company participation and the work ethic it implies in communities presents both dangers and opportunities for long-term sustainability. A company needs to be able to identify the systematic variation in motivation, values, ideology and practices between different communities in order to optimize its approach to each of the community intensive projects. A wrong approach may easily prevent the company from reaching its chosen goals and – in the worst case – also severely harm the community itself. Consequently, a general framework for assessing the sustainability and conditions of success of a community of open collaboration will be useful in generating a strategy for interaction between companies and volunteers.

II. FOUR ASPECTS OF SUSTAINABILITY

Free and open communities such as Debian and Eclipse are by nature hybrid, consisting of actors with divergent goals and motivations and from both commercial or non-commercial cultural backgrounds. Companies have increasing interest in collaborating with these communities, which presents both dangers and opportunities for long-

term sustainability of a community. In the following, we analyse four aspects of community sustainability: 1) social, 2) cultural, 3) legal, and 4) economical.

A. Social sustainability

The social sustainability of a community depends on the individual characteristics of its members, on its size and form, and the division of labor and power in the community.

Surveys on free/open source software developers show a variety of backgrounds, motivations and values. Multiple motivations are suggested in the literature, including hedonism (“just for fun”), software politics (free software ideals), altruism, identification with a community, peer-recognition, personal technological needs, reputation, learning and working for hire [2], [3]. Different community ideologies can be identified in different projects like Debian, Linux, Eclipse, OpenBSD, Creative Commons and Wikipedia.

Although in the big picture developers seem to be a heterogeneous group, there is more detail when looking at particular projects. For instance, in a recent survey on Debian and Eclipse developers [1], we identified some clear differences between these two communities. Largest differences were that a majority of Eclipse developers are paid to work on free/open source software while for almost all Debian developers it is a hobby; Eclipse developers are on average older than in Debian, and Debian developers are more aware and care about political issues such as copyright and software patents.

The variety of personal characteristics can be either a benefit or risk for sustainability. Eric Raymond's rule “Given enough eyeballs, all bugs are shallow” [4] assumes a large, diverse tester and developer base. In the ideal case, this group includes a whole range of users from less skilled to those with very specific skills, and a wide variety of different use cases, environments and equipment. Variation in aspects like socio-economical status, level of education and geographical location may increase the effectiveness of the group.

Ye & Kishida [5] describe free/open source community participant roles using an onion model. According to the model, at the heart of the community is often a single person, a project leader, with several supporting core developers around him or her. In middle layers of the onion are active developers, peripheral developers and bug fixers, and on the outer layers users who participate in the

community only by reporting bugs or following and trying to understand the software.

The outer layer of the onion is the largest group and the group size gets smaller as we approach the center. A well-known rule of thumb in sociological research on voluntary organisations is the so-called 20/80-rule (derived from the so-called Pareto Principle), according to which 20 % of the volunteers do 80 % of the work. It seems that software communities roughly follow this rule, with the number of active members drastically reducing with each step towards the core [6]-[9]. Naturally, in a complex or broad project (such as the GNOME), the developer group is divided into several subgroups roughly corresponding with different subtasks.

Krishnamurthy [10] found that 71 percent of hundred most active projects on Sourceforge had five or less developers and 51 percent of the projects had only one project administrator. Projects like these are probably highly dependent on the project leader. The project leader plays an important role also in larger projects such as the Linux kernel. Although Linus Torvalds writes only a minor portion of the new code, he is important for the project as a charismatic leader. The Linux community respects Torvalds' power partially for historical reasons, but also for his skills, and developers see him as essential. In 2002, the community had a "Linus doesn't scale" problem when Torvalds couldn't anymore handle the flow of modifications to the kernel, and a system of trusted "lieutenants" had to be build. Before that, social sustainability of the kernel community was low because of too centralized power and knowledge. With the lieutenant system, (tacit) knowledge is distributed more evenly which makes it easier and more probable for developers lower in the hierarchy to take certain responsibilities if the project leader has to step down for any reason.

Equally important for social sustainability is the system of decision-making and conflict resolution. As a small project grows in time, the diversity of developer opinions and views increases, creating more potential conflicts over technical decisions. The "benevolent dictator" approach chosen by communities like the Linux kernel has been accepted by most, although conflicts have arisen from time to time around issues like the use of proprietary version control system and licensing issues of binary modules. The Apache Software Foundation calls its system "meritocratic" and has a voting system but aims for consensus, which they consider "a very important indication of a healthy community" [11]. It seems that not one system of governance is more sustainable than others – one model does not fit all – but it is important to have a system and it must be suitable for the size and culture of community and do it's job; not too bureaucratic, not too antidemocratic.

In sum, the following heuristics can be used for evaluating the social sustainability of a community:

Increases sustainability:

- diverse user and developer base
- large number developers
- large number of users and contact with the users
- developers in different roles (project leader, core group, bug fixers, bug submitters) with dynamics that encourage learning
- moderately decentralized communication or power structures
- a system of decision-making and division of labour

Decreases sustainability:

- user and developer base with unified background, skills and use contexts
- small number of developers
- small number of users
- no prospective developer base or closed development process
- very centralized communication or power structures
- bureaucratic system of decision-making and division of labour

B. Cultural sustainability

The distinction between social and cultural sustainability is not clear-cut: cultural meanings and artefacts have their effect only as embedded in social practices. However, for the purposes of analysis we may differentiate between the two by noting that the cultural sphere exists, first, on a higher level of abstraction. Cultural aspects of interaction depend on interpretation, language, and coherent patterns of behaviour. Second, the cultural level is temporally different from the social. While some cultural artefacts and meanings may change rather rapidly, there are cultural layers that change little, if at all, during the lifetime of a generation or an individual.

Cultural sustainability of a community is defined by its traditions and history that create and shape its social and ethical norms and practices. While social sustainability is a matter of interaction between individuals, cultural sustainability is something that is created during a longer time period as the community matures. Communities have created documents fixing their position on certain philosophical or technical issues, such as the Debian Social Contract and the related Debian Free Software Guidelines. Changes in practices, such as decreasing openness and transparency, will have a feedback effect on the cultural sustainability.

One of the most famous and important cultural formations discussed in the context of open collaboration is the so-called hacker culture or hacker ethics [4], [12]-[14]. The hacker ethic is thought to contain a loosely interconnected set of values and beliefs that hackers internalize in the acculturation process of becoming active members and contributors of the community. While different authors present the tenets of hacker culture in different ways, it seems that the credo "information wants to be free" and the various temporally changing technological ways of promoting this credo ("the Internet

treats censorship as damage and routes around it", "we make the Internet not suck") crystallizes the basic pillar of hacker culture. "The hands-on principle" and a mistrust of all authority and concentration on what is fun or "scratching one's own itch" are other hallmarks of the cultural *ethos*.

However, since the end of the '90s the paradigmatic form of open collaboration, free and open source software development, has seen a radical change in its cultural environment. Through the launch of the open source movement – the explicit motivation for which was to increase the business friendliness of free software – the motivations and institutional background of developers, and consequently, the developer culture, have shifted. In many influential and important OS communities, a significant portion if not a majority of the developers are paid to do the job. On one hand, this has increased the stability and credibility of the communities, thus increasing sustainability, but on the other hand it has brought the traditional hacker culture in contact with the culture or ethics of the "salaryman" who, in the worst case "just works here." For instance, Pekka Himanen has described the hacker culture as a direct opposite of the protestant work ethic ([13], relying on [15]), where stable working hours and hierarchical structures and a clear division of labour with extrinsic motivations for working dominate.

In large and well established communities the clash of the different cultures does not necessarily materialize, as different social arrangements, such as foundations or councils (Eclipse Foundation, Gnome Foundation), can be set for taking care of the interplay of interests. The tension is more eagerly felt in smaller communities in which developers working under the assumptions of hacker culture may – with or without good reason – feel threatened or exploited by a company taking part in and harvesting fruit from the collaborative development work. Correspondingly, a company taking part in open collaboration may consider the unpredictability and uncontrollability of the hacker contingent of the community at least an unpleasant unknown if not an actual risk in itself.

In cases where the company involvement is intense and clear, such as the MySQL community, the risk for sustainability this tension creates is minimal, as practically all responsibility is carried by the company. Mark Shuttleworth has reported of an interesting cultural clash, which involves importing the protestant ethic on hacker culture [16]. In the attempt to boost the development of a software called SchoolTool, Shuttleworth hired a group of hackers for the project. The idea was that given the economical possibility to work exclusively on the software, the team would rapidly augment and enrich the software for which a clear and urgent need was felt. However, the development was slow, if not stalled, because given free hands and ample resources, the hackers did not concentrate on keeping schedules and delivering updates, but started, quite well in line with the hacker culture, to find the best, most robust and sustainable basic structures and architectures for the software. The two cultures did not initially gel in a beneficial way: the logic of paid work did not function in the context of hacker culture.

Over time, communities have developed practices and codified their key principles in documents like the Social Contract of Debian. These documents are often referred to in debates and they produce and maintain the ideological basis of developers. These documents maintain project ideals in the long term and provide common ground for decision-making, and therefore probably have important meaning for the cultural sustainability of the community. (Cf. [17].)

Schematically, then, the evaluation of cultural sustainability of open collaboration may be done along the following heuristics.

Increasing sustainability:

- large volunteer organisation with hacker culture (for example Debian, Wikipedia, GNU, etc.) - well-funded and planned "protestant work ethic" culture (size does not matter so much, for example MySQL)
- explicit foundational documents providing a common ethical ground for developers

Medium sustainability:

- unclear and/or unstable mix of hacker culture & "protestant work ethic" culture (Shuttleworth's story on SchoolTool, the tension between Ubuntu and Debian developers)

Decreasing sustainability:

- small volunteer organisation with hacker culture (risk of losing principal developers; e.g., a majority of dormant sourceforge projects)
- tension between hacker culture and "protestant work ethic" culture (suspicions of being exploited, risk of forking)
- competing ideologies or no common ethical ground.

C. Legal sustainability

In ideal world, legal sustainability should not be an issue for free and open source communities. Unfortunately, the importance of legal risk management has risen sharply during the last decade. The economic significance of software has drawn also the attention of the legal community and as the result the risk of getting sued is today very real. Also the governments are monitoring Internet with closer scrutiny, which means that the questions like taxation and work legislation has to be addressed by the projects.

The "environmental situation" is especially worsened by the fact that both criminal and civil sanctions for IPR-violations have dramatically increased. This is mainly due to IPR-holder's successful lobbying efforts in World Trade Organization (e.g. TRIPS-agreement), EU (e.g. IPR enforcement directive) and the U.S. (e.g. No Electronic Theft (NET) Act) [18]-[20].

To survive in this environment, free and open source communities have to have developed processes and strategies, which minimize the legal risks. Välimäki and Oksanen [21] have developed a framework for risk mitigation, in which five possible options were identified (Table I.)

TABLE I. COMPARISON OF DIFFERENT DEFENSE OPTIONS FOR OPEN SOURCE DEVELOPERS [21]

	Scope	Effectivity	Speed	Price
Disclaimers	Licensees	Low	Fast	Low
Insurance	Market	Medium	Fast	Medium to High
Patenting	Market	High	Slow	High
Avoidance	Market	Medium	Fast	Varies
Lobbying	Regulatory	Medium to High	Slow	Medium to High

The most simple and widely used method is the legal disclaimers. These can be found from virtually all free and open source licenses. However, they offer protection only against claims from the licensees i.e. they offer no protection against 3rd party claims, which are most common in IPR cases.

Insurance is one of the oldest options for risk management. It has been slow to take on in the software sector. Even today, very few companies offer insurance services for the free and open source environment. This is understandable as there would be very few customers i.e. the insurances are typically so expensive that only the richest projects could afford them. On the other hand, there have been some examples of legal defense funds, which are in effect close to mutual insurances. For example, Open Source Development Labs created a special defend fund for:

The Linux Legal Defense Fund was created to defray legal expenses of Linux end users who may become involved in litigation with The SCO Group on issues that affect the Linux community and industry. The Fund also covers the legal expenses of Linus Torvalds, Andrew Morton and OSDL in connection with the pending SCO/IBM litigation. [22]

Also patenting can be seen as a way to mitigate risks - defensive use of patents is generally useful against patent claims from competitors. Since software patents are typically despised among free and open source developers - and secondly - are very expensive to get and maintain, this option is used rarely. However, certain open source companies like Redhat and Novell have somewhat explored this option.

Another way to reduce risks is avoidance, which covers actually wide set of actions. A very basic example of this could be consulting an attorney for legally unclear matters before making decisions. A strict control on persons, who contribute code, is another typical example, which benefit comes limiting the chance that 3rd party code would added illegally. One quite used strategy is limiting project's scope or innovativeness to avoid liabilities e.g. project may decide that developing p2p-features to its product is currently too risky. Cynically speaking, staying decentralized and poor belongs also to this category, since it make it hard to make profit from legal actions.

The final option in our framework is lobbying for "less hazardous legal environment". This option has been realized recently in certain high-profile campaigns e.g. in

the fight against software patents in European Union. The free and open source activists were instrumental in the fight, which ended - against all odds - to the dismissal of the directive, which would have legalized software patenting in Europe.

This more pro-active attitude has been demonstrated also in the more active enforcement of free and open source licenses. In addition to Free Software Foundation (which has been enforcing the GNU GPL), projects like gpl-violations.org have arisen against commercial misuse. Gpl-violations.org defines its goal as:

- Raise public awareness of the infringing use of free software, and thus putting pressure on the infringers.
- Give users who detect or assume GPL-licensed software is being misused a way to report them to the copyright holders. This is the first step in enabling the copyright holders to push for license compliance.
- Assist copyright holders in any action against GPL infringing organizations.
- Distribute information on how a commercial entity using GPL licensed software in their products can comply with the license.

This enforcement is essential for the health of free and open source movement since it helps those companies, which adheres to the rules, against the "bad apples". Indeed, we believe that this enforcement will be even more paramount in the future as the countries with little or no tradition for license compliance turn into biggest development centers of software. However, too rigid control of licensing may also raise the general costs of using free and open source licenses and thus be counter-productive.

Yet another factor for legal sustainability is the choice of free and open source license. A badly chosen license prevents other projects from benefiting from the code, which lessens their interest to contribute. For example, there has been arguments that SUN made a mistake because it did not choose GPL for Open Solaris, which prevented direct code contributions from Linux and vice versa. (e.g. [23]) Furthermore, the compatibility issues may arise also in GNU-world since GPLv3 won't be compatible with GPL version 2.

In summary, the following attributes add to legal sustainability:

- The project uses risk mitigation strategies
- The project's economic footprint is small
- The project is not dealing with legally hot questions like p2p
- The project enforces its rights against misuse
- The license is compatible with the mainstream licenses.

and the following reduce sustainability:

- The project does not have any policies on risk management
- The project has either financial resources or it is causing economic harm to somebody else
- The project is dealing with a legally risky topic

- The project does not care if its rights are being violated
- The license is not compatible with the mainstream licenses.

D. Economical sustainability

The very large majority of free and open source projects do not use any other financial resources than the time of their participants. It is therefore natural that most of the early articles on the economics of open source were focusing on the personal motivating factors of the developers. ([24]-[25]). The main theory was that the developers are investing their time because they could get better reputation among their peers – and also among possible future employees. The empirical studies somewhat verified this theory but also found other reasons like personal learning and supporting the goals of free software movement [26].

The most recent economic literature is dealing with the companies' motivations to invest in free and open source projects. The change is very understandable since the projects, which are either started by a company (e.g. MySQL, Maemo) or heavily supported by a company (Mozilla, Google) have become more common and important. It would be fair to say that no firm conclusions exist yet in this area as the companies are still experimenting the co-operation with the community. Ari Jaaksi, Nokia's leader of 770 Internet Table development, lists following reasons for Nokia to use open source:

- Availability of good quality code
- Availability of well-thought architecture and integrated subsystems
- Licensing rules have been decided by the licensee
- No need to execute complex licensing negotiations
- Saving can be up to 6- 12 months in real projects
- The work and credentials of a developer or a subcontractor are open for analysis
- The quality of the people and the components can be analyzed from the source code
- Their willingness to help is easy to verify – just ask
- The activity and direction of the component or product can be analyzed through the project discussions.
- When everything goes wrong – you can take the code and run with it
- Even branch to meet the deadlines (Jaaksi 2006)

In conclusion, the following elements increase economical sustainability:

- The project helps its developers' careers
- The project survives without financial support e.g. volunteers can operate it
- The project is financed by a company, which has a business model.

Similarly, the elements, which most likely decrease the sustainability, are:

- The project does not bring reputation benefits to its developers

- The project is so large/complicated that it requires professional support
- The project can't get support from companies.

III. APPLYING THE FRAMEWORK

We have described above the sustainability framework created based on our experiences with free/open source software communities. In the following, we use the framework to examine two different open source communities, Debian and Eclipse. Debian (www.debian.org) is one of the largest Linux-distributions. It has strong cultural traditions tied to the hacker culture, including a hacker type work ethic [13] and heightened sense for Free Software values. Eclipse (www.eclipse.org) is an extensible development platform and application framework for building software. In contrast to Debian, it has a strong corporate background having been launched by a group of companies including IBM, Borland, SuSE and Red Hat.

Through an analysis of the characteristics of different open source communities, several "ideal types" of communities can be identified. In the survey described above we could recognize two distinct types of community ideology and work ethic. What we call *the hacker ideology* is the traditional FOSS work ethic of freedom, fun and sharing of information, while the opposing ideology is the traditional, *salary-based work ethic*. These two types of ideologies both correspond to certain kind of structures of power and authority. Therefore by "volunteer community" we mean those communities where the hacker work ethic is dominant, and by "company-based communities" we mean the communities where companies and business objectives have more importance and a large percentage of developers are paid for their contribution. In company-based communities traditional hacker values or freedom and sharing have much less importance and participants may not be interested in issues like copyright, software freedom or software patents (identified as "the ideological factor" above).

More detailed analysis and a typology of communities can be created by combining the voluntary/company axis with some other variables. Based on our observations, we provide a preliminary typology of FOSS communities. Four elements are investigated in tandem with the voluntary/company axis: the size of the community, its age and history (in other words maturity), the centrality or decentrality of communication and decision-making in the community and the strength of chosen license.

1) Size of the community. We assume that a larger community is always more efficient and sustainable but potentially increases problem complexity for company participation. The size of the community must also reach a certain minimum size in order to make the open source effect work.

2) Maturity of the community. By maturity we mean the strength of the social and cultural ties, traditions and practices. A mature community is often old in age, and has developed common guidelines and best practices.

3) Communication and decision-making structures of the

community. Different systems of governance exist in free/open source software communities, including democracy, meritocracy and dictatorship. Here we look at how centralised communication is. This tells something about the governance structure, hierarchy and bottlenecks.

4) License. The type of free/open source software license chosen by the community potentially affects who will participate in the community. We classify licenses based on how strong copyleft effect they have. GNU General Public License, for example, is a strong copyleft license, while Eclipse Public License gives more freedom, and licenses like the BSD license are not copyleft at all.

When we combine these four elements with the volunteer/company axis, differences between communities can be identified as can be seen in table II (with examples).

TABLE II. COMMUNITY TYPOLOGY

<i>size / hybridity</i>	<i>volunteer</i>	<i>mixed</i>	<i>company</i>
small	Wordpress		MySQL, Laika
medium	OpenBSD	Mozilla	OpenSolaris
large	Debian	Linux (kernel), GNOME	Eclipse

<i>maturity / hybridity</i>	<i>volunteer</i>	<i>mixed</i>	<i>company</i>
young	Gnash		Laika
developing	Wordpress	Mozilla	OpenSolaris, Darwin
established	GNU, Debian	Linux (kernel)	MySQL

<i>decision-making / hybridity</i>	<i>volunteer</i>	<i>mixed</i>	<i>company</i>
decentralized	Debian		Eclipse
balanced		Linux (kernel)	
centralized	GNU	Mozilla	MySQL

<i>license / hybridity</i>	<i>volunteer</i>	<i>mixed</i>	<i>company</i>
non-copyleft	OpenBSD	Apache	
weak copyleft		Mozilla	Eclipse, OpenSolaris, Darwin
strong copyleft	GNU	Linux (kernel), GNOME	MySQL

In the classification above, we can see both differences and similarities between communities. Based on this analysis, some “ideal types” can be identified which characterise some of the most prominent differences between communities. Four ideal types could be identified:

a) Centralized, company-driven, small community (e.g. MySQL)

b) Large community, several companies, business work ethics (e.g. Eclipse)

c) Large community, several companies, hacker background (e.g. Linux kernel)

d) Volunteer, decentralized, large (e.g. Debian)

Correspondingly Eclipse and Debian have different bottlenecks with regard to sustainability.

To start with Debian, the size and age of the community point out that from the social and cultural perspectives it is very mature. It is very improbable that the community would vanish overnight. On the cultural side, Debian has one of the most developed and explicit guidelines for conduct, The Debian Free Software Guidelines. For Debian, the biggest challenge is that of leadership and decision-making. The community is very large and sometimes the ultra-democratical or anarchic decision making system is felt too slow or otherwise ineffective. On the other hand, it may be precisely this “slow and ineffective” modus operandi that has guaranteed Debian's longevity in the turbulent distro jungle. The hacker volunteers are motivated by group-enriching motivations, and get satisfaction from working together. This binds the community together even in glitches in decision making are sometimes experienced.

On the legal side, Debian has been consistently relying on the GPL, and the principles of free software. This has been one of its hallmarks and may be expected to continue to be so. This formalism has alienated some developers, which have moved to less orthodox projects. In addition, this limits the software the project is capable to offer. For example, the project may not carry the official version of Firefox-browser in the future if the trademark-issues Mozilla foundation are not settled [28]. The project is also in favor of several large companies with big patent portfolios like Nokia, which offers at least implied protection from patent litigation. The project has also well-defined processes for handling alleged IPR-problems.

From the economic perspective Debian also seems well set, as work is mostly volunteer-based. However, the combination of the social and economic perspectives provides a glimpse of the issue that may prove to be most challenging to the sustainability of Debian. Currently the community is dominated by the hacker ethic, but as companies increasingly start using Debian software in their products, they also increasingly employ developers in the salary-based mode. The developers of Debian expressed very positive attitudes towards company participation in our survey, but this may change as the clash between the work-ethics becomes more visible.

Eclipse, on the other hand, is economically sustained by the presence of several large companies. This seems to provide a firm ground in the reasonably foreseeable future. The project has well defined legal guidelines available, dedicated person for legal matters and their license is optimized for the purpose of the project. On the social side the community is fairly heterogeneous, and the project thrives on technological progress. If a rival technology would provide better possibilities, the Eclipse community could face a difficult time.

IV. CONCLUSION

In this article, we developed a framework for examining the sustainability of open collaboration communities. Based on our experiences from free/open source software communities, we presented four aspects of sustainability which are 1) social, 2) cultural, 3) legal and 4) economical. Using this framework, we looked at two open source communities, Debian and Eclipse. Strengths and potential bottlenecks were identified. In the case of Debian the maturity and established culture of the community are a great asset, as well as a clear legal policy. However, a clash between hacker ethic and salary-based ethic can be predicted in the near future. In the case of Eclipse, the social and cultural heterogeneity of the community makes it more vulnerable to erosion. The promise of technological superiority and progress are the main things keeping the community together, and if the project's progress change, e.g., because of a rival technology, the community may dissolve over time.

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Comparing Innovation Adoption and Organizational Buying Behavior Approaches in a Context of Technological Investment Decision-Making

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Keywords— technological investment, technological innovation, innovation adoption, organizational buying behavior, decision-making

Abstract— The statement by Cyert, Simon and Trow [1, p. 237] that “Decision-Making – choosing one course of action rather than another, finding an appropriate solution to a new problem posed by a changing world – is commonly asserted to be the heart of executive activity in business.” holds true still after fifty years although a lot has changed in business from those days. New products are launched more frequently to markets and technological innovations alter structures of competition and disturb equilibrium of markets. These dynamics can pose not only opportunities but also threats for firms, depending upon the timing of adoption. The most innovative companies may gain competitive advantage over competitors by adopting and implementing performance improving technologies. On the other hand, the non-adopters may suffer from the improved performance of the adopters. This paper examines conceptually a process of decision-making on new technology discussing organizational buying behavior approach and innovation adoption approach in regard to general decision-making approach and finally combines these fields in order to conceptualize and understand better the process of decision-making on new technological investment.

I. INTRODUCTION

Decision centrality is common to theoretical discussions, innovation adoption and organizational buying behavior. The most widely referenced models of organizational buying behavior (e.g. [2], [3]), namely *the buygrid model* [4], *the general model for understanding organizational buying behavior* [5] and *the model of industrial buyer behavior* [6] view organizational buying as a complex process of decision-making [7]. Studies in which organizational innovation adoption has been scrutinized have mostly concentrated on decision-making outcomes and factors affecting a decision process. Although these factors and their influence on the decision process are extensively studied, the process

itself is considered as “black box” yielding innovation adoption or rejection. The studies of the dynamics of the innovation decision process, and the identified factors influence on each step of it, are rare [8]. On the other hand the innovation adoption approach, although being powerless to consider the process, captures well the complex nature of new technologies affecting the process. Vice versa organizational buying behavior research considers the purchasing process dynamics, but is a general theory of how various sort of products are being bought and in this way is incapable to capture the special nature of new technologies.

This paper examines conceptually a process of decision-making on new technology discussing organizational buying behavior approach and innovation adoption approach in regard to general decision-making approach and finally combines these fields in order to conceptualize and understand better the process of decision-making on new technological investment. In the literature, the link between innovation adoption and organizational buying behavior is considered to some extent [9], [8] but remains largely implicit. Due to the essential role of decision-making for the successful consideration of these approaches, we shall next consider the structure and features of decision-making in more detail and then zoom into the innovation adoption approach and then into the organizational buying behavior approach. Finally the work is drawn up in findings, discussion and conclusions and combination model of the approaches is presented.

II. THREE PERSPECTIVES ON TECHNOLOGICAL INVESTMENT DECISION-MAKING

A. Decision-making Approach

According to Mintzberg, Raisinghani and Théorét [10] decision is “a specific commitment to action” where the action has strategic consequences for the organization making the decision. Cyert and March [11] define organizational decision as an “execution of a choice made in terms

of objectives from among a set of alternatives on the basis of available information. On an abstract level decision-making refers to organizational behaviour that takes a process form and has certain consequences and prerequisites. Produced decisions link the current organizational activities and commit the organization to certain new direction and towards certain goals in a future. In this sense decision-making can be seen economically motivated purposeful action.

On a basis of a context of decision-making and its role in economical activity different decision types can be recognized. *Operating decisions* refer to decisions that deal with the firm's resource-conversion process and are taken in order to maximize the profitability of current operations. Operating decisions include areas as supervision of performance, resource allocation among functional areas and product lines, scheduling of operations and applying control actions. Key characteristics of this type of decisions are that they are decentralized, repetitive and self-regenerative and consider the value-added processes in organizations. Decisions that concern the link between organization and external environment i.e. what business the firm is in, what businesses it will try to enter and what are the products the firm offer are called *strategic decisions*. The strategic decisions are centralized, non-repetitive and not self-regenerative. *Administrative decisions* mean decisions to organize the structure of the firm in a way which creates a maximum performance potential. Through administrative decisions the structure for the value-added processes are created and match between strategy and operations is improved. Administrative decisions may be triggered by strategic or operating problems or opportunities [12].

Managerial problems vary from truly generic to truly unique events. The classification of the given problem is essential phase for the successful problem solving [13]. Simon [14] divides decisions into *programmed* and *non-programmed* decisions. These two represent polar types of decisions located in the opposite ends of a continuum. There can be found also decision in the area between these two. Repetitive and routine decisions are programmed decision to the extent that a definite procedure has been created for handling them. Novel, unstructured and unusually consequential decisions are non-programmed decision. There is not an exact procedure to follow due to newness or importance of the decision making situation or the elusive or complex nature and structure of the decision at hand.

Simon [14] divides decision making into four phases: finding occasions for making a decision, finding possible courses of action, choosing among courses of action and evaluating past choices. Drucker [13] identifies six steps in an organizational decision making process: problem classification, problem definition, the answer specification, the best solution decision, realization plan and evaluation of the realization plan. Although the number and naming of stages differ the central idea of these processes is same.

Basing on Kunreuther and Bowman [15] and *reactive* and *proactive* pattern of behavior (see e.g. [16], [17]) we

propose the following model of organizational decision-making (Figure 1).

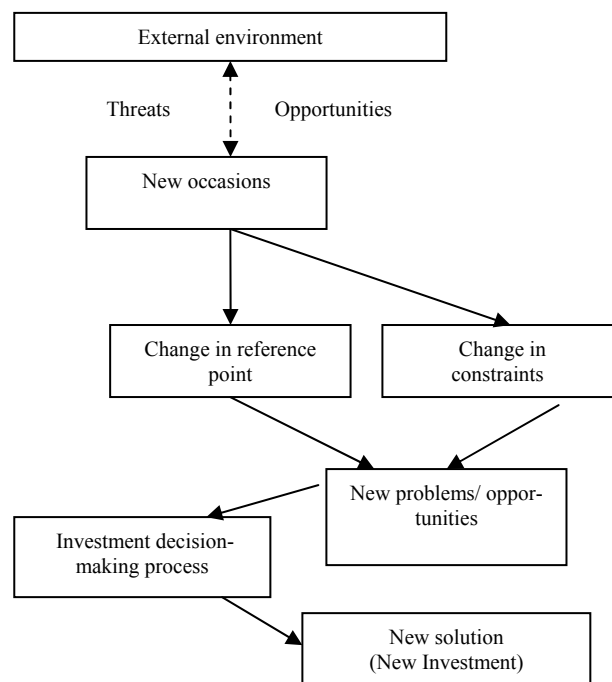


Figure 1 A Dynamic Model of Organizational Decision-Making (revised from [15], p. 407)

According to reactive and proactive patterns of behavior, the environment-organization relationship is seen as two-way (Figure 1). In the reactive pattern of behavior, new problems are solved through a technological investment. In the proactive approach the organization actively seeks new opportunities and attempts to exploit them by investing in new technology.

The model presented is not statistically tested, but rather constitutes a rough formulation of the decision process. The idea of the model (Figure 1) is that changes in environment generate problems and organizational decision-making is an act to overcome these problems. The decision-making and the proposed course of action is evaluated comparing it with the status quo. According to Kunreuther and Bowman [15] "Reference points are specific values or states of the world used to judge alternative proposals." Several different reference points may be used in the managerial decision process. A great number of organizational studies show that status quo is used as a reference point and change is resisted in organizational decision-making [11], [18] although changes in reference point may occur that may lead to new problems or opportunities.

Changes in reference point can come from outside or inside the firm. Mintzberg [19] has studied an organization's response to its environment and argues that patterns of strategic change are never steady, regular or foreseeable. Periods of change follow periods of stability in the organizational environment. Tushman and Romanelli [20] describe organizational activity as "punctuated equilibrium" in which stability and change alternate with each other, some-

times triggered externally and sometimes internally. New laws or restrictions made by a government are examples of factors changing the reference point outside the firm. Intra-firm debates or different events may change the reference point from inside the firm. Instead of the status quo being a reference point, the firm can start to evaluate the proposed course of action by comparing it with a worst case scenario, for instance [15].

“Constraints represent limitations or restrictions on the actions a firm can take.” [15]. Internal or external factors may cause a change in constraints. The emergence of new constraints or changes in old ones can be due to organizational shifts within the firm, such as the appointment of a new manager whose views differ from the predecessors’, or they may also be triggered by external events such as new legislation, increased costs of capital or changes in consumers’ attitudes. A study of 30 businesses in the US health care industry showed that the firms were likely to make strategic changes due to changes in the rules of the business that were in turn due to government legislation and new regulations [21].

A change in reference point or in constraints leads a firm to a new situation in which it has to take action to maintain balance with the environment. In Figure 1, this new situation is discussed new problems or opportunities. The decision process is set in motion to find a match or fit with the environment. The output of the decision process is considered as new solutions (or new investment) in the model presented.

The decision-making processes vary in terms of length and scale. Kriger and Barnes [22] have developed a six-level classification of decisions according to decision complexity (cf. [23]). *Decision choices* are single go/no-go choices. The actual choice appears at a moment in time, although these choices often occur after extensive individual or organizational analysis. *Decision Actions* e.g. writing a letter, holding a press conference, are aggregated decision choices. Within decision actions there are several decision choices. Decision actions construct *decision events* that usually involve actors both inside and outside the firm and last from a day to a week. Different meetings may constitute decision events. A series of separate, but related decision events generate *mini-decision processes* that might last from a several months to about a year. The decision processes to form a consortium or merge with another company are examples of mini-decision processes. *Decision processes* span periods of time lasting one or more years and usually involve hundreds of actors. *Decision theatre*, the last and broadest concept, refers to very long-term decision processes such as a worldwide strategic decision and its implementation [22].

B. Innovation adoption approach

Innovation adoption is a part of an *innovation diffusion process* that refers to antecedents and timing of an individual adoption decision by an adoption unit and factors affecting that adoption decision. This research tradition has its roots in consumer marketing context but the approach has been applied later on business to business context as

well. As a part of the innovation diffusion approach an individual adoption decision is interesting only in a sense that factors affecting it can be generalized to cover other adoption decisions on that specific innovation within the same social system and this way it gives insights of an aggregate level diffusion phenomenon that recruits mathematical modeling usually (see e.g. [24] for a review). Diffusion models can be divided into those considering a diffusion process as a whole on an aggregate level and models concentrating on determinants of individual adoption decisions. The former are known as *diffusion models* and the latter as *adoption models* [25], [26].

It seems that innovation adoption has at least two different meanings. In a context of diffusion it is understood as a *choice* type decision. This perspective has dominated the field as research has been typically carried out with a large sample of organizations and focusing on correlations between groups of variables and a specific outcome. These models are incapable to explain how these factors evolve and interact with other factors during the process finally producing adoption (or rejection see e.g. [27]) In a context of intra-firm decision-making innovation adoption refers to a whole decision-making *process*. As a process, innovation adoption is not seen only a vehicle producing innovation adoption or rejection that is interesting only as a part of an aggregate level cumulative pattern. Rather it is considered meaningful itself. This perspective brings innovation adoption close to organizational behavior and innovation adoption can be seen as an organizational action taken to change the relationship between the organization and its environment somehow [28], [29]. This process perspective has been manifested for example by Drury and Farhoomand [30] who claim that innovation adoption should not be treated as dichotomous organizational choice decision but rather there is a need for integrative theories considering adoption as a chronological process (see also [31]).

In addition to duality of a phrase “innovation adoption” recognition of a process nature of industrial innovation adoption has led to various interpretations for the term adoption in this process context. Consumer adoption decisions differ in many ways from industrial market adoption decisions. Unlike consumer durables, organizational innovations need to be implemented as a part of value adding activities of an adopter organization. This lack of a concrete implementation phase or a process in a consumer innovation adoption context has led to difficulties and various interpretations when researchers have tried to apply conceptualizations into the organizational innovation adoption context. Sometimes these terminological pitfalls have been tried to avoid by using other, in common language quite similar meaning possessing concepts for adoption in order to distinguish a piece of research from the fuzzy innovation adoption approach, even though the underlying idea has been drawn from the innovation adoption context. This has created even more disorder.

Intra-firm diffusion, implementation and *organizational acceptance* are closely related concepts that generally refer to actions that are taken in order to take the adopted inno-

vation in full use at the adopter company and after that to use it by the employees (cf. [32]). The concepts of *authority decision* as organizational adoption decision on an innovation that is targeted to be used by individual employees and that following *end-user's adoption decision* as a decision taken by an end user to take the innovation in his use have been used by Leonard-Barton and Deschamps [33]. Both these approaches advocate an idea that for some type of innovations an organizational adoption decision process is followed by implementation and individual decision processes within an adopter company. Meyer and Goes [34] define *assimilation* as "an organizational process that (1) is set in motion when individual organization members first hear of an innovation's development, (2) can lead to the acquisition of the innovation, and (3) sometimes comes to fruition in the innovation's full acceptance, utilization, and institutionalization." The process of assimilation is divided further into three sub-processes (a knowledge-awareness stage, an evaluation-choice stage and an adoption-implementation stage) each consisting of three episodes. This term covers widely an adoption decision process, its outcome as an innovation adoption choice decision and a phase of implementation and intra-organizational diffusion after that. Woodside and Biemans [35] have described comprehensiveness of assimilation using terms breadth of use (cumulative number of users) and depth of use (extent of use and its impact on the firm).

To conclude we state that adoption as a process refers to an organizational decision process from its outset until the decision to adopt an innovation (see e.g. [36], [35]). The processes that follow this organizational adoption decision process are not included into our definition, but should be named rather as suggested above (see [37]). This ideology has its roots on an idea that underlies the whole adoption and diffusion literature that originally adoption refers to acceptance of change and episodes before this acceptance and is finished when the decision has been made. Episodes and processes that follow the adoption process are seen as concrete conduct of this accepted change.

Langley and Truax [23] put process-oriented technology adoption models (innovation and technology are considered as synonyms quite often in the literature see e.g. [38]) into three classes: sequential models, serendipitous models and political models. In *sequential models* adoption is seen as a multilevel decision process composed of series of sequential phases involving different activities. This process approach is supported by an extensive empirical literature on strategic decision-making in general (see [10] and [39]) and was put forward in the innovation adoption context by Rogers [40] establishing a permanent approach and followed by a stream of research (see e.g. [41], [42], [43], [44], [8]). A number and order of stages of different models varies but the basic idea remains the same.

Serendipitous models understand adoption as an outcome of a wide variety of organizational routines. Innovation adoption is included in these standard operating routines that are basically organizational responses to an environment. Under some conditions interplay between an organi-

zation and an environment produce innovation adoption [45], [23]. Langley and Truax [23] give the well-established garbage can model of decision-making by Cohen, March and Olsen [46] as an example of ideology advocated by serendipitous decision-making models in general. The garbage can model promotes an idea that organizational decision-making is not in reality as linear, mechanistic and sequential than the sequential models describe it to be: "Although it may be convenient to imagine that choice opportunities lead first to the generation of decision alternatives, then to an evaluation of those consequences in terms of objectives, and finally to a decision, this type of model is often a poor description of what actually happens." [46].

Political models consider adoption as a political process where adoption decisions are fostered by technology advocates who have an influence on managerial level decision-makers. These models emphasize social interaction during the process. The participants of the adoption process can be grouped into champions, boosters and approvers of technology. Reasons for adopting a technology can be based, for example, on financial or strategic components, the credibility of advocates or political pressure. Political models take into account the different influences on adoption from outside and inside the organization during the process. Decision-making and the power of the organization are considered to be centralized and open to influences. [4].

C. Organizational Buying Behavior Approach

The more complex the product is the lengthier the buying process is likely to be due to difficulty of risk evaluation. A risk can be divided into a performance risk and a psychological risk. The former refers to an extent to which the purchase meets the expectations and the latter to how other people in the organization react to decision. Low involvement buying situations are likely to be handled autonomously by an individual decision-maker according specific buying criteria. Due to a higher risk and higher organizational involvement for complex products a buying center makes the buying decision [47]. The former captures three critical concepts (underlined) of organizational buying. The following section starts a discussion from a buying process and then moves on to consider different buying situations or tasks as one factor affecting the buying process and finally zoom into a concept of buying center. The buying task has been chosen among other process influencing factors due to the context of technology buying and because it has been suggested to bridge the innovation adoption and organizational buying approaches [9].

This structure of consideration is in harmony with a classification of organizational buying behavior research offered by Möller and Wilson [48]. They propose that the traditional research of organizational buying can be classified into studies focusing on (1) the phases or sub-processes of the buying process, (2) the characteristics and composition of and interaction within the buying center and (3) factors influencing (like buying situation) the process and buying center.

1) Buying process

Organizational buying behavior has been approached from several different viewpoints. The three main approaches are task models, nontask models and complex models [49], [50]. According to Webster and Wind [5], *task models* often focus on economic aspects of organizational buying behavior such as price or related costs (see also [49]). These models ignore the influence of the characteristics of the individual decision maker, interaction among members of the buying organization and the nature of the formal organization on the decision process outcome. These models lack behavioral explanations and consider the individual as a rational decision maker synonymous with the firm. *Nontask models* introduce nonrational/noneconomic factors affecting the decision process and concentrate on the psychological aspects of an individual. These models, being more holistic and understanding the circumstances of the decision process more widely than task models, lose the point that the organizational decision process is problem solving with specific objectives and goals. The decision maker is also considered synonymous with the firm but interested primarily in self-gain [5], [49].

The problem with the task and nontask models is that they both emphasize some set of factors while excluding the others. An attempt has been made to overcome these problems by presenting *complex models* combining the best features of both types of model [49]. Johnston [51] argues that the buygrid model [4], the general model for understanding organizational buying behavior [5], the model of industrial buyer behavior [6] and the industrial market response model [52] are four of the best developed and comprehensive complex models presented.

Johnston and Lewin [3] analyzed and summarized the 25 years of research of organizational buying behavior initiated by Robinson, Faris and Wind [4], Webster and Wind [5] and Sheth [6], by reviewing 165 articles on the topic. Since the presentation of these models, they have established the conceptual foundation for the study of organizational buying behavior to this day and followed by hundreds of articles extending or testing them. ([3], p. 1–2 see also [2] p. 7) The idea of seeing organizational buying behavior as a process composed of a sequence of phases or stages is common to the three models. Although the number of stages in the process varies between the models (buygrid: 8, general model for understanding organizational buying behavior: 5 and model of industrial buyer behavior: 4), the nature and sequence of events are quite similar. In addition to the process nature of the models, they all present variable categories influencing the buying behavior (buying process). Of the total nine different categories three are shared between the models, namely the category of *environmental influences* (physical, political, economic, suppliers, competitors, technological, legal, cultural and global), category of *organizational influences* (size, structure, orientation, technology, rewards, tasks and goals), and the *individual participants' characteristics* (education, motivation, perceptions, personality, risk reduction and ex-

perience). In addition to these the Robinson, Faris and Wind model and the Sheth model have *purchase characteristics* (buy task, product type, perceived risk, prior experience, product complexity and time pressure) and *seller characteristics* (price, ability to meet specifications, product quality, delivery time and after-sales service) in common.

The sixth category, *group characteristics* (size, structure, authority, membership, experiences, expectations, leadership, objectives and backgrounds) is presented in Webster and Wind's general model for understanding organizational buying behavior, and two final categories in Sheth's model: *informational characteristics* (salespeople, conferences, trade shows, word-of-mouth, trade news, direct mail and advertising) and *conflict negotiation characteristics* (problem solving, persuasion, bargaining and politicking). After 25 years of empirical testing, these nine fundamental concepts (the process nature of buying and the presented eight influencing factors) of the models still hold valid. But on the basis of an extensive review of articles in the field, four constructs needed to be added: on an intra-firm level *decision rules* and *role stress* and on an inter-firm level: *buyer seller relationships* and *communication networks*. The latter operates also on an intra-firm level. Decision rules refer to the rules used by the buyer to handle different buying situations. These rules vary in their degree of formality. The second intra-firm level concept, role stress, means ambiguity or conflict in buying objectives (cost reduction and concurrent quality improvement). An inter-firm level concept, buyer seller relationship, refers widely to a dyadic and network perspective of organizational buying. The implicit view in this addition is that factors affecting buying behavior also combine to affect a firm's supply relationships. The other added concept, communication networks, refers to an intra-firm level to communication in buying center and on an inter-firm level to communication between different actors [3].

2) Buying task

Möller [53] states that attempts to generate generalizable results on the structure and elements of the buying process face an essential problem caused by "the complex idiosyncratic nature of organizational buying". This is due to variance in buying situations, people, departments and organizations involved and a context or an environment. The situational variances led to the classification of new buying task, modified rebuy and straight rebuy [4]. This classification is closely linked with an information level of the buyers, a risk perceived and search behaviour, but is insufficient to provide a definition for product complexity or significance in a situation at hand. Möller [53] suggests replacing this paradigm with extensive problem solving, limited problem solving and routinized response behaviour categorization of decision processes (see e.g. [54] and [55]).

This categorization however does neither explicitly take into account a relative importance of the buying situation or

the product. To offer a more comprehensive conceptual framework Möller [53] superimpose an organizational commitment dimension on the presented categorization. Here organizational commitment refers to a degree of the organization's perceived commitment to the product. The commitment dimension together with the categorization of decision processes offers potential for developing time and organizational buying policy based hypotheses about movements of products and buying situations in a two dimensional buying (high commitment-low commitment) space. The transition can be initiated from an internal (buying policy) or external context of a company [53], [56].

3) *Buying center*

The notion of a buying center has been the most important conceptual contribution within the research on organizational buying behavior [57]. Finding an answer to the question "who does the buying" has been a primary attempt within the organizational buying behavior research. From a marketer's point of view this kind of knowledge is an essence to approach a customer. Since 1970's the idea of buying as a multi-person process culminated in the concept of "buying center" [5] that became the prevailing framework to conceptualize industrial buying [58]. The buying center concept refers to all those members of the organization involved in the buying decision process with responsibility for buying [5], [59], and [60]. It can be stated therefore that to understand organizational buying behavior one must understand group behavior [61].

There have been various attempts to find a covering solution to questions that when the buying decision is done by a single person and when it calls for multi-person commitment (see e.g. [62] and [58]), what is the relevance of the different members in different buying situations [63], [64] and what are the stages of buying [65] but common answers covering all buying situations have not been found. The studies of the buying center have their theoretical backbone mostly in the social influence/interaction theory and organizational psychology [53].

Understanding how influence is distributed within a buying center is critical but still a fuzzy area in the organizational buying research. McQuiston [66] defines influence in the buying center as "the extent to which the communication offered by an individual for consideration is perceived to affect the actions of other participants in the decision-making unit." Research of personal influence within the buying center can be put in two: the research examining the influence of people in certain positions during the different phases of the decision process and the research concentrating on how some individuals influence and change the opinions and actions of others. Despite the contribution of both approaches during the long research tradition there are still gaps in understanding influence within the buying center especially in a case of new task buying situation in which typically new knowledge is generated during the process [67]. Possession of information may be affected by a position in the organization or personal needs and charac-

teristics. Control of information was found to be important base of influence within organizational buying decisions by Pettigrew [68] and after that a critical role of information with limited access has been confirmed by various researchers [69], [70].

Lichtenthal [50] suggests definitions of buying center roles to be the most permanent concepts in the organizational buying behavior research. Roles allow members of a buying center to be studied as individuals as well as a part of the group. The roles are in a key point when attempting to find a solution to the question "who does the buying?". Lichtenthal [50] propose that neither an individual nor an organization resolves a buying situation but rather the decision will come up as a result of a small group task process, which consists of outcomes from individual task processes. Concentrating on behavior results makes identification of different stages of the decision-making process and the organizational positions of the members less important in understanding the buying process. In other words, rather than the positions the distribution of complementary role behaviors, which members execute, form a structure for a buying center. On the other hand adopting a group behavioral view on buying, the documented variance of number of stages during the process (see e.g. [51]) is easy to understand. The stages identified in different studies reflect rather a few acts in the buying process or major behavioral events during it consisting of hundreds of behavioral acts [50].

Webster and Wind [5] have proposed five roles for the buying center participants: users, buyers, influencers, deciders and gatekeepers. *Users* are those who use the product to be bought. *Buyers* and *influencers* are those who influence the process directly or indirectly by providing information and evaluative criteria. *Deciders* are capable of making the choice among alternatives. *Gatekeepers* filter incoming information to the buying center. This classification is very intra-firm oriented and gives an idea of the organization as a passive information seeker. The role of active outward orientation is captured in the boundary spanning role suggested by Tushman and Scanlan [71] and defined as an individual who actively participates in various types of inter-organizational networks. It has been proposed that different persons may hold the same role or one person can perform various roles [50].

Rogers and Kincaid [72] presented an information network approach that can be well applied on an intra-firm or inter-firm level to describe communication processes among certain systems. The network approach adopts communication links rather than isolated individuals as units of analysis and aims to make visible, understandable and manageable the communication structure that people live within. Instead of restricting a unit of analysis to individuals, communication network analysis conceptualizes human communication as a process of mutual information-exchange. Rogers and Kincaid [72] define communication as "a process in which the participants create and share information with one another in order to reach a mutual understanding." This means that communication is always a

joint activity, a mutual process of information sharing between two or more parties and involves always a relationship. These interrelated relationships form communication networks of interconnected individuals “who are linked by patterned flows of information”. As a result of information-sharing, individuals converge or diverge from each other in terms of their mutual understanding of reality [72].

At individual level information processing involves perceiving, interpreting, understanding, believing and action, which results perhaps to new information for further processing. Collective action, mutual agreement and finally mutual understanding may be achieved through a combination of the individual level actions. The other possible results in addition to mutual understanding with mutual agreement are: mutual understanding with disagreement, mutual misunderstanding with agreement and mutual misunderstanding with disagreement. The prerequisite for these collective results is that individual information processing becomes human communication among two or more persons who hold the common purpose of understanding one another [72].

III. FINDINGS, DISCUSSION AND CONCLUSIONS

In the literature, innovation adoption decisions are often considered as decision choice type decisions [73], [74], and [75]. On the other hand in some studies (e.g. [8]) innovation adoption can be seen to refer to a whole decision process, not just an outcome, culminating in innovation adoption or rejection. These process adoption models as well as organizational buying behavior models [4], [6], [5] see investment decision-making as mini-decision process or decision event.

The innovation adoption approach recognizes the dynamic link between organization and its environment demonstrated in Figure 1. Damanpour and Gopalakrishnan [28] view an innovation adoption as “an organization’s means to adapt to the environment, or to preempt a change in the environment, in order to increase or sustain its effectiveness and competitiveness.” This idea lacks from the organizational buying behavior approach as it traditionally concerns other types of products (raw materials etc.) than technological investments that has power to change the prevailing organizational structures. In this sense the innovation adoption approach highlights the change in a reference point or constraints launched by an external factor as it considers a new innovation and awareness of it an initiator of the decision-making process. The organizational buying behavior approach sees the process more internally oriented. On the other hand the innovation adoption approach fails to capture the intra-firm dynamics during the process namely how investment decision is generated through individual level interaction among decision-making participants. This is considered explicitly in the organizational buying behavior approach. As buying process a process of investment decision-making on new technology is a new task buying situation and due to newness and most often high risks and high commitment the process is lengthier and various participants are involved within an organization. Investment deci-

sions on new technology, seen as adoption or buying may be strategic or operating by their nature and the way they are processed may fall to programmed or non-programmed category depending on a complexity of a situation. The stages of the process vary between the models but the step by step progressing approach is shared commonly. Although serendipitous innovation adoption models make an exception of this as they deny clear stages and instead accentuate the interplay between the organization and the environment producing investment.

These similarities and differences between the innovation adoption and organizational buying behavior approaches form a fruitful basis for combination of these approaches in order to better conceptualize and understand the process of decision-making on new technology. The combination of innovation adoption and organizational buying behavior approaches is presented as *the preliminary model of technological investment decision-making* in Appendix. The model has two levels: micro and macro. The macro level refers to the macro environmental dimensions (political, economical, social, technological, legal, and cultural) that have influence on an organization. The relationship between the organization and its environment is highlighted in the model. The investment decision-making process is an outcome of this relationship. The environment poses both threats, for which an organization may prepare itself, and opportunities which the organization may attempt to seize. The investment decision-making process may be triggered by both reactive and proactive factors. Reactively initiated processes result from some changes at the macro level that an organization is passively forced to response. Proactively initiated processes are the result of an organization’s active monitoring of an environment. Organizations attempt to gain competitive advantage over the others by investing in new technology.

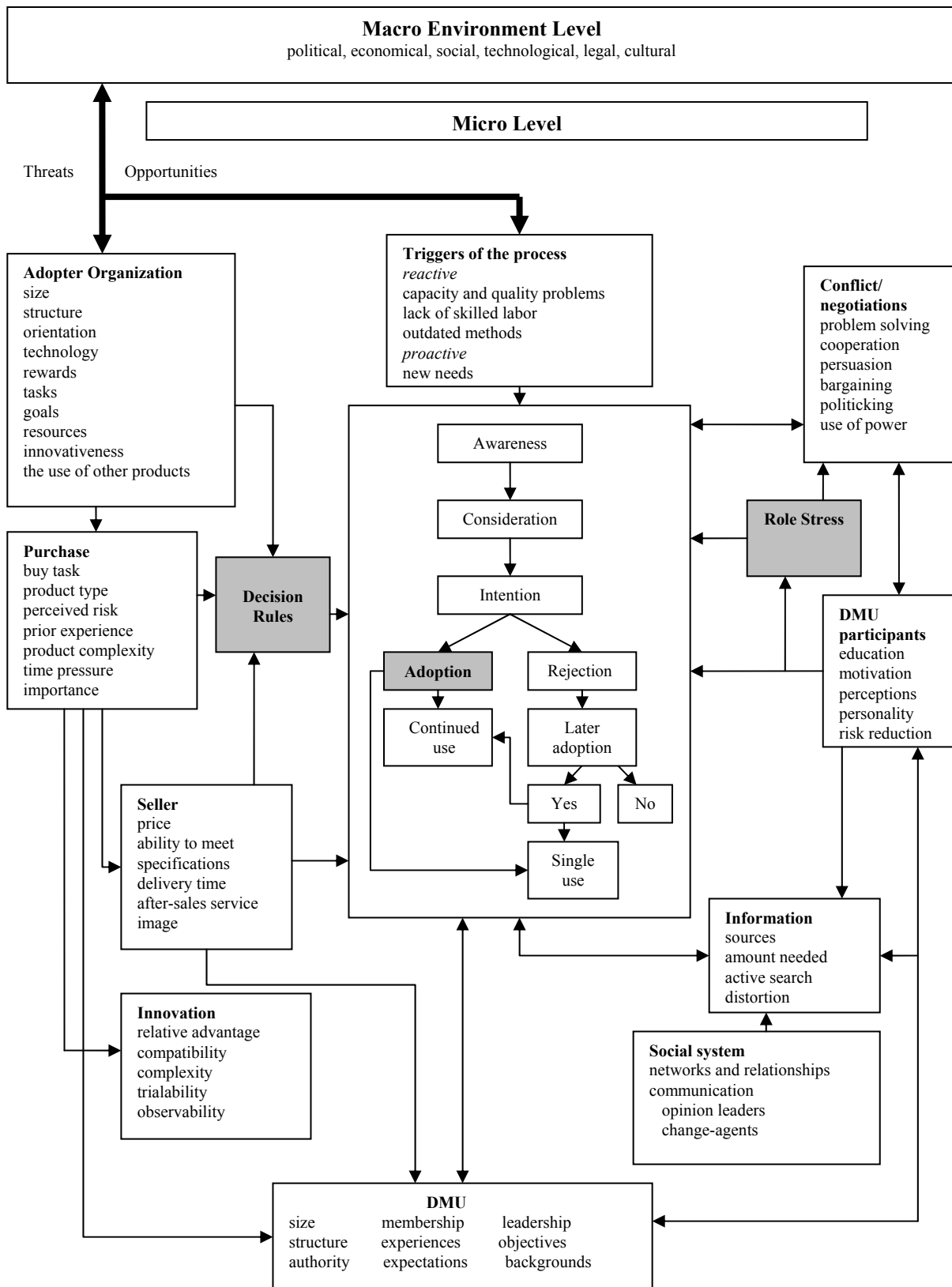
The preliminary model of technological investment decision-making (Appendix) consists of combination model of buying that based on meta-analysis of 165 buying related publications [3], combination model of innovation adoption ([8]) and other innovation adoption related literature [75], [76], [77]. The model is not statistically tested but presents rather a proposition for further research attempts. The model is composed of the *decision process*, which is put in the middle of the model, and the *factor groups* (adopter organization, purchase, seller, innovation, decision-making unit (DMU), social system, information, decision-making unit participants, conflict/ negotiations) that have an influence on the decision process, and two concepts that partially filter the influence of the factor groups: *decision rules* and *role stress*. Decision rules refer to formal or informal rules and procedures that guide the decision process. Role stress is operationalized as role ambiguity and/or role conflict. Role conflict refers to degree of incongruity or incompatibility among purchase expectations. Role ambiguity is interpreted as lack of information about the expectations related to a purchase, the methods for satisfying known purchase expectations and/or the consequences of role performance [3].

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Appendix The preliminary model of technological investment decision-making



Competition within the Finnish games industry

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Abstract — Competition is commonly understood as a process where the market shares are reallocated from the less efficient firms towards the more efficient ones. Within the evolutionary framework it is also emphasized that innovation is an important competitive weapon that will allow the firm to escape fierce price competition. The findings from the Finnish games industry suggest that efficiency and market shares are not an insightful way to analyze competition as the size of the market is not constant even in the short run, the products are far from being perfect substitutes and, as it is a case of steep increasing returns, the efficiency in game development is not of prime importance. Also, additional consideration should be given to the competition over resources and the way in which competition both encourages and restricts innovation.

Keywords — Competition, evolutionary theories, selection, specialization, games industry

I. INTRODUCTION

A. Background

The topic of this paper has emerged during a case study on the development mechanisms of the Finnish games industry. Here the games industry is defined to comprise firms that engage in game development and/or publishing for various platforms, such as consoles, PCs, mobile phones or online. For the case study the representatives (CEO, CFO or equivalent) of eight Finnish firms have been interviewed.

The phenomenon under interest is competition within the games industry from the viewpoint of the Finnish firms. As the representatives of several firms were interviewed a paradox emerged. The interviewees usually stated that they do not have direct competitors. However, they all talked about competition or competitors during the interview.

This phenomenon is approached with the evolutionary paradigm, since it allows the examination of competition in the form of selection. This means that competition is not seen merely as a relationship between two firms, but selection pressure is induced by many actors and features of the market in question.

B. Objectives

The objective of the paper is to analyze the paradox mentioned above. This means finding the factors that induce selection pressure over a firm.

The research question is the following:

What kinds of selection mechanisms operate within the Finnish games industry?

This is operationalised with the following research questions:

How do the firms compete?

How is succeeding in that competition determined?

How does the market limit the performance of a firm?

The aim is to find out which factors limit the payoff from possibilities or opportunities that the firms face. This analysis is not limited merely to direct competition between two firms and resulting market shares. The aim is also to describe the mechanisms that encourage or force the firms to specialize, to choose where to invest and how to form competitive advantage. Fundamentally, it is a question of what do the firms have to do in order to avoid bankruptcy or in order to enhance profitability. Thus, it is about how the firms choose the battles to partake in and what kinds of rules govern succeeding in such battles.

II. COMPETITION IN EVOLUTIONARY THEORIES

A. Competition as a mechanism of economic change

The development of such a knowledge-intensive industry is regarded as an evolutionary process in this research. An evolutionary process constitutes of variation within the characteristics of a population, selection that winnows down the variation and mechanisms that renew the variation. In this research the firms within the industry constitute such a population. They are different from each other in many aspects thus making up the intra-industry variation. As the firms compete, the market functions as a selection mechanism whereby the profitable firms survive. On the other hand, new firms are born and new products, services and production methods are created. Thus, the variation is replenished continuously.

The evolutionary view on the development of an industry emphasizes the impact of competition in determining the direction and pace of change. However, within a knowledge-intensive industry competition tends to be more subtle. Defining competitors may be hard and the result may vary according to the viewpoint taken at a given time. This is because the firms are usually highly specialized. In addition to market processes the firms base their decisions on information and knowledge that they can acquire from their environment. This means that it is not necessarily failure in the selection process that forces them to search for something new, but new directions are taken in order to avoid competitive selection by specializing and thus creating further variation.

Within the evolutionary theory variation and selection are regarded as two complementing forces. The interplay of these forces is the fundamental interest in the study of

evolution in different contexts. “The focus of attention is on variable or set of them that is changing over time and the theoretical quest is for an understanding of the dynamic process behind the observed change; ---. The theory proposes that the variable or system in question is subject to somewhat random variation or perturbation, and also that there are mechanisms that systematically winnow on that variation.” [1]

In an economic context such selection operates in the form of market competition. Nelson and Winter [2] state that their evolutionary theory of economic change emphasizes “the tendency of the most profitable firms to drive the less profitable ones out of business”. Thus the main selection mechanism is the market that determines the profitability of each firm which in turn translates into higher survival rates for more profitable firms.

Within an industry the firms compete based on the similarity of their products. High degree of similarity leads to intense competition whereas lower degree to a lower intensity of competition. However, the intensity of competition is not necessarily zero between two products although they would have a very low degree of similarity. [3]

Competition within an industry lowers the existing variation as some firms, products or production mechanisms are taken out of the system as losers of the competition [4]. This is quite a paradox as the fundamental prerequisite of selection is pre-existing variation. “Processes of competitive selection necessarily destroy (or rather absorb) the very variety on which evolution depends.” [5]

However, variation is replenished as new firms are born and the existing firms innovate. As selection winnows existing variation the entrepreneurs and firms have the motivation to replenish it as there is room in the market for new things. This is a reciprocal cycle where innovation drives competition and competition drives innovation [6]. This process has been named “creative destruction” by Schumpeter and according to him what matters is “competition from the new commodity, the new technology, the new source of supply, the new type of organization”. [7]

B. Definition of competition

Dictionary definition of competition is “a rivalry between individuals (or groups or nations), and it arises whenever two or more parties strive for something that all cannot obtain”. (Stigler 1987 in [7]) Within the economic domain there are two notions of competition, namely competition as a state of rest and competition as a process (see e.g. [7] or [8]). Competition as a state of rest is the predominant interpretation in economics and relates to the notions of perfect competition and equilibrium. However, what is more interesting is competition as a process. Metcalfe describes the process of competition as follows: “competition is a succession of events, a dynamic process, a voyage of exploration into the unknown in which successively superior products and production methods are introduced, and consumers discover who meets their

particular needs and how. Neither producers nor consumers know in advance the outcome of the competitive process, for that can only be established by trial and error.” [9]

When we talk about competition we often refer to efficiency as the outcome. This means that competition is a process whereby the market shares within the industry are reallocated from the less efficient firms to the more efficient ones. This results from the reduction of profits of the less efficient firms which reduces their market shares. [8] Hözl [8] states that: “The market shares define the structure of the industry and changes in market shares are the ultimate measure of evolutionary competition.” [8] However, also many other variables, such as concentration, pure profits, price cost margins and revenue, have been used to measure competition [8].

According to Vickers [7] there are several indicators of having “more competition” that have been used commonly. The list includes 1) greater freedom of rivals following from, for example, removing barriers to trade, 2) greater number of rivals, 3) breaking up of a cartel and 4) increase of the reward for succeeding in the competition. Basically all these origin from the openness of the system and incentives to do well.

Competition as a selection process (also called “Darwinism”) in the economic domain is used with two meanings. It is either seen as a metaphor and a way to describe the competitive struggle or as an analogy meaning that economic selection is in fact very similar to natural selection in the biological domain. [10] In both cases it is understood that: “some firms survive and some die, depending on the pay-offs associated with a particular strategy. If the selection pressure is high enough only the most efficient survive. The surviving firms therefore act efficiently, even if the strategy choice is not entirely deliberate.” [10] However, the criticism of this line of thinking is that the logic is tautological; the surviving firms are efficient because only the efficient firms can survive. [10] On the other hand, it is not just about the survival of the efficient but about growth associated with profitability. “For selection to be operative, the market’s signals of profit and loss must correspond to “selective advantage”; that is, the group of profitable firms must, as an aggregate, have a higher growth rate than the group of unprofitable ones.” [11]

So far we have talked about competition in the output market. However, there is competition also in the resource side of the firms. As Metcalfe puts it: “competing to sell the product and competing to acquire the inputs are the two principal forms of economic interaction.” [9] “Firms are competing with each other, at the most basic level, through emulation, variation and substitution of each other’s resources. It is the competitive struggle over resources that may be viewed as the fundamental driving force of the capitalist economy.” [12]

As the employees are the most important resource to a firm within a knowledge-intensive industry it is also important to note managerial selection. This means that a firm evolves through the managers selecting teams and

people to perform certain tasks. However, as Knudsen [10] points out, managerial selection can be done based on many reasons. Within the competitive selection of firms the reason is the economic result and as a contrast it is not always the primary concern when managers select some teams over others. "In sum, we have an evolution of teams within firms by managerial selection and an evolution of firms in markets by competitive selection. The former process is nested within the latter, and evolution refers to the replication of the routines of the sort of team that is well liked by managers. Success, also in this case, refers to the literal addition or expansion of teams through replication of existing ones." [10]

The concept of managerial selection refers to managers deciding on the growth or decline of teams. Basically the manager tries to steer the firm to a direction that he perceives the market would favor. This would mean allocating larger budgets to teams with a better fit with market demands and better competitive edge. This is, however, not the whole story on what happens in firms. Teams that do not respond well to market demand are not simply victims of cost-cutting procedures but they are ordered or encouraged to change what they do and how they do it to be more competitive.

C. Succeeding in competition

There is no absolute measure of being competitive as such success is always determined by interacting with a population. Even though economic fitness is measured by expansion or decline rates of business units, it is not solely determined by the capabilities and intention of that unit. "However, the crucial property of economic fitness is that it is not a property of the business unit alone, but arises from the interaction between rival business units in a given market environment. It is inherently a feature arising from membership of that particular population." [9] Thus, if no firm does things too well in the scale of what is possible, a firm can succeed even with mediocre performance. What is good performance is relative and this brings us to the traditional indicator of success, namely efficiency.

In terms of efficiency, what is usually assumed is that "a firm with lower relative costs will enjoy a higher market share and a higher price cost margin, and hence, *ceteris paribus*, higher profits than its rivals." [13] This means that the managers would have an incentive to try to get the costs down and this would be the main source of competitive advantage. However, this is not the whole story, as Vickers [7] states. Besides avoiding sloth and slack to succeed in competition firms also innovate to achieve better productive efficiency. With a more passive view of the firms, competition simply causes efficient organizations to grow which results in higher mean efficiency within the industry.

What is missed in discussion on efficiency is that firms innovate not just to be more efficient but to produce different kinds of products. Thus, as Schumpeter pointed out, competition comes also from new products. As Hölzl [8] puts it: "Innovation is a central competitive weapon for firms." This means that firms specialize in order to avoid

fierce price competition. This means that even though in analytical frameworks innovation and competition, or creation of variation and selection on variation, are separate processes, it is not easy to make the distinction in practice. Innovation is a competitive move as competition is also an incentive and a source of inspiration for innovation.

III. CASE STUDY FINDINGS

The case study on the Finnish games industry has been conducted by interviewing the representatives (CEO, CFO or equivalent) of eight game firms. In table 1 the basic information of the firms and a brief statement of their thoughts on competition are given. The first sub-chapter analyses competition and selection among game titles and the second one discusses that among game developer firms.

TABLE 1
SUMMARY OF CASE STUDY FINDINGS

Firm	Founded	Employees	Platform	Subcontractor	Developer	Publisher	View on competition
Alpha	2004	35	Mobile		X	X	Against low quality developers
Beta	2002	27	Mobile	X	X		Sets upper limit on price
Gamma	2000	24	Mobile		X	X	Group effort against international big companies
Delta	1999	100	Mobile		X	X	Neck to neck with international heavy league players
Epsilon	2000	170	Online, mobile, handheld, console		X	X	We do our thing and we are not that interested in what others do
Zeta	2002	9	PC, online	X	X		Imposed by international publishers
Eta	1995	25	Console, PC		X		It is about owning a segment that is large enough
Theta	1995	13	Console, PC		X		International publishers are very picky

A. Competition among game titles

We will start the conceptualization of competition within the Finnish games industry by analyzing selection that operates on game titles. Thus, firstly we are interested in product market competition. Naturally, the selection that operates on the game titles makes up the selection operating on the firms, but we shall return to that in the next sub-chapter.

Selection on game titles constitutes of three rounds. The first is the phase in which potential game ideas and concepts compete with each other within a game developer firm. Only a fraction of game ideas is developed to the stage where they can be sold to game publishers. The

second round is that of game concepts competing for publishing deals. Also here only a fraction will survive. The third round is selection enforced by the consumer market. As most games are financial disasters, the bulk of the published game titles will make losses and only a small number will end up as hits with huge sales. This is presented in figure 1.

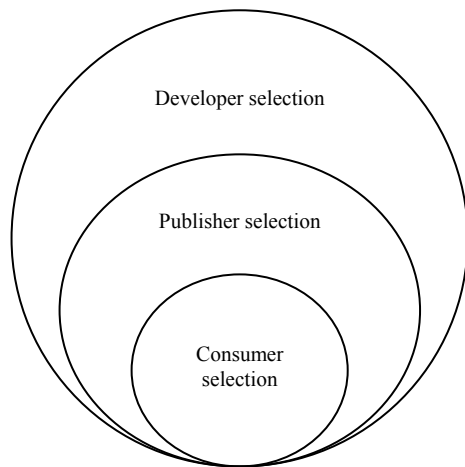


Figure 1. The three rounds of selection on the game titles.

The criteria for game concept selection within the developer firms are often described as more of an art than a science. The interviewees used words like feeling, excitement, intuition and consensus to describe the decision process. This is well described in the following quote.

"We do not have any scientific method or a scoring system. Somehow consensus arises if consensus is required. The founders are more equal than the others. We have developed also ideas put forth by others. And if the team gets excited then start doing it." (Theta)

However, even though such soft things would be important in making the decision, it is usually backed up by sound business logic. As the following quote suggests, decisions to reject are also based on low market potential and technical problems, and those overrun any greatness that the content would have.

"A small developer like us has to operate more based on intuition and feeling on where this world is heading to. In our system each game has a decision life cycle. Once a week every Tuesday we sit down and go through each project. We have killed projects if we have felt that even though the idea has been good but for some reason these kinds of games do not sell at the moment or that the developer cannot do it or there are technical problems for which the game will not run properly. So we have killed quite many projects after starting them and even after we have spent money on them. There is no sense in doing a game if you don't believe that there is business. That is a raw fact. If you don't believe that it will bring you money then it dies no matter how a great piece of art it is." (Gamma)

Another reason for discarding a potential game project is the budget. This happens especially in firms that have more

of a subcontractor status. Also following from such a status is that the contracts may limit the scope of projects that can be undertaken in the near future.

"In some instances we know what the budget is and that it is just not going to fit in it. For example a three-dimensional car game cannot be done with just some euros. It costs more than a two-dimensional game. Then there are legal matters. If we do a top-view car game for some customer then after six months we cannot do the same thing for another customer because of the contract. In such a case the first customer would pay for the learning and we would use that in the second project." (Beta)

What is also a very important factor in making the decision to start developing a game concept is competition from established brands in a given genre of games.

"At the moment we have more than one hundred game concepts and we have seven games and we a roadmap for four months. About 90 percent of the ideas are discarded. Usually the reason is that the business potential within our key markets is not sufficient. It's nice to do an ice hockey game but ice hockey is not even continentally very appealing and another matter is that there is one huge competitor Electronic Arts that is now very strong in sports games. Many game designers would like to do games for themselves but this is a business. If someone likes to play a niche role playing game then that's fine but we have to go with what is the market potential. And that is the most important reason for discarding an idea." (Alpha)

"The typical reason is that if there is a lot of competition. If there are big competitors then it will not pay off to do it. For example it is not a good idea to do a football game because there are big licenses and brands like EA Fifa 2006 against which it is quite impossible to compete. And if you think that the idea does not have mass market appeal but it is a niche concept and we are trying to reach the global market. One typical case is ski jump game which we have but no-one wants to hear of it in the US or in England." (Delta)

It seems to be quite a paradox to come up with an idea that would be internationally appealing to the masses but not yet implemented by anyone. The solution is to do something different and compete by innovating but that strategy has its problems as well.

Interviewer: Do you try to avoid such predefined genres?

Interviewee: Actually yes, but it feels like the slightest innovative twist that we offer seems to be too much, unfortunately. We have tried some new approaches lately so that the high concepts would not be totally alienating." (Theta)

This means that in order for a game concept to get a chance at the developer it should be different from the existing ones, but not too different to appear strange for the potential publisher and finally to the consumers. And all this should fit within the budget and be technologically feasible.

As a game concept has been selected by the developer to be developed further a demo is made. Then this demo is

presented to the publisher, in order to get financing for the rest of the project and to make a deal on the mechanisms to share potential profits. Usually the developer get all the money needed to finish the game and perhaps even some profit margin is included. In addition to this the publisher will pay royalties based on sales, but only after the publisher has made enough money to cover the investment in game development. As publishers loose money on most game titles, such royalties are only paid in case of a big hit. But in order to get to that stage the developer has the pressure to make a deal with a publisher for the game title.

"You go with the package to the publisher and if the developer has been able to finance the project that far that they have some material to present to the publisher, then that is where it usually ends. Like you can show the idea and how it runs on a screen and you have one minute of the game done. Then they say yes or no. At that point the publisher comes to finance the project. In some cases the developer can develop the game further but risks rise all the time. Even if you have a completed game it is possible that no-one wants to publish it." (Theta)

As the publishers carry most of the financial risks and there is a smaller number of them than there are developers, they have a strong position in selecting which games will get the deal. This means that there are many demos presented by different developers to choose from. This gives the publishers an edge in demanding certain things in development contracts.

"Usually the first draft is the worst possible like you have to give up your daughter and sign the paper with blood. Our own experience is that there is some room for negotiation and you can get reasonable things. The project is scheduled with some milestones and the publisher pays as the milestone is completed. The developer has the pressure and they are hanging on the publisher who can have quite tight strings depending on the situation. And if we are talking about a console game then it is quite a large part of the income of the developer then the publisher can dictate the artistic direction and whatnot." (Theta)

This would mean that the selection environment for the developer firms would be very much directed by the publishers. However, this is not the entire story as good game concepts are in high demand. This means that a developer with a good track record may have several publishers to choose from.

"Before our first success it was very hard like it is for everyone. I wasn't there in that rumba but I have heard the war stories how hard it was. But it is not that hard now. You are as good as the last game you have sold. At the moment the situation for us is good and we want to hold on to that and that is done by doing good games. And also by doing everything professionally. That means keeping promises and in general doing things honorably. And leaving business partners with a good aftertaste. Firm reputation consists of so many things. There are the games but there is also the way in which you do business. Competition is tough and although some old firms die darwinistically all the time also new good firms re born

every year. You cannot rest at any point. It is very rough and the four or five large publishers only want to work with four or five external developers so you have to work hard to stay on that list once you get there." (Eta)

As the publishers have such power in deciding which game concepts are taken forward and which are not, there is some tension between the developers and publishers. A common criticism concerning the publishers' decision making logic is that they are willing to finance only such games that repeat things that have sold well in the past and would thus be to the liking of the mass market. This means that novelty would not be appreciated.

"Often people ask why there are only certain kinds of games and the reason is that publishers are public companies and they have to do interim reports. That means that a game has to sell a certain amount and in order to do that you have to avoid risk and please as many consumers as possible. Hardcore gamers dread such games and I don't know who buys those games because usually the critique is that games are always the same. So why are so many of those made? We would like to do different kinds of games." (Zeta)

Another criticism of the publisher actions is that they determine some games to poor sales by cutting their marketing budgets. However, even huge marketing efforts cannot turn a very bad game into a big hit. Thus, it is acknowledged that both good game quality and good marketing are necessary but not sufficient conditions for good sales.

"The success of a game is determined six months before it is published. It starts with how the publisher believes that the game will succeed. They make projections based on how these kinds of games have sold previously and that is the first problem if your game is of a new type. There is no evidence of good sales for its type and the publishers do not want to invest in marketing. And when there is no marketing then it becomes a self-fulfilling prophecy. Perhaps some types of games never get a chance. Big games that are advertised on the sides of buses and on TV have for some reason been believed in. So often success has been guaranteed with a previous success. However, there are games that despite huge marketing budgets have not succeeded. So there has to be both good game and good marketing." (Theta)

Within the mobile phone games the factor with most influence on selection induced by consumers is said to be deck placement. This means that games that get good placement in the operator deck are sold more than those with a less good placement.

"It is not really rocket science if you look at how the end user makes the decision to buy. In the end it is dependent on one thing; it is the deck placement when you go to Vodafone Live or T-Mobile operator portal. On average 90 percent of European consumers do not have flat rate but they pay time-based on browsing. He buys a game with good deck placement, such as top ten or game of the week or something. And to get a good deck placement for a new game you arrange a campaign with the operator and that is

why we put a lot of ammo to marketing and do co-marketing with operators. Of course quality helps but we do original IP that competes with Star Wars for example and no one has heard of our stuff so we really have to have higher quality than others.” (Alpha)

The fragmentation of the market means that there are no direct rivals in the sense that it would be either our game or their game that would get certain good deck placement. This also means that thinking of competition in terms of market shares is not very insightful.

However, deck placement only applies to mobile phone games. But for console games the market is just as dispersed. There are many genres and segments to which games are classified and in each genre there is competition.

”If we can own a mind share in the mind of the gamers like when you say movie-like action game then we hope that they think about our game. And that competes in the action adventure category. It owns a small segment and we hope that it is large enough to be financially sustainable. But in any other genre let’s say strategy games which is a large one then you have to have some innovations related to either technology or gameplay so that it differs from all the rest. If there is a genre with Coke and Pepsi and you try to bring in another cola drink then you are not likely to win that battle.” (Eta)

However, it is not just competition within a genre that is important. There is also competition between genres, and looked with a wider scope, there is also competition between games and different forms of entertainment.

The logic of the three selection rounds is that in this way the concepts that are likely to be unprofitable are selected out prior to reaching the consumer market. However, this is based on the assumption that the concepts that survive developer selection are actually of the kind that are appealing to the publishers and the ones surviving publisher selection are appealing to the consumers. Thus, the assumption is that the two first selection rounds would consistently winnow down variation to cover at least the area that will survive in the final selection round. However, there is no way of knowing whether the games that are developed and published at the moment cover any more than a fraction in the space of all possible games that the consumers would be willing to buy. This is presented in figure 2.

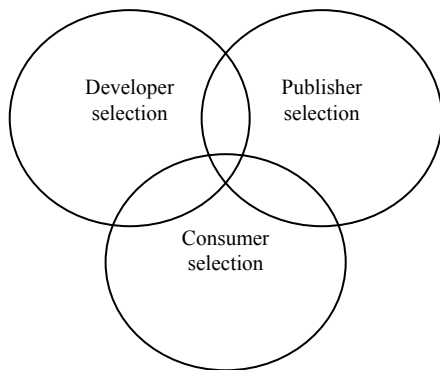


Figure 2. Three rounds of selection without the consistency assumption.

Based on this it is possible that there are game titles that the publisher would like that do not survive in the developer selection. Also, there may be game titles accepted by the developers that the publishers discard even though there would be substantial consumer appeal. But to conclude, it is quite certain that there are possible games that the consumers would buy but no-one has come with the original ideas for those yet. And this is also the reason novelty is created by developer firms and expected by publisher firms in order to find and make good use of such consumer potential.

B. Competition among developers

Game developer firms are usually small and young. This is because the industry is growing and new firms are founded. However, the other reason is that the industry is quite volatile and firms also die, which means that the number of old firms is small. The volatility of the industry can be explained by several factors. As such a firm is founded it requires many kinds of competence to make it run smoothly. Firstly, there is the technological competence that has to be up-to-date and developed continuously.

”I would say that what usually happens is that they also run out of competence in two ways. First is that they are not able to make the jump from console generation to the next when it become technologically more complicated. From PlayStation 1 to PlayStation 2 quite many developers died and now to PlayStation 3 many will die too.” (Eta)

Besides technological competence there has to be certain business competence relating to project management, contract negotiations and the overall strategy of the firm.

”Basically no matter what the business is it takes certain competence to set a firm up and it takes certain competence to handle the growth and if you don’t get the competence from outside and change your procedures you will die in that environment. Quite traditionally game developers have had a great game designer or a great programmer that has been ordered to be a project manager or CEO. Not surprisingly he has not been that interested in building the business processes or infrastructure. People have had a garage way to work and perhaps they have accidentally sold IPs or they have become a subcontracting company that will be the victim of cost-cutting and will eventually die. But behind it all is the lack of business competence.” (Eta)

But even such competences are not sufficient in guaranteeing the success of a developer. It is the nature of the industry that you have to make a bet on the game concept that you believe in. In many other industries that produce consumer goods the financial outcome of trying to sell a new product can range anywhere from zero to huge amounts and a moderate result is the most likely. For game developers the most likely outcome is zero, the less likely outcome being sufficient to cover the costs and the very unlikely outcome being a big success. A developer firm may be able to survive one zero outcome but not two. Thus, the selection environment for the developers is very harsh.

Surviving in such selection environment is challenging

and success factors include first and foremost the quality of the game. Also the track record of the firm is an important success factor. When there is history that shows that this firm is able and willing to do what they say that they will do, then they have good chances in succeeding.

"The product has to be in good trim. Then you have to have good reputation and brand. And it is very important that when you work with the same firms you have to be able to show that it has been profitable for both of you. Then you have to have resources to push the product and to do marketing campaigns." (Delta)

Competition between the developers is not as straight forward as the idea of market shares reallocated based on efficiency would suggest. Most of the interviewees stated that they do not have any direct rivals because the products are so different.

Interviewer: Do you have direct rivals?

Interviewee: No.

Interviewer: Why is that?

Interviewee: We sell orange juice and the others sell beer. These are different kinds of brands and we all compete over free time. Of course we have competitors but you can't say that we would compete with some other game. We compete with the Olympic Games on spare time. Like how people spend their spare time and excess money is what we compete on. I guess with other forms of passive entertainment like watching TV and surfing on the web. Like whatever that takes time. Nowadays people may play a couple of hours a night and we compete against anything else that could happen during the evening. And if we do a game for younger people then we compete over whatever they would do when they come home from school." (Eta)

The absence of direct rivalry is also a matter of variability of demand. If a hit game would not have been developed, published and finally bought by large number of customers, it would not mean that they would have bought some other game instead. Perhaps a part of them would have and a part would not. And as the criteria for choosing a game vary from consumer to consumer the consumers buying a game instead of the hit game would have ended up with different substitutes. However, within the mobile game market direct rivalry is detected in the form of competition on the deck placement.

"Of course there is direct rivalry because in Europe there are about 700 mobile developers and if there is an operator that publishes ten games a month then there is quite a hustle and bustle. At the moment the industry is developing so that foremost competition is against firms developing bad quality games. Because they slow down the growth of the market and the problem is that unless the market grows we don't have business after two years." (Alpha)

As this indicates there is however more of an effort to have the market grow than to win existing market shares. This is highlighted especially in Finland as the firms do not see much sense in competing against each other as they all try to sell their games internationally. This brings us to the resource side of the competition, where employees are the first scarce resource.

"I think that in Finland within the games industry there is no competition. Like if they do a game then that doesn't harm us in any way. In that sense there are no competitors, only potential collaborators. I think that the only sign of rivalry is that employees may go from firm to firm and that gives you the impression that we are competing now with them. But that is only about employees and not about market areas." (Zeta)

The second scarce resource is capital and the third is competence relating to capital.

"If we think about competition in Finland then it is about funding because there is very little capital moving at the moment. It is a zero sum game. If someone gets the money ten no-one else gets anything." (Gamma)

This means that so called "smart money" is not available that would entail both a monetary investment and also an investment in competence in the form of skilled board members.

Interviewer: What keeps you from getting to your dream situation?

Interviewee: Funding and the understanding of the business. There are no people in Finland that would understand about marketing games like who would have been launching an international game project. There is a lack of capital and lack of marketing and advertising competence. In terms of content I believe that Finland would have a lot to offer because things are done smart and efficiently here. I believe that games can be done with less money here than in many other countries. Compared to Silicon Valley the cost level here is about one fourth and half compared to London." (Gamma)

This would suggest that the selection environment is quite complex and that the barrier to success is not just someone else getting ahead. The institutional setting of the industry affects to a large extent on who will make it and whether anyone will. In that sense future of the industry in Finland can be affected by many actors and is not solely determined by the efforts of the firms.

IV. CONCLUSIONS

The main conclusion is that within such a scattered field competition can not be seen merely as a race over market shares, but as a complex process where simply being efficient in producing high quality products is not sufficient. Within the games industry success comes from originality, but that is a double-ended sword. Your game has to be different from others in the market in order to succeed, but it should not be too different since that will make it impossible to get a publishing deal. As it is a hit-driven business with high risk associated to high potential payoff, there is fierce competition over investments. Also, skilled employees are extremely valuable for the firm. Thus, the resource side of the business also enforces selection pressure over the firms.

Basically efficiency is understood as producing the same output with less input. However, within the games industry succeeding in competition is not about making the same stuff cheaper, but about making new, different and better

stuff with reasonable cost. The development costs of especially console games have been rising exponentially in recent years and this would imply that efficiency in terms of low development cost is not a key success factor. This brings us to the notion of increasing returns that dominate within the games industry. The cost of the development of a game title is constant as the number of physical game copies rises. Even though there are costs associated with producing the discs, cases and printed materials, as well as retail costs, the next sold game copy will reap more profit than the one before. Thus, the more copies you sell the more profit you will make per game copy.

Efficiency is easily defined in industries that produce bulk products such as electricity, concrete or potatoes. Even though they may entail other attributes besides price, e.g. some varieties of potatoes are better than others and better suited for certain purposes, the measurement of efficiency is pretty straightforward as the unit cost usually provides basis for comparison. As a contrast, within the games industry such price per unit efficiency loses its meaning. Even though console games tend to sell for a certain price as do also mobile phone games, the price per game copy is not a relevant measure. The consumer is interested in the amount and quality of entertainment the game will bring. These are very hard to measure and to make things worse, these vary consumer to consumer. Different people appreciate different attributes, such as fun, excitement, easiness, graphics artistry, etc. Thus, "price per unit of fun" (or whichever attribute the consumer in question appreciates) would be the correct measure of efficiency.

The market share thinking is problematic as there is no constant market size that would be shared by the games published during a given year. A big hit can increase the size of the market both temporarily and permanently. The temporal increase will follow from a substantial share of that year's sales coming from this one game. The permanent increase will follow from the power of a hit game in attracting new consumers to buy the first game of their life and more importantly investing in the hardware necessary for playing. This also means that if such hit would not have come to the market then consumers would not have necessarily bought some other game as a substitute. For example, parents often buy a console game for their child as a Christmas present. If there is no game that the child would like over the others then perhaps he/she will ask for a new mobile phone instead. Thus, games are not perfect substitutes, actually far from it. And the size of the market, which is by no means constant even in the short run, is determined by the supply and its consumer appeal.

ACKNOWLEDGEMENT

This paper was produced within the TIP Research Program (Knowledge and Information Management in Knowledge Intensive Services). The program is funded primarily by The Finnish Funding Agency for Technology and Innovation. The research is conducted at the Institute of Business Information Management at Tampere University

of Technology and Professor Marjatta Maula is the director of the program.

I would like to thank all the representatives of the games firms that I have interviewed regarding my research project and also the staff of Neogames: The Centre of Game Business, Research and Development for helping me in directing the study towards interesting issues.

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Creating Consumers' Acceptance of Electronic Risk Manager

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Abstract — This paper clarifies how insurance companies can promote issues of consumer safety and risk management in electronic environment. On the basis of both qualitative and quantitative studies the suggestions for developing eRisk Manager are provided. The theoretical background of the paper relies on risk classifications and consumer perceived risk factors. The paper contributes theoretically by introducing widened framework of consumers' experienced risk classification and providing empirical results in the under-researched area of consumers' risks.

Keywords — Consumers, insurance, risks, risk management, Internet services

I. INTRODUCTION

Financial services have been rapidly moved to electronic business infrastructure during the last ten years. In this, the Nordic countries have proceeded as forerunners, and in fact, Finnish banks introduced electronic banking with basic transactions in 1996. Insurance companies followed and first of them opened their Internet home pages also in 1996. Step by step have financial organisations moved their services to electronic environment and today there are a vast variety of services available on the net.

Finnish consumers are used to electronic services. Today over 50 per cent of them use regularly electronic banking. However, those services that are needed infrequently have not been that successful among consumers. Yet, there are services that are not available on the Internet, and mainly they are services that are considered complicated. In these cases, the personal interaction is preferred.

For above reason, there are no extensive risk identification and risk management services for consumers on the Internet. Risk construct deals with situations where consumers are placed at risk because of decisions they make in the marketplace, other areas of life or even in government inaction. The underlying notion is that there is a possibility to be harmed [1] or win in some way.

So far the other problem is that insurance companies do not have enough resources to provide personal risk management services for consumers. As a consequence of this consumers are left by themselves, although they have not enough capability to handle these issues. Therefore, many households are remained uninsured.

However, high personal risk management level in common serves both consumers and insurance companies. It prevents accidents that cause costs and many kind of troubles for both parties. In reality, risks and risk management thinking seem to be unfamiliar to consumers. Their knowledge of risks should, therefore, be improved by providing concepts and ways of thinking by using terminology which is familiar for them. Even the concept of risk have different meanings for experts and for lay persons [2]. In addition, consumers need more information and reminders of every day risks and how to prevent them. Also the negative attitudes towards risks may be one obstacle of active personal risk management.

The purpose of this paper is to clarify how insurance companies can promote issues of consumer safety and risk management in electronic environment. The specific research questions are following:

- 1) *how consumers perceive safety, risk taking and risk management?*
- 2) *how electronic environment can serve as a media to diffuse risk information and risk management tool kits?*
- 3) *what are the key factors attracting consumers to use electronic risk manager?*

The literature concerning consumers' risks and risk management is quite limited and research offering overall consumers' risk scope and risk dimensions is scarce. There are, however some specific risk classifications concerning consumers' behaviour and consumers' purchase decisions (see e.g. [3]), societal risks (e.g. [4]) and risks of specific activities, such as electronic equipment and traffic (e.g. [5]).

The article is organised as follows. First the theoretical approaches of consumer risk classifications and perceptions are discussed, then the empirical data and findings of two studies are presented. Thereafter we suggest, how to create an acceptable electronic risk manager for consumer use, and finally we discuss the challenges given by this paper for academic and practical fields.

II. CONSUMER RISK CLASSIFICATIONS

Various risk classifications have been presented to describe consumer decision making and consumer behaviour during purchase processes (see e.g. [6]–[8]). Based on these classifications and our focus group study (see section Data and Methodology below) we developed the framework for overall consumer risk experience (Figure

1). The framework provides a holistic perspective and divides experienced risks into eight classes as follows: 1) economic risks, 2) physical risks, 3) psychological risks, 4) social risks, 5) time dependent risks, 6) activity based risks, 7) technological risks and 8) global risks.

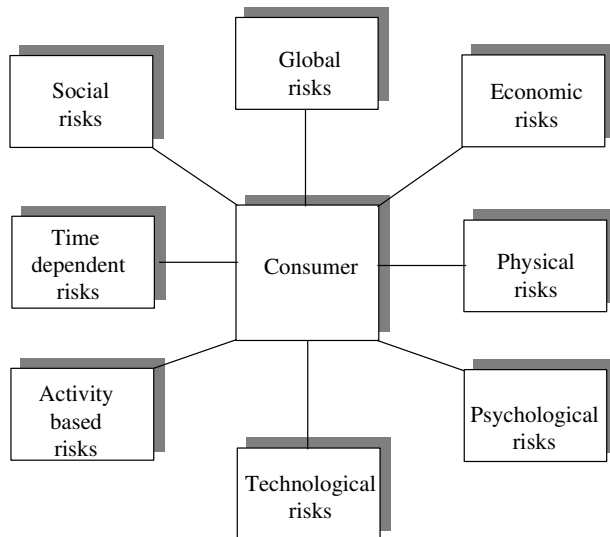


FIGURE 1
FRAMEWORK OF CONSUMERS' RISK EXPERIENCE [9]

The problem with various classifications seem to be their inability to pay attention to situational factors affecting consumers' risk experience. In addition, consumers' own view and explanations, e.g. so called "consumer own voice" cannot be revealed from the pressure of strict categorization. Moreover, classifications offer rather general description of risks without searching more deep individual risk contents and constructs. Instead, we encourage researchers to listen consumers' free talk and outlines by giving room to the flourishing semantic part of language. Only after this simultaneous classification and deep analysis of content can be executed.

III. CONSUMER PERCEIVED RISK FACTORS

According to McGregor [1] risks perception is a lens through which consumers view risk. It is defined as their judgement of the likelihood that a consequent loss or harm will occur, and as their judgement about the seriousness of its likely consequences. Perception of risk arises from unanticipated and uncertain consequences of the unpleasant occurrence. Even though McGregor's risk perspective seems to be concentrated on negative occurrence only, we would like to remind, that risk consequences may be positive as well.

McGregor [1] has developed seven risk factors on the basis of conventional risk perception theory. These factors are:

- Degree of knowledge and information measuring the extent to which consumers feel informed and knowledgeable about a risk.
- Perception of locus of control containing consumers' mental image of controlling things.
- Degree of perceived risk.
- Expectations of risk dealing with degree of satisfaction or disappointment whether an occurrence meet expectations of risk.
- Past experience with particular risks assisting in risk judgement even if consumers lack full knowledge about the risk.
- Influence of activists in order to reduce risks by lobbying authorities to make changes.
- Outrage attributing to situations where consumers are concerned with possibility of any harm to themselves.

In addition to the above factors McGregor [1] pays her attention to various issues concerning risk perception. She considers that many things are out of consumers' control, and it is very hard for them to assess risks in these circumstances. Also most decisions about risks are made with partial information because the future is unknown. On our opinion, all this make risks a difficult construct for consumers to understand and therefore, they find that personal risk management is outside their systematic control and competence.

McGregor also reminds that caring up close is easier than caring at a distance. Geographies of responsibilities accommodate the idea that distance is a source of moral harm. This offers us a reason to believe that global hazards, e.g. wind storms or earthquakes, on the other side of the world do not touch consumers feelings of risks as close as storms at the backyard.

Cultural environment affects also consumers' risk perceptions. McGregor even argues that consumers tend to trust authorities to play their part in the economic system. This may be the case in developed western countries, but surely many Africans feel completely otherwise.

IV. DATA AND METHODOLOGY

The research project started by following inductive logic. The first item of the empirical data was gathered by two focus group interviews that were carried out in October 2005 and February 2006. Altogether 15 consumers were attending the two focus groups. They were picked up among consumer panel maintained by National Consumer Research Centre. The advantage of a focus group method is that participants are able to discuss various phenomena in depth and from various points of view ([10]–[12]).

The study continued by the survey at the end of May 2006 forwarded to 940 respondents. All consumers of the consumer panel formed the sample of respondents. 770 respondents, i.e. 82 per cent, returned the questionnaire.

The sample can be considered large enough for generalising the results of the study. The questionnaires are analysed by statistical methods, e.g. factor analysis. Socio-economical variables are used in forming various risk profiles. At this stage, only the preliminary results of the study are available.

The research is one part of the publicly funded large research project titled “eInsurance - Novel Electronic Insurance Services”. The main purpose of the project is to develop tool kits that make it easier and motivate consumers to use electronic risk management and insurance services. The results of the two studies serve that purpose. In addition, our results increase insurance experts’ understanding of consumers’ perceptions of risks. In order to achieve the goals of the project, eInsurance also targets to fill gaps between consumers’ subjective risk perceptions and objective risks identified in literature and by experts.

V. EMPIRICAL RESULTS

A. Consumer risk perceptions

The results of the qualitative study show that consumers’ risk experience and perceptions vary vastly. They prefer to tell risk stories that have happened in their own life and they refer to their neighbours experience. Usually consumers do not waste their thoughts for risks in every day routines. Traffic risks are exceptions and they are given a lot of attention. However, traffic risks are considered as risks caused by outsiders, and consumers feel that they themselves cannot influence on the probability of accident. Moreover, the spontaneous risk talk deviates from studies that were conducted quantitatively.

Common risks such as danger situations at home are not necessarily recognised. They are treated more like a part of every day life by using common sense to handle them, but not a part of personal risk management. On the other hand, consumers see life as involving a wide variety of risks of different levels. It may be difficult for consumers to discuss their own attitudes towards risks and they fail to recognise in themselves “pure” types with respect to risk attitudes. Apart from physical risks, consumers identify risks in their economic decisions, lifestyle, hobbies, and social relationships. Risks from technology, such as those related to data security, are mentioned as well. Global hazards, however, are not referred to.

The study reveals gaps in consumers’ risk perceptions. Consumers do not notice some risks at home or surroundings at all, even though the risk to be injured in the accidents at home is quite large and every year approximately 2.000 people die in these accidents in Finland. Same time consumers are more worried about traffic accidents, where approximately 400 people die annually. Yet, traffic is more dangerous in consumers’ minds than home activities.

Consumers do not take risk management as a systematic function such as it is treated in business life context, but they have acknowledged the importance for protective equipment. Insurance is considered rather as a protection against economic losses than as one instrument of risk

management. However, for some reason life insurance is not as popular than non-life insurance. Consumers consider insurance types and terms complex and difficult to understand and offer that as a reason not to insure or to underinsure. In addition, common private insurance types are considered expensive and their deductible too high. Therefore, the notice of termination of insurance cover is easily given in cases, when there is a need to save in personal costs and financial difficulties.

B. Perceptions of electronic insurance

The preliminary results of our survey reveal that consumers’ attitudes are more positive towards electronic insurance services, as over fifty per cent of respondents are willing to purchase either all or part of their insurance cover on the Internet. The largest obstacle to use Internet services seems to be the complexity of insurance terms and conditions, which makes consumers feel themselves uncertain. Therefore, they prefer to interact with insurance experts face-to-face. Many consumers still believe that they are unable to survive in electronic environment. They are afraid of making wrong choices, which may later cause economic losses.

Questions of privacy protection and Internet safety are not a major concern nor are they considered an obstacle to the use of electronic insurance services. The need for more interactivity and customised services is emphasised instead.

TABLE 1
MOST IMPORTANT INSURANCE AND RISK BASED ACTIVITIES
ON THE INTERNET

Activities on the Internet	Amount of respondents, per cent
Comparing insurance and insurance companies	69
Examples of claims covered	66
Premium calculators	63
Electronic claims applications	52
Updating and checking insurance terms and cover	46
Identifying requirements of household insurance cover	44
Clear insurance vocabulary	44
Quick response to questions	32
Insurance purchase	19
Information of accidents, risks and their prevention	15
Information of safety equipment	14

Respondents of the survey comment which electronic services they are willing to use in connection of risks and

insurance (Table 1). Most popular would be the ability to compare various insurance types between insurance companies. At the moment, there is no such service available.

More detailed information of most usual hazards at home raise interest among 46 % of respondents. On its part, 35 per cent of respondents are eager to learn more about hazards typical for children and how to prevent them, whereas 34 per cent are interested in hazards of senior citizens and their prevention.

Over 60 per cent of the respondents would like to have more examples of paid claims, and also over 60 per cent find premiums calculators useful. Most insurance companies in Finland offer such calculators. All in all, as Table 1 shows, consumers find most of the services interesting, only safety and risk prevention earn less interest (14-15 %) among respondents.

VI. SUGGESTIONS FOR DEVELOPING ERISK MANAGER

Development of electronic services should be started by consideration, what kind of electronic services will fulfil consumers' needs and offer substantial benefits. Otherwise they do not attract consumers to move to electronic business environment. Instead they stay with their old habits and especially in connection with insurance and risk management this means personal interaction with insurance experts. However, those experts have limited capacity to serve all their private customers individually, and in this electronic vehicles could on their part take care of consumers, if there were sufficient risk management and insurance services available on the Internet.

As far as risks and risk management are concerned, the important question is, how eRisk Manager could support consumers to identify and manage their risks? The task is difficult, because consumers consider safety and risk management issues odd in electronic environment, although they are interested in dealing with their insurance cover electronically. In addition, our studies confirm that consumers' attitudes towards security issues are narrow focusing to safety equipment only, but they do not identify dangerous situations and places.

In order to develop a successful eRisk Manager at least following characteristics have to be taken into account. It should guide consumers to identify risks and provide preventive information of various hazards. In addition, it should combine customer registers with insurance and claims registers at company level and at customer level. Combined info can be used to affect customer behaviour with suggestions and personal guidance to avoid most probable risks. Also eRisk Manager should be easy to use and allow access 24 hours a day.

In addition, it should offer added value for consumers moving to electronic insurance services compared to traditional contacts. In this in-time interactive customer service would help consumers to get replies and solve their problems by return.

Providing security is an important part of risk management. According to McGregor [1] the human security concept includes personal well-being of individuals and their ability to feel secure in the basic needs that affect their day-to-day existence. If consumers are conscious of various risks in their every day life they most probably will act to prevent them. eRisk Manager could act as a reminder of most typical accidents at home, in the backyard and in the neighbourhood. In addition, there should be risk lists of hobbies and real examples which accidents can be insured and which cannot.

Insurance companies have enormous amount of information of risks occurred and risks that have been close to occur. This information should be utilized in visual and simple ways as a part of eRisk Manager. There are new ways and technologies to offer this information for consumers. This may even provide competitive advantage for those insurance companies that first pay their attention to develop this kind of risk service, because so far the security information on the Internet is fragmented and uneasy to find.

Finally, as a part of risk management eRisk Manager should recommend suitable portfolio of insurance types and covers. Respondents also wish more simple and understandable risk and insurance services. Moreover, tailor-made insurance cover should be also available on the Internet. Currently the offerings are limited to standardized services only.

Consumers tend to feel uncertain in front of new systems, services or products (cf. [13]). They are not yet used to electronic insurance services, as they have adapted them more slowly than internet banking. This should be kept in mind when introducing eRisk Manager. In order to gain acceptance consumers should either be educated to use new system, they have to have opportunity to trial use without threat of failure or it should provide new attractive benefits.

VII. DISCUSSION

The paper contributes mainly by introducing the widened framework of the consumers' risk dimensions. It confirms that the empirical results of the both studies can be analysed by the aid of our framework with eight classes, but some of the classes proved to be more important than others. For example global hazards are unfamiliar risks for consumers, whereas physical risks dominate their talk about risks. Traffic is considered the main danger factor because dangerous traffic situations are seen to be caused by others and, therefore, are difficult to anticipate. However, economic risks are also well recognised. In this our results deviate from those of Cunningham et al [14], as they conclude that financial risks are drivers of most other risks.

Most of the consumer perceived risk factors seem to be realised in our empirical studies. Only lobbying of activists and outrage are not revealed at this stage of the analysis. In addition McGregor's ideas of difficulties in assessing risks are well recognised on the basis of empirical results. However, we believe that better risk perception will lead to risk-reducing behaviour as Yeung and Yee [15] suggest.

For practitioners and members of the project group this study offers new information how consumers perceive risks and what kind of attitudes they have towards various risks in their own life. It also reveals that systematic risk management among consumers is rather unfamiliar and random phenomenon, and provides useful tips how safety and risk management issues should be presented in order to gain consumers' acceptance. Most of all, the results of the study can be utilized in developing electronic risk manager, i.e. tool kit for consumers to avoid and manage risks.

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Defining Cyberethics

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Abstract — Focus of this paper is on ethical issues related to the era of Internet, e.g. cyberethics. Approach used in this paper is phenomenology, whereas definitions of cyberethics are discussed from the viewpoint of pragmatic ethics, while questioning existing basic values in society and proportion these into pragmatic, de facto ideology. Resulting comparison provides conceptual analysis on cyberethics as well as provides new perspectives on research on cyberethics. This paper demonstrates, that there exists a conflict between pragmatic and general moral law, which is foundational one.

Keywords — Cyberethics, Virtuality, eSociety, Self regulation, De facto ethics.

I. INTRODUCTION

This paper focuses on ethical issues closely related to the era of Internet, e.g. cyberethics. In this paper the authors a) provide a definition of cyberethics from the viewpoint of pragmatic ethics, and b) discuss certain basic values (democracy, freedom of speech, equity) and proportion these into pragmatic, de facto ideology. Resulting comparison will provide following contributions; a) conceptual analysis on cyberethics and b) new perspectives on cyberethics research.

Methodologically this study is phenomenological one. According to Gilles Deleuze, philosophy is needed especially in situations, where new phenomena already exist, and both concepts and words are swarming in space. It is philosophy's duty to clarify situation [1]. This study accepts the challenge proposed by Deleuze (as well as Félix Guattari) – after all, virtual reality is one metaphor for dimension like space. Phenomenological bracketing was chosen as a research method particularly because of “being behindhand” [2]. In phenomenology central concepts or phenomena are taken into consideration from different perspectives. It is quite obvious that for example concept “digital divide” has a number of meanings depending on chosen discipline, or viewpoint. In phenomenological reduction attempt to define significance and discipline becomes a systematic attempt on controlling chaos [3].

Defining the cyberethics is a cross-disciplinary project. Topic is related to such concepts as internet ethics, self regulation, game theory, plagiarism, trust and privacy, digital divide, professional ethics, surveillance and regulations related to freedom of speech, to name a few. These are very common topics in publications concentrated on internet ethics [4]–[8].

According to pragmatism, values are being tested all the time with reality [9]. This is to say that pragmatism does not accept any permanent values, and therefore it is suitable for describing virtual ethics and reality. Usually development in value hierarchies is slow, but sometimes it

is surprisingly fast [10]. Pragmatism is also based on scientific optimism [11], where it can be said that pragmatic ethics reflects advances in IT.

There is a common principle that applies on both Internet and information technology in general. As soon as a new technology is being introduced, everyone is eager to utilize it as soon as possible. There are no significant attempts in creating standards to follow, but instead solutions created by one vendor will quite soon become “de facto standards”. Application is being accepted by general public without being defined and accepted officially, because this would take too much time.

Similar de facto –practice appears to exist in moral issues related to Internet. Moral codes are being molded and introduced taking only pragmatic issues into account. Actors are everything but professionals. A new moral is being created in Internet all the time; new virtual communities are being born all the time, and these form rules and practices, which depart greatly from commonly accepted ethical codes in society. From ethical viewpoint this phenomenon is interesting – it appears that everything is happening faster in Internet [12]. Pragmatism is suitable way for describing the development of Internet, all de facto practices, which are being measured based on their suitability alone. Likewise, the concept of self regulation is more than applicable with pragmatic ethics.

Self regulation creates ethical codes while at the same time influences existing regulations, norms taking shape. This type of action is very Hobbesian by nature. There exists pragmatic de facto ideology behind self regulation. A justified question stated is: what basic values self regulation takes into account and which it chooses to ignore? One could argue that binding moral values into consequences of actions is basically simplifying ethics. Ethics, which studies consequences (pragmatism, de facto), aims to be able to estimate and evaluate consequences of actions. Thus everything is measured in money (or by effectiveness).

When considering possible consequences of action and compatibility with existing moral law, for example violence provided by Internet does not gain amnesty – even in cases where a proof about caused damages can not be given [13]. In this study authors analyze chosen basic values (democracy, freedom of speech, equity) and proportion these to pragmatic de facto ideology. As a result, this study provides a comparison which illuminates a) basic concepts in detail, and b) opens new perspectives for research in cyberethics. Authors will demonstrate that there exists a conflict between pragmatic and general moral law, which is foundational one. Explanatory power of pragmatism is greater though.

II. METHOD

Phenomenology can be called eidetics, which means that it is possible with the assistance of the eidetic reduction to reach the essence of the things and phenomena [14]. In his earlier studies Edmund Husserl (*The Idea of Phenomenology*) [15] claims that the universal is seen in the individual. The move from the individual intuition to the grasp of the universal is a move to grasp the essence. Husserl calls this "method" eidetic intuition. Husserl believed that it was possible to have an insight into the essential nature of things. He argued that these essences could be seen in a manner analogous to perceptual seeing of a physical object [16]. This eidetic seeing is what Husserl calls seeing essence or essential seeing.

The traditional phenomenological method turns problematic when cyberethics is defined. In our opinion cyberethics is not a concept or an idea but an ongoing dynamic process that is almost impossible to grasp by means of a model, for instance. Things that are changing irregularly all the time can be handled in the same way as Zeno tried to deny the motion. In his aporia or paradox about the arrow that never gets to the target Zeno claimed that at any point in time a moving object must be at rest [17]. That's how the models are constructed, they require an infinite amount of "rest positions", whereas we suppose that cyberethics is an entity that is changing all the time. How is it possible then to define such a phenomenon? We need to take an ontological standpoint. We don't ask what cyberethics is but how it is. The crucial question is how cyberethics exists?

When defining cyberethics we are not trying to gain the essence of the concept but the meaning of it. As E. D. Hirsch states, an interpretive hypothesis is ultimately a probability judgement that is supported by evidence [18]. When defining cyberethics, the researchers are actually interpreting the society and the cultural strata of it. We are in the middle of the life flow all the time, which means that we are only able to understand the factual reality, in other words we are commuting between two existential categories, the actual projects and the factual reality. [19] - [20]. When an individual is interpreting his own life, he is actually moving in the same way as the life itself. Husserl calls the life-world the ultimate horizon of all human achievement. As conscious beings the individuals always inhabit the life-world. It is pre-given in advance and experienced as a unity. It is the general structure that allows objectivity.

We are in the life-world and at the same time we are interpreting a particular area of it, i.e. the virtual reality and the values – the cyberethics. The results of our research depend on the standpoints that we have taken – in practice it is impossible to occupy all the possible viewpoints. That's why we have to be content with the probability in our research – we aspire to give an account of the cyberethics as it is seen in this phase of our culture and civilization. The result of the phenomenological project is always the insight of the phenomenon and the description of this insight.

III. THE ETERNAL RETURN IN CYBERETHICS – FREEDOM OF SPEECH

The history of mankind is filled with myths of eternal return (Spengler, Nietzsche, Antics, Christianity etc.). But it is not only in mythology and fairy tales that this theme is constantly repeated. It is possible to find the same model in science, too. In his book *The Structure of Scientific Revolutions* (1962) Thomas Kuhn presents the idea that science does not progress via a linear accumulation of new knowledge, but instead undergoes periodic revolutions which he calls "paradigm shifts", in which the nature of scientific inquiry within a particular field is abruptly transformed [21]. The paradigmatic shifts are preceded by periods of stagnation. The progress of science, as Kuhn describes it, can be seen in a circular way, the scientific revolution always returns, it had to take place.

The same phenomenon can be seen in the products of all creative activities. The creative periods are always followed by stagnation and institutionalization. The corresponding development is to be discerned in all social, cultural and technical phenomena – and in the arts [22]. Many of the cultural structures and phenomena can be seen and described with the help of the eternal return (repetition) [23].

The same concerns the Internet. Upon the introduction of Internet, many pioneers of the information age had high hopes for it. Maybe the Internet didn't fulfil those expectations. People were talking about increased democracy and freedom, better possibilities in all social participation and communication and so forth, basically about the democratic values. Jürgen Habermas says in his theory of discourse ethics that there is a communicative void in the society. The more people and institutions communicate in a society, the more efficiently democracy is working. [24] The Internet should fill this communicative void. This also means that the Internet could be socially valuable, positive value. But the Internet is constantly changing; it is a dynamic communication environment. According to Habermas the bourgeoisie, when it had taken the power, began immediately to work up the public sphere, where communication takes place, in the favour of its own interests. There prevails only one truth in that kind of society. The Internet, on the contrary, represents pluralism, competition between different opinions and genuine free public debate [25]. Economical interest, commercialism and the commercial media threaten free communication. According to Habermas these do not belong to the area of free communication, nor do the administrative organisations. In the early days of the Internet there was no commercialism and as little administration as possible. Lee Salter, a Habermas researcher, says that the Internet grows apart all the time from those ideals of free communication which were so typical of it in the beginning. The government uses the Internet more and more for administrative and propagandistic aims, and they are trying to use the Internet as a means to control citizens. The ideal of Internet communication was interactivity in the beginning, whereas

communication has recently become more and more one-sided or non-communicative. [26] Deborah G. Johnson claims that commercial interests have all the time increasing their influence on the development of the Internet. This is based on the fact that free market forces have realized that the Internet is an important and efficient tool and media [27] and have taken over it.

Democracy was one of the great ideals in the pioneering times of the Internet. (Yoneji Masuda and the computopia, 1972) [28]. Like other positive values it was like an impetus or a driving force that put the Internet's development in motion. But as it is with all the ideals and beautiful values, they do not flourish in reality. Many on the NSMs (New social movements) make use of the Internet when communicating. Internet is cheap, fast, interactive and offers possibilities to anonymity. But these movements that operate underground or outside the control of the society are often organisationally antidemocratic. [29] So it is possible to see the model of the eternal return here, too. It means the fall of free, progressive forces and the victory of institutionalization and stagnation.

The faster the Internet and ICT are growing and developing, the better has become the methods of controlling the citizens. Panopticon, Michel Foucault's all-embracing metaphor telling about and describing the official horror and terror, has finally been realized [30]. At the same time when the Internet makes the communication between individuals run smoothly, it gives the public administration and terrorists (hackers etc.) a comparable and as efficient a tool to supervise and sort people, to invade citizens' privacy. With the assistance of figure and face recognition it is possible to pick up persons from an anonymous mass and build up their virtual identities that has little to do with the real personae. Is the effective way of controlling people valuable in one way or the other? Of course, if we think of the public administration, bureaucracy and all the overseeing authorities (the police, the customs, security services or tax authorities), the efficient monitoring is a useful phenomenon. [31] The question is about the balance between privacy and thrust. The more the public takes over the area of personal privacy, the more the citizens feel anxious and defend against the intrusion [32]. But at the same time the area of free communication is threatened. Here the freedom and effectiveness are fighting against each other. When defining the valuable, we must decide which viewpoint we choose – this is one of the main questions in phenomenology. Are we obliged to take a stand? Are we going to evaluate the effectiveness from the point of view of the authorities, or are we going to take a stand on citizens' favor? It is here, where the question about different ethical theories comes along.

IV. PRAGMATISM AND DE FACTO ETHICS

Is pragmatism the best possible ethical theory suitable for cyberethics? Pragmatism explains technical development and progress in moral well but when justice is taken into account, pragmatism is not the best possible

explanatory model. Pragmatism emphasizes the importance of activity in human life. Pihlström says that although the scientific worldview would not be the best possible (to the mankind), we can make the world a better place to live in through our active work [33]. In addition to optimism William James's and John Dewey's pragmatism emphasized development and change, that is why it suits well the world of information technology. According to pragmatism, values are being tested all the time with reality [34]. This is to say that pragmatism does not accept any permanent values, and therefore it is suitable for describing virtual ethics and reality. The norms exist in relation to the surroundings, they are context bound. The individual reactions against the value hierarchy can change it. Usually development in value hierarchies is slow, but sometimes it is surprisingly fast.

The moral action is not only the adaptation of moral rules, because the moral principles are suppositions or hypothesis, which have to be tested constantly. They must fulfill certain qualifications or requirements and they are open for changes. When we test moral rules we also interpret them. Legal system and legislation are good examples: The judges not only adapt the law but they also interpret it because they so often had to do with precedents without applications.

According to pragmatism things don't have any values, they are value neutral. After all, pragmatism accepts value hierarchy. But this hierarchy is not a permanent one. Why don't we think likewise about the Internet? It is possible to measure the usefulness of the Internet and we can call the result of the measurement the utility of the Internet. Now we are very near consequentialism, which, as its name suggests, is the view where normative properties depend only on consequences. This general approach can be applied on different levels to different normative properties of different kinds of things, but the most prominent example is consequentialism about the moral rightness of acts, which claims that whether an act is morally right depends only on the consequences of that act or of something related to that act, such as the motive behind the act or a general rule requiring acts of the same kind.

The pragmatic moral bound to consequences is an easy way to describe the Internet and the fast technological advance. Many of the traditional pragmatists agree on the idea that everything, also the moral arguments, can be measured. The argument "Violence is unethical" can be tested as well as any other proposition.

Immanuel Kant argued that moral requirements are based on a standard of rationality. Kant called this rule the Categorical Imperative. It is one of the main clauses of the deontological normative ethical theory. According to Kant we are acting in a certain way because we have different kinds of duties towards ourselves and others. This may appear strange to the adherent of pragmatism.

Edmund Husserl held an interesting lecture on ethics in Vienna in 1935. [35] The highest ethical goal of the rational culture and civilization is its spontaneous and self-steered improvement. In the same way as a rational

individual is able to evaluate and study his practical goals, so can a whole culture. European (or western) culture is therefore able to direct its future itself. According to Husserl there are ideal absolute goals, as well as ethical, that can never be gained or fulfilled totally, but they are something worth aiming at. Here Husserl comes near Immanuel Kant's regulative principle. These aims and the relationship of the European civilization to these goals can be evaluated over and over again, and this is the strength of the rational European civilization. Edmund Husserl doesn't name precisely what these goals may be, but it is highly probable that the idea of equality could be among these definitive aims. [36] As T. Miettinen states, equality in a society can't be described quantitatively or geometrically. Nevertheless, we understand what it means. We are able to evaluate our activity in proportion to this goal even though we can never achieve it. Although it is out of our reach, it determines our activities and choice. [37] This means that we are trying to achieve equality, for instance, over and over again. This project originates (socially) from French Revolution in 1789 and is still going on. The original Internet enterprise (ARPANET) in the 1970s was based on this kind of noble ideals (democracy, equality, non-commercialism, free speech and communication), but as Deborah Johnson stated, these pioneering dreams have been crushed. Control has taken over and because of commercialism there is no democracy, equality or area for free communication, to put it simply [38]. However, these goals or absolute ideals do still exist and are waiting for the new evaluation, as Husserl said. Husserl speaks about reappraisal and new beginning, but on a very universal level.

Pragmatism is based on so called *de facto* ethics, and it easily neglects values like democracy and equality. Profit, surplus, effective use of time, logistics, effectiveness, price and usefulness are some of the "values" typical of the *de facto* pragmatism. But it is not so simple. If pragmatists get an assignment that consists of the development of Internet democracy, they certainly accomplish it, without thinking of the meaning of the word democracy. According to Husserl, the civilization is in crisis when the pragmatic science dominates. To solve this crisis Husserl invites rational thinking [39].

How to define *de facto* pragmatism? In the introduction we compared it with *de facto* standards. As soon as a new technology is being introduced, everyone is eager to utilize it as soon as possible. There are no significant attempts to create standards that should be followed, but instead, the solutions created by one vendor will quite soon become "*de facto* standards". Application is being accepted by general public without being defined and accepted officially, because this would take too much time.

Similar *de facto* –practice appears to exist in moral issues related to the Internet. Moral codes are being molded and taken into use taking only pragmatic issues into account. Actors are everything but professional. A new moral is being created in the Internet all the time; new virtual communities are being born all the time, and these form

rules and practices, which differ greatly from commonly accepted ethical codes in the society. From the ethical viewpoint this phenomenon is interesting – it appears that everything is happening faster in the Internet.

There are many causes behind this *de facto* practice. Husserl would say that it depends on the triumphal march of the applied sciences. Deborah Johnson would probably say that the American domination in the Internet is the main cause (Pragmatism has always been American philosophy). We think there are other reasons, too. Attitude education has certainly good possibilities to clarify the ethical background of the Internet. It is certainly necessary, because we all want to be sure that the Internet is going to be working smoothly in the future, and a fair, righteous and democratic Internet is reality. But because of the times we are living in, some of the typical Internet principles (anonymity) and the internationalization/globalization, are not that easy to carry out in reality.

V. SELF-REGULATION AS A HOBBSIAN ENTERPRISE

European Union has started a project, where great emphasis is on the encouragement for self-regulation of the Internet. The Safer Internet plus programme aims at promoting safer use of the Internet and new online technologies, particularly for children, and at fighting against illegal contents and contents unwanted by the end-user, as part of a coherent approach by the European Union. [40]

Behind self-regulation is a desire to promote the functioning of the same set of values and professional ethics. S. Visala states that when the Internet crossed the borders of the scientific community and became a commercial and civic enterprise, the whole gamut of human activities and interests came along. Money, flaming, plagiarism, copying of data files etc. finished the well working self-regulation. [41]

A classical example of self-regulation is the Leviathan of Thomas Hobbes (1588 – 1679). Hobbes described the society that had plunged into anarchy. In such a society the inhabitants can't predict or make plans for the future. Unable to rely indefinitely on their individual powers in the effort to secure livelihood and contentment, Hobbes supposed, human beings join together in the formation of a commonwealth. Thus, the commonwealth as a whole embodies a network of associated contracts and provides for the highest form of social organization. On Hobbes's view, the formation of the commonwealth creates a new, artificial person (the Leviathan) to whom all responsibility for social order and public welfare is entrusted. [42] Leviathan was written during the English Civil War; much of the book is occupied with demonstrating the necessity of a strong central authority to avoid the evil of discord and civil war. The war or anarchy can be compared with the Internet, where there is no executive or legislative bodies.

Patricia Wallace has stated that the Internet and the co-operative groups work effectively and without quarrel or contradictions, if they are homogenous [43]. In this respect

the Internet is full of paradoxes. Globalization shrinks the world and spreads the Internet, but simultaneously the amount of potential troublemakers increases [44].

The Safer Internet project has listed ways to increase the functioning of the Internet with the help of self-regulation. There are certainly many technical devices. But the most important way to improve the working of the net is to increase education and enlightenment. This will also improve self-regulation [45].

VI. CONCLUSIONS

It is obvious that the principles of virtual ethics (cyberethics) can be drawn from traditional ethics. On the other hand, according to the idea presented by Intona [46], electronic mediation is inducing a sense of hyperreality into our world, thus vitiating our ethical sense of being. Then again, Hobbesian Leviathan tells us how the development from an anarchistic state goes on voluntarily towards working operational environments. Here the acquired benefit is bigger than the other values, such as freedom, excitement or possibility to make big and quick profits.

There are some special features which are typical for the Internet, which may inhibit the development of solid sustainable ethical code. One of these characteristics is the fast growth and the hectic nature of the Internet. This is why the concept of de facto ethics is so well suited to describe the real ethical meaning of cyberethics – or is it better to call it a non-ethical theory (a theory that describes practical activity) that defines only technical, goal-oriented activity or goal rationality.

According to Beck [47], the social production of wealth systematically goes hand in hand with the social production of risks. According to him [48], risks and the potential of self-threat have been unleashed on a hitherto unprecedented scale as a consequence of the exponential growth in the forces of production as the process of modernization continues. This is a place for a well founded question: *How can ethical discussion take place, when the consequences of possible risks are well beyond comprehension?* Husserl explains convincingly how the ethical principles in a community “ought” to work. Husserl’s observer, or scientist (philosopher), is situated in the middle of the life flow, bound to the historicity and lifeworlds, and somehow he is able to outline the ethical condition of the culture. Husserl’s idea that we have to redeem our ethical goals over and over again can be seen as a well-defined comment against pragmatism and de facto ethics.

De facto ethics and pragmatism don’t operate on the same level with traditional ethics or ethical code. There are no distinct and unquestionable principles in pragmatism; efficiency, usability and fastness can be seen as one of the main criteria to the activity of good quality (valuable). But it might be so that sometimes it would be useful to study the ethical foundations of all the activities in a society. Husserl’s ideas bring ethical content to the non-ethical environments.

Husserl’s idea about the revaluation of ethical code, goals that had to be evaluated over and over again, is based

on the idea of western rationality, but it certainly conflicts with the ideas of freedom in the different sectors of the society. De facto ethics explains the factual situation in a society that is getting more and more technical all the time. Self-regulation on the other side is a typical way of trying to get the Internet function. Because of Internet’s voluntarily character that has not always been very successful. Many of the different self-regulation projects (The Safer Internet project, information literacy, rules of the computer games) have improved the functionality of at least some of the Internet environments. In self-regulation we can see some kind of eternal return to the times when the pioneer spirit of the Internet was dominant.

De facto ethics makes it possible to describe the factual ethical situation in the Internet; traditional ethics tells us how it should or could be. If we give priority to values like freedom, democracy and equality, there is certainly a big difference between the factual situation and the absolute ideas (ideals, natural values, as described in traditional ethics). The problem in this kind of evaluation is the definition of the absolute values which is important in quantitative research and is called operationalisation: in ethics it is extremely difficult to answer the question “How do I measure what I am interested in studying?”.

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Do Enterprise Systems Enable Supply Chain Integration

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Abstract — Features of ERP systems such as standardized business processes, data integrity, real-time availability, visibility and processing capability of information are expected to create an excellent backdrop for embarking on integration with external partners in the supply chain. This paper reports on the enabling role of ERP systems in achieving supply chain integration from an interpretive case study analysis. Study observed that the organization is slow in embarking on changes to the inter-enterprise processes and not taking full advantage of the high potential. Reasons noted for constraining role of ERP systems in achieving an effective supply chain integration are changes in power and organizational structures, inadequate integration of internal processes, limited flexibility of processes, lack of decision support capability of the ERP system, and general inertia for further changes consequent to ERP implementation. In addition other factors such as supply chain partners inability to take a holistic view, complexity of developing technology interfaces, industry characteristics, and lack of information technology sophistication of the smaller partners are also limiting the potential.

Keywords — Enterprise Systems, Supply Chains, Integration

I. INTRODUCTION

Enterprise Resource Planning (ERP) systems, comprehensive transaction management systems are now in most of the organizations today and has become a defacto standard. Having achieved some level of integration within enterprise by implementing Enterprise Resource Planning (ERP) systems at great cost and efforts, many large organizations have moved on to address the supply chain. In order to leverage all this integrated information into a real competitive advantage and achieve returns on investment in ERP systems, organizations are extending beyond their enterprise. Organizations have realized that it is not possible to achieve successful e-business and supply chain integration without a sound, robust and well integrated back-end enterprise wide information system. After consolidating the gains of internal standardization of processes and integration, organizations are now investigating how they can help them move beyond the enterprise and achieve supply chain efficiencies.

Recognizing the need for further research in this area, this study investigates the role of ERP systems in enabling the supply chain integration using an interpretive case study

approach. It will first present a review of the literature on ERP systems and analyze its strengths and weaknesses in the context of supply chain management. It then briefly explains the research framework and methodology and discusses findings.

II. LITERATURE REVIEW

A. ERP systems and Supply Chains

Integrating information across the enterprise and across the supply chains has long been considered an important strategy to achieve substantial cost efficiencies. Though enterprise resource planning (ERP) systems were considered costly and risky in the 1990s, its benefits are well recognized in the literature. Some of the benefits ERP systems could bring include operational efficiency and reduced costs, enforcing a discipline of best practice processes and consistency [1], [2], [3], [4].

After successfully achieving the benefits of information and process integration across the enterprise globally and improving internal processes, organizations are now examining how these ERP systems can help improve processes across the supply chain. Typical features of enterprise systems such as data integrity, real-time availability, visibility and processing capability of information and standardized business processes are expected to create an excellent backdrop for embarking on integration with external partners in the supply chain [5]. Even though the primary focus of ERP systems was to execute and integrate internally oriented applications such as finance, accounting, manufacturing, order processing and human resources, today, they are considered a critical prerequisite for supply chain integration and e-commerce [6].

In this environment, organizations moving in the direction of supply chain integration have several options. These include, implementation of ERP (Enterprise resource planning) system and SCM (Supply chain management) systems, implementing a full ERP system that has all the capability, to custom-built application integration, or to implement some supply chain management software. Implementing both ERP and SCM systems is the most popular option. After the implementation of enterprise systems, several companies are now concentrating on adding SCM systems. ERP systems are viewed as a precursor to SCM effort and complementary in nature. While the ERP systems aim to integrate and optimize internal business processes within the organizations, the

SCM systems take a broader approach and facilitate integration of processes across the enterprise. The focus of ERP system is on transactions, while the SCM offers intelligent decision support. ERP systems store data about all events in the sourcing, production and delivery cycle, and act as integrators of SCM systems. Together, they can position the organization for effective management of the supply chain.

SCM software solutions such as i2, Manugistics etc. can increase the speed and accuracy in planning and scheduling by concurrently managing the constraints across the supply chain [7]. Drawing its resources and transactional data from enterprise systems, these SCM systems can dynamically take into consideration the constraints imposed by customers, markets and suppliers and can support the decision processes in supply chain with their modeling and analytical capability.

While transaction centric ERP systems provide some tools that can support supply chain integration, some of their features could also obstruct integration with business partners [8]. Internal process integration and real-time information visibility and tracking are the most important tools a transaction-centric ERP systems offer to support supply chain integration with business partners [8]. The unwillingness of business partners to share information, however, may actually obstruct the integration even though ERP system offers opportunities for sharing of information about demand, products and production.

B. Information Overload

Large volumes of transaction based planning and operational data generated and stored by ERP system could be useful for planning and demand management. ERP systems, while providing good transactional engine for operational control, tend to increase the volume of information available to managers [9]. Thus, too much information in overwhelming detail, may contribute to information overload. This information, however, is about the internal processes and internal supply chain. Information sharing and transfer from the other partners, external supply chain information and the product demand and planning information may actually may further intensify the information overload.

C. Data Reliability and Controls

Right operational data to move onto the next level of collaborative planning in supply chain is critical. If the system cannot find basic control and operational data to feed into planning model, the intra-enterprise planning becomes irrelevant. The multi-enterprise collaborative planning is almost impossible in such a situation where even basic operational data is not available. Despite the latest systems, absence of control data and reliability of the data are considered main barriers for an effective supply chain [10]. In this context, ERP system provides operational data that is consistent, accurate and real-time.

Enterprise systems generally have the ability to streamline the entire financial and operational reporting process, without any need for traditional batch controls and

audit trails. In a supply chain context where information is shared and transferred among the partners, data integrity is critical. The risk for data accuracy and integrity in an ERP enabled environment may still exist because of the close interfaces with other business partners.

Unless there are special data cleansing programs incorporated in the ERP systems, it is not possible to guarantee accuracy and currency of the operational data. Even though ERP software vendors incorporated software features that will ensure data entry accuracy and cross-checking of the validity of data, and specified user views of data, the risk may still exist.

Reliability of data is the key to the effective and successful collaboration between supply chain partners. Reliability of data, on the customer side, involves attributes such as deliverability, quality, service, and agility. On the supplier side, reliability means reliable forecast and sharing data with vendors. Because of their real-time orientation, enterprise systems are more dependent upon programmed controls than on human intervention to validate important transactions. This risk is further exacerbated by the elimination of several supervisory roles and control roles as a result of implementing enterprise systems. In many instances, the organizations are dependent on one or two individuals for their critical data.

The issue becomes critical in a supply chain context since this information is the basis on which partners in the supply chain make decisions and carry out collaborative planning. Importantly, in an environment where 'trust' is critical in initial stages, lack of reliability of the operational data that is routinely shared by the partners may endanger the potential collaborations and the eventual supply chain integration.

D. Internal Integration

Since most of the claimed benefits of ERP systems over legacy systems and best-of-breed systems arise from the integration of information across functional areas, the ability to extract benefits will be reduced if only a limited set of ERP modules are implemented. Evidence from the field suggests that the so-called integration is not full and complete even in organizations where full implementation has reportedly taken place [11].

In certain organizations where only two or three modules are implemented for whatever reasons, the level of integration, and therefore the extent of the visibility and accessibility of the information across the organization, is limited. If information integration is not achieved because of limited implementation, then all potential benefits of ERP systems should not be expected, including that of improved managerial decision-making. If internal integration itself is not completely achieved, the potential to extend that integration of information and processes across the enterprise is also low.

E. Decision Support Capability

ERP systems, because of their transaction-centric nature, have traditionally inadequate or limited capability to support decision-making in organizations. Even though

increased transaction processing efficiencies, higher quality information and greater accessibility of information, and greater support for ad hoc reporting were identified as some of the benefits of implementing ERP, very little impact on the business analysis and decision support areas was noticed in the past research [12]. Recognizing and acknowledging this weakness, several major ERP software vendors have started offering extension products such as Advanced Planning and Scheduling (APS), Supply Chain Management (SCM), Customer Relationship Management (CRM), Product Life cycle Management (PLM), Business intelligence Warehousing (BW) etc that offer decision support capability.

Organizations are increasingly 'bolting-on' such extensions on top of existing ERP system and deriving the powerful decision support capability [13]. For example, SAP, even in their recent 'mySAP ERP' all-in-one solution, has incorporated new reporting functionality in the form of 'Business Analytics' to their new customers in the mid-market. These developments explicitly signal that ERP systems by themselves have limited capacities to meet such needs, and software vendors are offering additional tools and solutions to support decision-making capability. As noted by Holsapple & Sena, the increase in such third party offerings and extensions to ERP systems by the major software vendors reflects the weakness of ERP systems in delivering unstructured decision support benefits [14].

F. Lack of Open Technologies and Architecture

ERP systems were originally intended to replace a multitude of legacy systems. Even though the later versions are now 'web-enabled,' the emphasis is still on the integrated architecture. This lack of open component based ERP system architecture in a dynamic supply chain management context may become its weakness [15].

With concerted move by almost all the major software vendors towards open integration technologies, acceptance of XML standards for document exchange and conversion, steady move towards web services standards and service-oriented architecture for technology, process and information integration, it is now feasible to extend the capability of enterprise systems to deal with external partners and achieve supply chain efficiencies. Technologies such as Web services would allow applications interactions across organizational boundaries economically and incrementally. With Service Oriented Architecture (SOA) as its underlying philosophy, Web services are expected to transform the inter-organizational business transactions in future [16]. These Web services, designed to support application-to-application interaction without human assistance, can be accessed by disparate devices from handheld devices to large servers. In supply chain management context, flexibility in business processes is critical. Web services that will allow loose coupling of business processes, allow the organization to mix and match their offerings without making large investments in change management [16].

G. Process Standards and Open Technologies

The moves by various industry groups and organizations towards development and acceptance of process management standards for different industries are expected to make process and information integration between partners in supply chain easier [17].

Some of the process activity standards popular in the industry are 'SCOR' (Supply Chain Operations Reference Model by Supply Chain Council) for manufacturing supply chains, DCOR/VCOR (Design Chain Operations Reference model for design and Value Chain Operations Reference model for value chains), eTOM in telecom industry, ITIL (Information Technology Infrastructure Library) for information technology industry, SEI (Software Engineering Implementation) capability maturity model for software industry etc. are expected to make process and information integration between the enterprises easier [17].

Recent developments of modern business process modeling and management tools such as PetriNets, eBRL, and several workflow modeling tools and languages are also expected to contribute to the full exploitation of the ERP systems' potential that is so far untapped.

H. Other Challenges

In spite of such exciting developments in technologies, standards and tools, several barriers are still apparent. For example correct implementation of ERP system is considered important pre-requisite for integrating supply chain. Without a properly functioning ERP system, supply chain integration may create more upstream and downstream problems at Internet speed [18]. The dynamic changing nature of supply chain, extent of change required in organisational culture, trust and understanding between partners, lack of standardized approaches to sharing information and knowledge, differences in technology investments between partners, implementation of SCORE and/or other modeling methodologies or lack of it, availability of relatively less expensive 'bolt-ons', the extent of internal integration of processes and data, problems with the continuous usage of legacy systems and other managerial factors pose new challenges and raises new questions.

III. RESEARCH FRAMEWORK AND METHODOLOGY

A. Research Framework and Significance

Academic and industry literature reported significant benefits of implementing ERP systems that include process improvements, standardized processes, information and data discipline [19]. However, research on how firms are extending and exploiting the capabilities of their enterprise systems beyond their enterprise is inadequate [20], [6].

Based on a comprehensive review of the research on ERP systems, Cumbie and others, identified the paucity of studies in supply chain context [21]. Burgess and Houghton on a study of the effectiveness of ERP systems in generating innovations in supply chain management pointed out the overwhelmingly positivist research that

generally ignored the social component, which is important in supply chain management context [22]. Research in supply chain management, by its nature is multidisciplinary and the research in the past generally lacked pluralist perspectives [22].

While some past studies have investigated the benefits and potential impact of ES on various organizational dimensions, processes and supply chains using quantitative methods, interpretive case studies that investigated the role of ERP systems in enabling supply chain integration are limited. Based on a Delphi study conducted on the future impact of ERP systems on Supply Chain Management (SCM), Akkermans and others have predicted a modest role for ERP systems. They have cautioned that “one should not expect too much from ERP for SCM in extended enterprises” and suggested further academic research on the business impact of ERP systems [23].

Especially in case of medium-sized enterprises or subsidiaries of large companies that are typically found in Australian context, the problems and challenges confronted by them in implementing IT-enabled innovations could be different. While the Internet has facilitated a shift towards dynamic communication with supply chain partners, the complexity of integrating the supply chains poses an enormous challenge to organizations in general, and medium sized enterprises in particular.

Studies on other IT-enabled innovations such as e-Commerce adoption and other information systems adoption, have consistently pointed out at the unique challenges faced by SMEs [24]. After improving internal processes through ERP, organizations are now examining how ERP systems and Internet can help them improve processes across the supply chain.

To take advantage of the supply chain management systems and thereby manage technology and processes well, organizations must ensure that their own ERP systems are correctly implemented. In an environment where the ERP system is not well implemented with full integration of internal processes and information, embarking on supply chain integration may actually create upstream and downstream problems at Internet speed [18]. It is not clear whether the enterprise systems are contributing to the process improvements at the supply chain level and its performance. While generic observations are made in terms of the potential benefits of such attempts, no evidence is available yet that explains how these systems are facilitating or hindering supply chain integration. This paper reports the work-in-progress research that investigates the role of enterprise systems in supply chain integration, with particular focus on medium sized enterprises. Thus the underlying research questions are:

1. How do enterprise resource planning systems facilitate improvement in supply chain management and integration in medium-sized enterprises?
2. What are the limitations of ERP systems in achieving such improvements in supply chain management and integration?

B. Research Methodology

In view of the exploratory nature of the work, a case study method that involves an interpretive approach is adopted to capture the corresponding contextual richness and complexity [25]. When the research involves ‘what’ and ‘how’ type of questions investigating the real life phenomenon where the boundaries between the context and phenomenon are not clearly understood, exploratory case study method is considered appropriate [25]. Using a case study approach, this research aims to explain the enabling and/or disabling role of enterprise systems in organisational attempts to achieve improvement in their supply chain management and integration.

Given the nature of questions, in-depth interviews based on the perceptions, views and experiences of the key individuals in the organization are considered more insightful. The theoretical propositions to be developed in this study based on case study analysis will be later validated using a larger questionnaire survey and further case studies. Findings of this exploratory study will lead to several theoretical propositions/hypotheses and identification of various variables contributing and/or hindering supply chain integration.

This study offers rich insights into the effects and influence of enterprise systems and the factors influencing the preparedness of organizations that are embarking on supply chain integration. Though anecdotal, the outcomes of this study will help managers in maximizing the benefits of enterprise systems and in achieving measurable supply chain performance improvements. The knowledge thus gained would assist the organizations in deriving better return on significant investments already made on enterprise systems and extended enterprise systems/supply chain management systems.

In accordance with the recommended qualitative research practice [26], data analysis was conducted in parallel with data collection, allowing each process to inform the other. The objective of initial analysis was to understand the participants’ perception of the issues.

Using semi-structured in-depth interviews with key respondents, primary data is collected in this study. The participants included managers who were responsible for implementation of the enterprise system and supply chain management initiative and functional experts/operations managers who were responsible for managing the processes.

A total of five managers were interviewed in this study. Interviews were approximately 90 minutes each. Permission to conduct the study was negotiated with the senior management who authorized interviews to begin. The interviews were recorded using the tape recorder with prior permission from the respondents. Detailed manuscripts of the interviews are being transcribed from the tapes and saved for further analysis.

A list of topics drawn from the literature briefly discussed earlier was used as an interview guide that collects information on the role played by the ERP systems in enabling or limiting the supply chain management and

integration.

In this context, respondents were asked to explain the impact of each of the main features of their ERP systems on their objective of achieving supply chain integration and improving supply chain efficiencies. Some of the issues considered for data collection include the role of best practice business processes embedded in ERP systems, software and process fit achieved by their company, real-time visibility of information, ability of ERP systems to adopt to changing supply chain needs, adequacy of ERP functionality for decision support and standardization of processes and information.

As is typical in any case study research, this study had limitations, including lack of generalizability and subjective bias [25], [26]. The findings of this study were specific to the situation observed and provide anecdotal evidence. Although the organization was accessible for research, the extent of cooperation from different respondents in the organization was not uniform, and the respondents may have either overrated or underrated the impact of ERP systems [27]. Even though this company had had an ERP system in place for more than two years at the time of the study, it was possible that the potential impact of these systems on supply chain integration and management are predicted by the managers based on their perception and planning, and could become apparent only after a relatively long period of time [27], [28]. Further, the limitations of studying a complex decision-making phenomenon influenced by the emotions, imagination and memories of decision-makers, the difficulty in isolating decision processes, and the difficulty in pinning down decision choices in time or in place, render it a complex subject for empirical research [27], [26].

The limitations discussed above could thus have influenced the process as well as the outcomes of this study. However, these limitations are unlikely to have affected the validity and reliability of the outcomes significantly because the objective of the study was not to generalize, but to provide anecdotal evidence.

C. Case Study Organization Background

A business unit of a large manufacturing organization was selected for this study. This unit employs about 160 staff. It is a part of a large manufacturing group that has several plants, distribution centers and other facilities throughout Australia and Asia-Pacific region and employs about 2000 employees overall. The company manufactures several products required for the construction & mining industry and has several trading enterprises and product divisions. It has both large businesses, small & medium sized enterprises (SMEs) and small individual contractors as its suppliers. In 2001-2002, SAP R/3 was implemented in this unit. Later on Supply Chain Management application software was also installed in 2003.

When the field study was conducted in 2004/2005, this unit already had some experience of working with the ERP system and its supply chain management extension. The objective for implementing the ERP then was to streamline and standardize their internal processes and information management practices and facilitate better control and management. The supply

chain management initiative was primarily implemented in order to improve their demand management and supply efficiencies. This organization was selected because of the access given to the researcher, its implementation of several modules, and therefore it's potentially rich organizational context to study the role of enterprise systems in enabling supply chain integration.

IV. ANALYSIS AND FINDINGS

Although largely anecdotal, interpretative in nature and limited to one case study organization, the findings in this study, because of their rich contextual nature, provide some insights into the opportunities, implications and limitations of ERP implementation in achieving supply integration. The study findings, some of them expected, confirm some of the past research findings and contribute to the knowledge in a modest way. A brief discussion of the key findings is presented below.

A. Standardization of Processes.

Study observed that the implementation of enterprise systems and the resultant standardization of business processes and information across the organization generally prepared the organizations better for supply chain integration. The case study organization appears to have taken a pragmatic approach with regard to the return on investment in ERP and SCM systems and believed that the real benefits will flow through in time. Even though there are some initial benefits such as process standardization, data consistency, and information visibility across the enterprise, there are no discernable benefits on the enterprise bottom line such as profitability and no visible direct cause and effect relationships between ERP implementation and profitability.

ERP system through its embedded best practice processes enforces internal processes. In time, with most of the business organizations having an ERP system in place, ERP system is expected to facilitate harmonized processes across the supply chain and access to consistent high quality single source of data.

B. Lack of Flexibility

An information system must be able to change dynamically in line with the changing customer needs in terms of product variety, volumes and demand. Management is aware of the limitations an ERP best practice business processes bring in. After investing significant amount of time and effort for implementing the new processes embedded in ERP software solutions and training the employees for managing and executing the processes, the management is reluctant to even consider changing the processes to meet the supply chain management needs. Supply chain integration is generally facilitated by enabling technologies as well as by the redesigning of inter-enterprise processes. By locking in the business processes with the implementation of ERP systems, the management consciously agreed to compromise the potential

improvements in the supply chain efficiencies by redesigning some of the inter-enterprise processes.

C. Change Management Implications

Managers believed that achieving internal process integration by implementing ERP systems gave them and the organization an important change management experience. However, it also appears to have resulted in some consequent inertia to embark on any further changes in the supply chain processes. The changes to the power and organizational structures consequent to the ERP implementation have made some managerial roles more powerful than others, and they are effecting these further changes to processes. In general, organization appears to be very slow and careful in embarking on the changes to the inter-enterprise processes after an ERP implementation.

D. Powerful Partners

Powerful partner in their supply chain appear to be playing a significant role in determining the supply chain integration and management decisions. In some cases, where the major customers are powerful players in the industry, their decision as to the extent and nature of information and process integration is a powerful factor influencing the medium-sized enterprise. This case study organization is skeptical about going ahead on their own in selecting and implementing the technologies, inter-enterprise processes and standards and in investing time and money while their major customer and/or supplier may steer them in a different direction.

E. Lack of Decision Support Capability

ERP system improved operational decision making within the case study organization. Centralization of information, and increase in visibility and accessibility of information across the organization, facilitated by the ERP system have contributed to improvements in operational decision-making. In particular, it resulted in improved degree of control, standardization and managerial monitoring of the operational performance and resulted in improvements in organizational performance. Most of these decisions, however, are still very much on the internal supply chains. For example, the 'Available To Promise (ATP)' check in a web-enabled ERP environment can be performed in real-time and the customer inquiry can be answered about the availability of the product. ERP system, however, does not have capability to analyze the profitability of that order instantaneously before the sales person answers customer inquiry. Thus, the ERP system, in its present state, does not offer any additional decision support capability in managing the supply chain and/or in improving the supply chain efficiencies.

F. Technology

Despite the evident advantages and advances in technology, integrating the supply chain is still considered a complex task by the case study organization. The sheer complexity of developing interfaces with external partners, general reluctance of their supply chain partners to invest in

money and time, and the trust related issues have all been cited as reasons for not achieving sufficient progress. The extended ERP systems in terms of Supply Chain Management (SCM) systems software solutions, advocated by the ERP vendor, may appear to be offering the additional functionality.

The management, however, believes that such extended functionality may again be constrained because of the additional investments in information technology required to create and manage interfaces with partner systems from time to time. The adoption of SCOR (Supply Chain Operations Reference) model, a process reference model developed by the Supply Chain Council (SCC) for manufacturing industry, appears to be at least helping this organization in developing a consistent process descriptions and structure independent of software platforms along with the frameworks for their relationships, metrics, and management practices. Though the impact and influence of such initiative is still not known and uncertain, the case study organization is hopeful of achieving higher level of integration with their major business partners in future.

G. Insufficient Integration

Insufficient integration of internal processes even after implementing ERP system is one of the major problem hindering the supply chain process improvements and integration. Selective and limited implementation of application modules and limited access to the managerial and operating staff because of cost implications are reportedly contributing to lack of full integration among internal business processes.

Integration and standardization of internal processes and information enabled by implementing ERP systems have certainly created uniform information flows, process structures and data models in this case study organization and therefore may help the company achieve dynamic supply chain configuration and integration easier in future.

V. CONCLUSIONS

Though ERP systems and other information and communication technology infrastructure have facilitated transparency and transfer of information across the supply chain, supply chain collaboration and integration is complex and challenging. Creating effective partnerships between several businesses is a complex thing and requires holistic and systemic view of the supply chain by all the partners. ERP systems were not designed just to support supply chain management and integration across multiple enterprises.

Lack of advanced decision support capabilities, lack of process flexibility in adapting to changing supply chain configurations and needs, inadequacy of technology interfaces to extend the ERP systems, and other change management implications, typical in an ERP-enabled environment, appear to be limiting the enabling role they can potentially play in achieving supply chain integration. In a way, ERP system may thus become a strategic disadvantage in network based economy dominated by the

supply chains rather than individual enterprises.

Integration of processes across the supply chain is just not connecting a series of internal processes across partner organizations. It is necessary to take a holistic view spanning the enterprises across and design these inter-enterprise processes rather than simply connecting them from one enterprise to another. ERP systems thus in its current state appears to have a modest role to play in achieving supply chain integration. The open, modular,

component based ERP systems with service oriented architecture and web services standards, expected to come in future, may facilitate better interfacing of disparate ERP systems and IT infrastructure components and help achieving easier integration of supply chain partners.

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E-Banking Integrated Data Utilization Platform WINBANK Case Study

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Abstract — we all are living in information society. Companies and Organizations have many information networks. But when we talk about information, we talk about a wide notion. Scope of modern organizations is not only having data. Their target is to gain competitive advantages from them. The basic means to achieve their target are the use of modern and steady methodologies and systems depend on them, in order to find hidden patterns or models. Our platform is an innovative one. We specify our methodology taking into account human factor and we build an integrated data utilization system. In the next paragraphs, we introduce our techniques and system.

Keywords — e-banking, knowledge utilization, data mining, internet banking fraud detection.

I. INTRODUCTION

Electronic banking adoption is grown rapidly the last years. E-Banking nowadays offers a complete range of services and products facilitating not only the retail customers but also institutional ones to conduct their transactions easily and securely [1].

WINBANK is the electronic banking division of Piraeus Bank. This unit is responsible for bank's alternative channels, such as internet banking, mobile banking, phone banking and ATMs. WINBANK has the most innovative electronic services in Greek e-banking market and keeps a very strong portfolio of services in comparison with other banks worldwide.

Last year WINBANK took winning prize in all awards which participated in. Those prizes prove WINBANK's leadership in electronic banking market.

Apart from prizes, increasing customer satisfaction annually certifies leading position. Those factors increase our concern and make us working harder in order to keep top quality of our services and customer satisfaction in high level.

WINBANK's big challenge was data and knowledge utilization [10, 11, 14, 15]. From this point of view, we designed, implemented and established in-house two major systems. The first one is for knowledge utilization in order to gain advantages both bank and customers. The second one is for data utilization in order to detect and prevent internet banking fraud.

In the next sections we describe briefly our integrated data utilization platform. Section 2 contains K.R.I.O.S.

system and its use, while in section 3 internet banking fraud detection system is described. Finally section 4 contains the impacts of our integrated platform.

II. WINBANK K.R.I.O.S. SYSTEM

K.R.I.O.S. is an innovative smart knowledge returning system [3]. The system has dual goal (Figure 1). It serves winbank's business needs, but it is also serves our customer.

We take advantage from K.R.I.O.S. in order to build a steady and healthy relationship with users. As a first step we offer personalized services for each user. Moreover, taking into account many parameters, our internet banking service returns knowledge to user during his/her navigation in our site.

In order to implement the main functions of the systems, there are many cooperating parts of K.R.I.O.S (Figure 2). These parts are:

Data Warehouse: All electronic transactions (both informational and financial), all transactions from other channels (cashier, ATMs, Automatic Payment Systems, etc.) and web log from secure internet banking site are stored in Data Warehouse. All this information is updated in weekly basis.

Modeler: Modeler is the subsystem which consist data mining [12], business intelligence, predictive analytics and ETL (Extract-Transform-Load) tools. This subsystem is responsible for data processing. In addition, modeler creates and educates models and patterns [4, 5, 6], which, in most cases, stored in Knowledge Base.

Knowledge Base: Our Knowledge Base is the main knowledge repository. Every single information represented to users, is exported from this Base. Knowledge Base is updated from Data Warehouse, Modeler and User's interaction.

Smart Agent (optional): This is an optional tool. Its usefulness based on contributing in a more friendly and familiar interface.

III. WINBANK FRAUD DETECTION SYSTEM

WINBANK takes into consideration all parameters which lead in internet banking fraud. Analysts established many detection rules [9]. Apart from the initial ones, new rules are added, when analysis finds out suspect patterns [16] and behaviors. Those rules enhanced in an offline fraud detection system [2].

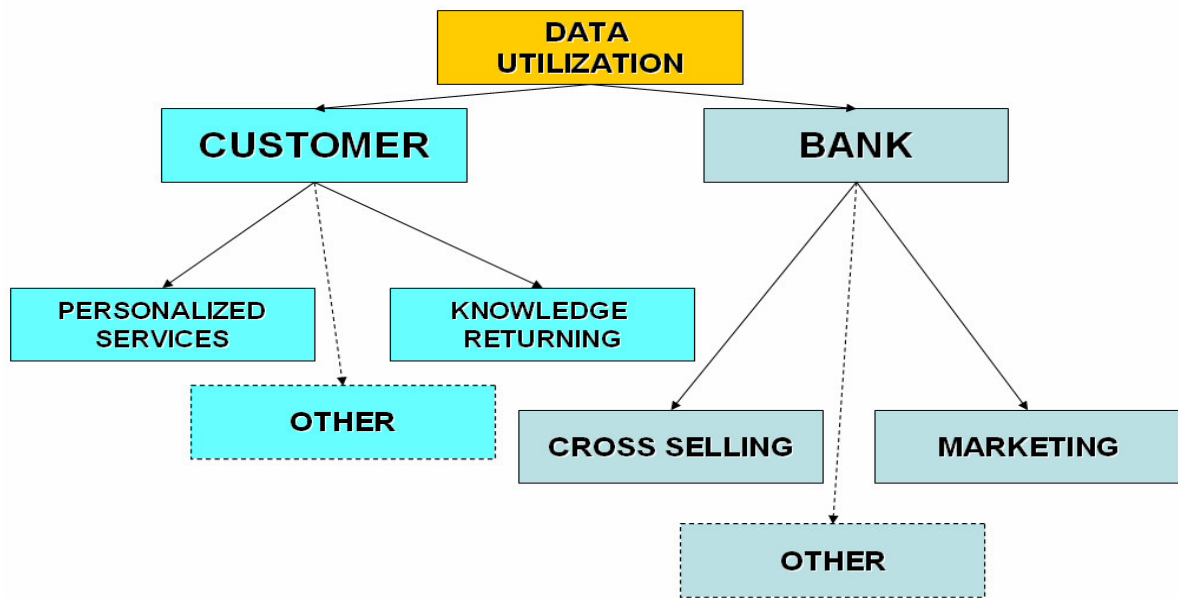


FIGURE 1 – System's Dual Goal

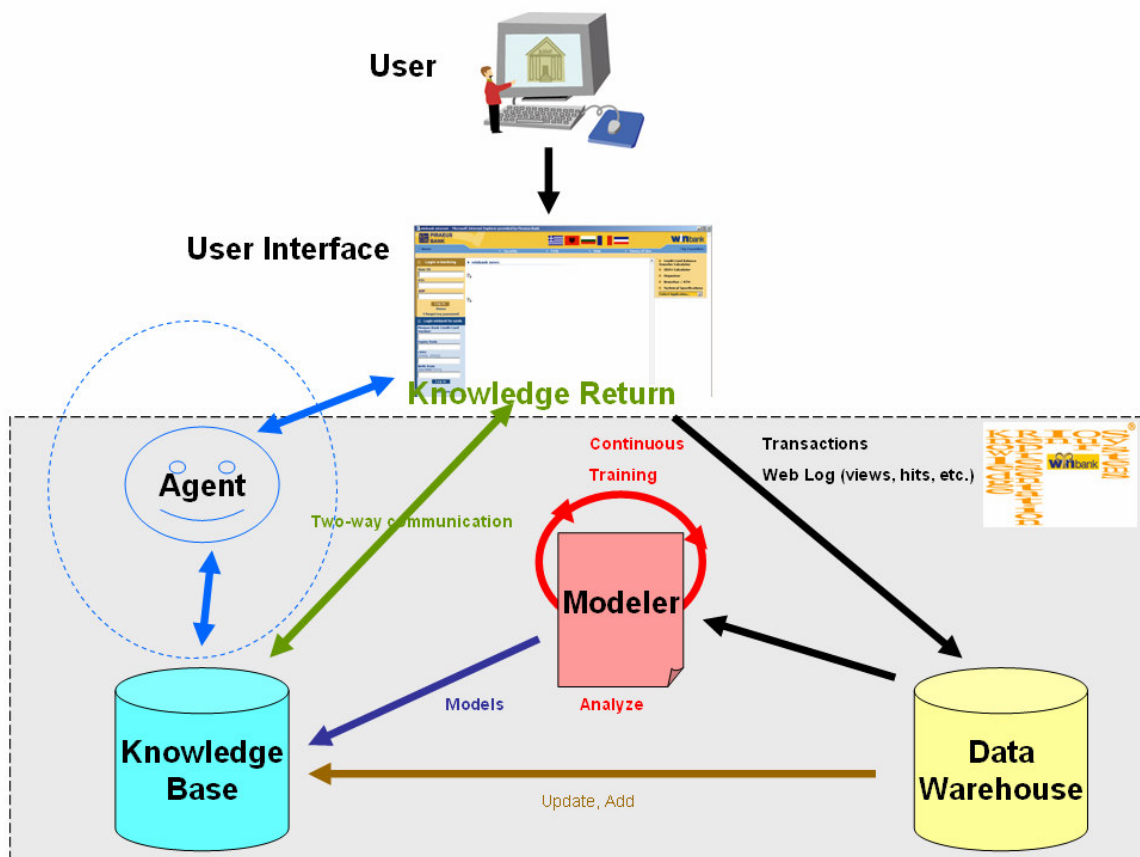


FIGURE 2 – WINBANK K.R.I.O.S.

System is offline because of its database update. New data are imported in database in constant time frames, not in real time. For time being there is no immediate need to upgrade system in online mode.

Analysis, design and implementation of the system took part in-house. Due to the bank's data sensitivity, one of the prerequisites was in-house set up and function of such system. Data mining [8] and predictive analytics tools contributed in all phases of project and they are part of the system.

Pilot operation period proved system's reliability, accuracy and success. Moreover pilot period helped bank scanning system's bugs, faults and defects. After that period, fraud detection system began to operate in production environment.

Figure 3 shows the fraud detection daily process

Suspect transactions are graduated. Accordingly to their risk, they are signed as high, medium and low risk (Figure 4). Probability of fraud is very low, less than 1% [7]. So the great majority of suspect transactions are not fraudulent. Nevertheless, bank obligates to search all suspect transactions (Figure 5).

Apparently the final target is the online implementation of above described system.

IV. IMPACTS

K.R.I.O.S. [3] offers advantages as the following:

- Good knowledge of the relationships [4, 13] between different types of electronic transactions.
 - Description and establishment of most popular internet transactions
 - The electronic services become more easily familiar to the public since specific groups of customers are approached, that uses specific payment manners.
 - Customer approach is well designed with higher possibility of successful engagement.
 - The improvement of already offered bank services is classified as to those used more frequently.
 - Redesign internet transaction structures for those which used rarely
 - Reconsidering of the usefulness of products exhibiting little or no contribution to the rules.
 - Personalized menus through preference mining
 - Customer views returning information via internet banking site
- In the other hand, offline internet banking fraud detection system [2] offers many benefits to both bank and customers.
- Fraud detection system gives added value to e-banking. Especially, nowadays, where fraudsters' attacks are increased considerably in our country, such system differentiate bank owner from other bank competitors.
 - Bank takes lead. Such in-house system implementations, which are set up for customer benefit, are infrequent in local market.
 - Fraud detection system indicates quality of e-banking services. Quality depends on user friendly interface, on a full of electronic transactions portfolio, but also depends on user protection and guarantee.
 - A significant number of users have the sense of care and protection from their bank. This sense helps customer loyalty escalation.
 - Official fraud victims informed from the bank itself as soon as fraud detected. Customers feel that their bank stands by them and that fact strengthens mutual relation.



FIGURE 3 – Fraud detection daily process

RAUD ALARM

MARTIOS

ΥΠΟΠΤΗ ΣΥΜΠΕΡΙΦΟΡΑ

ΣΤΟΙΧΕΙΑ ΧΡΗΣΤΗ ΜΕ ΥΠΟΠΤΗ ΣΥΜΠΕΡΙΦΟΡΑ

ΜΗΝΙΑΙΑ ΣΤΟΙΧΕΙΑ ΧΡΗΣΤΗ

Χρώμα	Κατάσταση	Χρόνος	Username	Πλήθος εγκρισιών ημερών με ύποπτη συμπεριφορά	Συνολικό Ποσό έσοπων συμπεριφορά	Ημερήσιος Μ.Ο. ποσού έσοπων συμπεριφορά	Πλήθος λογισμικών υποδοχής	Τύπος συναλλαγής	Μηνιαίο Πλήθος συναλλαγών	Συνολικό Μηνιαίο Ποσό	Μ.Ο. ημερήσιος ποσού συναλλαγών	Μ.Ο. ποσού συναλλαγών
ALARM	1st time			2	1.150,00 €	575,00 €	1	Πληρωμή σε τρίτους Εντός Τρ.Παραϊκός	2	1.150,00 €	1,000	575,00 €
ALARM	1st time			3	1.800,00 €	600,00 €	0	Online Εμβάσματα	3	1.800,00 €	1,500	600,00 €
ALARM	1st time			2	1.200,00 €	600,00 €	1	Πληρωμή σε τρίτους Εντός Τρ.Παραϊκός	2	1.200,00 €	1,000	600,00 €
ALARM				4	2.400,00 €	600,00 €	0	Online Εμβάσματα	4	2.400,00 €	2,000	600,00 €
ALARM	1st time			3	1.800,00 €	600,00 €	1	Πληρωμή σε τρίτους Εντός Τρ.Παραϊκός	3	1.800,00 €	1,500	600,00 €
ALARM				10	6.000,00 €	600,00 €	1	Πληρωμή σε τρίτους Εντός Τρ.Παραϊκός	10	6.000,00 €	5,000	600,00 €
ALARM	1st time			2	1.200,00 €	600,00 €	0	Online Εμβάσματα	2	1.200,00 €	1,000	600,00 €
ALARM	1st time			2	1.200,00 €	600,00 €	0	Online Εμβάσματα	2	1.200,00 €	1,000	600,00 €
ALARM	1st time			3	1.800,00 €	600,00 €	0	Online Εμβάσματα	3	1.800,00 €	1,500	600,00 €
ALARM	1st time			2	1.190,00 €	595,00 €	0	Online Εμβάσματα	2	1.190,00 €	1,000	595,00 €
ALARM				4	2.400,00 €	600,00 €	0	Πληρωμή Πιστωτικής Κάρτας άλλης Τράπεζας	4	2.400,00 €	2,000	600,00 €
ALARM	1st time			3	1.800,00 €	600,00 €	1	Πληρωμή σε τρίτους Εντός Τρ.Παραϊκός	4	2.300,00 €	2,000	575,00 €
ALARM				2	1.200,00 €	600,00 €	1	Πληρωμή σε τρίτους Εντός Τρ.Παραϊκός	2	1.200,00 €	1,000	600,00 €

Double click στο username για ανάλυση κινήσεων

Πλήθος usernames με ύποπτη συμπεριφορά: 30

Record: 14 of 30

FIGURE 4 – Main fraud detection report

ALARM 1st time

11 6.467,00 € 587,91 € 1 Πληρωμή σε τρίτους Εντός Τρ.Παραϊκός 11 6.467,00 € 0,367 587,91 €

FRAUD DETECTION

ANALYSE SYNALLAGON

Crs Id

Username

Τύπος συναλλαγής

Πληρωμή σε τρίτους Εντός Τρ.Παραϊκός

FRAUD!!!

Κωδικός συν/γής	Ημερομηνία	Ώρα	Ποσό	Λογ. Χρέωσης	Λογ. Πίστωσης	Client IP	Χώρα Προέλευσης
70340109	06.09/2005	00:22	570,00 €			82.40.75.124	UNITED KINGDOM
70700573	08.09/2005	22:07	587,00 €			82.73.69.40	NETHERLANDS
70833330	10.09/2005	21:00	590,00 €			84.68.167.11	UNITED KINGDOM
70853745	11.09/2005	21:52	589,00 €			85.68.223.69	FRANCE
70910757	12.09/2005	12:25	594,00 €			150.214.199.30	EUROPEAN UNION
71082537	13.09/2005	22:10	593,00 €			217.216.62.196	SPAIN
71282525	15.09/2005	14:27	596,00 €			24.182.249.50	UNITED STATES
71383305	16.09/2005	12:59	579,00 €			82.32.92.9	UNITED KINGDOM
71457453	17.09/2005	18:02	591,00 €			82.73.69.40	NETHERLANDS
71478876	18.09/2005	17:51	589,00 €			216.239.65.226	CANADA
71543715	19.09/2005	12:15	589,00 €			217.216.61.38	SPAIN

Record: 1 of 11

FIGURE 5 – Fraud detection specific report

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Effect of Knowledge on Organizational Change

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Abstract — Knowledge is nowadays considered to be the main source of competitiveness in many companies. Knowledge may also be the facilitator of organizational change, and thereby, contribute indirectly to the competitiveness. Organizational change is, however, a broad concept and it is examined from many perspectives in multiple disciplines. Therefore, the aim of this theoretical paper is to analyze and categorize concepts, theories and models of organizational change. This paper also provides some preliminary views of what is the role of knowledge for changes in organizations. Based on a literature review, change is categorized based on the theory (selection, adaptation, or co-evolution), intentionality (planned or emergent), and the type or magnitude of change. Knowledge forms and processes are proposed to be seen as a facilitator of incremental and radical changes.

Keywords — Organizational change, Incremental change, Radical change, Knowledge.

I. INTRODUCTION

Knowledge may affect an organization's ability to change and improve its competitiveness. Studies of learning organizations and continuous innovations have underlined the importance of knowledge, but it is yet, however, unclear how knowledge and change are related in a bigger picture. For example, does an organization that has a great amount of organizational knowledge change more efficiently than one that does not have much knowledge? So, the question is, in what way may knowledge facilitate changes in an organization, or has it any influence on change at all? These questions are relevant for organizations operating in dynamic environments, especially if their business activities are largely based on the use and production of knowledge. In order to sustain competitiveness, they should also be able to change when needed.

Organizational change is, however, a broad concept and it is examined from various perspectives in multiple disciplines. For example, learning and innovation in organizations are popular topics nowadays, but change is conceptualized in different ways in them. Therefore, this paper has two objectives. First, it aims at analyzing and categorizing concepts, theories and models of organizational change, in order to have better understanding about change. Secondly, to examine the role of knowledge, this paper provides some preliminary views of the question *what is the role of knowledge as a*

facilitator for organizational changes. Although the main focus is in theories and types of change, the issues of maintenance and decline are also shortly discussed.

This study is a conceptual analysis, and it is based on a literature review. Thus, the paper is theoretical and it aims at describing and categorizing the phenomena and the concepts of the issue. Literature review was carried out in the fall 2005. The material for this study has been gathered through library databases of Tampere University of Technology. The research material consists of books, journals and doctoral dissertations. The value of this paper is that it combines both knowledge management and change theories in general, and offers help to both practitioners and researchers in understanding the area.

This paper is organized as follows. In the beginning, a brief review of organizational change is presented, including several theories and models of organizational change. After that, forms and processes of organizational knowledge are presented, as well as some conclusions about how knowledge may generate change in organizations are provided. Finally, the summary is presented.

II. TYPOLOGIES OF ORGANIZATIONAL CHANGE

Organizational change has its theoretical roots in sociology, business economics and strategy, and organization theory. Many concepts and theories for organizational change are also borrowed from other disciplines, such as child development and evolutionary biology and therefore, theoretical approaches and concepts are multiple [1]. For example, concepts of 'development', 'renewal', 'transition', 'transformation', 'learning', 'innovation', and 'decline' all explain changes but in various ways. These terms can be considered as synonyms or sub-concepts of organizational change. Change can refer to continuous renewal of existing condition or to a transformation to entirely new condition. As a concept, the term 'change' is neutral: it can describe change in both good (improvement) and bad (decline).

According to Van de Ven and Poole [1], the term 'change' refers to an observed "difference in form, quality, or state over time in an organizational entity," such as an individual's job, a work group, strategy, a product, or the overall organization. Also Hildén [2] emphasizes that organizational change is "the realized difference in one or more sub-systems, such as structures, processes, information systems, culture, social capital, or competence." These definitions view change from the outcome point of view. However, organizational change

can also be seen as a process where an organization changes from a current state to a wanted future state in order to increase, for example, its competitiveness or flexibility. With the goals of change, an organization usually aims at new or improved ways of using its resources and competences. This approach to planned change usually describes multiple stages of how change is being executed in organizations and what actions and roles are involved (see, e.g., [3]; [4]).

In addition to outcome and process views of change, organizational change can be examined from several dimensions, such as the content, magnitude, or tempo of change (see, e.g., [5]). Changes can also occur in different grades in organization, i.e., change may take place within an organization which itself remains unchanged (first-order change) or change involves a variation whose occurrence changes an organization itself (second-order change) [3].

To gain better understanding about the why and how of organizational change, this paper aims at describing several theories and models. These are presented next.

A. Theories explaining organizational change

Theories explaining changes in organizations may be usually regarded as *selective* or *adaptive* [6]. According to Volberda et al. [7], from the selection perspective, change is "highly restricted by resource scarcity, convergence to industry norms, and structural inertia" (p. 160). Theories that are mainly based on selection are, for example, population ecology [8], evolutionary theory [9], and resource-based theory ([10]; [11]) [6]. On the contrary, Volberda et al. [7] argue, from the adaptation perspective, that companies can and do change, overcoming their rigidities: successful companies learn to behave differently and they seek for new competencies. Such theories of adaptation include, for example, dynamic capability theory ([12]) and learning theories ([13]) [6].

In the last few years the concept of '*co-evolution*' has gained ground in the literature alongside with selection and adaptation (see e.g., [6]; [7]; [14]; [15]). Instead of being purely selection or adaptation, co-evolutionary approach views change as interrelated process of both of them [7]. For example, Lewin and Volberda [6] define co-evolution as "the joint outcome of managerial intentionality, environment, and institutional effects." Thus, change occurs continuously when units at the different levels of the organization develop in co-evolution with each others and also with the environment. As Mitleton-Kelly [15] emphasizes, it is relevant to point out the difference between adaptation and co-evolution. In adaptation it is assumed that only the organization changes, but in co-evolution the organization changes with the environment and changes within the organization also affects the environment. Co-evolutionary influences can be observed also inside the organization, between units and between organizations.

B. Intentionality of change

In general, change can be either internally produced *endogenous change* or *exogenous change* that is caused by

external environment [16]. For example, management can produce change from top to down by changing strategy, size of the organization, management practices, or introducing new technology. These changes are considered to be proactive, "in anticipation of external events that may occur" [17]. By contrast, external environment may and do change increasingly fast and changes can not be controlled or selected by organization. These changes are considered to be spontaneous from the organization's point of view and are just reacted and adopted in best possible manner. [16]

As described above, there seems to be two views of understanding the intentionality of organizational change: change can be planned or emergent. Planned change is usually referred to as managed or controlled change. They are usually strategic, episodic changes that aim to transform the whole organization (or a selected function, etc.). Emergent changes refer to unintentional actions and spontaneous changes that are continuously happening while organization naturally grows and develops. When an organization and its management are functioning quite passively, change in its environment may affect the whole organization, and the environment may select companies that will survive.

In addition to exogenous changes, emergent changes may also be internally produced, occurring from bottom to up, when employees and units communicate with each others. These changes are usually emergent from the management point of view. In this way, the concept of 'emergence' is widely used in complexity studies. According to McMillan [18], emergence means "a phenomenon of the process of evolving, of adapting and transforming spontaneously and intuitively to changing circumstances and finding new ways of being." An emergent process can include, for example, the creation of new knowledge and innovative ideas in group work, because new knowledge can be considered as something totally new and unexpected, and not only as a sum of existing ideas.

C. Models and types of change

In the literature, many models have been developed to describe the nature of organizational change. Up to the late 1970s, the *incremental model* of change dominated and after that, researchers began to draw attention to two other perspectives: the *punctuated equilibrium model* and the *continuous transformation model* [19].

Incremental change model views change as a process whereby individual parts of an organization deal incrementally and separately with one problem and one goal at a time. When managers respond to pressures in their local internal and external environments, in this way, over time, their organizations become transformed (see, for example, [17]).

Contrary to previous view, punctuated equilibrium model views the change evolving through "long periods of small, incremental change that are interrupted by brief periods of discontinuous, radical change" [20]. Radical change is seen as a large-scale process that deals with the whole

organization in short time.

Change can also be seen as continuous: it is neither incremental nor radical and thus, does not belong to the previously discussed models [20]. Weick and Quinn [5] combine all ongoing, evolving, and cumulative organizational changes under the term 'continuous change'. They suggest that substantial change can be cumulated and created with small continuous, simultaneous, and interdependent adjustments. Advocates of the continuous transformation model disagree with both the incremental change and the punctuated equilibrium models and claim that an organization should develop its ability to change continuously in order to survive [19]. This has led to the ideas of 'learning organizations' and continuous innovation.

Typologies of organizational change and their descriptions are collected in Table 1.

TABLE 1
TYPOLOGIES OF ORGANIZATIONAL CHANGE

Frameworks	Concepts	Descriptions
Theories	Selection	Change occurs through competitive or management's intentional selection.
	Adaptation	Changing by adapting to existing internal or external conditions.
	Co-evolution	Parts that are in contact with each other change together and are dependent on one another.
Models	Incremental change	"Changes that focus on individual components, with the goal of maintaining or regaining congruence" (p. 196) [17].
	Punctuated equilibrium	"Change through relatively long period of stability (equilibrium periods) that is punctuated by relatively short burst of fundamental change (revolutionary periods)" (p. 1141) [22].
	Continuous change	Uninterrupted and growing change occurs simultaneously in the whole organization.
Types	Incremental change	For example, first-order change [3], and organizational development [24].
	Radical change	For example, second-order change [3], and organizational transformation [24].
Intentionality	Planned	Internally planned, managed, and controlled change [3].
	Emergent	Change that is emergent, spontaneous and surprising, caused by internal or external forces [19].

Debate about the efficiency of incremental change model and punctuated equilibrium model has been an ongoing issue in the literature in the 1990s. According to Romanelli and Tushman [22], small changes do not accumulate over longer periods to accomplish fundamental transformation of organization's systems, strategies, and structures, but this could be attained only through revolutionary, episodic, and radical change. Therefore, they speak rather about the state of organizational equilibrium than about incremental change. As Brown and Eisenhardt [20] note, the focus of the punctuated equilibrium model is in radical change, although incremental change is assumed to occur. In contrast, Dean et al. [23] claim that companies are adopting radical change only when the attempt to change

incrementally fails. They suggest that incremental change is an equally valid response to major environmental change than a more risky punctuated change.

It could be assumed that all these changes occur in organizations in different phases of their life cycle. The concepts and models of organizational change depend on the view of how an organization and its environment are seen. At the same time when conceptions of organizations are changed from traditional and mechanical to dynamic and more complex, also views of organizational change are renewed. For example, according to McMillan [18], traditional and classic views of change are: 'linear,' 'disruptive,' 'cause and effect,' 'incremental,' 'an event,' and 'controllable,' whereas modern and dynamic views are: 'full of opportunities,' 'revolutionary and incremental,' 'continuous,' 'about learning,' 'non-linear,' 'uncontrollable,' and 'creative.'

Now that theories, models and types of organizational change are presented, it is time to analyze how knowledge in organization may affect these previously identified changes. Instead of focusing in one specific model, this paper further investigates two types of change, namely incremental and radical change. For example, how are organizational knowledge and change related and in what way can knowledge generate change in the whole organization? These issues are discussed next.

III. HOW DOES KNOWLEDGE AFFECT ORGANIZATIONAL CHANGES?

To sustain and increase its competitiveness and to function efficiently in dynamic environment, an organization should be able to produce change and to develop itself. To understand what knowledge may facilitate changes in organizations, it is important to examine different forms and processes of knowledge. These issues are discussed in the next section.

A. Knowledge forms in organizations

Typically, organizational knowledge is categorized by different forms, for example, knowledge can be explicit or tacit. Data and information are examples of explicit knowledge, and they can be stored in the organization's information systems. According to Kogut and Zander [25], organizational information includes "facts, axiomatic propositions, and symbols" (p. 386). Tacit knowledge is usually considered as individuals' skills and experiences, although it can also be organizational. For example, Kogut and Zander [25] refer to organizational know-how as "higher-order organizing principles of how to coordinate groups and transfer knowledge" (p. 388). Furthermore, Spender [26] uses the term "collective knowledge," a social type of knowledge that is "embedded in the firm's routines, norms and culture" (p. 52). Tacit organizational knowledge is therefore embedded in structures and actions. A third form of knowledge is "potential knowledge," as suggested by Stähle and Grönroos [27]. It refers to new knowledge that is not yet available to the organization but may exist in intuition and weak signals.

As we can see, organizational knowledge is not the same as the sum of the employees' knowledge. Organizational knowledge is more like knowledge collectively stored, shared, and experienced. Although experts working in organizations have much knowledge in their heads, it does not mean that the whole organization is knowledgeable. Therefore, employees' knowledge should be transformed to organizational level in order for this knowledge to facilitate and improve change in the organization.

Different forms and sources of knowledge have facilitative effect on changes. From the selection perspective, it can be argued that the most essential form of organizational knowledge is explicit. In selection, especially in external selection, organizations usually have strong bias towards exploitation, and therefore, knowledge that effects mostly on change comes from the market [7]. For example, Volberda et al. [7] use March's idea of exploitation and exploration in organizational learning when they identify four renewal processes for organizations. Exploitation refers, for example, to efficiency, selection, and choice, where as exploration includes such terms as variation, risk, experimentation, discovery, and innovation [28].

If an organization has been capable to create a balance between exploitation and exploration, the essential form of knowledge could be considered as tacit. Adaptation and co-evolution require learning and incremental development among entities, such as management and employees. On the other hand, if exploitation and exploration are not in balance but fluctuates from one to another, potential knowledge may facilitate changes that may emerge spontaneously and can also be radical. This phenomenon is typical in the punctuated equilibrium model and these radical changes, or discontinuous changes, are usually considered as innovations (see, e.g., [29]).

B. Knowledge processes facilitating changes

To make change easier and through that to increase their ability to adapt and be successful, organizations should improve their knowledge processes [30]. The impact of knowledge processes on organizational change may vary, and may result in incremental or radical changes.

Probably the most cited knowledge process is the knowledge creation process of Nonaka and Takeuchi ([31]; [32]), which is based on four interaction patterns between tacit and explicit knowledge, namely, socialization, externalization, combination, and internalization. These interaction processes represent how to convert individuals' existing knowledge into new knowledge. However, at the organizational level, knowledge creation can also mean searching knowledge from external sources. For example, according to Maula's ([30]; [33]) model of living composition, organization can interact with its environment and also coordinate itself continually with the changing environment through a specific knowledge flow that is termed 'organizational senses.' This knowledge flow enables organization to collect weak signals, triggers, and new ideas from the environment. By doing this, organization is more capable to adapt environmental

changes and also to develop its own renewal processes also in a radical way if needed [30].

In addition to knowledge creation, the key knowledge processes in organizations include knowledge sharing and integration [34]. According to Pöyhönen [35], continuous use, sharing, and development of organizational knowledge generate incremental change. In contrast, she also argues that gathering and creation of entirely new knowledge and innovations may generate radical change.

To fully understand organizational change, we should note that change is only one side of the coin. To be effective, the organization requires some degree of stability. By stability we do not refer to stagnation or decline but maintenance or exploitation that was discussed earlier. Maintenance consists of effective standardization and replication of the existing organizational-level information and tacit knowledge across the firm; "it implies changes only in individual skills and knowledge" [35]. According to Maula [30], this organizational efficiency is based on internal knowledge flow that she terms as 'organizational memory function'. This function aims at maintaining daily operations by exploiting existing information and previous experiences.

C. Challenges for Organizations

The impact of knowledge on the capability to change can also be seen as negative. For example, existing organizational knowledge can prevent from realizing the need for change, hinder change forces for activating change processes, or some other way slow down change processes. However, knowledge can still be considered as the enabler and facilitator of changes, even if the effect and the direction of change are negative. Then, change can be referred as decline when existing organizational structures, routines and culture do not maintain organizational activities efficiently and they even prevent anything new to be created [36].

It is not, however, certain that knowledge codification, sharing, or creation generate changes in organization at all. Knowledge has insignificant role for changes when existing knowledge is not used efficiently to produce change. Although an organization has a lot of knowledge and knowledge is brought mainly to the organization by recruiting new employees, through customers and research, this knowledge may still not produce the needed change. Pfeffer and Sutton [37] refer this phenomenon with the term 'knowing-doing gap'. They claim that typical knowledge management practices make this gap even worse, because they concentrate still too much on technologies and the transfer and storage of codified knowledge instead of transformation of tacit individual knowledge to organizational knowledge.

Based on the literature it is not evident if knowledge has any effect on change or not. Therefore much more research is required. For example, within the emergent approach on organizational change it could be studied whether the amount, form, or process of knowledge affects change.

IV. SUMMARY AND CONCLUSIONS

Based on a literature review, this paper examined concepts, theories and models of organizational change. Organizational change is conceptualized in the literature from both output and process point of view. Diverse concepts indicate, for example, the magnitude of the change or why and how the process unfolds. In the literature, there are three theories explaining why the organizational change occurs: selection, adaptation, and co-evolution. Further, three models explain the type and nature of change: first the incremental change model which means a gradual step-by-step development, secondly the punctuated equilibrium model which means alternating from incremental to radical change, and thirdly a continuous change where change is neither incremental nor radical. Change can also be classified as planned or emergent, based on the source of knowledge that facilitates change processes.

When the organization is to conduct changes, it is relevant to analyze the role of knowledge as a facilitator of change, not as an output of that change. Knowledge can also be seen as a process that generates the actual change processes. Change in an organization is therefore highly dependent on how knowledge in its different forms is used in both internal and external knowledge processes of the organization. In order to change itself efficiently, the organization should recognize its existing knowledge bases, and balance both internal and external knowledge codification, sharing, and creation. Furthermore, the change may be incremental or radical. Incremental change was seen as the balance between exploitation and exploration, whereas unbalance between these actions was considered to lead to radical change. The use of knowledge in explicit form effects mostly on maintaining the efficiency in organizations. Incremental change can be facilitated by sharing and developing existing knowledge, by transforming explicit knowledge into organizational structures and practices as well as by developing tacit knowledge at the organizational level. Finally, tacit knowledge at the organizational level can generate radical change in creation of new knowledge together with the environment.

Future research work could include deeper analyze and development of a model for how different forms and processes of knowledge may produce changes in organization. Through that model, it would be easier for managers to identify strengths and weaknesses of their organizations' knowledge processes and develop them further in order to generate desired changes within an organization.

ACKNOWLEDGEMENT

The study for this paper is part of a TIP-research program Knowledge and Information Management in Knowledge-Intensive Services, which is coordinated by the Institute of Business Information Management, Tampere University of Technology, Finland, and financed by Tekes Finnish Funding Agency for Technology and Innovation,

and several private firms and public sector organizations. The purpose of the research program is to analyze, for example, the competitiveness and development potential of knowledge intensive service organizations from the angle of knowledge and information management. I would like to express my acknowledgements to Professor Marjatta Maula, Research Director of the research program and to my colleagues in the research group.

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Electronic Government and Public Service Modernisation: Experience from the frontline

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Abstract — The paper is based on research into public service modernisation initiatives undertaken in County Donegal, reviewing these initiatives and setting out the progress achieved to date. Progress is evaluated in the context of international and national public service modernisation developments and the contribution made to the overall vision of delivering integrated public services. The interdependence between local and national initiatives is examined with the impact on outcomes evaluated. Key lessons emerging from the experience of using technology (eGovernment) to modernise service delivery are synthesised with a view to distilling the imperatives to be considered in maximising the benefits from eGovernment initiatives. EGovernment has a critical role to play in service modernisation with best results likely to be achieved through incorporating technology into an integrated service modernisation strategy. Imperatives to be addressed are set out, along with a roadmap for use in undertaking a complex public service modernization programme.

Keywords — Ireland, eGovernment, Public Service Modernisation, service delivery, change management.

1. INTRODUCTION

A. Background to project

Donegal County Council embarked on a service modernisation programme in 1995, with the decision taken by the Council to establish a network of new area based Public Service Centres throughout the County. The initial aim was to deliver the full range of Council services locally to customers through these Public Service Centres. An awareness that customers of the Council were also customers of other public service agencies, with overlapping needs, led to a widening of discussions with these other agencies to consider the customer-centric integration of public services across public service agencies.

Donegal Integrated Service Delivery Project, a partnership of public service agencies, was formally inaugurated in June 2001 to advance the interagency collaboration required to deliver on the evolving vision of integrating service delivery around the needs of the customer. The Partner Agencies in the project are Donegal

County Council, FAS, the Health Service Executive North West, Comhairle and the Department of Social and Family Affairs. This Project has also had a key role in informing the development of the Irish eGovernment programme, with County Donegal named as a pilot site for eGovernment initiatives.

This paper reviews the initiatives undertaken in the modernisation of service delivery and outlines the progress achieved to date. Initiatives undertaken are set in the context of international and national public service modernisation trends and developments over the period and the contribution made to the overall vision of delivering integrated public services evaluated. The interdependence between local and national initiatives is examined with the interdependence and the impact on outcomes evaluated. The developing role of eGovernment in service modernisation and delivery is also analysed.

B. Background to public service modernization developments

The present wave of public service modernisation in Ireland commenced with the launch of the Government's Strategic Management Initiative (SMI) in 1994. Borrowing from public service modernisation developments in Australia and New Zealand it set out the objective of presenting public service management with an opportunity to make a substantial contribution to national development, through the provision of services to the public which were both excellent in quality and effective in delivery. The emphasis was placed on delivering improved quality services to the customers and the initiative set in place a framework to support the required work. The supporting framework was further developed in 1996, through the second report of the Co-ordinating Group of Secretaries [1]. This report set out a vision for the Irish Civil Service based on the provision of quality services, including sound policy advice as the essence of an excellent Civil Service. It stated that the conditions necessary for achievement of the vision included a new management structure and new approaches to human resource management, a fully integrated performance management process, reform of the financial management system and effective use of information technology. The immediate implementation process was based on widening and deepening the SMI

process within the whole public service. The achievement of the vision for the Civil Service was to be built around six key organisational themes:

1. A framework for change emphasising, in particular, a customer orientation, results orientation and the embedding of a strategic management process at the heart of Departments
2. Delivery of quality services
3. High quality policy advice to Government
4. Reduction of red-tape and regulatory reform
5. Open and transparent service delivery
6. Managing cross-departmental issues.

The development of these key organisational themes over the remainder of the decade provided the organisational backdrop and framework within which the Donegal service modernisation programme evolved. Plans were developed in Donegal to localise service delivery and to organise these services around the needs of the customer. Delivery on these service modernisation plans would make an important contribution to addressing a number of the key organisational themes, specifically through the contribution to delivery of quality services, the resultant cross-departmental working and the more open and transparent service delivery. The effective use of information technology was identified as a key enabler in the Irish Governments modernisation initiative and has also been recognised as having an important influence on the unfolding developments in the Donegal ISD Project. The service delivery model would be underpinned by eGovernment policy developments in Europe and Ireland as outlined below.

The European Union [2] recognised the importance of Information Technology and the role it could play in modernising service delivery in the agreed action plan from the Lisbon summit. This action plan set the goal of establishing Europe as the most competitive and dynamic knowledge based economy in the world. Four distinct stages were identified in the development of online public services with action plans set out to ensure that administrations in member states worked towards this goal. Information provision online was identified as the starting point followed by interaction, two-way interaction, and finally full service transaction online. Recognising the important role of information technology in the modernisation of service delivery and in furtherance of the eEurope agenda the Irish Government published its second action plan on the Information Society [3] setting out the Government's programme for the three years to 2005. Picking up on the eEurope agenda [2] it placed the emphasis on the integration of services stating as a priority the, "*Rearrangement of information and service delivery around user needs, and available in an integrated manner through a single point of contact with government*" (3.2). It also recognised the need for, "*...a greater internal e-government focus on streamlining background processes, facilitating cross-organisational collaboration, continuing*

to develop an organisational culture with a user-centric focus". (3.4). In setting out these objectives the Action Plan aimed to address the issues required to facilitate the full transaction of public services online.

This change of focus onto the organisation and delivery of services around the needs of the customer conferred an additional legitimacy on the Donegal ISD Project. As outlined in the next section work was now well underway in County Donegal on developing an infrastructure capable of supporting a localised delivery of service and work had commenced on tackling the background processes and issues required to facilitate customer-centric service delivery. Planned eGovernment developments as outlined [2] [3] provide the supporting framework to effectively meet the challenge.

II. INITIATIVES AND REFLECTIONS

A. Initiatives implemented in project

The Donegal ISD Project has taken a lead from these national and international trends, developing strategies to translate modernisation initiatives into action at the service delivery level. In the main, this has involved developing the infrastructure to support the new localised service delivery model with a network of five area based Public Service Centres (Carndonagh, Milford, Letterkenny, Dungloe and Donegal) covering the different geographic areas of the County opened for business and delivering services to their local communities. The main innovations arising from the development of the Public Service Centre (PSC) infrastructure and Inter Agency collaboration include the following:

- Independent Information and advice units are in place as a first point of contact in each PSC. Funded in partnership by the participating Agencies, their role is to ensure customers get impartial, independent information on all public services, to connect customers to the relevant service and to act as advocates on behalf of the customer where this is required.
- The full range of services delivered by Donegal County Council has been localised and is now delivered through the Public Service Centres. This includes the accepting of Applications, all follow up activity relating to service applications and requests and the making of all decisions on applications.
- The Public Service Centres have been developed as a first point of contact to services. Customers requiring services from Agencies not based in the Centres are facilitated through the provision of information, application forms and appropriate referrals, thereby removing the need to make further enquiries in regard to basic public services.
- Partner Agencies have relocated and are delivering services from the Public Service Centres adding to customer convenience through increasing the

range of services directly available from the centres and the range of service delivery staff available for consultation in each Centre.

- The provision of new Public Service Centres in each Electoral Area in County Donegal provides an important infrastructure for the staff and customers of public services, providing state of the art meeting facilities along with private consultation facilities where customers can transact business in complete privacy.
- The Public Service Centres also provide the infrastructure (space, systems, people, etc.) and the opportunity to test new concepts and initiatives. This includes testing concepts around the Public Service Broker and alternative methods/channels of service delivery as these come on stream.

The result of these developments is that an infrastructure, physical and people, is now in place capable of delivering a localised public service to citizens and customers in County Donegal. This infrastructure and the underpinning interagency collaboration has been used to undertake an extensive research programme aimed at increasing the understanding of issues involved in integrating service delivery and at developing new service delivery channels. The research undertaken has focused on the issues to be addressed in delivering services on a cross agency and customer focused basis, addressing the organisational, structural, technical and policy issues among others. Research has also been undertaken to identify the most suitable services to be deployed and tested in a pilot Contact Centre and to project the willingness of customers to use alternative channels. This research also reported on the sustainability of a pilot Contact Centre, forecasting the implications of scaling the pilot to National level; and attempted to gauge the effects of the Contact Centre pilot on the traditional points of public service delivery. The most recent research focused on cross-departmental issues in the administration of social housing support schemes and has led to an Irish Government decision in July 2004 to take an integrated interagency approach to the provision of social housing supports and to differentiate more clearly between short and long-term accommodation needs.

In summary, the research programme, made possible by the unique circumstances developed through the project has increased the knowledge of the issues involved in moving to an integrated delivery of public services.

These lengths include appendixes and references.

B. Reflections on progress made

The Public Service Centres developed in County Donegal have made a difference to the customer. Customer surveys undertaken confirm that the effort to date on co-ordinating service delivery across agencies and delivering these services through the new Public Service Centres has made a difference. It has brought the services closer (physically) and made them more accountable through the localisation of the decision-makers. Regrouping services in

the Public Service Centres has made it easier for the public to access services and transact business with government. This addresses the emerging theme [4] [5] [6] of placing the customer at the centre of the reform programme and of developing services around customer needs as opposed to the interests and needs of the individual agency [7].

While the Public Service Centres provide customers with a localised and personalised service, recent research [7] indicates that the customer should have a choice of interfaces available in their dealings with public services. The research undertaken by the Donegal ISD project has identified how other channels (phone, online, etc.) can be used to deliver services and the most suitable services, from the customer and service provider viewpoint, for delivery through alternative channels.

Joining up the front end (where customers interact with services) has contributed to an improvement in service quality and delivery. Research studies on the work of the Donegal ISD Project [8] [9] further confirm that the initiatives implemented have contributed to an improved service to customers. However, real improvements and efficiencies await a re-engineering of the back end (systems and processes) to support the new delivery of services. Process re-engineering is still very relevant and vital to public service modernisation. The national service modernisation effort to date has centred on automating existing services, making information available and getting application forms online with little attention given to rationalising processes. The Donegal project provides the foundation for testing all of the issues surrounding the re-engineering of the back-office processes that are essential to the development of e-government services.

Issues identified and dealt with in enabling the co-ordination and integration of services in the walk in mode, as facilitated by the Public Service Centres, will contribute important information and should help identify the issues to be addressed in delivering services effectively through other channels (online, phone, etc.). This will be important in offering the customer choice of access channel and in utilising technology and systems efficiently to deliver value to all stakeholders. The OECD [10] concluded that the impact of eGovernment at its broadest level is simply better government and noted that eGovernment is more about government than about "e".

Leadership has been identified as a key requirement, with a need for clarity around roles and responsibilities [6]. Top management within each of the Agencies locally has provided a firm focus and leadership to the initiative and has formed a strong guiding coalition among the partner Agencies. It is crucially important to the success of a project of this nature that similar leadership and support is demonstrated at national government level. Support is required from central government and central government Departments to ensure maximum progress is made. The Centre is required to set out the supporting national framework mandating Agencies to collaborate in service provision and to take an active role in co-ordinating the

process. Frameworks envisaged under the SMI initiative and intended for this purpose remain to be fully developed.

The experience to date indicates that technology is not the main or only issue, concurring with the EURIM [11] view that technology is a key enabler in service modernisation but not an end in itself. The Donegal experience has been that people, organisational and structural issues require much attention. An early assumption was made by the Project that Donegal had sufficient control of the agenda to influence upwards and to achieve the desired level of service integration. Over time this has developed into a realisation that there is a bigger game being played out and that the Donegal ISD Project is only one component of the service modernisation process.

Service modernisation involves a major cultural change programme [11] [12] taking time to deliver and implement. The Donegal ISD Project has adopted an inclusive approach involving staff at all levels from the partner agencies in work groups and in the various research initiatives undertaken. This has helped raise awareness and to create the conditions necessary to support a new way of doing business with the customer and has helped in securing the commitment and engagement of staff required to support the ongoing change effort.

This review of the initiatives implemented and progress to date validates locally a number of imperatives emerging internationally on joined up service delivery, summarised as follows:

1. The customer needs to be placed at the centre of any reform programme.
2. The customer should have a choice of interfaces available, including the option of personal contact.
3. Services should be joined up, in advance of offering through electronic channels to have most beneficial results.
4. Real benefits will come from reorganising services and service delivery around the needs of the customer as opposed to the desires or needs of the individual agency.
5. Leadership is vital, with the need for clarity around roles and responsibilities as outlined.
6. Technology is a key enabler in modernisation of services but is not an end in itself.
7. Finally, this all involves a major cultural change and will take time to implement.

The challenge ahead is to build on progress to date, developing and agreeing plans to deal with these imperatives in an integrated manner (between local and national levels) in the drive to deliver joined up customer-centric services. The following section explores this challenge further, setting out the main considerations and issues facing the next wave of modernisation activity.

III. THE CHALLENGE REMAINS

A. Co-ordination of service delivery has made a difference, but integration remains the goal

Co-ordination of service delivery as experienced at present through the Public Service Centre initiative in County Donegal has brought services closer to, and made them more responsive to the customer. While this initiative has brought benefits to the customer, international experience [6] [10] [11] confirms that further steps to integrate service delivery around the needs of the customer are required in order to deliver the full potential to the Agencies and other stakeholders. The efficiencies to be gained through the elimination of the duplication of effort and the introduction of a shared service concept remain untapped. The next wave of activity nationally and locally will have to deal with rationalising processes and integrating services in order to maximise the benefit to all stakeholders.

B. Structural issues require attention

Lack of strong leadership, co-ordination of effort and a coherent framework at the centre have been identified as key inhibitors to service modernisation. These key issues remain to be addressed and are required urgently to facilitate the collaboration required at central, local and all levels in order to deliver customer-centric services. The level of interagency work and collaboration experienced in County Donegal does not exist elsewhere and requires a coherent national support framework if it is to be successfully replicated.

C. The value of local projects

Donegal ISD Project provides an infrastructure that can facilitate further innovation in service organisation and delivery. More importantly, the co-operation and collaboration at all levels in the partner Agencies provides a framework and context to support innovation. The willingness to collaborate and to engage in innovation provides an ideal opportunity to test initiatives before having to migrate them into the wider public service.

D. Finding quick wins

In order to sustain a project such as this for a long period it is important to identify areas where progress can be made and quick wins achieved. In the context of the Donegal ISD Project social housing provision and housing support services have been identified as one such area and will be used by the project to further promote interagency service provision around the needs of the customer over the coming period. Successful design and implementation of this interagency initiative will involve change to back office processes and prove the concept of joined up customer-centric service delivery.

In conclusion, the following quote from a EURIM paper [12] confirms the scale of the challenge involved:

"Modernising Government is a huge change programme on an unprecedented scale".

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Empirical Evaluation of ICT Adoption in Australian SMEs: Systemic Approach

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Abstract — Many SMEs are adopting information and communication technology (ICT) and services based on them. However, there is little systematic research into how they are doing this and what the organisational and environmental factors associated with the adoption are. That is, hardly there is any study in the literature which is looking at the overall firm's performance and if, once adopted, ICT fulfil expectations of their adopters.

The growing importance of SMEs and ICT in contemporary economics and IS and management theory have been a subject of large static research. In this paper we have adopted a dynamic approach to evaluate adopted ICT in a firm as a complex adapting system (CAS).

Thus, here an organisation is studied as complex social system, because complexity provides an explanatory framework of how organisations behave; as well as how individuals and organisations interact, relate and evolve within a larger social and environmental system. Complexity also explains why ICT adoption may have un-anticipated consequences on firm's performance and inter-relationships of elements within a complex system which give rise to multiple chains of dependencies.

In this article authors evaluate factors for ICT adoption in Australian SMEs in the post-adoption period. The methodology in this article was based on interpretative action research based on "soft systems thinking", because the setting up an information technology system is itself a social act, requiring some kind of concentrated action by many people.

However, the formal method is the case study method which answers the question how these factors are interacting in the particular firm.

After the introduction, a general framework, based on recent literature review, was used to identify necessary factors for the ICT adoption. Those factors are then evaluated in an Australian company (case study) using systemic (five stage) approach and its tools.

Preliminary results of this study confirmed that entrepreneurial ICT adoption initiative is not only subjected to selection as a result of environmental pressures but also is strongly subjected to the sub-systems influences and inter-dependencies.

Thus from the complex and adaptive systems perspective we may infer that necessary factors are not all (and always) sufficient factors for the full utilisation of ICT and achievement of firm's goals.

Keywords — ICT, complex systems, systemics, SMEs, factors for ICT adoption and utilisation

I. INTRODUCTION

In this article authors analyse factors for ICT adoption in Australian SME, their empirical validity and relevance for the firms' performance in the post-adoption period. We recognise that ICT is not a value per se, but only becomes a value in the interaction with the users of ICT. Therefore, many aspects of ICT need to be assessed in interaction with other parts and the organisation itself to fully understand its utilisation that influences firms' overall performance and profitability. Thus, using a case study research method and applying holistic/systemic approach we will try to answer the following questions:

- How does interaction of ICT factors impact company's overall performance measured by the relative advantage in the market by adopting and fully utilising ICT?

- What are the factors in the company that influence the extent of ICT utilisation?

The units of analysis for this Australian – based study were small to medium enterprises (SMEs). Criteria for choosing the company for this study were the levels of ICT adoption. In the first stage we approached and worked on five Australian SMEs which adopted ICT. Those companies were part of an earlier investigation about models of ICT adoption [1]. However, results presented here are those from analysing one case study only.

II. BACKGROUND

There are enormous investments in ICT - over \$316 billion is spent annually on ICT in the US alone, and the world's IT spending now exceeds US \$2 trillion annually. In 1999, the share of ICT investment was 4.54% of GDP in the US, up from 2.60% in 1992. For the EU as a whole, the corresponding estimated GDP share is 2.42% in 1999, up from 1.81% in 1992 [2]. In 2000, the share of the ICT investment was particularly high in the US, Finland and Australia.

Intangible effects of ICT found in the literature are an increased variety and quality of products/services, improved timelines of delivery, personalised customer service, improved employee' expectations and motivation. All of these benefits are poorly represented in productivity statistics because it is hard to measure the intangible and indirect costs and benefits of ICT [3]. Studies done so far

mainly applied traditional statistical methods to establish the correlation between the investment in ICT and the productivity or profit growth, in order to determine the value of ICT. However, correlations between IT/ICT investment and organisational performance and productivity do not necessarily imply causation, according to [4]. Those applied methods did not take into account most of the intangible effects and/or contexts of ICT. Therefore, using 'hard numbers' only is not capturing all the effects and values brought about by the ICT investment, which as a consequence has appeared to lower revenue, increase production time, and reduce the firm's productivity and overall performance. Hence, the values of investment in ICT fall short of profitable investment creating the "*productivity paradox*".

In this study we will try to explain those multiple aspects of ICT not taken into account in the literature (together with taken ones) in order to understand the whole, dynamic picture and relations between ICT, its stakeholders and organisation.

III. CONCEPTUAL FRAMEWORK

There is replete of literature available on the adoption of information technology in small business ([5]-[9]). Most recent literature which looked into the necessary and sufficient factors leading to adoption of IS/IT by SMEs formed the basis for the empirical component of this study (see Fig. 1).

ICT can impact a company on three different levels: individualistic or user level, organisational level and external or environmental level. In addition, technological and economical contexts are of great importance in facilitating organisational decision regarding which ICT to adopt, how to use it, and should be taken into account as well. Therefore, influencing factors for ICT adoption examined across a range of contexts suggested by the literature ([1],[10]) can be organised within five contexts: technological, organisational, environmental, individualistic, and economic context.

The *technological context* such as compatibility with existing technology in an organisation is one of the reasons why ICT can be underutilised and lead to the *legacy system* issue. Technological characteristics of ICT influence the choice and use of ICT and explain the occurrence or absence of certain effects related to the use of ICT.

Organisational context is usually considered in many empirical studies. Factors such as organisational culture, readiness to change, size and others play important roles in ICT adoption and utilisation.

The *external environment* has a significant role in the adoption of new technologies but was not included in many IT/ICT empirical studies. One of studies which took this context into account was the study by [9]. They found that competition insignificantly influenced ICT adoption in small businesses, while on contrary [8] found that competitive pressure was the only factor influencing IT/ICT

adoption. As [11] emphasised the role of the government policy in fostering an environment enables firms to make effective use of ICT.

The *individualistic context* (employees, managers) is crucial to take into account since individuals use ICT for their everyday work and know best how ICT influence them and processes in the company. [12] emphasised the importance of a manager's characteristics such as education, age, experience, and psychological traits which have been found to strongly influence innovation adoption. They found that the manager's innovativeness and IT/ICT knowledge had a positive effect on IT/ICT adoption.

The *economic context* is important for a company since ICT costs are not just related to hardware and software, but also to employees and organisational changes that are taken in order to make ICT effective in the workplace. These complementary investments usually cost much more than the initial ICT investment itself.

Similarly to the previous conceptual framework, [1] developed an adoption model of ICT by applying the Qualitative Comparative Analysis (QCA) and its formal language - Boolean algebra. Using that as a departure point in this study we are extending the investigation process of finding the necessary and sufficient factors for ICT adoption in the post-adoption period and argue that adopted ICT itself is not a guarantee for the improved performance of a company. It has to be evaluated and considered as a dynamic part of a complex system, which can be characterised as non-linear, co-evolving, self-organising and which is on the edge of chaos. Considering a company as a complex adaptive system requires mixed, multidimensional, multi-stakeholder, explicitly value-based assessments approaches. ICT depends on many factors and its effects are different for every organisation, since technological systems are socially constructed [13]. As a result ICT needs to be taken into account together with its interactions with people, organisation and processes. Hence many authors are arguing that the only way to consider ICT effects on a company is to use systemic approach [14]. Following that lead we employed the systemic approach with its tools as outlined in the following sections.

IV. SYSTEMIC APPROACH

This section describes the systemic approach and its tools, which will be used in this study. According to [15], the five-stage systemic approach consists of five stages each with two sub - stages as listed in Table 1 ().

Tools of the five-stage systemic approach used in this study are explained in the next table (2). Those tools, i.e. tests will be used to check the relevance of the ICT adoption factors in influencing the company's performance, as well as the interaction of the factors. Following the systemic approach rules and its tools, as well as applying systemic data gathering strategies [focus group meetings, the landscape of the mind (LoM), reflect back workshops, in-depth semi-structured interviews, mapping of email

connectivity (NetMap), and participant observation] we have changed factors developed in the conceptual framework to accommodate participants observations. With adjusted factors we have finally constructed the stimulating and inhibiting interrelations (respectively) impact matrices of factors for ICT adoption as presented in Figures 3 and 4.

After constructing those matrices in the following section results are interpreted.

V. RESULTS AND THEIR INTERPRETATION

The results of the systemic analysis are presented in the 'Map of interaction'. This map's goal is to transform the highly concentrated knowledge of the 'Double-cross-impact analysis' to the *right brain-hemisphere* way of thinking, in order to create a picture of different dimensions of the system.

Horizontal axe of the map of interactions (fig. 4) represents the degree of activity of factors of ICT in the system while the vertical axe represents the degree of dynamics (interactions). This map can be also divided into four quadrants.

In our double cross impact analysis factors in the top circle (see Fig. 4) of the map of interaction [(16) *Fast developing new IT solutions*, (4) *Adoption costs*, (1) *Relative advantage in the market by adopting ICT* and (5) *Perception of company image*] are the components that are the most connected factors in the system. The factors in the middle circle [(7) *Quality of IS & capabilities*, (15) *Managers knowledge of ICT* and (2) *Attitude toward adopting ICT*] are less strongly interacting factors within the system, followed by factors (14) *Managers innovativeness*, and (10) *Top management support* and (3) *Technological compatibility in the company*. The rest of the analysed factors are much less interacting. They have still roles in the system, although they are moving slower.

The striking characteristic of the double-cross-impact analysis is that there is actually the only one real activator for positive dynamic in the system – factor (16) *Fast developing new IT solutions* – which should be given priority in a constructive and innovative way in order to easy the problem solving process.

An innovative approach to the system – for instance if the company is to define the new contents, then factor (14) *Managers' innovativeness*, combined with factor (9) *Specialization within the company* should be of interest to management. To achieve that goal, one would have to find solutions to influence the activities of factor (14). So, the degree of interaction would be reduced and the system gets more passive, and in that case factor (14) would 'move' into the field of 'goals'. In reality that means that the influence of innovation through management could become less intensive, e.g. managers could become subject to 'the other influences'. Similarly, factor (14) would change from a 'transformation key player' that company relay on to a 'quality indicator' which can be steered and supported.

In the figure 4 we can look at different areas of

interactions of factors of ICT, which can be summarised in the following six points (which correspond to the numbers in the figure 4).

Number 1 describes the system as a whole which is well differentiated by the degree of interaction. However, it is less differentiated in the degree of transformation. It means that we have identified the key factors in the system. Apparently, the system has only small negative feedback, meaning the system is a dynamic one – it can be influenced either by enforcing the positive development or lowering the negative one.

The most recognised factors in the system – passive outcome or symptom – are factors (4) *Adoption costs* and (2) *Attitude toward adopting ICT*. Both could be fields of actions for the fast solutions and achieving results. However, both would be only an indication of success, since they do not really change the system as whole. We can use those factors for 'symptomatic solutions' that is, only in the case of 'crisis management' or if the company needs to get recognition in order to continue to operate and to survive. Therefore, we should not be tempted to act upon those kinds of factors. Instead, the company should focus on factors that are stable in the active part in the system. However, those two factors should be measured and controlled regularly, as the best indicators of transformation processes.

Factors that are maintaining processes of transformation are: (1) *Relative advantage in the market by adopting ICT*, (5) *Perception of company image*, (7) *Quality of IS & capabilities*, (15) *Managers' knowledge of ICT*, (14) *Managers' innovativeness* and (3) *Technological compatibility in the company*. Having them in the system, the firm would have troubles to transform new ideas into a new solution. However, without that transformation area the investments would not succeed in the way it is expected. So, if there are problems in this area, the firm should discuss the risks, and make the plans for improvements.

The only fast driver within the system is factor (16) *Fast developing new IT solutions*. This factor is absolutely crucial and has to be part of the solutions in all scenarios. However, as with all dominant factors, factor (16) could foster good, as well as bad developments. Fortunately for the company it is possible to find other factors in the system that can be acted upon for long term solutions, like factors (11) *Competitive pressure from other firms*, (12) *Competitive pressure (costumer, suppliers)*, (8) *Information intensity* and (13) *Public policy and governments roles*. The challenge to develop sustainable solutions is therefore to put factor (16) in a creative and adaptive interaction with (11), (12), (8) and (13) in order to get more successful solutions of the project.

The actual identified structure – without changing factors and interactions – is focused on the goals or results of the ICT adoption process to foster (9) *Specialization within the company*, lower (12) *Competitive pressure (costumer, suppliers)*, (11) *Competitive pressure form other firms* and

increase (8). *Information intensity*. So, if the company was 'happy with this result', which would mean more specialization within the company, less pressure from costumers, suppliers and other firms, and the current level of intensity of information, then, the firm can use the existing structure to succeed working on solution as discussed above under the point 3. However, if a company was not 'happy', then in would be necessary to reorganize the structure which discussed in the following point.

The final reflection on the system is almost as 'painting of dynamical information'. For example, if the firm wants to change the 'field of goals' by accomplishing successful ICT adoption and utilisation, then the firm would have to change the structure in the both active and the passive parts of the system. Or, if the firm would want to make the system more sensitive to changes then they must find new ways of interactions of factor (3) with other factors in the system.

The final principal participant observations and recommendations would be to the company to build a high commitment with all involved in the project in this company. ICT adoption is an innovative part of the process of developing solutions for the full utilisation. So, the firm should be creative and not fixed on the 'actual structure' of the system. It is necessary to understand the wholeness and decide on what to keep and what to change in the actual situation.

VI. CONCLUDING REMARKS

In this article authors by analysing factors of ICT in the post adoption period tried to answer the question how interaction of ICT factors on firm's overall performance. By applying the systemic approach and its tools they identified the key factors and their interaction and influence on the system. The results of the double cross impact analysis revealed six dimensions that can influence the performance of the system. Although they were kept at a very general level, they still can be very instructive for the company wanting to utilise adopted ICT to the full and consequently increase the performance.

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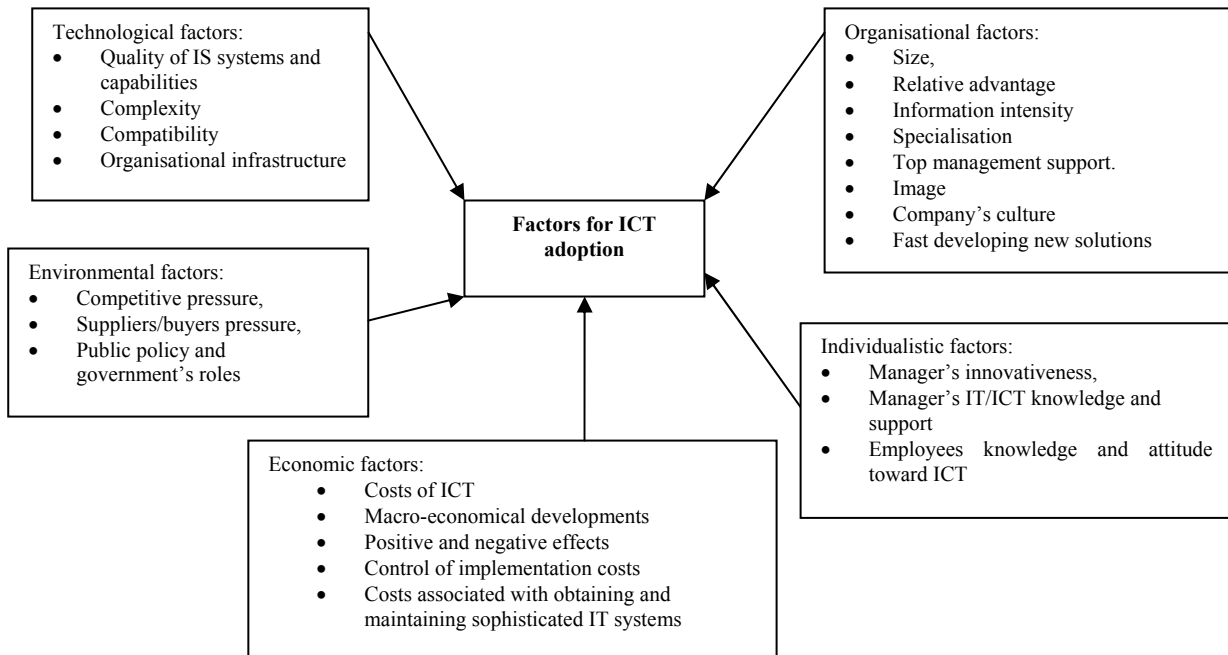


Figure 1: Factors and contexts for ICT adoption

TABLE 1. METHODS FOR EACH STAGE USED FOR THE FIVE-STAGE SYSTEMIC APPROACH

Stages	Methods	Description
Stage 1 A	Brainstorming, brain writing, method 635, rich picture, PAT-mirror, Syntectic, progressive abstraction	Stage 1 (a and b): Discover and identify opportunities and problems The first contact with a complex phenomenon is done by first describing fuzzy statements or set of factors (1a and b). In this stage different roles and different key players are identified. There are no solutions or interpretations in this stage.
Stage 1 B	Concentrate data to cluster and clear statements: Mindmap, set of factor, role settings, syntegegration, dialoguing	
Stage 2 A	Holistic test, holistic potential test, holistic environmental turbulence score, gap-analysis	Stage 2 (a and b): Reflect wholeness, analyse interactions and tensions The goal in this stage is to test the data on wholeness (2a), and then to define and analyse the interactions between the factors (2b). Different tests (from holistic test to double-cross-impact analysis) are completed in order to find the interactions which are normally not seen and therefore left out.
Stage 2 B	Double-cross-impact analysis, loop diagrams, family constellations	
Stage 3 A	Interpretation of systems dynamic, critical systems heuristics, systemics goal definition, Presencing	Stage 3 (a and b): Work out possibilities of design and steering, understand dynamics In this stage information that transforms into knowledge is reflected. Double-cross-impact analysis is interpreted, results are reflected and the goal is (re)defined (3a). From dynamic interpretation to four drive method we achieve a generic playground for new solutions. It is important to stay open for new information in this stage and to ask in order to make statements.
Stage 3 B	10 points for viability, sensitivity analysis, risk analysis, Neuro-Linguistic programming (NLP), four drive method	
Stage 4 A	Syntectic, morphology, the six thinking Hats method, precise destroying, Osborn-Checklist	Stage 4 (a and b): Develop causal solutions and sustainable decisions In this stage new knowledge is produced for solutions (4a) and making decisions (4b). These insights are crucial for recognising that all scientific concepts and theories are limited and approximate. Solutions are seen as emerging opportunities.
Stage 4 B	Simulation, scenario technique, holistic value-benefit analysis, four force field reflection	
Stage 5 A	Project management, process coaching, balanced scorecard, consultancy, coaching, portfolio of activities	Stage 5 (a and b): Consolidate commitment and realise viable processes In this stage action is being taken (5a), followed by the feedback from the environment. Shift from isolated positions to networks as a metaphor for sustainable solutions: there is no signal "right thing to do", as the strategy includes a network of parallel processing.
Stage 5 B	Micro-article, knowledge management, Network, Lessons learned, EFQM quality model, reflecting groups	

Adopted from [15]

ICT-application in a company

Figure 2. Impact matrices of stimulating interrelationships

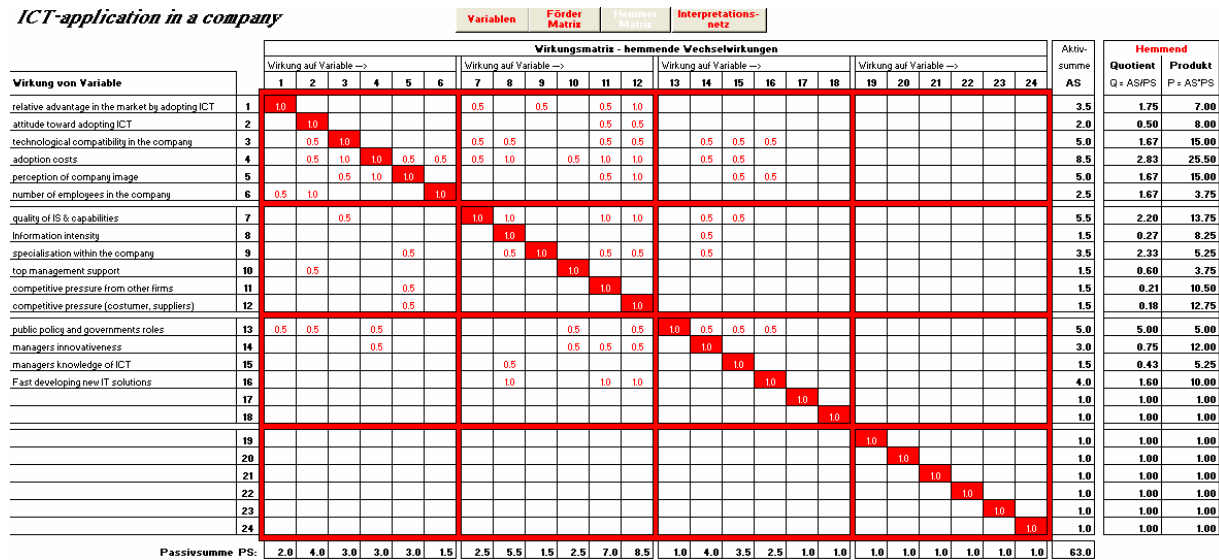
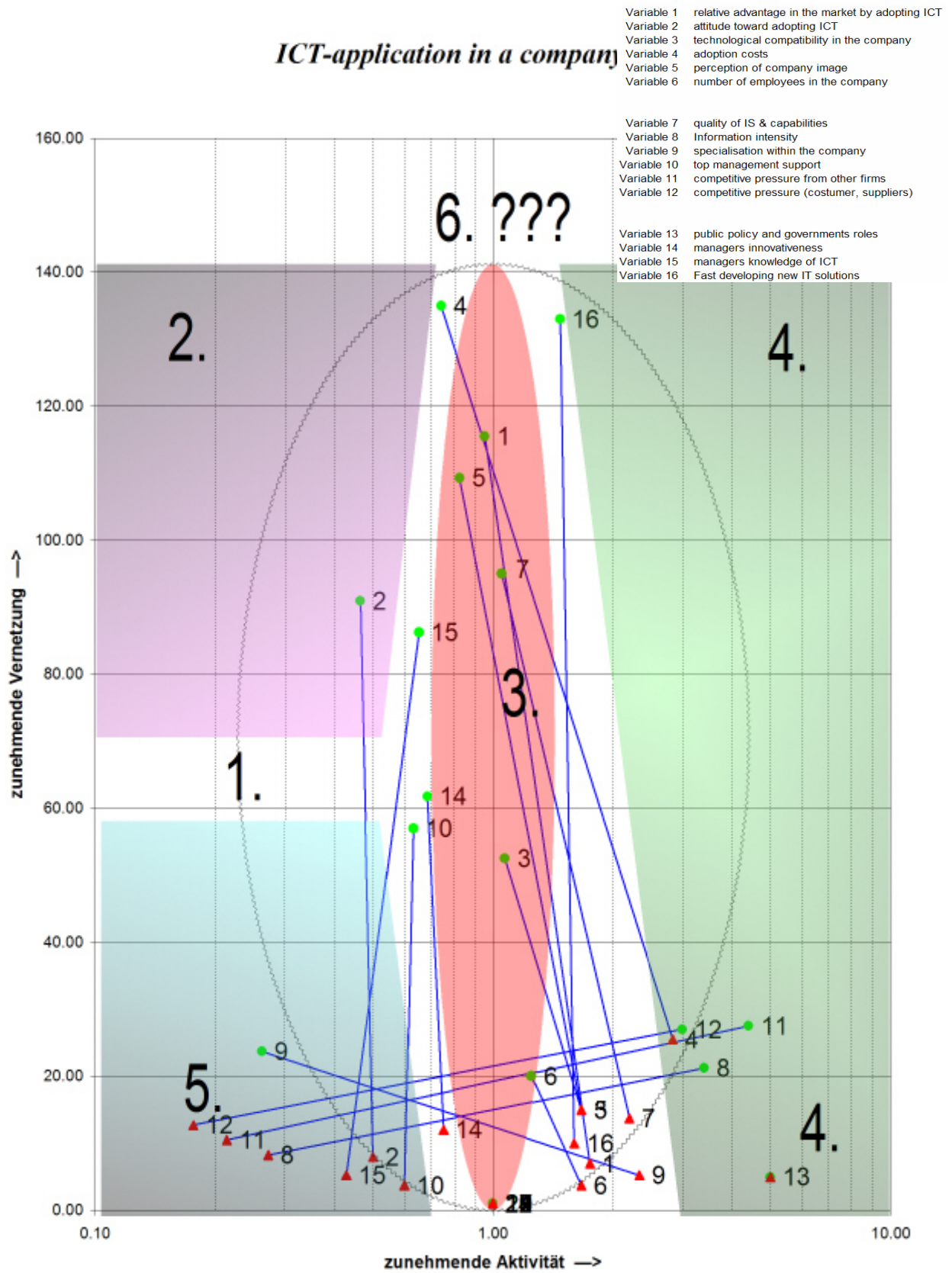
ICT-application in a company

Figure 3. Impact matrices of inhibiting interrelationships

TABLE 3. QUADRANTS OF THE MAP OF INTERACTION

Passive and highly interactive factors These factors are influenced by and interact with the rest of the system	Active and highly interactive factors These factors influence and interact with the rest of the system
Passive and less interactive factors These factors are influenced by and are less interactive with the rest of the system	Active and less interactive factors These factors influence but less interact with the rest of the system

ICT-application in a company

Enhancing Student Learning of Enterprise Integration by deploying SAP R/3 into curriculum

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Abstract — Though the ability of enterprise systems (ES) software solutions in teaching concepts of cross-functional enterprise integration and process orientation are well recognised and discussed in the academic literature, many business schools/faculties, for different reasons, are slow in incorporating these latest software products in their curricula. This paper reports on one curriculum development project that extended the deployment of SAP R/3 into the business curriculum for enhancing students learning of enterprise integration. Employing questionnaire survey and self-assessment of the knowledge and skills gained in the course, the effectiveness of the curriculum design and delivery are reported in this paper. This study demonstrates the powerful role played by the ERP system in developing business process orientation and cross-functional perspective to business students.

Keywords—Enterprise integration, SAP, Business curriculum, process orientation

I. INTRODUCTION

The sophistication of the new, integrated, ever changing world of work requires the ability to critically evaluate situations from multiple perspectives. Business graduates must be able to apply the knowledge of concepts, principles and methods learnt during the university education to the work situation and not being shackled by the discipline-centric narrow view of the business. These integrative skills and cross-functional perspectives not only help the graduates to function effectively in a work environment later on, but also encourages deep learning from pedagogical perspective in the class room.

This paper reports on the extension of the deployment of SAP R/3 an enterprise resource planning software solution, to teach enterprise integration to business students. It will first provide a review of the literature on the deployment of SAP R/3 in business curriculum and discuss its extension to other units and its pedagogical benefits. It describes the approach taken in incorporating SAP R/3 in teaching and learning. Employing a questionnaire survey and focus group discussions in data collection, this attempt is analysed and reported in this paper.

II. BACKGROUND AND LITERATURE REVIEW

A. Inadequacies of Business Education

The pedagogical model of business education that was based on disciplines/functions was developed at the beginning of the 20th century. These functionally specialized schools/disciplines were designed to meet the needs of large, highly bureaucratized organizations. Many business schools still have this model and are typically organized into functional departments such as accounting, marketing, human resources, logistics/operations etc. With its strength in developing specialist technical professional in accounting, or operations, or finance, business schools are criticized for their inability to produce a well-rounded business graduates.

By mirroring the traditional business organization's functional silo structure in their teaching and curriculum, business schools are criticized for producing narrowly trained individuals who hold a compartmentalized approach to the way business is conducted [1], [2], [3]. These functional silos in a business organization restrict their ability to respond to dynamic customer needs and environment, and are inconsistent with the idea of integrated processes [4].

Several reviews of higher education by practitioners as well as experts have been highlighting this lack of a multidisciplinary view of business graduates. These reviews have strongly recommended incorporating cross-functional perspectives, business process orientation and integrated view of business in business curriculum [5], [6], [7], [8], [9] and [10].

Stimulated and led by the employer groups such as Business Council of Australia and Australian Chamber of Commerce, these employability skills, if effectively incorporated into the university business schools curricula will provide a bridge between education and work [11]. The Federal Government, through the Department of Education, Science and Technology, has been encouraging development of an overarching strategy to embed such 'employability skills' in the universities that include integrated business view, business process orientation and several generic graduate attributes.

With the Just-in-Time (JIT), Total Quality Management (TQM), and reengineering movements in the 1980s and 1990s, many business organizations have shifted their focus towards cross functional processes and emphasized management development away from specialization and towards the integration of different disciplines and functional departments [12].

University business schools, however, have not adopted the same approach, even though businesses increasingly seek graduates with ability to analyze problems by drawing cross-disciplinary knowledge [13]. This has resulted in gap between what businesses want and what university business schools offer. Business school graduates view their career from a functional perspective (e.g. as accountants, marketers or financial analysts) and cannot see an integrated view point until they are well into their careers.

B. Past Pedagogical Strategies

In the past pedagogical strategies such as integrated case study, team teaching, capstone group projects and simulation games were used to teach multidisciplinary perspective to business students. The effectiveness of these strategies, however, were not empirically measured and not known widely. It is however, argued that these strategies would help students to develop these cross-functional perspectives [14].

Achieving an integrated view of business is an ongoing process and achieving an expert status requires a high degree of self-awareness, critical thinking and deep learning [15]. Apart from helping the business graduates to function effectively in a work environment later on, pedagogically this cross-disciplinary perspective is also expected to encourage students' deep learning and better understanding of intersections and interactions of the traditional disciplines such as marketing, operations, accounting and human resources [16].

C. Business Information Systems Role

With its focus on business processes and information sharing/transfer, the discipline of business information systems in general, and the enterprise resource planning (ERP) systems software products in particular, provide the most common link between traditional functions such as marketing, operations, accounting and human resources [17], [18], [19]. In spite of such persistent demand for graduates with integrative skills and multidisciplinary perspective, and the powerful capabilities of these enterprise systems software solutions, adoption of these enterprise systems software into the business school curriculum has been relatively slow.

The uncertainty of its pedagogical benefits and non-traditional assessment methods, complexity and challenges involved in designing appropriate assessment tasks and mechanisms, administrative and academic challenges of incorporating and continuous updating of such complex best practice industry software solutions into business

curriculum have been affecting the ability and motivation of many business schools [20], [21].

Anecdotal evidence from recent attempts of integrating software products such as SAP R/3 appear to be positive. These initiatives are contributing to the development of integrated cross-disciplinary perspective and deep learning among university business students, and are helping to move the business curriculum closer to the 'real world' environment [22], [20], [21], [23].

In this background, SAP R/3, one of the most popular industry standard ERP software solutions was incorporated into one post graduate unit and one undergraduate unit in the year 2004 as a pilot in the business school at the University of Sydney. Based on anecdotal feedback from students and graduates, the course so far proved to be the "most useful at the workplace" and appears to have "significantly enhanced their multi-disciplinary perspective and employability."

Considering the successful pilot, it is proposed to extend its usage in the design and delivery of integrated curriculum that spans the disciplines of Business Information Systems (BIS), Accounting and Work & Organizational studies in the Business School. Embedding this key employability skill more deeply into curricula and student assessment will assist the business school in strengthening the linkages between education and the labour market [11]. With this objective, the usage of SAP R/3 as a teaching aid is extended and to other units as explained in the following section.

III. RESEARCH FRAMEWORK & METHODOLOGY

A. Research objectives and features

The objective of extending the deployment of SAP R/3 into one human resource management subject is to develop an understanding of the concepts of business processes relevant to that functional discipline, and their integration and to impart a cross-functional perspective. Accordingly, two laboratory sessions are incorporated into this unit. The focus of these two lab sessions is on generic cross-functional orientation and integrative capability of the SAP R/3 software, process cycles relevant to the human resources function, master data and configuration.

These SAP sessions are taught in a computer laboratory environment where access to the system is readily available for demonstrating concepts and carrying out exercises. At the end, a small assessment task is given to students. This task involves creation of master data and execution of process cycles relevant to Human resource module.

B. Data Collection and Analysis

A questionnaire with a series of statements was employed as the primary method of data collection. The items in the questionnaire were designed based on the objectives of these laboratory sessions, learning outcomes expected from these sessions and necessary skills and knowledge to be

acquired. The first set of statements measure students' perceived improvement of the knowledge on aspects such as enterprise integration concepts, purpose of enterprise systems in business, inter-dependencies between human resource function and other functions, processes and activities in human capital management and information flows across various activities.

Respondents are asked to make self-assessment of their understanding and knowledge using a 'Likert' scale of 1 to 5 (1 = very low, 2 = low, 3 = neutral, 4 = high, 5 = very high) on specific issues taught in these lab sessions. Other statements are included that seek students' perception on issues such as hands-on experience with SAP software, laboratory learning of SAP Human capital management module and measured on 'Likert' scale of 1 to 5 (1= agrees strongly, 5=disagree strongly).

In addition, respondents are asked to rate their view of the potential impact of the ERP-enabled work environment on employees' (ERP users) broader perspective, cross-functional process understanding and interfacing effect of ERP system. In addition, respondents are asked to give qualitative comments on the SAP lab sessions.

IV. ANALYSIS AND FINDINGS

A. Demographics

All the students enrolled in the post graduate unit titled 'Human resource management processes' are respondents in this study. Out of the 54 students enrolled in this study, 51 responses are found to be valid. Out of the 51 respondents, 58% of the students are employed currently and 53% of them are local students. 59% of them have no previous employment experience.

B. Respondents' Understanding and Knowledge

The following table presents the improvement of respondents' understanding and knowledge of various theoretical concepts after the SAP lab session.

TABLE 1
RESPONDENTS' UNDERSTANDING AND KNOWLEDGE

No.	Factors	Mean	Std. deviation
1	Process and information integration concepts	2.89	1.05
2	What ERP systems are about	3.41	1.06
3	Inter-dependencies between human resource function and other functions	3.45	1.22
4	Processes and activities in human capital management	3.51	0.93
5	Information flows across various activities in human capital management	3.59	0.98

Above table shows that the average level of understanding is relatively high (in a scale of 1 to 5). A significantly higher level of knowledge and understanding is observed with reference to all the dimensions except the process and information integration concepts. Importantly, the respondents have reported a significant gain in their

understanding of the processes, activities and information flows relevant to human capital management, and in inter-dependencies between human resource function and other functions such as marketing, operations/logistics and accounting (more than 3.00).

Respondents have also rated the SAP lab sessions and given their perceptions. The following table gives a summary of respondents' views on SAP lab sessions and the perceived gain in software skills.

TABLE 2
RESPONDENTS' PERCEPTION OF SAP LAB SESSIONS

No.	Factors	Mean	Std. deviation
1	Hands-on experience with SAP software (1= very poor, 4=good, 5= very good)	3.76	1.35
2	Learning of SAP software skills in laboratory (1=very easy, 5= very difficult)	3.59	0.94
4	Confidence in improving SAP software skills (1= very low, 5 = very high)	3.71	1.31
5	Ability to become an effective manager in an ERP-enabled work environment (1=very low, 5= very high)	3.24	1.30
3	Performance in the assessment task (1=very poor, 2=poor, 3=average, 4=good, 5= Very good)	3.79	1.15

As shown in the above table (table 2), respondents generally appear to have gained good level of knowledge and software skills relevant to human capital management module (3.59). Given the limited laboratory sessions and the limitations on what can be covered in these two sessions, the respondents felt confident that they can improve their software skills with sufficient training (3.71). Similarly, the respondents also expressed confidence that they have acquired basic skills that will help them become an effective manager in an ERP-enabled work environment.

Importantly, the performance of the students in the assessment task is observed to be good (3.79). This assessment task involves a series of exercises that involve creation of organizational structure, positions, jobs and recruitment of persons and assignment, and maintenance of employee master data.

Teaching and assessing SAP R/3 software skills is a challenge, particularly differentiating between the system errors and students' mistakes in creating master data and performing various transactions. It is also difficult to ascertain whether this assessment task has measured students' knowledge of the processes and information flows relevant to human capital management or whether they have routinely performed the transactions or not. The level of knowledge the respondents appeared to have gained on processes and information flows relevant to human capital management, however, are high (3.51 and 3.59).

Self-assessment of the knowledge and the performance of respondents in the academic assessment task appear to be consistent with each other. Therefore, it is safe to conclude that the students have acquired adequate software

skills and knowledge of processes relevant to human capital management.

Even though the number of sessions are limited, the level of knowledge gained in SAP software skills appears to be good. In general, software based courses are hands-on in nature, and present opportunities to students to participate actively in the learning by doing things in the class. Because of these features, they stimulate learning strongly than other traditional teaching strategies. In addition to these, they expose students' to real-world business contexts, business processes and transactions, and potentially equip students with employable skills. All these features will stimulate students' interest further and enhance their learning effectiveness. Confirming this observation, a large majority of students reported satisfaction with this part of the course and reported improvement in their integrated view of the business enterprise.

C. Potential impact of ERP enabled work environment

As mentioned in the previous section, respondents were asked to express their opinions on the potential impact of ERP-enabled work environment. A summary of their response is presented here.

TABLE 3
POTENTIAL IMPACT OF ERP-ENABLED WORK ENVIRONMENT

No.	Factors	Mean	Std. deviation
1	ERP users will have broader perspective of their function	3.71	0.92
2	ERP users will have a broader perspective of their organization and their processes	3.72	1.15
3	ERP users will be more aware of the transverse character of cross-functional processes	3.47	0.84
4	ERP users will be more aware of the effect of their actions may have on the work of others	3.35	1.06
5	ERP users believe that they have a single system of reference	3.53	1.12

In general, it appears the respondents have developed a good understanding of the impact of ERP-enabled work environment (all of them more than 3.00). Even though this is not the main focus of the course, the respondents have identified positive impact of ERP-enabled work environment in terms of developing broader perspective of processes and organization, cross-functional processes, and the inter-dependency aspects.

D. Differences

Previous experience is considered a critical variable that might differentiate the understanding and knowledge gained and the perceptions of the respondents. In order to see whether there are any significant differences between these two groups of respondents, two tailed t-tests for two independent samples at 5% significant levels are considered appropriate and employed. Because of its robustness,

versatility and its general acceptance in the literature, parametric tests such as t-tests are increasingly used with ordinal data [24]. Table 4 gives details of the t-test results analysing the differences between respondents who have previous experience and those who did not have any previous experience.

TABLE 4
DIFFERENCES BETWEEN RESPONDENTS – T-TEST RESULTS

No.	Items (Not previously employed = 30, Previously employed = 21)	No previous exp	Prev. exp.	t-value	Significance
1	Integration concepts	3.20	2.40	1.75	0.04
2	ERP systems use in business	4.00	2.50	3.60	0.00
3	Inter-dependencies between HR and other functions	3.90	2.57	2.56	0.02
4	Processes in human capital mgt module	3.90	2.71	3.23	0.01

Respondents with no previous experience have reported higher understanding of the theoretical concepts that deal with integration, ERP systems use, inter-dependencies of functions and processes. It is possible that students with no experience perceived higher level of knowledge gain because of their limited exposure to the concepts. On the other hand, respondents with some previous experience, probably have some basic knowledge of these concepts in practice and did not report as much gain in knowledge.

On other aspects such as potential impact of ERP-enabled work environment, general perception of the lab sessions, SAP software skills, and actual academic performance task (SAP skills), no significant differences are observed.

E. Limitations

This study was designed and administered by the author with the help of research assistants and tutors. The findings therefore may have some inherent bias. Since the study was designed and managed by the author, the findings may have some inherent bias. In addition, general limitations of a typical questionnaire survey and self-assessment of students' knowledge would apply to this study. Possibility of over or under assessment of the perceived knowledge, ambiguity of the statements designed and the variation of perceptions due to previous knowledge and experience are some of the weaknesses in the study. In spite of such limitations, this study will make a positive contribution to the knowledge on the effectiveness of incorporating enterprise systems into the business curriculum.

V. CONCLUSIONS

This is a limited attempt at extending the deployment of SAP R/3 into the business curriculum and particularly to the human resource management related course in a particular university. The specific objectives of this deployment are achieved and respondents are generally satisfied with the outcomes. Some of the key areas of understanding that are typically neglected in the past are business processes and the inter-dependencies of various

business functions. This study demonstrates the powerful role played by the ERP system in developing business process orientation and cross-functional perspective to business students. While the existing course including this attempt generally focused on the integration concepts, and SAP transactional cycles in specific module and the

associated information flows and processes, emphasis on the use and management of enterprise systems is necessary in future courses.

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Exploring the Possibilities for Mobile Insurance Services

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Abstract — Due to the complex nature of insurance, customers often require the assistance of insurance officers when upgrading their insurance cover or managing other insurance related tasks. The current electronic services provided by the insurance companies are more or less product-oriented and therefore difficult to manage, or even understand by ordinary customers. As modern technology enables the development of graphical game-like approach on services and taking more benefit out of mobile device characteristics, it is more likely to persuade the customers to operate in the electronic environment in order to get themselves familiar with insurance related issues.

In this article, we are taking the future perspective on the topic by considering what kinds of electronic insurance services could be offered in mobile service environment. More precisely, we discuss how Web-based (already existing) insurance services could be applied in mobile service context, and what kinds of new features (e.g. location information and mobile identification) could be utilized in context of mobile services to enhance the overall service.

Keywords — electronic services, mobile services, Web services, non-life insurance, consumer

I. INTRODUCTION

Web is nowadays an essential channel for customer service functions as companies target their services to mass markets. Complex and only occasionally used services, such as insurance, also benefit from the electronic environment by providing the customer with the freedom of time and place. Independency of time and place makes it possible for the customers to gain information about insurance products and their features whenever it is necessary and most suitable. However, as the complexity of insurance matters does not fully support self-service, the main advantage of the electronic environment remains in the informational level for most insurance products. Therefore, the main focus of the insurance acquisition still relies in the face-to-face contact between the customer and the insurance company personnel or independent brokers. On the other hand, these informative services can be developed to be more visual, and thereby, easier to use for the customers.

According to a research made by Gartner in 2005 for non-life insurance companies, over 80% of the Web sites had included the ability of sending email to the insurer, but fewer than 25% had included the functionality of making policy changes or additions in their Web site [1]. Further, including advisory or demonstrative services (i.e. services which demonstrate the characteristics of different insurance products to customers by utilizing the strengths of the electronic service environment, such as combining voice, picture and movement) to the Web sites of insurance company is still generally remained as unused possibility in order to enhance the electronic service concept [1].

As to electronic service channels, Internet has been the only channel for offering electronic insurance services so far. Some early mobile service applications for insurance industry have already been launched as is discussed later in this article. However, the possibilities of other electronic channels, such as mobile phone, and digital TV, to either support Internet-based service or even function as an alternative electronic service channel to the Internet, and thereby complementing the overall electronic insurance service concept, are yet somewhat unclear.

In this article, we take a role of visionary by considering what kind of insurance services could be created in the mobile environment. In addition, we discuss how Web-based (already existing) insurance services could be applied in mobile service context, and what kinds of new features (e.g. location information and mobile identification) can be utilized in context of mobile services to enhance the overall service. We limit our viewpoint to consider non-life insurance products which are targeted to consumers. However, the presented models can possibly be applied also to life and health insurance in some degree.

We begin with a theoretical discussion based on literature and earlier research by defining what is meant by electronic services (especially mobile services), and describing the current state of mobile services with our focus within the non-life insurance sector. Further, we compare the Web and mobile environment in order to discover the service characteristics and technology innovations that attract customers to use the services and provide them with positive service experience in both environments. Based on the theoretical discussion and the previous research related to electronic insurance services [2], [3], we suggest a theoretical three phase model that can be used in developing and

transferring electronic (Web-based) insurance services to the mobile environment. Relating to the model, we present the preliminary results of the “eInsurance – Novel Electronic Insurance Services”, an on-going research project within the insurance business area. The research project aims at developing Web-based insurance service concepts that support the customers in their online transaction process by demonstrating the characteristics of different insurance products, and thereby increasing the understanding of the customers, in the electronic service environment. Finally we conclude the paper by discussing how the proposed theoretical model can be used in practice. We suggest that the mobile dimension with its extended features is expected to enhance electronic customer service platform of insurance companies even more. Insurance companies are, thereby, able to provide the customer with more comprehensive electronic insurance services, and also more extensive selection of possibilities to fulfill insurance-related service needs.

II. THEORETICAL BACKGROUND

A. General characteristics of services

Services are usually characterized by intangibility, simultaneity (production and consumption at the same time), perishability (services cannot be stored), lack of ownership (services cannot be owned), and heterogeneity (service encounters are not alike) [4]-[6]. The above presented list on service characteristics is, by any means, exhaustive but due to their essential nature the content of services might, however, be more difficult for customers to comprehend than product characteristics.

Certain types of services are especially difficult to be understood by customers. These kinds of services are normally reflected by, for instance, high levels of intangibility, heterogeneity, and infrequency of use [7]. In service literature these kinds of services are referred as complex services [7]-[9]. Complex services are defined as “services that consist of many attribute values per attribute, which are often tailor-made, infrequently purchased, more difficult to comprehend, and require in general assistance during the decision-making process” [10].

Earlier literature on service research has suggested that certain branches can be perceived as complex. For example, financial services, especially insurance [8] and banking to some extent [7], [10], are considered as complex services due to their service characteristics, such as, complexity, abstract, heterogeneity, physical and mental intangibility, infrequency of use, and abstract nature.

In the focus of this study complex services are approached from the insurance perspective. In addition to the complexity of the service itself, the service environment, on the other hand, makes it even more challenging for the customer to comprehend and experience the service. In this study insurance services are considered to be in the electronic service environment, especially in mobile service environment. Electronic service environment, such as the Internet, is generally based on self-service principle [11]

meaning that customers are using the services available in the electronic channel by themselves without any physical support by the service provider. Therefore, complex services which are transferred to the electronic service channel might be even more difficult for the customers to understand.

In order to summarize our view on the development of mobile insurance services, we are keeping the essential nature of services, especially complex services, in mind but also considering the challenges related to the electronic service environment. In addition to the discussion on the nature of services the essential nature of electronic services and also mobile services are discussed more thoroughly in the following section.

B. Electronic services

Due to the growth of Internet connections in the past decade, the need for services that make use of this medium has become obvious. Kalakota has suggested that the evolution of electronic services can be divided to three phases [12]. In the first phase Internet services were only informative; the users browsed through Web pages (addresses) that consisted of text-based information and figures related to different topics. This was followed by external documents and applications that could be stored to the Web page and downloaded or in other form used by viewers. In the next phase, the first interactive (or semi-interactive) services enabled the users to fill in a form, print the information on paper and send it to the service provider or other instance using regular mail. Finally, and due to the growth of both public and private information services on the Internet, the need of faster and easier communication channels enhanced the development of truly interactive electronic services. These services enabled real-time communication and transaction between different instances (B2B, B2C, C2B, etc.) first by email and later on the Internet.

Currently the trend is going towards multichannel services that enable easy accessibility for example by using mobile phones or PDA (personal digital assistant) devices. However, simply trying to remove the restrictions of time and place by developing an alternate graphical user interface to a service isn't necessarily enough for the customers. Instead, the service should make use of the alternate channel features therefore providing added value to the customers and persuading them to use the service.

Electronic services are defined to “comprise of all interactive services that are delivered on the Internet using advanced telecommunications, information, and multimedia technologies” [13]. In this context, the term “electronic service” defines a Web page that requires user interaction in terms of, for example selecting elements, filling in a form or in some other way providing the service with information that is either personal or relates to the person's own interest areas and therefore makes it possible to personalise the service to meet the user preferences. As a result of this interaction, the electronic service provides the user with information related to a certain topic. In terms of electronic insurance service, the information relates to insurance products or other personal security or risk manage-

ment related issues.

The benefit of the electronic channel varies depending on the business area. If we exclude certain limitations such as the ability to touch or test a product and the receiving of immediate gratification in the service, the electronic channel can be perceived as flexible and practical alternative for the customer to fulfil his service needs [14]. Book trade is an example of a business area where the electronic channel has been taken into full use as bookstores have developed electronic marketplaces to enhance their business (e.g. Amazon.com). On the other hand grocery stores have very little to offer in the electronic environment due to their product characteristics (use-by dates determined by legislative bodies, freshness and durability of certain products, etc.). In the financial sector banks have transferred majority of their daily services, but also services related to long term saving and/or investment activities, into the electronic environment. However, insurance services are still highly dependent on personal contact due to the complex nature of insurance.

In conclusion, the growing amount of Internet connections and technology development in the past decade has made it possible to develop truly interactive services that enable multichannel access and provide added value to the customers thus persuading them to use electronic services. In this context the electronic service consists of a Web page that displays personalised content to the users based on their selections or other kind of information entry. The benefit of the electronic channel varies depending on the business area, based on the characteristics of the products and service assortment.

C. Mobile services

The variety of services targeted to mobile customers has grown significantly in the 21st century. As novel technology innovations such as 3G (Third generation wireless broadband mobile communications) or AIPN (All-IP Mobile Network) provide customers with moderate or high-speed Internet connections, the mobile network has become an important channel for many service providers. Despite minor changes in the graphical interface, mobile services do not necessarily differ from the traditional Web services, but instead they extend the freedom of time and place by enabling service transactions during lunch hour or even a journey abroad. Further, as the mobile phone or other form of PDA (personal digital assistant) device is almost always at hand, the threshold of using it for service transactions is much smaller than a personal computer at home. In addition, the extended features of mobile devices, such as location information or mobile identification, can be utilized to provide novel service innovations to customers on the move. In insurance business this requires both technology utilization and business process development, but it might introduce a new area of services that make efficient use of the new technology, thus providing the insurance company with a service concept that enables competitive advantage in the worldwide scale.

Generally a mobile service consists of an application in a user terminal, wireless access networks and servers that

provide chargeable content to the users. In the context of this paper, mobile service can be defined as an electronic insurance service used via mobile terminal in a wireless network. These can be regarded also as consumer mobile applications [15], because the users of these services are customers in contrast to corporate mobile applications where the service users are insurance agents, brokers and other intermediaries.

There are only a few mobile applications available for consumers. Harris-Ferrante et.al. [15] suggest in their study that there is very little demand for business-to consumer mobile applications in the insurance industry. In USA (2004) approximately 10 percent of life and health and 3 percent of non-life insurers enable customers to obtain information via a wireless device [15]. However, it can be expected that the use of mobile services for consumer transactions in insurance context will grow over time.

As an example of a successful mobile service is the "Pay As You Drive"TM insurance from Norwich Union, one of the biggest insurance groups in Great Britain [16]. In this service the monthly car insurance premiums are based on how often, when and where the customer drives. A telematic unit with a satellite position receiver and wireless communication is installed into the customer's car. The telematic unit monitors customer journeys, which allows real-time information to be relayed to the insurer's central computer. The customer's premiums are then calculated based on car usage. The telematic unit acts also as a stolen car locator that can be used for tracking the car in case of theft.

Other more common mobile services are information applications. One practical example about information applications can be found from the Finnish insurance sector. The largest non-life insurer of Finland, If P&C Insurance Company Ltd., launched "If 24h Mobiili" service for travel insurance customers in May 2006 [17]. It is a simple information application that can be used in several Nokia mobile phone models. It simply displays important phone numbers in case of an emergency.

In the future, the key issues of mobile insurance services will be the development of services that utilize both customer mobility and presence information. The successful mobile services will be those that can take benefit from both of these.

III. METHODOLOGY

The background of this article is in a public project, "eInsurance – Novel Electronic Insurance Services" funded by Tekes – Finnish Funding Agency for Technology and Innovation and managed by the School of Economics and Business Administration at University of Tampere and VTT Technical Research Centre of Finland. The other research partners in the project are Tampere University of Technology and National Consumer Research Centre. The industrial business partners are a Finnish insurance company Pohjola and two software companies Profit Software and Mermit Business Applications. The project is carried out during June 2005 and February 2007. The main objec-

tive of the project is to develop a comprehensive and visual electronic insurance service environment to the Internet in which the customership life cycle logic [18] is followed and applied in the insurance context.

The concept work mentioned above was already applied in a preceding project "eInsurance – Electronic insurance business and risk management" (2003-2004) that introduced a concept for selecting and evaluating the insurance cover of the customer. This was performed by mapping the customer profile in a game-based interface. The customers provided the required information on their housing, family and assets by using the mouse to select and move objects on the display. In return, the customers received suggestions on mandatory and optional insurance products that related to their profile together with short descriptions and additional risk data that was linked to the objects during the selection process. Finally the customers were directed to a phase where they could 1) find additional information from the insurance company Web pages, 2) buy insurance products and/or 3) send the profile to the insurance company together with the customer's contact information. The service was published in January 2005 and later exploited in a practical business context by the Finnish insurance company Pohjola. They developed their own "Insurance selector" service in July 2006 which was based on the service concept model developed in the first eInsurance research project.

The proposed theoretical model for developing successful mobile insurance services consists of three phases that are listed below.

1. *Design and development of an electronic insurance service in the Web environment*
2. *Evaluation of the service in the Web and mobile viewpoint (business and technological characteristics, advantages, disadvantages, etc.)*
3. *Design and development of a mobile insurance service based on the existing electronic service*

The practical focus of this article is in phases one and two due to the concrete examples from the two eInsurance projects. Phase three is handled from a visionary viewpoint, suggesting mobile services that could be developed based on the existing and future Web services as well as the capabilities of mobile technology.

Since our view on visioning mobile insurance services is rather realistic than utopistic, we are leaning on concrete and practical concepts that are already tested in the Internet environment, and that already are in real use or may have potential to become utilized in practice. Therefore we are following the above described three phase model in considering and visioning the development of mobile insurance services.

For mobile service, the availability and usability regardless of location or time is the essential advantage. However, there are some technical characteristics to be considered when Web-based services are transformed into the mobile environment.

Due to the fact that the user interfaces of mobile terminals are more limited than in PCs, the Human-Machine

Interface (HMI) must be redesigned according to the following rules:

- avoid extensive textual information,
- prefer flat menu structures,
- prefer audio instead of text

Location-based services can be exploited for example in travel or car insurance applications by following the guidelines mentioned below:

- Because the speed of the wireless network is usually lower than that of a fixed broadband network, the amount of data transfer should be kept in minimum.
- The characteristics of client application software in mobile terminals are usually limited compared to the client application software in PCs.

Due to the above mentioned possibilities and limitations of mobile services, Web services have to be carefully analysed before transferring them into the mobile environment.

IV. RESULTS

In this chapter, we present the results according to the proposed theoretical model. We begin by describing two examples of a Web-based electronic service as defined in the theoretical model phase one; the first example is the eInsurance service for selecting and evaluating insurance cover as an existing and the second example is the eInsurance "safety advisor" service as a future service in the insurance business area. Then we evaluate the two previously described services as defined in the theoretical model phase two. In the evaluation, we are trying to discover the key elements of each service from the Web and mobile viewpoint. Based on this background information, we move on to the theoretical model phase three and present as concrete results the potential mobile services and technological characteristics that either enhance the Web-based services or replace them.

A. The eInsurance service

The eInsurance service for selecting and evaluating insurance cover is a browser-based Shockwave application that can be downloaded from the project Web site [19]. The service requires an Internet connection for downloading the Shockwave application, but also for certain features of the service such as

- sending customer profile information to the insurance company for contact purposes,
- obtaining additional information from the insurance company,
- buying insurance products from an on-line marketplace provided by the insurance company

The first phase of the service (selection phase) collects information on the user. The phase is divided into three parts in which the user provides the service with information related to the following areas;

- type of accommodation (apartment, row house, detached house)
- family members (myself, spouse and/or other family members, children, pets)
- assets (car, motorbike, motorboat, bicycle summer

cottage, valuables, etc.)

First the user is asked to select the type of accommodation by clicking on one of the three accommodation types shown in the display. Second, the user is required to drag and drop family members to the selected house based on the user profile.

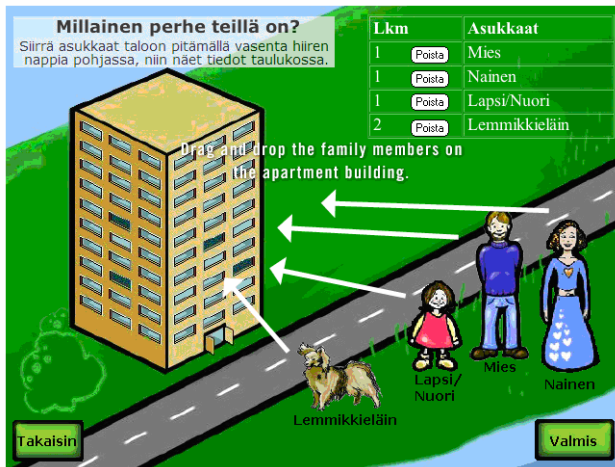


FIGURE 1. EINSURANCE SERVICE – SELECTING FAMILY MEMBERS

Third, the user is required to drag and drop different assets to a garage. Different assets such as vehicles, summer cottages or valuables are shown in the display.

After making the selections, the user is transferred into the summary and suggestion phase. The display is divided into two columns in which the left column consists of the objects that the user has chosen and the right column contains suggestions on insurance products that are mandatory or voluntary for that certain object (Figure 2). In addition to the actual insurance product, the column provides also detailed information on the product features such as additional services. The user is also able to open the summary in a separate browser window for saving or printing the information. Later in the service, the user has also an option to send the information to an email address specified by the user.

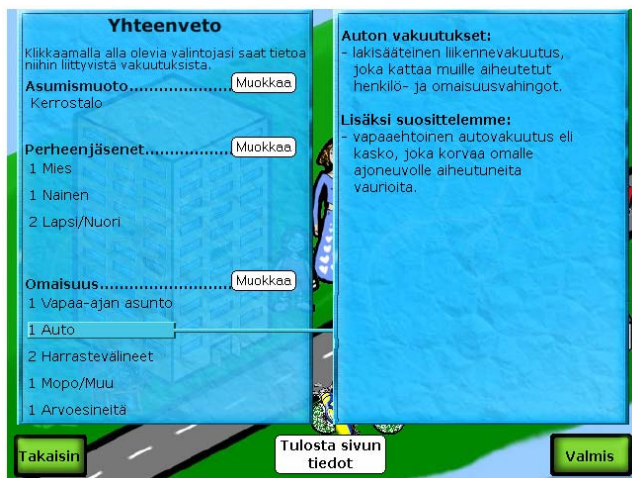


FIGURE 2. EINSURANCE SERVICE - SUMMARY OF THE SELECTIONS AND SUGGESTIONS ON SUITABLE INSURANCE PRODUCTS

The final phase of the service presents the user with different options on further actions (Figure 3). The window contains three buttons with the following options:

1. transfer to the insurance company's Web site to receive further information on the products
2. transfer to the insurance company's Web site for buying insurance products
3. send the information to the insurance company via email to receive an offer or to contact an officer

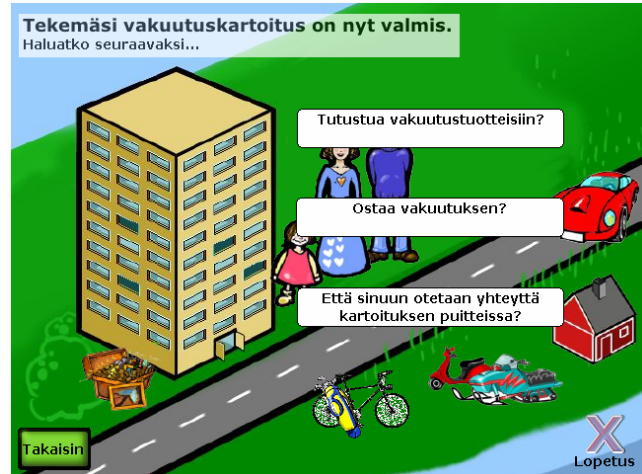


FIGURE 3. EINSURANCE SERVICE – FURTHER ACTIONS PHASE

The service provides also useful information related to the different risk factors in the user's life. The risk information is shown in balloons that are displayed whenever the user places the mouse cursor on top of any object in the selection phase. The balloon consists of either statistical information for instance on common accidents or basic information on insurance products concerning that object.

B. The eInsurance "safety advisor"

The objective of the future eInsurance "safety advisor" is to support customers during the insurance acquisition phase. After the customers have performed the insurance selection and evaluation phase, they are shown a display of a typical home based on the given profile information. In practice the family members as well as other assets are displayed in a graphical environment in which the customer can move and make observations. The purpose of the service is to visualise the different characteristics defined in insurance product descriptions that might not yet be known by the customer. In addition, the safety advisor displays also information on practical issues, for example measures in case of an accident, travel checklists or useful Web-links. The development of the "safety advisor" service has begun in fall 2006 and the publication is scheduled in March 2007.

C. Evaluation of the Web-based insurance services

The key elements of the eInsurance service for selecting and evaluating insurance cover are the following:

1. customer-oriented viewpoint
2. game-based graphical interface

3. simplified structure of the service
4. common information on risks displayed in balloons during the service process

The customer-oriented viewpoint is adopted in the eInsurance service for selecting and evaluating insurance cover instead of the traditional product-based viewpoint commonly used by the insurance companies. This enables the customers to approach the complex insurance context by describing their own living environment first before receiving information about products and services provided by the insurance company.

The graphical interface of the service provides the user with game-like visual experience instead of matter-of-fact traditional insurance service encounter, thus giving the customer the feeling of a successful accomplishment in the service. At a general level, games also support learning, which makes the service perhaps easier to adopt.

The service was designed to be short and very simple in order to provide the users with a positive service experience. The results of the service are displayed after three phases that require little influence from the user. The results cover one phase after which the user is forwarded to the final phase, i.e. choosing whether to visit the insurance company Web pages in order to acquire more information, to buy insurance or send the collected information to the insurance company for contacting purposes. Due to the fact that the environment is usually characterized as complex and matter-of-fact, the simplified structure of the service also supports this viewpoint.

The useful risk information displayed in balloons during the service process can also be considered a key element of the service since displaying the potential risk factors in life might awaken the users and have an effect in their habits.

In addition to some of the key elements defined above, the future eInsurance “safety advisor” service is thought to contain the following key elements:

1. the content is targeted to support the understanding of insurance issues (i.e. avoid misunderstanding)
2. the graphical interface adopts to the user’s selections
3. wider perspective to useful risk information

The objective of the “safety advisor” is to visualise the different characteristics defined in insurance product descriptions that might not yet be known by the customer and therefore avoid any misunderstanding related to them.

The graphical interface of safety advisor adapts to the user’s selections, for example when the person has selected a certain accommodation type and the number of family members in the eInsurance selection and evaluation phase, the selected environment is displayed to the user in the “safety advisor” phase. This way the user becomes acquainted with the service which supports the acquirement of a positive user experience.

In addition to the previous service, the “safety advisor” is planned to display also information on practical issues related to risk management, for example measures in case of an accident, travel checklists or useful Web-links.

D. Visioning the mobile insurance services

The different possibilities for mobile insurance services

development vary depending on the purpose and technological perspective. As mentioned already in the theoretical background chapter, information services as well as location-based services have already been implemented to the insurance business environment, but only in a narrow scale. Below we propose potential mobile services that could be implemented either to enhance, and support the use of already existing electronic (Web) insurance services (supporting role) or to function as independent option to Internet-based electronic service (alternative role).

TABLE 1. POTENTIAL MOBILE INSURANCE SERVICES

Mobile service name	Mobile service function	
	supporting	alternative
Service for selecting and evaluating insurance cover		x
Traveller’s insurance initiator	x	(x)
Information directory service (in case of an accident)		x
Insurance cover verification reminder	x	
Service for determining risk and safety related issues	x	(x)
A safety application for the elderly		x

The “Service for selecting and evaluating insurance cover” consists of a mobile application that follows the current Web service concept developed in the eInsurance project and is targeted to private customers. Similarly as the corresponding service concept utilizes the graphical capabilities of Web environment, the proposed mobile application would exploit the graphical capabilities of mobile devices and therefore provide a customer with an equal alternative to the use of Web service.

The “Traveller’s insurance initiator” is a mobile application that initiates the owner’s travel insurance by SMS or directly through the Web whenever the mobile device is located over a certain distance from home or other specified location. The service supports a Web service for managing the travel insurance characteristics or replaces the previous when ordering and managing the service with the insurance company call center. The idea has been applied from the Norwich Union insurance service and the application would utilize of the location-based information of the mobile device [16].

The “Information directory service” resembles the “If 24h Mobiili” service [17], but provides more information related to for example to-do checklists in addition to phone numbers in case of an emergency. The application consists of an off-line directory database that can be browsed through depending on the case (accident, damage, etc) and the information requirement. The directory could be updated automatically via an on-line connection to the insurance company and therefore offer a corresponding option to existing Web service in mobile service channel.

The “Insurance cover verification reminder” is a supporting service that reminds the customer at a certain schedule to update the customer’s personal insurance profile. The service could first be based on SMS messages sent by the insurance company, but later based on, for example the change of owner information in the mobile device (address

change results into a suggestion to contact the insurance company) or even location information (if the principal location of the phone changes for a longer time period, the application notifies the customer).

The "Service for determining risk and safety related issues" applies the characteristics defined in the future eInsurance "safety advisor" service. It is a supporting service that enables the user to visualize the potential risks related to home, traffic, travel, etc. environment by visualizing the information in a device that can be taken to the actual location. The service would utilize the graphical capabilities of the mobile device and due to the right location enhance the influence of the displayed safety messages.

Since insurance business is also safety business the last vision is targeted to increase safety among customers, in this case, elderly. The "Safety application for the elderly" is an application that makes use of the motion detection capabilities of certain mobile phones thus replacing other safety devices. In case of the target person falling down, for instance, the mobile phone would react to the sudden movements and make a ringing tone in order to check that the owner is ok. In case of the owner not answering the phone, the application would then contact a specified person (family member, home care, etc.) and play a pre-recorded message together with the current location information to notify the target person of the emergency.

V. DISCUSSION

Technological capabilities of mobile phones and other devices enable the use of mobile services targeted to ordinary users. However, there are some restrictions concerning the visualization and content of services for example due to their limited user interface and data transfer speed. In this perspective, the evaluated Internet-based insurance service concepts follow the given rules based on their short and very simple structure.

Based on the evaluation, both presented Web-based insurance services were considered to be fully or at least in some degree convertible into the mobile environment. The service for selecting and evaluating insurance cover was considered to offer an equal option to the Web-based service due to the simplicity and graphical requirements. However, and partly due to the incompleteness and the more complicated nature of the concept, the "safety advisor" was considered to be only a supporting service to the Web-based version.

The other proposed mobile services were based on examples from the insurance and other business areas. The "Traveller's insurance initiator" service and partly both the "Insurance cover verification reminder" and the "Safety application for the elderly" services were implemented from the location-based insurance services mentioned earlier in this article and developed based on the knowledge of current mobile device capabilities and new innovative navigation methods.

On the other hand, the "Information directory service" vision was further developed from the service published by If P&C Insurance Company Ltd in 2006 with the idea of an

application that consists of the necessary and/or vital information that might be useful in case of traffic or other accident. This service idea requires further development related to search and context awareness methods, but in a few years time also these issues might have already been solved due to the automatic communication of mobile devices and vehicles.

Even though the above presented visions related to mobile insurance services might sound complex of their nature, the future of mobile services in the insurance business area might also consist of as simple elements as SMS or even a traditional call-service as an intermediate phase before full implementation to the mobile environment. The exploitation of the eInsurance service for selecting and evaluating insurance cover has been made by the Finnish insurance company Pohjola that was participating in the eInsurance project. Their "Insurance selector" service was published in July 2006, and the profile information sent from the service is processed by the call center that contacts the customer for maintaining or upgrading the customer's insurance cover. According to the first impressions, the visual Web-based insurance service might be a "killer application" even though combined with a telephone connection between the insurance company and the customer.

VI. CONCLUSION

When using complex services, such as insurance, customers often require the assistance of service officers in terms of understanding and managing the service as a whole. However, by fully exploiting the advanced possibilities of modern Web-technologies, successful electronic insurance services can be, and also have been, implemented.

Mobile insurance services are particularly advantageous when the benefits of mobility — the freedom of time and place and location dependence — are exploited. Having this in mind, the already available electronic services can be transformed to the mobile environment. During this process also the limitations of mobile terminals have to be taken into account.

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From Ordinary to Virtual Teams: a Model for Measuring the Virtuality of a Teamwork

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Abstract — Virtual teams and teamwork have been researched as a group level phenomenon as well as a new emerging type of organisational form. As most of the modern teams use to some extent virtual teamwork the question raises - how to measure the degree of virtuality of the teamwork used (v-score)? The current paper presents a communication based approach model that enables to develop a typology of virtual teams by joining ordinary- and virtual teams into one model and also describing all the middle forms of teams in between those two pure types of teams.

Keywords — virtual team, ordinary team, v-score, typology of teams.

I. INTRODUCTION

A. The aim of the article

Virtual teams and management processes in them have been researched mainly theoretically. Most of these papers concentrate on presenting the definition and/or on outlining the advantages/disadvantages of virtual teams. As most of the contemporary work teams use at least some extent virtual teamwork, then the question raises – how to measure the degree of virtuality of the teamwork (how to calculate the v-score)? If there would exist such kind of framework enabling to measure the degree of virtuality then researching of virtual teams as well as management of virtual teams would be easier as this model would be bases for drawing a typology of virtual teams and at the same time would enable to distinguish ordinary- and virtual teams. Based on that suggestions how to manage & how to avoid most common mistakes in virtual team management, for managers of teams with different degrees of virtuality, could be made. The aim of this article is to present a model that enables to draw a typology of teams from pure ordinary teams (only face-to-face meeting) to pure virtual teams (never meeting face-to-face); including all the forms of teams in between these two pure forms of teams and that is possible by measuring the degree of virtuality of teamwork (v-score).

B. Background and definitions

The organizations have started to use teamwork for solving the problems and tasks mainly during the past 15 to 20 years. A *team* is a group of individuals who work interdependently for solving the problems and accomplishing tasks [1]. Relatively recent developments in the field of information- and communication technology (ICT) have enabled the organizations to start using also the so called virtual teams. Virtual teams have been defined as: "...groups of workers with unique skills, who often reside in different geographical places and who have to use for co-operation means of ICT in order to span the boundaries of time and space [1]". Use of virtual teams is a growing trend in our modern society and most of the organizations are increasingly affected by that.

The subject of virtual teams requires further research mainly due to the fact that management of ordinary- and virtual teams are substantially different. The change is required in: understanding of the group processes, manager-subordinate communication, communication among the group members (colleagues), delegation, empowerment, achieving of synergy, main functions of management *etc.* Turning ordinary teamwork fully (or at least partially) into virtual teamwork introduces a whole new range of problems for managers; and first of all there is required a clear understanding of the difference between an ordinary (mostly or only face-to-face meeting team) and a virtual team (never or rarely face-to-face meeting team). Also would be beneficial to have a model encompassing all the middle-forms of teams (described by different degree of virtuality) between those two „pure” types of teams. That kind of model would serve as bases for further analyses, what kind of managerial problems are there present in teams with different kind of degrees of virtuality.

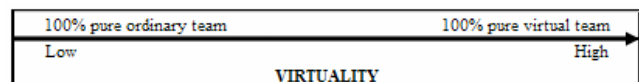


Figure 1. Level of virtuality in ordinary- and virtual teams.

Here and in the following text the *pure type of team* is used and understood as such kind of team that does not use any other elements of the other extreme type of team (see Figure 1). Pure ordinary team (or 100% ordinary team) is a team that uses for co-operation purposes only eye-to-eye meetings (without any use of ICT for co-operation). Pure virtual team (or 100% virtual team) is a team that uses for

co-operation purposes only ICT mediated communication (without any eye-to-eye meetings between the team members).

The number of published articles and books on the subject of virtual teams (and ICT mediated communication) has grown substantially during the past five years. Most of these publications deal with the issue of the definition of the virtual team [2], [3], [4], [5], [6], [7] and/or are written on outlining the similarities and differences between ordinary and virtual teams [2], [8], [9]. Second major group of works concentrates on discussion of the strengths and weaknesses of virtual teamwork in some specific area, e.g. education: challenges related to and reasons to use e-learning [10], [11], [12].

Regarding the term „virtual team” can be found many alternative options that are used to describe the same phenomena: off-site teams [8], off-site employees [13], remote teams, distance work etc. At the same time it is apparent from the context or definition, that these terms are synonyms and all mean virtual teamwork, but not in all cases pure virtual teamwork.

Some of the authors go even further and expand the virtual teamwork idea from group level to organizational level by describing virtual teamwork as a new form of organization. Lipnack, Stamps [14] and Potter *et al.* [15] state that virtual teams are the newest forms of organizations. By Lipnack and Stamps [14] the 21st century organizations are made up of virtual teams and networks of teams. Although the authors start with the statement about the birth of a new organizational form they still continue with the discussion, definition and analyses at the group level.

There is a variety of names used for virtual teams and virtual organizations (in many cases there is no clear distinction made between organizational and group level): „*spider web, modular, cluster, learning network, perpetual matrice, spinout, third-millennium group, boundaryless organization, postmodern organization, alternate office, extended enterprise, flexible manufacturing network, distributed global work team, turbo task force and autonomous work group outside existing organizational structures* [16]”. By their meaning and definition all of them can and have been used for virtual teams. Below are outlined just a few definitions used to define the virtual team:

„A virtual team is a group of people who work interdependently with a shared purpose across space, time, and organization boundaries using technology [9]”.

“Group of geographically and/or organizationally dispersed coworkers that are assembled using a combination of telecommunications and information technologies to accomplish an organizational task [17]”.

„Virtual team is a collection of task-driven members behaving as a temporary group, whose members are separated by geographic or temporal space [18]”.

„Groups of people who work closely together even though they are geographically separated and may reside in different time zones in various parts of the world.” And also “cross-functional work-groups brought together to tackle a project for a finite period of time through a combination of technologies [19]”.

As it appears from this relatively small selection of virtual team definitions there are a few reoccurring words, phrases (underlined in the definitions), that are similar in meaning and are thus the core of the virtual team phenomena. These are: shared purpose/working together, use of ICT for communication, team members are separated from each other geographically, team members work in different time zones. The first of these aspects is currently not important, as it is not specific for virtual teamwork and is a general aspect of teamwork. In this article the definition of virtual team by Henry and Hartzler [19] is used.

Different author's have different views which of those aspects to consider the most important in differentiating the virtual team from the ordinary team. Rad, Levn [20] consider it to be the geographical distance between the team members. At the same time other authors, trying to come up with a precise and important aspects' describing definition for virtual team phenomena, have come to conclusion that not the geographical distance, but use of ICT for communication between the virtual team members is the main criteria, that distinguishes virtual teams from the ordinary ones [1]. This is a logical conclusion, because if team members, who work together in the same building, but use for communication and coordination only tools of ICT (instead of meeting eye-to-eye) is a team with a high level of virtuality and the team members of that team experience the same problems and challenges as if they would be separated by a long distance. The author agrees with the reasoning that the main criteria for distinguishing virtual teams from ordinary teams is the use of ICT for communication between the team members and continues with the development of the virtual teams' typology model from that notion.

II. TYPOLOGIES OF VIRTUAL TEAMS

Before introducing the new model – overview of the work done on that field. In author's view there are only a few serious (academic, scientific) type of works attempting to offer a framework for showing that there are different types of virtual teams used, e.g. Bell, Kozlowski's [2]. Their typology is based on all the main characteristics that are outlined and considered important in the virtual team definitions by the time the article was written. Firstly Bell, Kozlowski [2] outline the differences between ordinary and virtual teams and then stress that, although usually in the papers it is assumed that there is only one ideal type of virtual teams, then actually there are used many different types of virtual teams in daily work practice. They offer four important characteristics for describing different virtual teams:

- 1) temporal distribution;
- 2) boundary spanning;
- 3) lifecycle;
- 4) member roles.

Bell, Kozlowski's contribution to the development of the typology of virtual teams is mainly to be the initiators of the discussion and research in this field. The newest and most interesting in their work is the idea that there is no one specific type of virtual team as a type of team among others, but there is the virtual team phenomena and it

appears to have many sub-types that can be described based on the four previously outlined characteristics.

Rad, Levin [20] also consider in describing virtual teams the communication aspect important, but they also point out the geographical aspect (team members' location) and subordinate status. Lipnack, Stamps [9] go beyond the communication aspect and inner processes of a virtual team and concentrate in their research on the idea that virtual teams and their networks are the newest organizational form. Figure 2 gives historical background and context for the development of virtual organizations; and the virtual organization is thus the newest of the forms.

SMALL GROUPS	HIERARCHY	BUREAUCRACY	NETWORKS
Time →			
Nomadic society	Agricultural society	Industrial society	Information society
3.million - 10,000 B.C.	10,000 B.C - 18th century	18th century - 20th century	1945 - 21st century
Members	Levels	Purpose	Links

Figure 2. Four ages of organizations [9].

Lipnack, Stamps [9] state that virtual organization is the future form of organizations and development trend of current organizations. And although the previous organizational forms remain, the virtual organization will be the surrounding structure of the previous organizational forms. There can be noticed two alternative directions in development of the typology of virtual teams:

- a) internal processes related typologies;
- b) form, structure related typologies.

Internal processes related typologies are based on the specifics of virtual teamwork (or on differences compared to ordinary teamwork), like Bell, Kozlowski [2] propose – boundary spanning, member roles etc. Although not a typology, but more of a test approach, using virtual team continuum, to find out employees attitudes towards virtual teams [24]; can also be seen as a start towards creating a typology of virtual teams by describing inter-organizational processes. Form, structure related typologies (e.g. Lipnack, Stamps) are based on the idea that organizational structure needs to be analyzed and that the virtual team or networks of them are a new organizational form. The model described next is based on the analyses of internal processes of virtual teamwork.

III. A MODEL FOR MEASURING THE VIRTUALITY OF THE TEAMWORK

All the previously outlined typologies of virtual teams start with the assumption that there are pure ordinary teams and pure virtual teams used in daily work practice and continue from there with the sub-types of virtual teams. None of these typologies tie together ordinary and virtual teams into one model enabling to outline all the middle forms in between those two pure types of teams. This can be done by using virtuality of the teamwork as the main characteristic of the teamwork used and in this case the

degree of virtuality can vary from 0% (pure ordinary team) to 100% (pure virtual team). Figure 1 illustrates the idea graphically.

It must be agreed that, it is very senseless and unrealistic to try to distinguish only the pure types of teams, as it is mostly only theoretical construction that enables it [1]. In real life, in daily work practices, all the teamwork used can be described by the characteristic of virtuality. Naturally, in the one end of the scale remain the teams that do not use any virtual teamwork elements for coordination of work. To the other end of the scale remain relatively smaller group of teams that use only virtual teamwork; but most probably the trend is in the direction of growth in that end of the scale, as well as in the middle. And the biggest amount of teams remains in the middle of the scale [21], [22] and can be described by some certain degree of virtuality. Much information could be obtained about modern teamwork reality, if research would be conducted about how much virtual teamwork is used by organizations in teamwork situations. Fortunately, in recent years also empirical research in this field is emerging. Beneficial for that kind of research would be a model, which describes the middle-forms of teams in between the two pure types of teams (basically the degree of virtuality can be used for showing how ordinary team becomes gradually a virtual one).

As the most crucial aspect that distinguishes virtual teams from ordinary teams is use of ICT for communication, then it is important to analyze more in detail the communication aspect of virtual teamwork. In the current (virtual)teamwork model communication is described using three dimensions:

- Richness of the communication channel;
- Time spent on communication;
- Frequency of communication.

Nowadays people use for communication very many different channels of communication (see Figure 3) and some of them are rich channels enabling to see the other person/people, hear the voice, observe the body language *etc.* At the other extreme of communication channels are the poor communication channels that do not permit the

previously outlined benefits. Due to different reasons in many cases members of the virtual team use a lot of relatively poor communication channels (or at least much less rich than ordinary team members who mostly use eye-to-eye meetings).

Richness of the communication channel							
Poor channel				Rich channel			
Official written report	Memo, ordinary mail	Forum	E-mail	On-line communication	Phone	Web-camera + phone	Meeting eye-to-eye

Figure 3. Richness of the different channels of communication [23], with author's additions.

Time spent on communication is also an important aspect that needs to be used in the model as the degree of virtuality of the teamwork is different when the virtual team members communicate e.g. once a month for 10 minutes using a web camera compared to an other virtual team that is constantly (24h) connected by web camera.

Frequency of communication shows how often the means of ICT are used for communicating with the other team members. The degree of virtuality is different when the team members change an e-mail once a month or once a day. Thus the degree of virtuality can be calculated based on the following equation (see Figure 4).

$$\text{TIME} * \text{RICHNESS} * \text{FREQUENCY} \\ = \text{SCORE OF VIRTUALITY (V-score)}$$

Figure 4. Equation for the score of virtuality.

Basically the new model is 3-dimensional, where each dimension is measuring one aspect of virtuality. If all three scales are constructed with the variation maximum up to 4, then there would be formed a cube that is made up of 64 smaller cubes. Later, in the empirical testing phase, these smaller cubes would be associated with the different types of (virtual)teams; in the theoretical framework these symbolize the different types of teams with different degrees of virtuality (see Figure 5).

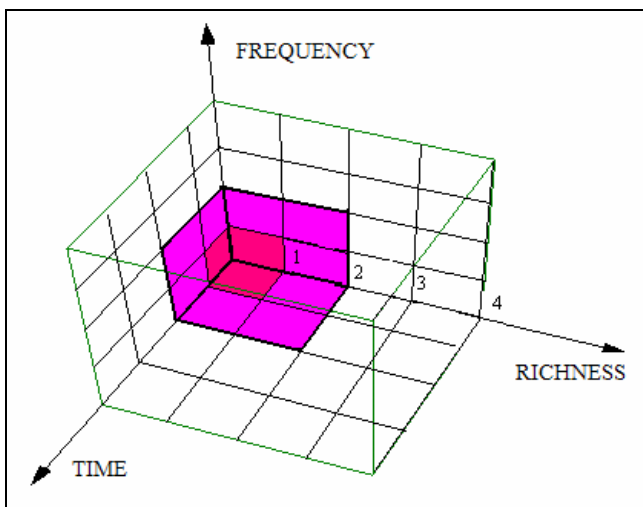


Figure 5. Model for measuring the virtuality of the teamwork.

The highest degree of virtuality has the cube (the pure type of virtual team), that is situated in the contact/start point of the dimensions. In this case the cube would have the smallest V-score. At the other end of the biggest cubes' diagonal are situated the ordinary type of teams and the pure ordinary team would have the biggest v-score, maximum 64. Thus the v-score vary from 0 to 64 points. Dividing scales into four should be numerically enough to describe all middle-forms in between the two pure types of teams.

The model also enables to draw a line between ordinary and virtual teams: the line bisects all the three dimensions in the middle, at the value of 2 (the 50% margin in case of the max value of 4). Thus there forms around the most virtual cube, in addition a group of 7 cubes and all together they form a cube of 8 sub-cubes. This is the bases for the typology of virtual teams in the context of this model, as these 8 are with the highest degree of virtuality. Stemming from that, there is possibility to outline 8 different types of virtual teams.

In the daily work practice the degree of virtuality of the teamwork varies in the different stages of the work process. The difference stems from the fact that the team members during the team formation stage, formulating the goal and distribution of tasks and roles (in the first phases of group processes) can choose to meet eye-to-eye much more often than during the other, later phases. The same applies in many cases to the final phase of work – eye-to-eye meetings, e.g. to finalize the groups' collective report of work or for giving direct feedback of the reasons of (un)success of the teamwork or for celebrating the end of the project. Thus the v-score calculated is not a constant, but rather a variable that differs in time and the teamwork's degree of virtuality can, and most probably does, vary in different phases of work. This is an important aspect regarding the planned pilot-testing of the model and in the future research in that field.

The model has 2 goals, options for use:

- 1) the model enables to measure the degree of virtuality of different teams;
- 2) the model enables to classify teams – from pure ordinary teams to pure virtual teams and all the middle-forms in between, using the v-score.

First of the goals is more practical in approach, as the measuring itself can not be the goal, the next step after that would be to associate different problems of virtual teamwork (e.g. managerial, communication, empowerment, decision making, the most suitable leadership style etc.) with different degrees of virtuality. This enables later to inform managers and members of teams with different degrees of virtuality, what are the major problems related to that type of virtual team and make suggestions how to prevent them. The second goal is more of theoretical value.

There is being constructed a questionnaire based on the model for testing the idea introduced in this article. After gathering empirical data the v-scores can be calculated and possible other forms of equation developed and the model itself can be re-constructed, if needed. Based on the v-score the researched teams can be then classified under a specific type of team. After the questionnaire based research, is planned case study based approach and interviews with the team members and managers of different types of teams. This enables to find out more in detail the (management) specifics and main problem areas of the specific types of teams. Starting with the 8 types of teams with the highest degree of virtuality; the results of the research enable then to outline the specifics of each type of virtual teams, name the types of the teams and also rank the main problem areas.

IV. CONCLUSIONS

The virtual team term is being used very frequently, but its definition varies relatively lot. The most common assumption appears to be that virtual teamwork requires use of ICT and that there is a big distance between the virtual team members. It is concluded in the article that the use of ICT for communication is the most important characteristic for describing a virtual team.

There can be found relatively many articles describing the difference between an ordinary and a virtual team. There is still very few typologies developed describing different virtual teams. The current typologies of virtual teams tend to describe the virtual team either based on internal characteristics (member roles, boundary spanning etc.) or based on external characteristics. The authors of the last ones are convinced that virtual teams and their networks are the newest form of organizational structure.

The new model described in the article enables to measure the score of virtuality for all types of teams. It can also be used to develop typology of virtual teams that includes ordinary teams. The model is based on communication analyses and defines virtuality using three scales: richness of communication, time spent on interaction with the team members and frequency of communication with the team members. The model is yet not empirically tested, thus it is new in its approach to virtuality and may have to be revised after the empirical data is used for testing.

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Health ecosystem as an interpretation framework for knowledge flows

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Abstract — This paper explores the concept of health ecosystem. The concept will be defined in the context of municipal health care in Finland. The paper argues that the ecosystem approach reconciles the descriptive viewpoints of integrated care and health system by highlighting the interconnectedness of the actors and the dynamic nature of the environment.

Keywords — Complexity, Knowledge management, health care

I. INTRODUCTION

A. Health care organizations as knowledge-intensive organizations

According to Miles et al. [1], knowledge-intensiveness is about the way how knowledge is produced and delivered, not about the amount or extent of knowledge. Miles argues that knowledge-intensive work requires a creative problem solving and abstract thinking and to be successful it requires knowledge processing and refining. Maula [2] states that knowledge-intensiveness can be seen in the content of a service, in experts' competences and their way of communicating between each others or with customers, in processes and systems that are used for producing and providing services and finally, it could also refer to the utilization of knowledge as a source of learning, innovativeness and renewal. In health care experts are highly

As it comes to health care services, those can be seen as knowledge-intensive service due the fact that they require highly specified knowledge about human physiology and many medical issues. Scientific research plays an important role in medical knowledge creation as well as human interaction at the operational level of health services. Health care organizations utilize and refine research results and knowledge in the form of services for their customers, which is the key function of knowledge-intensive organizations.

B. Purpose of the paper

Purpose of this paper is to study health care as an example of knowledge-intensive services and to further develop the concept of health ecosystem as a theoretical pattern that could be used for conceptualizing municipal health care in Finland. This conceptualization will be used

as a basis for the study of knowledge flows of health care.

It has been argued that in health care organizations information and knowledge are fractured. This refers to the fact that available knowledge, capabilities and supporting technologies have in many cases developed along with the specialization of services. Specialization has differentiated working practices and complicated knowledge flows between different occupational groups. [3], [4] This has hindered also the accumulation and utilization of knowledge for management purposes. Development initiatives relating to knowledge accumulation and utilization in health care sector are in many cases strongly technology oriented and in Finland, they have been mainly focusing to compilation of statistics at the national level. In many cases these initiatives lack the viewpoint of municipal health care organizations and the needs of their management. Therefore, there seems to be a research gap in the area of knowledge management processes within public health care organizations.

The current Finnish health system is highly decentralized and government regulation has been partly replaced by steering through information. This focus on information urges the need for information and knowledge management research in health care. The paper aims to describe the complex environment of Finnish health care and offers conceptual tools for enhancing the understanding of the role of knowledge management and knowledge processes in the sector.

From the theoretical viewpoint the paper also aims to find answers to the question of: How can knowledge-intensive organizations benefit from the complexity sciences? This is a question that has been raised in many occasions. Academics and consultants highlight the possibilities of complexity thinking in organizational context but business managers are still skeptical.

C. Case study in the Health care district of Forssa

Practical examples presented in this paper are based on the underlying case study that was conducted in the Health care district of Forssa (FSTKY). Qualitative data was collected by interviewing some key personnel of FSTKY. The interviewees were the director of the health care federation, development manager, quality and development manager, chief physician of neurology, medical doctor of health care center and an information specialist. In addition, author observed the meetings of the management group for a period of six months to form a general understanding of the health care organizations. Also many informal

discussions with health care specialists and people involved with health care have greatly advanced the understanding of the sector. Results of the case study have been used for adjusting the theoretical compilation of health ecosystem.

Health care district of Forssa (FSTKY) is a federation of five municipalities that started as a joint municipal health care authority at the beginning of 2001. The current population in the area is about 35 000. Federation provides primary health care, special health care, mental health care, environmental health care and A-clinic services for the inhabitants of its area in the south-west Finland. The federation provides employment in health care for about 640 people.

D. Complexity-based knowledge management

Koivuaho and Laihonon [6] have created the framework of complexity-based knowledge management (CBKM) for the purposes of studying the possibilities of complexity sciences and knowledge management in the area of knowledge-intensive services.

Complexity-based knowledge management is composed of three theoretical backgrounds (see Figure 1). The most important part of the framework is knowledge management, since the main research interest of authors arises from the knowledge management domain. Other domains are complexity thinking and organization theory.

Complexity sciences and knowledge management both highlight the importance of interconnectedness for organizations. It has been pointed out in several discussions how important interconnectedness and knowledge sharing are for contemporary organizations. Based on these discussions, the framework parallels interactions to knowledge flows and communication processes and presupposes that this might offer a promising link for combining these disciplines and their research results.

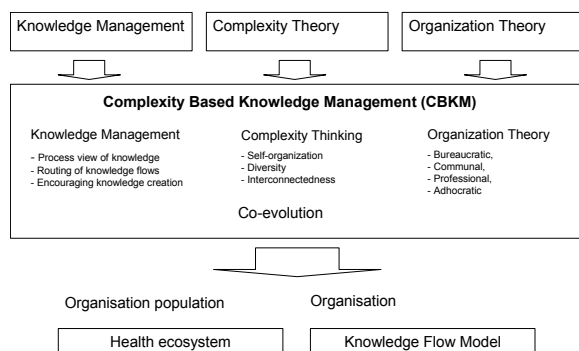


Figure 1. Complexity-based knowledge management (based on [5]).

Koivuaho and Laihonon [5] have previously used the framework at the organizational level. In this paper the focus is at the organization population level and therefore author has made some modifications to the framework. The ideas concerning health ecosystem presented in this paper follow the framework and the concept has been added to figure.

To position CBKM framework in the field of knowledge

management, the framework takes the process view of knowledge. Alavi and Leidner [6] have separated five different viewpoints on knowledge, in which process view is one. According to the Alavi and Leidner [6], process perspective of knowledge management concentrates on routing knowledge flows and on encouraging knowledge creation and sharing activities.

Within the complexity-based knowledge management framework, complexity thinking is brought into the discussion through concepts such as self-organization, diversity, co-evolution and interconnectedness. It could be described that the framework aims to understand knowledge flows from the complexity thinking perspective.

Organizational theories bring in the concept of an organization and different approaches to their functioning. The CBKM framework distinguishes four different categories of organizations from the view point of internal communication and knowledge flows. These organizations are able to accomplish different tasks depending on the context of actions and novelty of the required actions.

CBKM framework, knowledge flow model and the concept of health ecosystem that will be discussed in more detail later in this paper are all interpretative concepts although knowledge flow model might also have some possibilities as a normative tool for managers. It is acknowledged that complexity thinking is a lot more than just knowledge transferring but to be able to understand the interpretation and decision making processes of individual agents it is needed to understand how knowledge is shared within the system.

To summarize, the basic assumption behind the CBKM framework and the ecosystem metaphor used in this paper is that lower level knowledge flows create complex behavior at the system level. In practice this leads to the proposition that the complexity of health ecosystem can be better understood by modeling the lower level interactions and knowledge flows. Based on this proposition the paper aims to further develop the concept of health ecosystem and the understanding of its knowledge flows.

II. HEALTH ECOSYSTEM

The health ecosystem is a novel approach to comprehensive health care. The concept is not very widely used, but few references can be found from literature (see e.g. [7], [8]). The basic idea of the concept origins from the complexity literature and therefore it provides an interesting starting point also for the application of CBKM framework.

In this paper the concept of health ecosystem is defined by integrating two existing concepts of health care literature – integrated care and health system. These two concepts are descriptive by nature whereas the health ecosystem provides also an interpretation framework. Conceptualization of health ecosystem is presented in Figure 2.

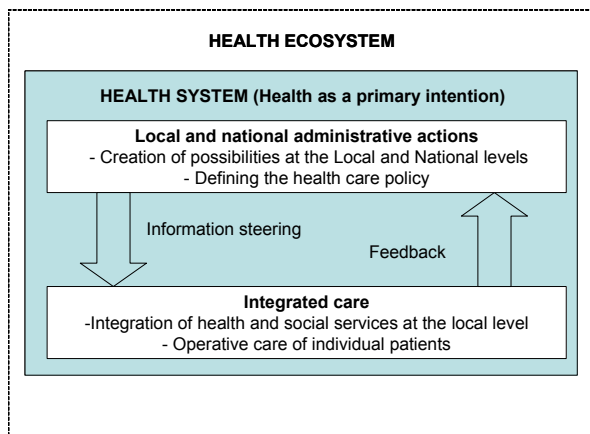


Figure 2. Conceptualization of health ecosystem.

Integrated care level of the system is responsible of integrating the services at the local level. In this integration process appropriate services are provided from the viewpoints of a patient and his/her clinical picture. Hardy et al. [9] have considered integrated care as “a coherent set of products and services, delivered by collaborating local and regional health care agencies.” In this paper integrated care is seen as a local implementation of service provision. Municipalities who are responsible of providing health services at the local level make independent decisions about the operational issues. These decisions cover the care of individual patients. The focus of integrated care is therefore in co-operation of separate specialists and separate activities that in the short run, with no doubt, gain for service users by overcoming fragmentation of services.

Murray and Frenk [10] have defined health system as follows: “A health system includes the resources, actors and institutions related to the financing, regulation and provision of health actions”. Therefore, the concept of health system describes the health care in a larger context. The system includes also the two-way information and knowledge exchange that are used by administrative level for setting the upper level targets and rules for the operative level as well as getting feedback from the operative level.

Health system is in this approach seen more as a political system that focuses on general health policies and creation of possibilities for local implementation of health care. These possibilities include, for example, issues like human resources, financing, legal settings of health care and general guidelines for health. The concept of health system can be used both at the national and local level. At the local level it includes municipal decision making and local adjustment of nationwide health policies to match local requirements. At the national level it presents nationwide health programs, guidelines and performance indicators. This sets the boundaries for local health care for example through legislation, information steering and other external settings from the viewpoint of municipalities.

Figure 3 describes this kind of information steered system where inhabitants of municipalities have a dual role. They are patients and customers of the system and at the same time they as representatives of different interest

groups also compose the information steering authorities both at the local and national levels. Figure 3 presents a highly simplified description of the Finnish health ecosystem. The description leaves out many important agents like private health care organizations but clarifies the idea of health ecosystem and the relationship between the concepts of health system and integrated care in a more practical sense.

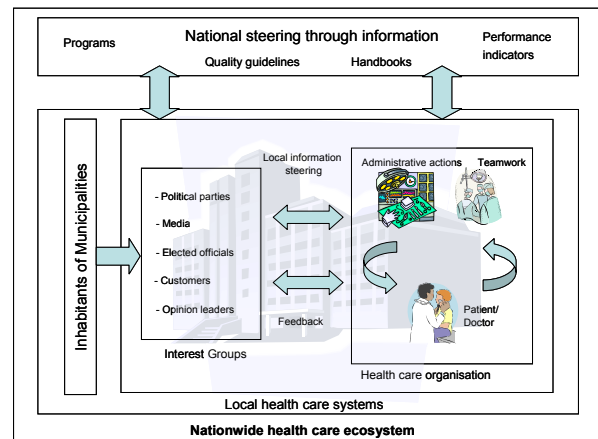


Figure 3. Finnish health ecosystem.

Kernick [8] has suggested that ecosystem metaphor might offer useful ideas for the development of health care. He argues that the emphasis is then on the relationships amongst a system's components and an understanding of what creates patterns of behavior among them. According to Kernick [8], the important features of health care system are diversity, connectivity, feedback and the existence of self-ordering rules that enable emergence of new order in a system.

The rationale behind the concept of health ecosystem can be drawn from Kernick's [8] argument that in complex systems, like health care, individual agents cannot be understood in isolation. In social systems agents have their own will and they make conscious decisions based on the existing information and knowledge. This autonomy of agents makes the system highly unpredictable and leads to the situation where, according to Holland [11], the only way to understand the system is to understand those ever-changing patterns generated by the system. Previously presented CBKM framework presupposes that knowledge flows generate these patterns and that by understanding them we can better understand the whole system. This leads to the interpretative nature of the concept of health ecosystem. The concept provides an explanatory framework [12] that could be used for interpreting the actors in their genuine environment and in a continuous interaction with other actors of the system.

Author's working definition of health ecosystem is:

“Health ecosystem is a dynamic structure which consists of an interconnected population of organizations that influence municipal health care. These organizations are e.g. municipalities, private health care organizations, third

sector organizations, hospital districts, inhabitants of municipalities, government and research institutions that provide the latest research results that are used for information steering or for medical purposes”.

In the next two chapters the focus will be on describing the Finnish health ecosystem with conceptual tools of CBKM framework. In chapter III, it will be discussed how complexity thinking fits in and in chapter IV the focus turns into knowledge flows of the system.

III. HEALTH ECOSYSTEM THROUGH THE LENSES OF COMPLEXITY-BASED KNOWLEDGE MANAGEMENT

A. Self-organizing municipalities

Municipalities that are responsible for providing health care services for their inhabitants gained a lot more freedom in 1993 when there was a major reform in the financing of health care in Finland. This reform can be seen as a one of the most important steps in the deregulation process, although regulation had gradually decreased already during 80's and 90's. [13] As regulation by norms further decreased, being almost nonexistent by 2000, steering through information became increasingly important for the government as a means of monitoring the health ecosystem. These changes provided municipalities the freedom to choose how to organize their health and social services. It can be interpreted that at a certain level the reform in 1993 launched a self-organization process where municipalities are searching for the most suitable organizational structures for their health care.

In practice, the opening of the system led to new kinds of co-operative and competitive relationships between municipalities and their health care organizations. The changes were not restricted to public organizations, the whole system opened and this has produced many innovative solutions of health provision.

Although health care organizations share a general target – the health of the population, there still exists both competition and cooperation simultaneously. Limited resources, specialization and fiscal pressures drive organizations to compete. Organizations negotiate and search for different possibilities to organize. In a sense, interconnections i.e. knowledge flows then act as an enabling factors and facilitators for self-organization as Laihonon [14] has argued. It can be concluded that the integrated care in many cases is an outcome of a self-organizing process. There is not any external source that defines how municipalities should provide the care for their inhabitants. The integration of services is an emergent property of negotiation processes.

Based on the analysis of the health care district of Forssa this self-organization process could be described more concretely. In Forssa district five municipalities started to study the possible advantages of cooperation already in 1993. This study indicated that no significant advantages would be attained. However, some cooperation in auxiliary services was started. Due to the financial pressures another study was conducted later on and finally in 1999 the

decision in principle was made and the first steps towards a current health care federation were taken. This process is one example of the self-organizing process that became possible after the strict legislation on health care was diminished. Currently, FSTKY operates as an administratively independent organization that together with its owner municipalities makes decisions about providing and producing the services of primary health care and specialized health care for the inhabitants of these five municipalities.

FSTKY operates as a service integrator at the local level. Organization's strategy in 2006 is “to defend and maintain activities at the current extent in its core know-how area, and to conceive and strengthen its operations in the selected focus areas and to organize auxiliary services in a most effective way in an overall economy”. In case of lacking know-how FSTKY has established co-operative relationships with other health care providers and produces and therefore it is able to provide also services outside of its own field of know-how. This kind of networking is the main idea behind the integrated care literature. Similarly, other municipalities in Finland have made decisions on their health care and are either producing it themselves or in co-operation with other municipalities. Some have even decided to outsource their primary health care to the private sector. These local processes can be seen as examples of self-organization that has enabled emergence of new order in the health ecosystem.

B. Diversity within the health ecosystem

As it was described in previous chapter, health care organizations in Finland have many possibilities to organize their operations at the local level. Diversity is a measure of these distinct possibilities. Health ecosystem provides a space of possibilities for municipalities. They can produce all the services themselves or they can, for example, join a federation of municipalities as municipalities in Forssa district have done. In addition to these solutions there are also several other ways that have been utilized in organizing health care services locally. Naturally, there are also some limitations that might diminish the set of possibilities. These limitations might include economical restrictions or some social factors like demographics of the area.

Diversity can be divided into the internal and external diversity of an organization. Internal diversity might refer to differences in organizations' employees, such as educational background, experience, skills, targets, ambitions and motivational factors. It could also refer to the internal processes, organizational culture and many other structural characteristics of an organization. External diversity refers to the organizations environment and the possibilities it offers. The greater the diversity the greater the amount of options to choose from. Therefore, increased diversity makes it more probable for the organizations to find an option that is suitable for its purposes.

To summarize, it can be argued that the external diversity sets the requirements for internal structures and for the internal diversity. Balancing of these is, according

to Clippinger, one of the greatest challenges to managers [15].

For health care organizations diversity represents all those possibilities that are available both internally and externally. Internally it is mostly a question of strategy. It is about adjusting internal processes based on the targets of the organization. Strategy defines organizations internal ways of operating. Supportive functions like HR, financing, marketing, management and all others should be defined to support strategy and targets. And most importantly, the key processes that in this case are naturally the nursing processes should be defined and implemented. Finally, supportive functions should be integrated into key processes. All of these describe the management of organizations internal diversity.

It is not possible to recognize all the external forces that influence the health care organization. Therefore, external diversity can not be fully conceptualized. External environment for FSTKY includes at least all the owner municipalities. In case of some of those municipalities is not satisfied with the situation, it might want to reorganize its health care. This would have a great effect on other municipalities belonging to the federation.

Legislation is also an important determinant in health ecosystem because it defines the boundary conditions for provision of health services. There are also countless amounts of different organizations, such as pharmaceutical industry, private health centers, patient associations, government institutions, and research institutions, to mention some, that influence and increase the external diversity of a health care organization. Specialization of knowledge-intensive services has greatly increased the external diversity of organizations and through that the need for co-operation and interconnectedness has also increased.

C. Co-evolution through interconnectedness

In today's highly connected business environment it is important to recognize that the above discussed phenomenon of self-organization always takes place in a certain context and in relation to the environment that is defined by a diverse set of characteristics that should be taken into account in decision making. This kind of interactive evolution is known as co-evolution in complexity literature. Mitleton-Kelly and Papaefthimiou [12] have argued that co-evolution in the context of social ecosystem means that "the evolution of one domain is partially dependent on the evolution of the other, or that one domain changes in the context of the other.

Interconnectedness is finding new manifestations after the opening of the health care system. Health organizations are currently competing and co-operating at the same time. They are competing of their existence but at the same time they also need to form alliances to be able provide integrated services to patients.

Interconnectedness and co-evolution are essential processes behind the idea of a health ecosystem. All the parties within the health ecosystem are interdependent. At the operative level organizations pursue for integrated

service provision, which requires co-operation between different organizations and sectors. These relationships lead to the situation where decisions made by any organization affects the operating environment of other organizations of the ecosystem, i.e. to the co-evolution.

Mitleton-Kelly and Papaefthimiou [12] have divided co-evolution into endogenous and exogenous. According to the authors endogenous co-evolution refers to the internal co-evolution of individuals and groups in organizations. Exogenous co-evolution refers to ecosystem level co-evolution where organizations are interacting.

Within the health system research institutions and governmental institutions are in a close interaction when they prepare health policies and legislation. This is supported by the operative level that provides the most up-to-date information and knowledge about the actual health needs of the population. For example, FSTKY has taken part into several commenting processes of health policies both at the national and local levels. In addition, FSTKY is very active in developing new approaches to health care discussions and actively takes part into knowledge sharing of its own experiences. The latter one includes methods like attendance in seminars and hosting of visitors from other health care organizations. This can be interpreted as exogenous co-evolution at the ecosystem level. Through the interconnectedness of the organizations the decisions made in different part of the system affect the decision environment of any other organization.

At the operational level, exogenous co-evolution refers to the integration of services. According to Hardy et. al. [9], "integrated care is required when the services of individual health care agencies do not cover all multi-problem patients' demands". In these cases organizations have to look for partners who can organize and deliver the care that they are unable to produce. It could be interpreted that also Hardy's ideas in integration of services stand for the usage of co-evolution in this context.

Furthermore, within the health care organizations, different departments continuously need services from each other. Primary health care sends patients for further examinations to specialized care and both of them need services of radiology and laboratory departments. In FSTKY also nursing division has been organizationally separated and therefore also these services are bought from different area of responsibility. These responsibility areas are dependent on each others, they are co-evolving. In this case it is a question of internal i.e. endogenous co-evolution of individuals and groups as Mitleton-Kelly and Papaefthimiou [12] have defined.

Interconnectedness and co-evolution have clear implications at many different levels of health ecosystem. The interdependence of individuals, groups and organizations has increased and will probably still increase in the future. The ideas of co-evolution emphasize the importance of knowledge exchange and communication at the different levels of the ecosystem.

IV. EXAMPLES OF KNOWLEDGE PROCESSES WITHIN HEALTH ECOSYSTEM

Above discussed processes and characteristics of health ecosystem have without a doubt induced requirements also for knowledge processes and their continuous development. In this chapter few of those processes will be described and analyzed based on the findings in health care district of Forssa.

The paper focuses on two levels of knowledge flows. First, knowledge flows within an integrated care will be described with an example of one nursing process. Second, knowledge flows of so called information steering will be described. Focus is on the explicit knowledge due

A. Knowledge sharing within the integrated nursing process

This chapter will describe the findings of modeling of knowledge flows within the process of diagnosing dementia in FSTKY.

The highly simplified process model of diagnosing dementia is presented in Figure 4. It illustrates the different phases and agents that constitute the diagnosing process after the suspicion about dementia.

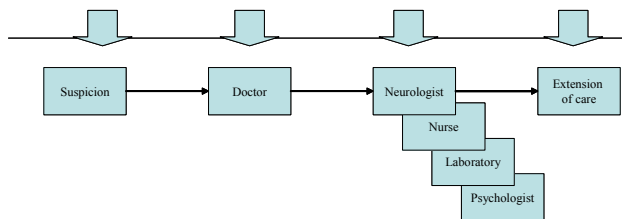


Figure 4. Simplified process model of diagnosing dementia in FSTKY.

Author's presupposition based on the literature was that there would be some problems in knowledge sharing within the nursing processes. These problems would cause, for example, unnecessary waiting for patients that enter the nursing process. Based on the knowledge management literature concerning health care or public organizations in general (e.g. [17]) it was supposed that the main problems would highlight issues like hierarchical structures, resistance to change, strong divisional boundaries and incompatible information systems as potential barriers for knowledge management.

Based on the interviews and observations in FSTKY all of these presumptions had to be discarded. First of all, it became clear that FSTKY as an organization, although hierarchical organization chart exists, is a very flexible one. Resources are transferred based on the actual need and demand peaks are leveled with external resources. These external resources provide the organization with tools for balancing supply and demand. With this kind of arrangements organization can also fulfill possible knowledge gaps in certain medical areas. In case of dementia, neurologist is available in Forssa based on the demand of his services, currently the need is two days in a

week. In a larger frame the continuous shortage of resources often discussed in the context of health care is a question of education politics and is not in the hands of FSTKY, which however has succeeded well in recruiting.

Distribution of work that relates also to the strict hierarchical and divisional boundaries was also not a problem within the studied nursing process. Primary health care and specialized health care have agreed on tasks that should be taken care in each sector. This distribution of work was regarded as a guideline that steers the process internally. The guideline has been established in co-operation between both sectors and organization's management and is considered twice a year in joint meetings. FSTKY has also appointed a responsible doctor for this nursing process.

One probable reason for the clear division of tasks in FSTKY is the organizational structure. Primary health care and specialized health care are provided within the same organization whereas in many cases these two are divided into separate organizations. This reflects also to knowledge sharing. Knowledge can easily be shared with medical workers from different sectors, of course within the boundaries of legislation concerning patient information. Another issue that supports and intensifies information and knowledge sharing is a shared information system. This system is available for both sectors and it contains all the medical information about patients.

It was found out that within a certain nursing process, explicit information has a vital role. Primary health care and special health care transfer information and knowledge mainly through the shared information system. The need for face-to-face consultation between doctors is insignificant, although due to the short physical distances it would be fairly easy. Information about the patient and his/her situation is collected through normal doctor's reception, medical tests, questionnaire sent to patients relative. All this information is stored into the same information system. In some cases patients are also sent into another health care organization, for example, in case of a special surgery. In most cases information can be delivered in electronic form to the receiving organization. Although information systems are under continuous development initiatives it seems that the system could support the process fairly well in this case.

To summarize, it seems that within FSTKY and especially within the processes of diagnosing dementia knowledge sharing is very satisfactory and that a shared information system together with the existing organizational structure where primary and secondary health care operate as a one legal entity creates a solid basis for knowledge sharing.

B. Knowledge flows as channels of information steering

As it was described earlier in this paper, information steering can be detected at two levels. National level of information steering sets the framework for the health care sector. Although information steering has in many cases replaced normative control the government still uses legislation to control the provision of health care services.

The Finnish constitution states that public authorities shall guarantee for everyone adequate social, health and medical services and promotion of the health of the population. To mention some of the most fundamental laws concerning health services we can highlight the Primary Health Care Act that obligates municipalities to provide health promotion and disease prevention, medical care, medical rehabilitation and dental care for their inhabitants. Municipalities are also obligated by law to arrange specialized medical care. The Specialized Health Care Act and the Mental Health Act regulate the organization of these services.

Legislative tools are not the only methods that are used for national level guidance. Tools and channels for information steering are diverse. Both physical and electronic methods are being used. Reports, handbooks, recommendations, guidelines and consulting are some practical examples of these tools. It is important to notice that these authoritative recommendations are not binding. Information steering does not constitute any minimal norms.

The Ministry of Social Affairs and Health publishes general guidelines for the overall development of the sector. For example, The Government Resolution on the Health 2015 is a public health program that outlines the targets for Finland's national health policy. There are also highly specialized recommendations like the one on usage of vitamin D.

The National Research and Development Centre for Welfare and Health (STAKES) is a sector research institute under the Ministry of Social Affairs and Health. Its core functions are research, development and information production. It also supports the Ministry in implementing the strategy of the administrative branch [18]. STAKES' operations are governed by the relevant Act and Decree. Its statutory functions are: to engage in research and development, to evaluate social welfare and health care, to refine and communicate information and develop expertise at national and international levels, to maintain statistics and registers, and finally, to influence social and health policy. As it can be seen from range of tasks and responsibilities STAKES holds, it has a very important role in Finnish health ecosystem as a knowledge broker and innovator.

In FSTKY there are not any formal methods for following this national level of information steering. The most common way of retrieving this information seems to be the traditional mail. In case of changes in legislation or recommendations given through information steering the management group discusses about them and makes a decision on future way of action. Media, pharmaceutical industry and patient associations have their own opinions on many issues and those have to be taken carefully into account in decision making. Current topics will be always discussed in management group as well as in coordination meetings of responsibility areas to form a general understanding about them in FSTKY. These are the official channels through which national level of information

steering is enforced in FSTKY.

At the local level public health care organizations operate under the supervision of municipal decision making. Without diving too deeply into the municipal possessory relationships and their peculiarities the most important municipal administrative institutions will be shortly described.

Municipal council is elected every fourth year. The council selects the municipal executive board and different committees to represent political parties based on the relative results of the election. Municipal executive board is responsible of the daily operations, financial management and prepares and conducts issues that fall into the authority of municipal council. Committees act under the supervision of executive board in their own sphere of authority. Local administrative information steering is mainly conducted by these municipal institutions. Each municipality should be able to enforce national level policies and programs that are suitable and essential for their local situations.

FSTKY is owned by five municipalities and therefore it has to operate according to their best interests. Municipalities negotiate annually on the provision of services with the health care district of Forssa. Municipalities and the FSTKY draw up a framework agreement for the following year on the amount of costs of services. This means that all five municipalities direct their resources aimed at arranging health care for population through the federation. This framework agreement and the whole negotiation process naturally can be seen as strong information steering from the municipalities. The agreement is a local implementation of national health policy.

FSTKY also acknowledges the important role of their individual customers. It provides multiple channels of feedback and all the feedback is discussed in management group meetings. Changes are also made for adjusting the internal processes accordingly. This makes the organization highly adaptable to external requirements.

In the dementia process information steering is discussed in shared meetings few times a year between representatives of primary health care and specialized care. In these meetings doctors form a shared understanding on current issues such as new methods of care. Especially new pharmaceuticals have raised discussions on proper treatment of dementia that has many social and humane aspects. These discussions also provide experts a channel to express their own ideas and to get feedback on daunting issues. These discussions can also be interpreted as learning situations for all participants.

To summarize, it could be concluded that the knowledge flows as a channels of information steering both at local and national levels are diverse and that the studying and understanding of these flows may greatly enhance the understanding of the whole health ecosystem and further, lead to efficiency gains in health care services.

V. DISCUSSION

This paper reported the work in progress. The theoretical

work on health ecosystem is still under development and the case study in FSTKY has not been completed. However some preliminary conclusion can be drawn.

A. Theoretical conclusions

The Finnish health system, as well as health systems in many other countries, is under the influence of many global forces. These economical, political and social forces drive change in health care delivery. In short, structural and organizational opening of the Finnish health system and the transition from normative control to information steering have increased the need for new approaches. The traditional system view of organizations, especially in case of complex knowledge-intensive organizations, has been challenged by complexity theories. Traditional view is not sufficient because of its machine-like approach to organizations. In social systems it is very hard to isolate actions and ideas as independent of each other, therefore the focus should be changed into the interdependencies. This is the basic idea that complexity theorists have highlighted.

Opening of the health system has broken the previously very strictly predefined system into pieces and in current system agents have a freedom to self-organize as it was described in this paper. Diversity of the system has also increased driven by the specialization and financial pressures. Specialization and the followed diversity have induced the need for co-operation and interconnectedness of the system's parts. Interconnectedness and the co-evolutionary nature of the system require holistic approaches. The mechanistic system with strict boundaries is not there anymore.

Based on the analysis presented in this paper the preliminary conclusion is that the concept of health ecosystem might provide a usable interpretation frame for utilization of complexity thinking and knowledge management in health care sector. Recognition of the patterns of interaction, i.e. knowledge flows of health ecosystem might help us to understand and adjust health care services accordingly in situations where change is inevitable.

This paper discusses health ecosystem in the Finnish context but the approach as such is not restricted to any given area. In literature, ecosystem approach has been seen as a novel approach to health care but the references are still few. The definition given in this paper provides the basis for further application. The paper argues that the ecosystem approach reconciles the descriptive viewpoints of integrated care and health system by highlighting the interconnectedness of the actors and the dynamic nature of the environment. Therefore, it also provides a promising basis for the study of knowledge flows.

The author sees the role of knowledge flows as building blocks of organized activity at the system level and assumes that by studying and understanding knowledge flows at the local and organizational level it is possible to better understand functioning of the health system and its overall complexity.

B. Practical implications

The concept of health ecosystem provides an interpretation frame for understanding the underlying patterns of health system. It is assumed that this understanding might also broaden practitioners' way of thinking. The understanding that legislation and information steering are enablers of self-organization should motivate the personnel of health care organizations. Local health care is not restrained by the normative control and it has an opportunity to utilize all its capabilities. The ecosystem metaphor also points out the importance of each decision. In co-evolutionary environment outcomes of any decision might have unexpected results at the system level, which makes decision making and negotiation processes purposeful.

The focus on information and knowledge flows highlights knowledge sharing practices. In the case study of FSTKY it was clearly detected that at the operational level a shared information system and suitable organizational structures greatly lower the barriers of knowledge sharing that were mentioned in literature. However, based on other studies carried out in Finland it seems that there are still problems in information sharing between different sectors of health system. For example, integration of services and knowledge sharing between health and social care still struggle with these barriers.

The concept of health ecosystem might prove to be an adequate concept also for the study of information steering. By interpreting the health system as a network of knowledge flows the focus changes to the interconnections and patterns that steer the system. The paper described that information steering can be detected at local and national levels. By understanding how these two interact and how they affect the actual service provision practitioners might be able to form a more realistic view of their role in this dynamic environment.

At this phase the concept of health ecosystem is merely an interpretative concept but it seems to provide a meaningful tool for interpreting and analyzing phenomena that are far from static and mechanistic. Requirements set for health care delivery change as well as the possibilities of the health system to respond to these requirements. Maybe we should also change our mechanistic view of the world towards a more realistic one.

ACKNOWLEDGEMENT

This paper was produced as a part of the TIP Research Program (Knowledge and Information Management in Knowledge Intensive Services), which is funded primarily by The Finnish Funding Agency for Technology and Innovation. The research was conducted at the Institute of Business Information Management at Tampere University of Technology. The work was supervised by Professor Marjatta Maula and Professor Matti Rimpelä. I would also like to thank the Health care district of Forssa and especially Markku Puro and Riitta Suhonen for their support for this work.

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Influence of Enterprise Systems on Business Process Agility

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Abstract — Business process agility (a combination of speed and flexibility) is increasingly becoming an important weapon for achieving a competitive advantage in today's growing competition and dynamic business environment. Based on literature review and past research by the author, this paper will present the development of a research framework to investigate the influence of enterprise systems on business process agility. Using exploratory qualitative case studies, this study will identify the major drivers and inhibitors for enhancing the process agility in business organizations that have implemented enterprise systems and investigate the possibility of attaining both process efficiency and agility simultaneously while automating and/or integrating business processes.

Keywords—Business process, process agility, enterprise systems, process change

I. INTRODUCTION

In the past quality, cost efficiency and speed, the traditional measures of performance, were sufficient to achieve profitability and maintain a competitive edge. In today's market place, firms must be able to change business processes rapidly and efficiently in line with the changing business conditions and customer needs. Thus, agility, a combination of speed and flexibility, is becoming a vital tool for innovation and competitive performance in contemporary business environments. Enterprise Resource Planning (ERP) systems have enabled cost-effective business processes and contributed to the improvement in process efficiencies. The pervasive influence of ERP systems on the ability of processes to adapt to changing business conditions is not known.

Using an exploratory case study approach, this study investigates the influence of implementing ERP systems on business process agility. The paper first reviews the literature on the concept of 'agility' in general and in operations management and information systems context in particular and discusses the significance of process agility for modern business organizations. It then briefly discusses the research framework and methodology and presents the propositions developed.

II. BACKGROUND AND LITERATURE REVIEW

A. Agility – a complex concept

Agility is a complex concept and has been analyzed across economics, strategic management, operations management and information technology/information systems disciplines. The concept of agility builds from the literature on flexibility in economics [1], and was further developed in the context of agile manufacturing. According to Yusuf and others, the concept of agility was first coined in 1991 by a group of senior executives and researchers at Iaccoca Institute, Lehigh University, to describe the practices observed and considered as important aspects of manufacturing [2]. This group argued that organizations must adapt to the changing business environment and needs such as speed, flexibility, responsiveness, infrastructure with a manufacturing system that is capable of quickly shifting among product models and/or between product lines.

Taking a strategic management perspective, Sambamurthy and others defined business agility as the capability of firms in managing their internal operations and interactions with their ecosystems of external partners and networks, and identified three types of agility – customer agility, partnership agility and operational agility [3]. While customer agility and partnership agility deal with the agility of the firm in managing relationships with customers and partners, operational agility is defined as the ability of the firm to redesign existing processes rapidly and to create new processes in a timely fashion in order to be able to take advantage of dynamic market conditions [3].

Mathiyalakan and others considered agility as a broader concept and defined it as the ability of an organization to detect changes, opportunities and threats in its business environment and to provide speedy and focused responses to customers as well as stakeholders by reconfiguring resources and processes, and through strategic partnerships and alliances [4]. This definition incorporates a strategic as well as an operations perspective of the term and explains how firms can be made agile in terms of managing capabilities, resources, partnerships, alliances and business processes.

B. Agility in operations management context

In operations management literature agility was studied in the context of agile manufacturing [5], [6] and in supply chain management [7]. Achieving flexibility and

responsiveness to the changing market needs [8] was the aim in both manufacturing and supply chain contexts. Manufacturing agility involves shifting rapidly among product models and/or between product lines in real-time response to customer demands [9, 10, 11]. Incorporating agility in the manufacturing process is expected to make the firm capable of surviving and prospering in the competitive environment of continuous and unpredictable change [12].

Implementation of manufacturing philosophy reportedly resulted in the reduction of the time required to get products to market [13]. Combining all the 'world class practices' such as total quality management, concurrent engineering, employee empowerment, lean production and learning organization in manufacturing organizations in the late 20th century, with the flexibility and speed of business processes, agility in a manufacturing context is described as an umbrella term [6].

Though operations performance objectives such as cost, quality and dependability are implicit in the term 'agile' enterprise, the two concepts of flexibility and speed are particularly important and inherent to the definition of agility in operations management literature [14], [15], [16], [17], [11].

Contrary to the traditional view of operations management in which these performance objectives were considered at times conflicting [18], the modern definitions of operational agility incorporate a combination of all these capabilities and postulate the possibility of simultaneously excelling in all of them. Thus, agility from modern operations management's view is a combination of all the five performance objectives – cost, quality, dependability, flexibility and speed, and particularly the combination of speed and flexibility [19].

C. Business processes and agility

To be agile, a firm must have the ability to redesign and reconfigure individual business process components, combining individual tasks and capabilities in response to the environment [20]. Business process agility is thus defined as the ability to dynamically modify and/or reconfigure a business process to accommodate required and potential needs of the firm [20].

Indeed, throughout the literature on agility, various authors have emphasized different facets of agility and this has lead to varied views reflected in the literature. These definitions are considered simultaneously in order to gain a better understanding of what constitutes agility. In this study, therefore, business process agility is defined as the ability of the firm to dynamically modify and/or reconfigure individual business process components rapidly to be able to meet the changing requirements of the firm and its business environment, without compromising other performance objectives such as cost and quality.

The present day requirements of a cost-effective and responsive enterprise make it difficult for enterprises to stick to well-defined static business processes. Further, collaboration with key stakeholders like suppliers, vendors and the partners has become a common need for many firms. In order to respond to the changes in markets,

suppliers and customer requirements, different stakeholders of a firm may be required to join or leave a business process and do it fast [21].

Adopting business process orientation and agile business processes has thus become an imperative for modern organizations [11], [3]. If business processes are well-designed to be agile, an enterprise is therefore more likely to experience success. Full management commitment and ongoing process changes are necessary to commit an organization to process-oriented thinking and make the processes agile [21]. Implementation of these initiatives requires redesigning of internal as well as external business processes and their interfaces, integration of associated information systems/technologies and processes, automation of some processes and realignment of processes, systems and structures [21].

Though some new technologies often lead to new business processes, fast paced changes to the existing processes are necessary to support new and evolving business models in response to the implementation of IT-enabled innovations and software solutions such as Radio Frequency Identification Tags (RFID), business intelligence, electronic commerce, supply chain management and product life cycle management. The literature recognizes the role of information systems/technologies as a 'platform for agility' and its ability to provide 'strategic value' to the enterprise [3].

A study on manufacturing agility revealed that the information systems themselves are not sufficient to achieve agility in business processes [22], and that manufacturing firms rely more upon non-IT attributes to improve the agility of their manufacturing operations than information systems. Software development methodologies are also evolving due to changing technologies and new demands from users. Emergent organizations in today's business environment are required to continuously adapt their structures, strategies and policies to suit the new environment.

Such organizations need information systems that constantly evolve to meet their changing requirements and traditional, plan-driven software development methodologies lack the flexibility to adapt [23]. Recent advances in information technology/systems such as grid computing, web services, service-oriented architecture and business process management tools and solutions are centered on the goal of providing the requisite agility for enterprises [24]-[25] and are expected to complement each other in making the processes more agile.

The level of business process agility is influenced by 'IT capabilities' and 'process agility drivers' [3]. Some process agility drivers include process management capability, process-modeling tools, process complexity and skills sets present in the organization for reconfiguring the processes. Nascent research on agile business processes suggests that they are difficult to develop and implement and are dependent upon organisational (size, process complexity, integrated processes, skills, information systems integration, data integration), environmental (external

competition, industry type/nature), technological (IT capabilities) and process (process management capability) factors [26] [21]. In addition to the above factors, organisational change, business process redesign, application transformation and infrastructure adaptability are some of the issues that need to be addressed to increase the agility of an enterprise [27].

Agile business processes, however, are expected to help organizations not only to achieve cost economies, but also to improve speed and accuracy with which the firm can exploit opportunities for innovation and competitive action [3]. Thus, agile business processes will contribute to the business agility wherein business processes are rapidly designing and/or redesigning in order to be able to respond effectively to unanticipated changes [28]. Importantly, it is necessary to study the enterprise as a system of processes. This system-level view potentially will reveal unanticipated synergies that can be created by exploiting interrelationships among its elements that exist in the new system, but did not exist in the old [29].

D. Process agility - significance

In the past, quality and cost efficiency, the traditional measures of process performance, were sufficient to achieve profitability and maintain a competitive edge. The time-based competition in the 1990s forced companies to analyze and speed up their crucial business processes [30] such as product development, sales and distribution and procurement, and enabled significant increases in productivity. In today's marketplace, speed alone does not enhance better performance in terms of cost effectiveness and time to market [31]. In order to position themselves better to respond to market dynamics, firms must be able to change business direction and business processes nimbly [32] and adapt quickly to rapidly changing business conditions. Business processes are the central building blocks of how individuals, organizations/functions and industries participate with one another [33].

Recognizing that process agility is vital for innovation and competitive performance in contemporary business environments, business organizations are increasingly relying on information technologies including process, knowledge and communication technologies to enhance their process agility [27]. Agile business processes are thus considered a critical requirement for organizations to sustain and improve their competitive positioning in the marketplace and for profitability [34], [3], [21].

E. Business process change and enterprise systems

IT-enabled innovations, whether simple innovations such as word processing or complex enterprise integrated information systems such as enterprise resource planning (ERP) systems, always have a significant impact on the way organisational activities are carried out. Information innovations such as transactional processing systems, decision support systems and executive information systems have traditionally enabled cost effective business processes [35].

Enterprise systems or enterprise resource planning (ERP) systems have long been associated with process change. The traditional view of process improvement and redesign generally associated with the implementation of enterprise systems and other IT-enabled innovations is that it would generally lower costs and improve quality [36]. The ability to standardize and automate basic transactional processes and thereby contribute to cost effectiveness and flexibility are some of the key benefits espoused by ERP software vendors such as SAP [37].

With the focus on increasing process efficiencies, business organizations, through implementation of the first wave of ERP systems, have concentrated on the simplification, standardization and automation of business processes and their consistent execution [21]. Second generation ERP systems reportedly offer better integration and flexibility through web services, service-oriented architecture and smaller components. In addition to supporting transaction automation at the enterprise as well as the supply chain level, they will be able to support process management and contribute to the development of flexible and agile processes [38].

Though reengineering and redesigning of business processes at the time of implementing ERP systems was advocated by software vendors, consultants and in the academic literature, many business organizations could not carry out process improvements for several organisational, cultural and resource-related reasons. Even though organizations hoped to redesign and standardize their business processes, a majority of them reportedly deferred the process redesign until after implementation [39].

However, in some cases where such changes were made, these improved processes were not capable of adapting quickly to external events and reportedly became expensive to modify. Achieving a suitable fit between the processes embedded in the ERP software solution and the existing business processes proved to be challenging for many firms [40]. While some organizations have discarded their existing processes and adapted the best practice processes embedded in the ERP software, others have decided to significantly modify the ERP software to match their existing business processes, recognizing the potential competitive advantage their existing business processes offer. In both cases of implementation, it is neither easy nor cost effective to change the processes again after such huge change management efforts.

In addition to the issues that relate to change management, the legacy systems still maintained by many large organizations for some specific applications, along with the ERP system, are posing further challenges for firms in building agility in business processes. Leading organizations that have succeeded in capitalizing on enterprise systems are striving to continuously improve their business processes and the fit between processes and information systems, and how they support their business needs and models [21]. In fact, building some level of process agility may actually go against the espoused benefits of maintaining and executing standardized best

practice business processes embedded in ERP software solutions. Rapid process change requirements are beyond the scope of most of the companies with enterprise systems, who generally prefer to leave a well-tested configuration unchanged [34].

Even though recent process improvement initiatives and information/process integration facilitated by the implementation of enterprise systems in firms have positively influenced the firm's customer focus, it is not clear how they have contributed to the agility of the processes. Even though it is argued that they can facilitate changes in the speed and variety of product and process offerings by firms, thereby enabling flexible delivery [41], it is not clear how the rigid standardization of the processes would allow them to become agile. The formalized and possibly outdated business processes that are embedded in existing systems and the difficulties of achieving cross-functional consensus for cross-functional systems and fit between business processes and related information systems/technologies are some of the challenges organizations may face in the future [42], [21].

While there is significant research on the relationship between resources such as information systems/technologies, infrastructure and firm performance at an aggregated level [3], research on understanding why some activities and business processes are able to generate competitive advantages while others cannot is very limited, though it is likely to be more helpful [39].

This study will, therefore, analyze the role of ERP systems on process agility, and particularly investigate whether it is possible to achieve process efficiency and process agility simultaneously after implementation. In the context of second-generation ERP systems that are web-enabled with service-oriented architecture and flexible/inter-operable process and technology management interfaces, and the availability of modern business process modeling and management tools, it is important to determine their contribution or lack of in making business processes more agile.

III. RESEARCH FRAMEWORK & METHODOLOGY

Business process agility is a critical requirement for contemporary organizations that are geared to respond to changing market requirements and conditions. Considering its exploratory nature and the nascent stage of this research area, this study aims to investigate the influence of enterprise systems on business process agility. The study will particularly investigate whether enterprise systems would contribute to the development of agile business processes or restrict them.

It will investigate the influence of typical characteristics of ERP systems such as standardization of processes, integration of internal processes and information integration, real-time visibility of information, best practices embedded in the software processes and automated transactions on process agility. Particularly, it will investigate whether it is possible to achieve both

process efficiencies and process agility in an ERP environment. The following section discusses the research framework and explains the propositions developed for further investigation.

A. *Standardized & best practice business processes*

Standardization of business processes, the key benefit of implementing ERP system, may actually restrict the agility of processes. The very purpose of standardization of business processes is to rein-in the variability and lack of standardization of the processes across the organizational business units and achieve the efficiencies and consistency in execution [21]. Similarly, the processes embedded in the ERP software solutions are typically considered best practices by the vendors as it is the outcome of a thorough study and modeling of the best practice business processes in the industry. In order to make them relevant to particular industry, several software vendors have actually developed industry specific software solutions for industries such as automobile, electronics, chemicals, higher education, research and development etc.

With these best practice processes standardized and embedded in the software, any variability in the process that is required for business reasons may have to be handled as an exception expending considerable resources. While arriving at an adequate fit between the software and existing business processes, organizations either decide to modify the software at a significant expense considering the competitive advantage their existing process could offer them.

Alternatively, the organization may decide to discard a wide variety of processes used in several parts of their organizations and implement the best practice processes embedded in the ERP software solution in order to achieve standardization and consistent execution of a particular business process. The objective therefore is to eliminate this variability in order to achieve process efficiency. When there is a genuine need for a change in the process, the organization will have to again revisit the process and ERP software fit, and goes through the change management processes if the business benefits of changing the process are compelling. Alternatively, organizations may actually leave this change until the next upgrade of the ERP software version, and then make a decision as to the changes in the process or software (and its fit). Thus the standardization and automation of transactions resulting from the ERP implementations are expected to limit the ability of processes to change.

Flexibility is an important feature of any information system. Once implemented, ERP systems are tightly linked with organizational structures and processes [37]. Therefore, it is very difficult to change the system without changing the organization and vice versa. The integrative nature of ERP system makes it difficult to change one aspect or area without affecting the other. However, by editing the key configuration and relationships stored in tables and

structures, it is relatively easy to make some organizational changes in an ERP environment. The meticulous segmentation of organizational operations and huge number of standardized procedural steps that define the system in an ERP environment may actually constrain the company's ability to respond to changes in external environment [43].

ERP software vendors argue that the business processes embedded in their software solutions are typically best practices. These large ERP software vendors reportedly investigated business processes across a wide variety of organizations and industries and then modeled the best of them into their software solutions [44]. Adapting those best practice business processes embedded in the software and discarding the existing processes is expected to improve the performance. This argument implicitly assumes that the best practice processes need not be changed as they are best practices and standardized. Therefore, this rigid standardization of these so called best practice processes is antithesis to the flexibility and agility of business processes. Thus, the following propositions can be hypothesized.

H1: Standardization business processes and their procedural steps resulting from the implementation of ERP systems decrease the agility of processes.

H2: Implementation of best practice business processes embedded in the ERP system software solutions do not contribute to the agility of processes.

H3: Automation of business transactions consequent to ERP implementation restrict the agility of business processes.

H4: It is possible to achieve process efficiencies and agility simultaneously consequent to the implementation of ERP systems

B. Integration of information and processes

Integration of the information and the consequent visibility and accessibility of information across the enterprise in real time is one of the key benefits of ERP implementations. ERP systems with its integrative capability facilitate centralisation of information and services such as purchasing, accounting, finance, or human resources [45], [46] and may facilitate improved flexibility in business processes. In a centralised information management environment, it is relatively easy to modify the processes in line with the business needs and roll them out across various business units. In a decentralised and unintegrated environment, however, this is considered very difficult. The following propositions can thus be hypothesized.

H5: Integration of processes across the enterprise consequent to ERP implementation improves process agility

H6: Integration of information consequent to ERP implementation improves process agility.

H7: Real-time visibility of information across the enterprise consequent to ERP implementation improves process agility

C. Decentralization of control

Since the information in an ERP environment is instantaneously visible to all employees and managers at multiple levels, it will empower them on information analysis issues. It is expected to bring in discipline in performing basic information transactions for efficiency and standardization across the enterprise and provide flexibility [45]. In an ERP environment, it becomes necessary for everyone in the organization to understand not only the process in which they work, but also their own specific task, along with the impact their work have on other aspects of business.

ERP systems can contribute to the downsizing and decentralisation of controls and centralisation of information management [45]. Consequent downsizing of the organization may lead to the loss of valuable tacit knowledge that goes along with the employees. This loss can reduce the ability of the organization to respond to internal and external changes and demands.

Similarly, the decentralisation of control achieved through layering of organizational structures requires a different set of skills at both employee and management levels. It requires employees to take ownership of their work and their role within the new system and to learn to monitor and manage the processes with the help of information-based and technology-enabled controls. This will enhance the process knowledge of employees and prepares them better for required changes in environment. With improved process knowledge and skills, the processes could become more agile. The following propositions can thus be hypothesized.

H8: The decentralization of control resulting from the implementation of ERP systems limits the agility of business processes.

H9: Requirement of new skills consequent to the implementation of ERP systems limit the agility of processes.

H10: Enhancement of process knowledge consequent to the implementation of ERP systems improves the agility of processes.

D. Other variables

Impact of ERP systems on organizations is dependent upon the extent of internal process integration achieved, extent of the legacy systems and their interfaces with the ERP systems, process-based thinking of the management, organizational size and characteristics of the business processes. The characteristics of business processes measured in terms of time-criticality, variability, complexity and uncertainty may inherently limit the agility of the business processes. In addition, level of business process agility is also influenced by the 'IT capabilities' and 'process agility drivers' [3] such as IT capabilities, process management capability, process modeling tools, process complexity, skills etc.

Nascent research on agile business processes suggests

that they are difficult to develop and implement and are dependent upon organizational (size, process complexity, integrated processes, skills, info systems integration, data integration) environmental (external competition, industry type/nature), technological (IT capabilities) and process (process management capability, characteristics of processes) factors [26], [47], [48]. Keeping in mind these limitations, the following generic propositions are hypothesized.

H11: Inherent characteristics of the process (such as variability, uncertainty, time-criticality, complexity etc.) influence the level of process agility achievable in ERP environment.

The above propositions will be investigated in this exploratory study with the help of an interpretive cases study. A brief summary of the proposed approach to the research methodology is discussed below.

E. Methodology

Considering the exploratory nature of the research questions (what and how), the formative stage of the research, qualitative methodology that involves semi-structured interviews [49] will be used in the first phase of the study. Semi-structured interviews are particularly useful in exploratory research and would offer rich insights on the topic because of their ability to produce data and information. They will help to generate hypotheses and develop questions or concepts for questionnaires.

A representative sample of four organizations that have implemented one of the enterprise systems software solutions will be selected for this pilot study. About four or five managers from each of the organizations will be interviewed. Focusing on some of the major business processes in case study organizations this study will explore the major drivers of enhancing business process agility and factors that could inhibit it in an ERP systems context.

A semi-structured questionnaire will be employed as a data collection strategy in this study. Interviews will be conducted in two phases with respondents in view of the limited time senior executives can allocate to research interviews. These respondents are senior managers or process managers who have supervised and/or implemented process integration and changes in the context of implementing enterprise systems.

The interviews will be recorded using tape recorder, with prior permission sought from the respondents. Detailed

manuscripts of the interviews will be transcribed from the tapes and saved for further analysis. The data thus collected will be codified and analyzed using a qualitative analysis software tool. The coded data will be categorized according to patterns or themes which emerge using pattern matching and explanation building approaches. Findings of this exploratory study will lead to several theoretical propositions/hypotheses and identification of various variables contributing and/or hindering business process agility.

IV. CONCLUSIONS

Quality and cost efficiency were the most important measures of process performance in the past and sufficient to attain firm's profitability. Apart from these performance objectives, speed and flexibility are also now considered important for the 21st century business environment, in order to change their business processes rapidly and met the dynamic requirements of markets, customers and partners. Agility of business processes that are capable of achieving speed and flexibility without compromising on the quality and cost efficiencies is now considered important to facilitate improvement in the company's ability to exploit opportunities for innovation and competitive action. Information technology enabled innovations in general and enterprise resource planning systems in particular, have contributed to the simplification, standardization and automation of business processes in the past. Building some level of process agility may go against the espoused benefits of maintaining standardized best practice business processes embedded in the ERP software solutions.

Though the second generation ERP software solutions are reportedly better in flexibility with open standards, component-based process models, standard reference models, web services and service oriented architecture, it is not clear whether they can facilitate better business process management and building up of agility. New research in this area is essential to prepare businesses for the next stage of business revolution that is going to be dominated by business processes, their management and the way the information systems support knowledge intensive work.

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Introducing a Strategic Information Systems Planning Meta-Method for Cooperative Inter-Organization Relationships

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Abstract — Strategic Information Systems Planning (SISP) and aligning IT with business has been in a key focus of IS managers for decades already. Constant changes in business environment and developments in technologies are hardly making the effort any easier. Characteristic for available SISP-methods is their focus on a single organization. However, in current network economy the role of inter-organizational systems is increasing creating a need for Inter-Organizational Strategic Information Systems Planning (IOSISP). In this paper a general requirements for such are sought and presented in a form of meta-method.

Keywords — Strategic Information Systems Planning, Inter-Organizational Relationships, Cooperation, Inter-Organizational Information Systems.

I. INTRODUCTION

In today's turbulent and increasingly complex economy businesses need tools for handling information flows efficiently and effectively. Organizations use information for various functions such as planning, controlling, organizing, and decision-making. Information, therefore, is unquestionably a critical resource in the operations of all organizations [1].

Strategic Information Systems Planning (SISP) has been developed to aid in recognizing appropriate portfolio of computer-based application and relevant information processing activities to support organizations' information needs [2]–[4]. SISP is not a single solution or method for IS-planning but an umbrella term for host of methods and techniques that are more or less based on different paradigms of world, organizations, and humans.

Characteristic for available SISP-methods is their focus on a single organization [5]. However, recent changes in business environment highlight the role and importance of Inter-Organizational Relationships (IOR) and business networks for competitiveness [6]–[9]. Cooperative networks, long-term partnerships and strategic alliances place challenges for efficient and effective organization of joint efforts. Information, communication, and relevant technologies have a crucial role in this effort.

Inter-Organizational Information Systems (IOSs) are

developed to help organizations to communicate and cooperate better with each other's. IOSs can contribute companies' competitiveness, and are thus strategic from nature [10]. However, adoption of an IOS is not a simple task because of the number of stakeholders involved [11], [12]. This implies that information systems development in business networks should be planned carefully. Because of the impact of IOSs to processes of multiple organizations the planning process should be inter- rather than intra-organizational [13].

Many SISP-methods have been developed, mainly for use of big corporations, but literature on Inter-Organizational Strategic Information Systems Planning (IOSISP) is only emerging (see for example [13], [14], [5]). SISP in cooperative business networks focuses on to identify application portfolio, that of IOSs, with a high potential impact. Studying general requirements of IOSISP is important to further theory and practice but has not been done previously. In this paper, requirements for SISP in cooperative business networks are searched.

The real life problem and the research question is: How to *improve* SISP in cooperative Inter-Organizational Relationships (IOR)? Currently ad hoc methods are mainly used in cooperative IOR environment or traditional methods are applied to network context as no systematic SISP method has been introduced for cooperative IORs. The purpose of this study is not to directly create one but to find out general requirements for such a method. Thus, the result of this study is a meta-method to guide the development or selection of IOSISP – Inter-Organizations Strategic Information Systems Planning – method.

From two main alternatives, empirical studies and theoretical development, the latter one is selected in this study. Drawing from literature of three most important subject areas, SISP, IOS and IOR [15], a meta-method is theoretically developed using conceptual analytical research approach based on design science paradigm [16]–[18].

The rest of the paper is divided to sections as follows. In Section 2 previous literature on SISP-methods is reviewed and evaluated as it lays the groundwork for development of IOSISP. Development of IOSISP requires understanding of the special features and requirements that multiple organizations place for successful SISP-processes. Business

networks and their distinct features are examined in Section 3. In Section 4 the IOSs are considered and their role in IORs. Drawing from these three knowledge areas a new meta-method for SISP in cooperative business networks is introduced in Section 5. An inherent part of any design science study is the evaluation of the research product. Thus, the developed meta-method is evaluated against a best challenger in Section 6. Section 7 concludes the effort with discussion.

II. STRATEGIC INFORMATION SYSTEMS PLANNING

Improved strategic information systems planning is and has been one of the most critical issues facing information systems executives for over three decades already [19]–[23]. SISP has huge potential to make contribution to businesses and other organizations [2]. With the advent of new technologies, such as Internet, the challenge of aligning IS with business is perhaps more significant and more difficult than ever [23], [24]. On the one hand, effective SISP can help organizations use information systems to reach business goals [25]. On the other hand, SISP can also enable organizations to use information systems to significantly impact their strategies [26].

Former of these approaches attempts to “align” MIS objectives with organizational goals and the latter to “impact” organizational strategies [27]. These two views are somewhat different, and usually only one will be used. When the driver of SISP is Business (Business→IT), risk arises that application portfolio is designed to support current business processes and full potential of IT is not discovered. On the other hand, if the driver of SISP is an advance in IT (IT→Business) risk arises to fulsomely invest to unprofitable applications. Balanced approach (Business↔IT) suggests that business opportunities and advanced IT technologies are considered together to enable innovative but also realizable plans.

In today’s turbulent and complex business environment achieving IS planning success has become more critical but also more difficult. Many experienced IS planners and researchers have considered that comprehensive IS planning costs too much and takes too long time in current turbulent environment and have hopefully viewed incremental IS planning as a potential, reasonable alternative. This has led much of the IS-strategy research to concentrating on contemporary technologies and strategies (or even business models), accelerated by rapid emergence of e-Business research and practice. This development of research and practice might be shortsighted, as some studies have founded that more extensive IS planning produce better results also in turbulent environment [28], [29]. However, different researches give mixed [30], [31] or even opposite results [32].

Planning success has been argued to be tied to approach selected for planning. Some approaches are more successful in certain environments, but also general

tendencies have been found. For example, studies have suggested that formal comprehensive methodologies such as BSP, Information Engineering, and Strategic Data Planning are too rigid and many times too complex to be successfully implemented [33]. More over, studies suggest that planning based on learning and evolution is more successful. Earl studied planning processes and found that “organizational” approach seems to be most successful. Planning as a structured process of learning builds in a level of flexibility and adaptability while maintaining coordination and control [3], thus solving the problem of being flexible/adaptive and comprehensive at the same time. Segars and Grover got similar results for their “learning” school of strategic IS-planning approach [33]. In addition, these findings are in line with prescriptions of successful strategy making in the emerging era of hypercompetition of Hart and Banbury [34].

A. SISP claims

In an earlier conceptual-analytical study based on existing literature it was found that comprehensive (yet flexible) SISP methods have still an important role in IS-planning [35]. SISP analysis produces greater knowledge to support strategic planning and can result in greater top management commitment and likelihood for implementation [30], [36]. However, instead of long-lasting and heavy bureaucratic planning process SISP processes have to become more flexible and nimble and to take an advantage of using multiple alternative methods and exploiting expertise of different stakeholders. Future SISP-processes should be more flexible, dynamic and participative learning processes of different stakeholders.

The connection to business planning should also be visible and active, as new technological solutions make it possible to create and implement new business models and organizational structures and many new management innovations [37] require sophisticated information systems for operationalization. Today, information systems development and business development goes more and more hand in hand.

The SISP claims can now be formulated as follows:

- SISP-1: Selection of planning approach should be done according to qualities of business environment and management culture of the target network. Some approaches provide better results in certain environments and cultures, but overall most successful approach seems to be learning-organizational-evolutionary approach.
- SISP-2: IT and Business alignment is perhaps the most discussed issue of successful SISP. Balanced approach to planning should be applied, as IT provides little value in itself. The real benefits lie in business change that IT enables.

III. COOPERATIVE BUSINESS NETWORKS

Today’s business environment is increasingly characterized by fierce competition, dynamic and fast

changing markets and global distribution of work. These changes in competitive environment has led companies to ever more concentrating on few core processes and developing their own core competencies [38] while outsourcing other processes where reasonable, as current management dogma propose.

This development goes a way back to writings of Smith [39] on division of labor, a subject perhaps first initiated by Plato [40]. The Smith's [39] main point was that an individual's productivity increases if the individual specializes in a particular productive activity and that increase in specialization and productivity increases the total volume of the markets. This notion is applied to organizations in the notion of core competencies [38]. When a company concentrates on its core competencies its productivity increases making products and services cheaper and to available for wider audience.

Many times concentration on core competencies goes hand in hand with outsourcing non-core activities for companies specialized in activities in question, e.g. cleaning, work-place eating services, security, IT and even some support processes attached to core processes. In addition to purely economic reasons of more cost effective total production suggested by Transaction Cost Economics [41], [42], specialization and outsourcing have other motives as well.

In contrast to the transaction costs logic, which emphasizes cost minimization, the resource-based rationale emphasizes value maximization [43]. Companies try to specialize and to develop their distinct resources to create strategic advantage [44]. For non-distinct resources firms are more likely to rely on the market, if efficient market exchange is possible. Strategic alliances are seen as a strategy used to access other firms' resources, for the purpose of garnering otherwise unavailable competitive advantages and values to the firm.

Knowledge resources are common motive for strategic alliances. Others cannot easily copy or imitate knowledge-based resources, because they are vague and ambiguous [43]. Sometimes the question is not just to get access to partners existing knowledge base but to cooperate to co-create new knowledge or capability as in knowledge based theory of the firm [45].

Nevertheless the current popularity of outsourcing, distribution of work between companies has also some limits. Specialization and outsourcing inherently pose a need for managing the inter-organizational relationships and to cooperate with outsourcing partners. Aulin-Ahmavaara's [46] 'The Law of Requisite Hierarchy' explains with mathematical precision why cooperation is required in inter-organizational relationships. The equilibrium of distribution of work between companies depends largely on complexity and novelty of inter-related tasks. Simple tasks are much easier to manage across companies than complex tasks.

The Law of Requisite Hierarchy suggests that when some task is distributed for number of actors, uncertainty

appears which will reduce the efficiency and effectiveness of the actors. To compensate this uncertainty, some control is needed, managed cooperation of different actors.

The equilibrium of reasonable level of distribution of work between companies (that of specialization and outsourcing) can be seen to increase in the course of time as new methods are developed to compensate appeared uncertainty. These methods can be, for example, standardization of components or modules or interfaces, more efficient and effective organizational and network structures and operational modes, as well as new information and communication technology and systems supporting cooperation of different actors. However, some of these and other factors can also have opposite effect on equilibrium suggesting companies to insource some tasks.

Inter-firm cooperation is not only required but also has also an influence on the way companies' competitiveness is formulated. Conventional strategic thinking has focused on individual firms as the competitive unit in any industry [47]. However, in today's networked business environment competition is moving from individual companies to networks of businesses [6], [7]. As a result, efficiency seeking has exceeded the company's borders to consider the efficiency of the whole business network. Creating close collaboration and integrating whole value chain in a way, that brings unique value for customers, can be source for sustainable competitive advantage [48]. Thus, collaboration can be seen as the key to value creation [7].

A. Business network claims

In an earlier conceptual-analytical study based on existing literature it was argued that cooperative inter-organizational relationships are of necessity in current business environment promoting specialization (concentration on core competencies) and outsourcing [49]. This distribution of work causes a need for managing the cooperation of different performers efficiently and effectively. Modern information systems offer plenty of opportunities to enhance the cooperative relationships. On the other hand, information systems also enable companies to better manage the drawbacks of extensive distribution of work, increasing the possibilities of outsourcing ever further.

However, it was also noted [49] that it is not worthwhile to develop and invest in equally to every relationship but to identify certain groups of relationship of different importance and develop each group accordingly. Between markets and hierarchies, three levels of cooperation were described according to complexity and novelty of tasks involved: communication, coordination and collaboration. Each of these levels requires different kind of approach not only for cooperative strategy but also for inter-organizational information systems used in a relationship. In certain relationships it is enough to enhance operations by communicating stock levels, production timetables and demand forecasts where as in other relationships synchronizing production is required or solutions that

support collaboration in new product development context.

From these we get the Cooperative Business Network claims:

- CBN-1: It is worthwhile to divide the entire business network to smaller sub-networks with special development focus. It is not reasonable to draw all business partners with highly different development interests beside the same table but to select participant with similar development challenges and interests.
- CBN-2: Many new inter-organizational business models are only manageable because of developments in ICT. As IOSs enable new organizational and inter-organizational forms, IT-strategy should be planned parallel with network planning to find out possibilities and opportunities that technology can offer.

IV. INTER-ORGANIZATIONAL INFORMATION SYSTEMS

Engagement in Inter-Organizational Relationships (IOR) has a deep effect to many aspects of organizational life. One of the most important subjects for development of cooperation is to ensure fluent information flows between cooperating partners. Modern information and communication technologies (ICT) have a great influence how these information flows are shaped and handled today. Hong [50] even argues, that 'there is a shift in the role of IT - from a competition weapon to a cooperation enabler among businesses'.

The Internet and related Information and Communication Technologies (ICT) have enabled the cost-effective dissemination of information [51]. According to [52] "all types of inter-organizational systems are increasing in number as business processes are modified so that organizations can respond to new opportunities as well as to the constant pressures for greater responsiveness to the needs of customers and trading partners". IOS can help to improve performance e.g. by lowering transaction costs [53]. Also, the strategic value of Inter-Organizational Systems (IOS) has been well recognized [54]. The context in which IOS is implemented is important as it has been argued that 'real benefits reside not within the IT domain but instead in the changes in the organizational activities that the IT system has enabled' [55].

The IOS projects differ from conventional Information Systems (IS) projects focused on single company, as in those cases legal boundaries of a company is not penetrated. In contrast to inter-organizational systems, traditional intra-organizational systems have two characteristics that facilitate their management [56]:

1. One organization can always fully control the information system
2. The cost caused by the information system can always be addressed to one single organization, so can the benefits they create

IOSs are central for the development of business networks by reducing costs and extending the possibilities

for communication, coordination and collaboration and by linking technologies and sources of knowledge to support innovations [57]. As Suomi [58] noted: 'In one word, the world of IOSs will be that of cooperation'. IOSs are needed to enhance the ever growing needs of inter-organizational cooperation. On the other hand, IOSs are also accelerating this development by offering opportunities for redesigning of cooperative networks and to outperform.

Johnston and Vitale [59] studied how inter-organizational systems could also help in creating competitive advantage and created a set of categories to guide exploration. They concluded that inter-organizational systems were an avenue to cooperation on a widening range of initiatives that improved the economic performance of each partner. Thus, inter-organizational systems are not only a mean to achieve objectives of cooperation but also a facilitator of cooperation as they 'necessitate some kind of cooperation because they are technologically and financially demanding projects' [53].

Contribution to partner development is partly due to the fact that building IOSs require ex ante investments binding partners to each others. The process of implementing and using IOS seems to imply a process of partners deliberately entering into situation where they become dependent on each other [8]. This situation reduces the possibility of partners to behave opportunistically and thus, IOSs as a "mutual hostage" increase trust [35].

A. IOS claims

A conceptual-analytical study based on existing literature of IOS success factors found that there are six kinds of factors influencing to success of IOS [60]:

1. environmental forces,
2. technological issues,
3. rational-economic issues,
4. socio-political issues,
5. knowledge issues, and
6. interrupting factors.

These factors follow two theoretical classification schemes. First, we have commonly held principle of division of labor to internal and external level applied to network context. Thus, we have external (influencing from outside the network) factors (1) and internal (influencing in inside the network) factors (2-5). Internal factors follow division to four main resources of an organization that correspond to four main functions of an organization: acquisition, upkeep and development of machines (2), finance (3), personnel (4), and information resources (5) [61]. In addition, we have one more factor (6) that can influence the results even the agreements and plans would have been successfully. Risks of an IOS implementation project can be anticipated in some extent with, for example, using scenario method. However, these issues are something that is out of the range of planning and agreements, they just have to be prepared for and managed if they emerge.

The characteristics of IOSs require these factors to be

considered when planning for an IOS adoption. In addition, as companies engage to interaction with each other, their knowledge and perception of IOSs will change [62]. To promote more dynamic and rich picture of IOS adoption the interplay between different factors and actors should also be considered [60].

Thus we get the IOS claims:

- IOS-1: Changes in business environment should be analyzed to be able to evaluate competitive factors and to identify possible threats and opportunities.
- IOS-2: Available technological solutions should be compared to existing IT-infrastructure to identify weaknesses and strengths of current IT-infrastructure (e.g. heterogeneity of IT-platforms) and threats and opportunities of available technologies.
- IOS-3: The expected benefits should be planned before hand, as it is difficult to reach goals that are not identified. IOSs are never an answer in themselves; they are at best a catalyst and an enabler [63].
- IOS-4: Establishing relationships on trust and mutual understanding is even more important in inter-organizational context that in intra-organizational, as formal authority might not exist to bring the changes.
- IOS-5: Different organizations and different participants might have different levels of IT-skills, knowledge and maturity to use IT. Planning process should be organized as learning process so that those with weaker skills and lesser knowledge on IT-issues can learn to understand the benefits and challenges of cooperative systems.
- IOS-6: Assessing risks and potential sources of failure is important before proceeding with implementation. If there are substantial risks in sight companies might not want to proceed, unless there are compelling pressures or enormous opportunities.

V. META-METHOD FOR SISP IN COOPERATIVE BUSINESS NETWORKS

Characteristic for SISP in business networks is presence of multiple stakeholders with varying levels of power and interest. This environment introduces some direct qualities that give network-SISP a distinct flavor. Basically, companies may choose to apply some existing SISP-methodology or to use more informal approach, but in either case it should follow the above mentioned principles.

These principles work also as a meta-method for IOSISP. This meta-method, illustrated in Figure 1, can help managers to develop their own SISP approach, customize some existing method or straightforwardly apply one. The difference with presented meta-method and the actual methods is that meta-method only suggests that

these kinds of issues should be considered, it does not make a stance how or who should handled these issues in practice.

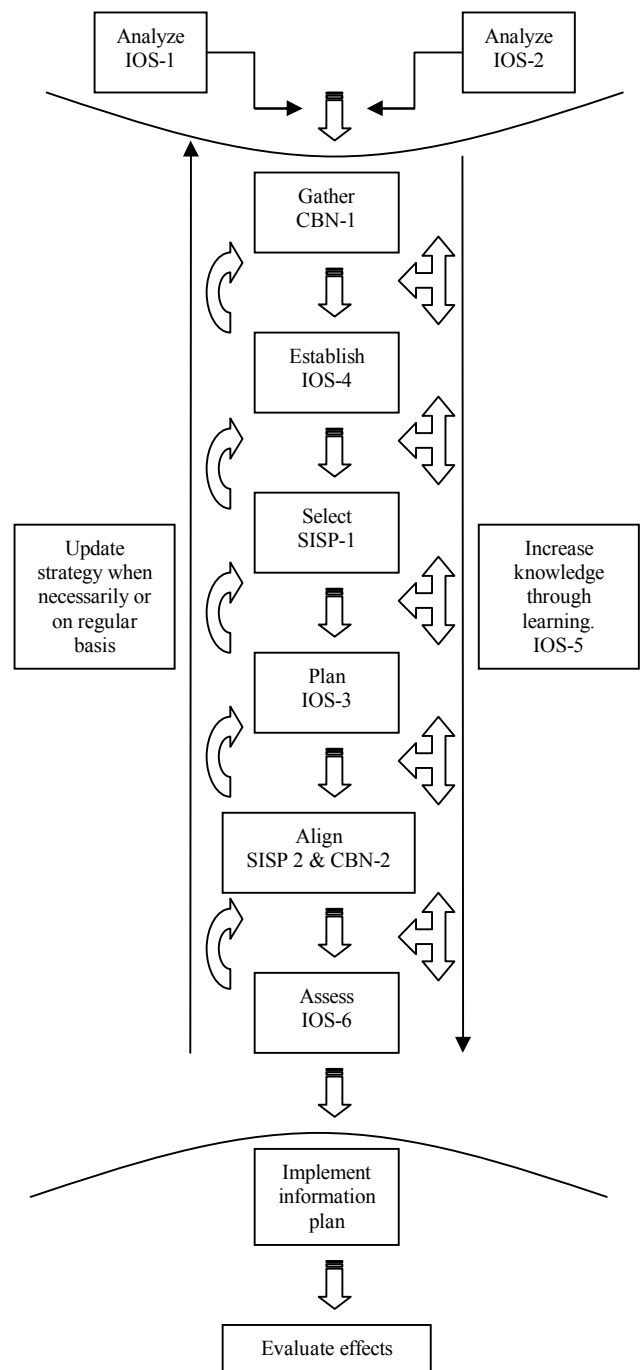


Figure 1. Mapping the principles to SISP-process.

In figure 1, the principles are organized in a rather linear manner, starting from analysis and ending up with assessment of risks, after which follows the implementation and the following phases. In reality the different principles might be followed in parallel and developed in evolutionary fashion. Thus, the meta-method should not be considered guiding the order of suggested issues; rather it illustrates one possible order with many back-switches, loops, and iterative processes.

In figure 1, there are two analysis placed on top of the figure. Analyzing the changes in business environment and competitive factors is important to recognize opportunities and threats (IOS-1). Stakeholder analysis is also worthwhile to conduct not only to find out different points of departure for each participant but also to discover potential external stakeholders. Sometimes these external players might have a lot to say when planning different ways to cooperate and to use IOSs. These external stakeholders can be, for example, governmental institutions, industrial bodies, trade unions and alike. Or just enough big buyer/seller in the markets who sees that sort of development to be harmful for them self.

Second analysis considers the developments is ICT, as many times new ICT-innovations opens up new possibilities also for management innovations. Also, when planning for adoption of IOSs, different partners' existing IT-platforms should be considered as planned solutions should be reasonable without exhausting renewing of other organizational information systems. Rarely everything can be planned for "greenfield site" but we have to develop from where we are [64]. Usually new IOSs are built upon existing heterogeneous system architecture of different partners.

These two analyzes can give suggestions if certain network should proceed or not to proceed with IOSISP. If there doesn't exist any threats or opportunities in business or ICT or at least they are not identified, it might be difficult to justify need for planning process, especially if there is rush to meet customer demand. If, as it could be expected, there can be found threats and opportunities, companies have clear reason to start examining the possibilities for development.

Third, as CBN-1 suggests, selection of participants should always follow the tasks in hand; it is not worthwhile to draw all companies in business network into a same planning table. Rather, grouping companies to several groups or sub-networks is a good idea and then proceed with each group in cooperation and SISP planning as appropriate. This grouping can be based on one single company's view of the situation or can be done jointly with key partners.

Next issue (IOS-4) considers the establishment of relationships between different companies. Many times IOS planning can also help in establishing cooperative relationships in the first place [13]. This issue is also about equality of different partners, or actually inequality of them. Different partners have different levels of authority and power, never minding the source of it (e.g. knowledge, size, position). Critical for successful IOS planning is not the possessing of power itself but the use of it. Balancing the use of this power is important, as rarely the power is absolute and undue use of it can result in rejection of other partners.

Finnegan et al. [13] argue that IOSISP environments can be describe along a continuum, and are described as ranging from monarchist (a single strong organization) to

club (no single organization holds much power over others). Significant power differences can give IOSISP a political nature. Thus, IOSISP can also be seen as a negotiation process. Personal relationships and mutual trust might contribute for turning this situation to collaborative joint effort.

Fifth, the nature of SISP-method should be flexible and nimble and to support multiple different methods to choose from. Not all companies and networks are similar and benefit from the same analysis and working methods. Selection of planning approach should be done according to qualities of business environment and management culture of the target network. A SISP framework should incite to carry on enough extensive and in-depth study for each situation. Studies have suggested that organizational-learning-evolutionary approach seems to be most successful approach to SISP [3], [33], [65]. In these approaches planning is a continuous decision making activity shared by the business and IS [13]. For example, a study in three different kind of networks revealed that, while little formal thought was given to planning process in any of the studied organizations, planning was nevertheless perceived to be an important aspect of the developments [13].

Sixth (IOS-3), benefits should be planned carefully and stated explicitly to ensure success and acceptance of a new information system. If it is not clear what effects these systems will have it is difficult to accrue commitment from different partners and may lead to failure of systems. Benefits can be various and argued differently. For example, some appreciate faster cycle times, or decreased communication costs where as others can highlight more accurate information or strategic importance of investment to partner network.

Seventh (SISP-2 and CBN-2), connection with business planning in network should be tight. Network's business strategy process can, of course, be done separately but it seems more feasible to consider both network strategy and IS strategy jointly as IS can contribute and is a major source of many business development innovations. This comes from the dual role of ISs as supporter and/or enabler of business models and processes. In addition, planning is often a negotiation tool used by IOS participants to establish inter-organizational arrangements, and not just to delineate systems products [13].

Eighth, paying attention to the fact that not all situations and factors can be anticipated, some mechanisms to manage surprises should be prepared. Assessing potential risks, their relative actualization probability and extent of damage can help network to anticipate and prevent negative outcomes. In any case some unanticipated interrupting factors will appear and how they are handled can determine the eventual success or failure of network-SISP. Some of the uncontrolled issues can include, just for an example, natural disasters, hostile competitor moves or bankrupt or take over of some key partner.

In addition (IOS-5), not all participants have equal

knowledge on IOSs, thus the whole SISP can be considered to be a learning process. This holds true also for learning about forms and levels of cooperation, in which each company seeks to be involved. Through interaction and communication participants learn other's positions, views and will and are able to "learn" how to best apply IOSs for benefit of business network.

Considering all the above requirements is needed to give full appreciation for network environment and its distinct features. It is not so important how the search for strategy is otherwise organized, as long as it is done efficiently and effectively. Some approaches suit better in some industries and for certain kind of companies. However, some methods seems more feasible than others, especially those with high focus on participation and learning [66] or those considering different value sets of different stakeholders [67].

Some common features for all SISP processes after initial planning is added to figure 1. These issues are added to highlight few important viewpoints and issues that might be sometimes forgotten. After implementation of plans the effects of change should be evaluated and followed. Also, the plan itself should not be freeze for too long time; rather it should be a living document that follows the changes in business, technology and network.

VI. EVALUATION OF THE META-METHOD

Every new theoretical construct should be evaluated to assess its strengths and benefits [16]. There are two main alternatives for such evaluation: theoretical and/or empirical. In this study the meta-method is evaluated only theoretically and empirical evaluation is left for further studies. The theoretical evaluation is conducted by comparing the meta-method to the best challenger recognized from the existing literature.

As no competing meta-method, guidelines or prescriptions for IOSISP was found from SISP literature, the competitor had to be sought from other streams of literature. Three different alternatives were recognized for potential source of best challenger.

1. First, as *ad hoc* methods are mainly used in IS planning in inter-organizational settings, they are evident challenger for systematic methods. However, as they are *ad hoc* methods and cannot be systematically documented to having any specific features there are hardly any mean to compare and to evaluate the "goodness" of developed meta-method against them. We will have to satisfy to note that some studies have found that systematic methods provide better results [28].
2. Second, as traditional SISP methods are somewhat applied also to network contexts, they provide potential source of competitor. Some of these organizational SISP methods could operate well as such in a "monarchist" [13] network environments, in which IOSISP

processes are rather extensions of single companies planning processes. Suitability of such methods can however be questioned in planning environments closer to "club" [13] environments, which is a focus in this study. In either case, it was considered that evaluating a meta-method developed for organizational context against meta-method developed for inter-organizational context using criteria of inter-organizational context would evidently do unjust for organizational meta-method.

3. Third, and most promising source of challenger is e-Business literature. However, the vast body of literature seems to be concentrating more on contemporary technologies and business models than actual strategic planning processes. Also, much of the literature is concentrating on business strategies using information systems, such as e-Shops, electronic auction systems, and B2B exchanges for use of commercial activity of single companies, rather than in cooperation of multiple organizations. A challenger coming from this stream of literature could be comparable, positing it is concentrating on cooperative planning.

From these three streams of literature a challenger was found from third group, as suspected. Finnegan et al. [13] developed guidelines for "Systems Planning in Business-to-Business Electronic Commerce Environments". Despite the misleading concept of "Electronic Commerce [that] refers to retailing and the consumer sector as well as mass marketing" in their title, authors don't restrict their examination on commercial applications only, but to all cooperative systems as well. Thus, authors provide recommendations for IOS planning guidelines that are comparable to meta-method suggested in this study.

A. Describing the competing theory

Finnegan et al. [13] draw their guidelines from literature relating planning environments (monarchist vs. club) that authors found to be of significant determinant, to five IOSISP areas: 1) IOS planning processes, 2) Roles in IOS planning, 3) The business direction, 4) IOS and organizational activity, and 5) Systems planning. From these five areas authors draw nine general guidelines:

- F-1a. Guidelines need to enable individual organizations to investigate their positions in the network, and determine their role in the planning environments.
- F-1b. Facilitate design of IOS planning process for individual organizations, and at a network level, appropriate for their role in the planning environment.
- F-2. Delineate inter-organizational roles and assigning people to these consistent with planning environment.
- F-3. Co-ordinate network participants in an

effort to match business requirements with IOS infrastructure consistent with appropriate planning environments.

- F-4a. Determine the effects of IOS on organizational activity that recognizes the dependence of such considerations on IOS planning environments.
- F-4b. Proactively determine organizational changes that facilitate the considerations of external parties.
- F-4c. Aid inter-organizational planning for structural integration recognizing the substantive issue as being beyond systems and technology.
- F-5a. Cover data planning issues of ownership, sharing methods and editing rights.
- F-5b. Facilitate planning for systems and technology that is inclusive of all stakeholder needs. These should consider communication standards and protocols as well as integration with internal systems.

B. Comparison of competing theories

Finnegan et al. base their nine general guidelines on two different planning environments, according to which every participant adopts their role in planning and understand their relative position in the network. Authors see that relative positions and power determine how the planning process will eventually follow; those with much power will dictate the planning process. We acknowledge that different participants have different relative power and influence to each others. However, this relative position and power is not static as they assume, because of the dynamic interactions [62] and evolving nature of relationships as a result of learning [65].

One important source for power today is knowledge and absorptive capabilities. Relatively less powerful company can in fact strengthen its relative position due to increased knowledge and understanding of required development and thus capability to direct development to more desirable direction. Thus, we have to question this approach to base IOSISP to pre-determined roles and positions (F-1a), as freezing the power and position relationships before actual planning hinder the possibilities for re-engineering the network in truly innovative matter. This conception can be drawn from the principle of tight connection between network planning and IOS planning presented in this paper (SISP-2 & CBN-2). However, the difference between these two views seems to be of philosophical matter. Finnegan et al. [13] seem to implicitly base their proposal to political school of strategic (IS) management where as in this paper the point of view is based more on notion of cooperation and joint effort of organizational approach (SISP-1).

Proposal F-1b is similar to SISP-1, only the above mentioned philosophical viewpoint differs. Proposal F-2 is somewhat similar to IOS-4, except the semantic difference

between roles and relationships. Proposal F-3 is directly comparable with SISP-2 and CBN-2. Proposal F-4a considers how IOS will affect intra-organizational processes, F-4b how company could better match their intra-organizational processes to partner needs and F-4c considers the need for structural integration of partners. Proposals F-4a-c considers the IOS effect on intra-organizational processes, which is not really considered in this paper. SISP-2 and CBN-2 suggest that I-O Business Process Re-engineering could be beneficial, but does not take account of intra-organizational changes. In this matter, Finnegan et al. [13] have more extensive method.

Proposal F-5a covers the data planning and ownership issues that have no counterpart in this new meta-method. The IS application portfolio in new method is a result of aligning IT changes with business changes (SISP-2 and CBN-2). It is implicitly assumed that issues of F-5a are covered during this effort. Proposal F-5b suggests that planning should be inclusive for the needs of all stakeholders. It has to be questioned if such a plan can be developed or realized. More often plan is compromise of different stakeholders. However, the fact of listening all stakeholders reminds of the principle IOS-4, to balance the use of power and to establish relationships on trust and mutual understanding.

As a summary, it was considered that Finnegan et al.'s [13] guidelines F-1a took wrong approach, and that F-1b and F-2 were weaker than SISP-1 and IOS-4. Proposal F-3 was directly comparable, but proposals F-4a-b are missing from new meta-method. Proposal F-4c, on the other hand, is somewhat similar to SISP-1 and CBN-2. Proposal F-5a was though to be implicitly but not explicitly covered in SISP-2 and CBN-2. This is strength of Finnegan et al.'s [13] paper. Proposal F-5b was seen partly weaker, partly similar to IOS-4. However, Finnegan et al. [13] did not consider several issues presented in this paper: IOS-1, IOS-2, IOS-3, IOS-5, IOS-6, SISP-1, and CBN-1. Thus, the meta-method presented in this paper is more extensive in whole. This suggests that selected approach to draw conclusions from three related subjects was a fruitful approach to provide fresh understanding of phenomenon and contributed the body of literature.

VII. CONCLUSIONS

Current business literature proposes that companies should concentrate on few core processes and development of their own core competencies [38] while outsourcing other processes where reasonable [68,69]. This development, in turn, has introduced the need for cooperative inter-organizational arrangements (e.g. [8,9]). In networked business environment also the IS-planning processes must be inter- rather than intra-organizational. Current IS planning approaches stop short of this [13]. This is not to say that IOS and IS planning have nothing in common. Rather, the new inter-organizational context of IS planning requires a rethinking of SISP guidelines to include an inter-organizational perspective [13]. In this

study these guidelines are sought and presented.

The relationship between organization-centric SISP and IOSISP is an important issue, though not extensively covered here. It is difficult if not impossible to start leading or even participating in sophisticated IOS development projects if intra-organizational IS infrastructure is still scattered. Participation in IOSISP can require concurrent development of internal IS-issues to meet the requirements of inter-organizational challenges. Connection between IOSISP and intra-SISP is a self-evident subject for future research. Also, elaboration on IOSISP meta-methods and eventually also with concrete methods is suggested.

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Investigating the Effect of Consumer Traits on the Relative Importance of TAM Constructs in an E-Commerce Context

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Abstract — This paper tests whether the Technology Acceptance Model (TAM) holds for different groups of customers. In doing so, we investigate the moderating effect of eight customer traits (socio-demographics, psychographics, and prior experience) on important relationships within TAM for an online shopping context. The results show that in general TAM is quite capable of predicting customers' online purchase intentions. For some moderators, however, the impact of a predictor is significantly different. Socio-demographics have the strongest influence on altering the relative importance of the predictors, while the moderating influence of prior online shopping experience is significant in some cases. Psychographics are found to be mostly unrelated to the extent to which TAM predictor impact purchase intentions. Theoretical and managerial implications are discussed.

Keywords — E-Commerce, TAM, Context-dependency, Online shopping experience, moderators.

I. INTRODUCTION

A. TAM and the E-Commerce Context

Prior research applied the Technology Acceptance Model (TAM) to predict Internet adoption and use. Researchers argue that TAM –originally developed to predict the adoption and use of information technologies such as computers and spreadsheet software programs [8], [9]– is capable of explaining online behaviors, as the E-Commerce context is heavily technology-driven [19]. Prior TAM studies performed in the Internet and E-Commerce context confirm that user's beliefs, perceived ease of use (PEOU) and perceived usefulness (PU) are key drivers of E-Commerce adoption and acceptance [10], [11], [14], [22]. However, similar to consumer behavior in general, the criteria to evaluate technologies (i.e., the Internet) are context-specific; that is, the nature and strength of relationships within TAM is likely to be dependent on the consumer, product and situation [25]. Early TAM research already suggested that the influence of PEOU may change over time, as individuals gain experience with the technology [9]. Also, customers differ in their capability to

use technologies, and these differences may result in differences in the evaluative criteria [18]. As the Internet is still growing and becoming more diverse, the question rises whether TAM holds under a variety of settings; that is, whether the TAM predictors are consistent predictors of online shopping intentions for different kind of customers.

B. Adaptations of TAM to the E-Commerce Context

To further improve TAM predictions in E-commerce settings, several authors have proposed TAM extensions with constructs such as perceived enjoyment [6], [16], perceived risk [15], [19], and trust/reputation [11], [19].

To capture the intrinsic motivations of using a technology, as opposed to extrinsic motivations which are clearly captured by PU [9], [26], many authors (e.g. [6], [9] 16) added perceived enjoyment to capture the pleasure and satisfaction derived from performing the behavior. The characterization of dual motivations is consistent with research on retail shopping behavior, which has supported the presence of both utilitarian (extrinsic) and hedonic (intrinsic) motivations [6].

Apart from extending the TAM with relevant constructs, researchers have adapted the measurements of PEOU and PU to the online shopping environment. Authors [15] have defined PEOU as the ease of information search, ease of ordering, ease of using customer service and overall ease of use, while PU has been referred to saving of money, saving of time, vast selection of products and services, and overall usefulness. In doing so, these researchers note that customers' evaluations of online shopping experiences go beyond the mere interaction with the website; consumers evaluate the total shopping experience in terms of what they receive (perceived quality) for what they give up (monetary and nonmonetary costs) [17].

Researchers in the domain of human-computer interaction are increasingly interested in modelling context-specific behaviors, as opposed to generic behaviors with computer technologies [27]. This shift towards focusing on contextual effects can also be noticed in the E-Commerce literature. After having identified the main criteria consumers use for their online shopping, researchers are now increasingly interested in modeling the effect of context-specific effects [7], [25], such as the influence of consumer characteristics (e.g., socio-demographics,

previous experience) and situational influences (weather, time pressure) on online perceptions and behavior [16]. This paper investigates whether the relative importance of TAM constructs differ according to specific consumer traits, including socio-demographics (gender, age, education), psychographics (privacy awareness, need for personal interaction) and previous experience (direct experience, Internet/online shopping experience, product knowledge). These issues are explored in the context of a comparison site for car insurances.

The main objective of this paper is to provide insights into the effects of these customer characteristics on the relative importance of TAM predictors. The investigation of the moderating influence of consumer characteristics yields important insights. From a theoretical perspective, insights into the influence of customer traits may help researchers in explaining inconsistent findings. From a managerial perspective, it can provide useful input for improvements in website design, based on the needs of different groups of buyers. Differences in the evaluative criteria between existent and potential customers, for instance, may be translated into customized pages.

II. LITERATURE BACKGROUND ON CONTEXT-DEPENDENCY

Although TAM has proven to be a viable model for examining consumer acceptance and use of new technologies, it is necessary to incorporate additional factors that help explaining contextual effects [16]. There is increasing evidence that the importance of criteria to evaluate information technologies, and in particular the Internet as purchasing tool, is context-specific; that is, the importance is dependent on consumer, product, and situational factors. In this respect, it is argued that socio-demographics (gender, age, education), psychographics (privacy awareness, need for personal interaction) and prior experience (direct experience, Internet/online shopping, product knowledge) are key moderators of important relationships in the online shopping environment [4], [16], [27].

For example, women are expected to be more strongly influenced by PEOU than men [27]. Increased age has been shown to be associated with difficulty in processing information and using websites effectively. Older people are less interested in using new technologies, and for them, it is a hassle to overcome; therefore, they rely stronger on PEOU than younger people [16], [27]. Higher educated customers are more comfortable using nonstore channels, and may rely less strongly on PEOU, but more on PU as they have experienced the benefits of shopping online [27]. Previous research also highlighted the role of direct experience in adopting and using information technologies. Empirical evidence suggests that nonadopters (inexperienced users or novices) differ from adopters (experienced users or experts) in the criteria they use to evaluate information technologies [13], [21].

A widely discussed topic in TAM is whether PEOU has a direct effect on behavioral intentions, or whether its effect is fully mediated through PU. Empirical studies find support for the direct link between PEOU and intentions [1], [22], [23], [26], whereas others find insignificant results [12], [15], [19]. A possible explanation for these inconsistent findings is that PEOU tends to become less salient for individuals with higher levels of experience [27]. PEOU is more salient in the early stages, where the learning process represents hurdles to overcome, which later become overshadowed by instrumentality concerns [9],[20]. After adopting the technology, PEOU will only affect behavioral intentions indirectly through PU [10]. In line with this reasoning, one study [19] found that PEOU did not directly affect behavioral intentions in the Internet savvy student sample, in contrast to the consumer sample.

Some researchers theorize that the impact of PEOU on behavioral intentions also depends on situational factors, such as the nature of the task. PEOU directly affects intentions when the primary task for which the system is deployed is directly associated with intrinsic characteristics of the system's use (e.g., browsing). On the other hand, when the system is used as a means to fulfill tasks that are not solely intrinsic in nature (e.g., purchasing), PEOU only indirectly affects behavioral intentions through PU [12].

In sum, a number of consumer traits are expected to influence the strength of important relationships in TAM. In order to fully understand consumers' motivations to engage in online shopping, these consumer traits need to be taken into account (see Figure 1).

III. METHODOLOGY

A. Data Collection and Sampling Procedure

The data were collected through an online questionnaire targeted at visitors of a comparison website of car insurances. Invitations were sent to the email addresses of visitors who recently (within the past 6 months) made an inquiry by inputting their (car) data. In total, 400 usable questionnaires, yielding a response rate of 19%, were collected of which 251 respondents completed the purchase process through the comparison website, and 149 who merely made an inquiry about a specific car insurance offer.

B. Research instrument

The research instrument contained items measuring the constructs of PEOU, PU and perceived enjoyment (see Table 1). The items were adjusted to the online shopping context. In doing so, PEOU refers to the ease or convenience of online shopping, based on a retail study [3]. PU refers to the degree to which consumers believe that online shopping is useful and increases their performance. This construct closely resembles perceived value [18]; i.e., perceived benefits and costs of using the website, including selection, price premium, time/effort required and level of control. Enjoyment was adapted from an existent scale [6], and represents the enjoyment experienced during the total

shopping process. In addition, background questions relating to socio-demographics (gender, age, income, education), previous experience and knowledge (internet, online shopping, car insurance), and psychographics (privacy/price/quality consciousness) were asked.

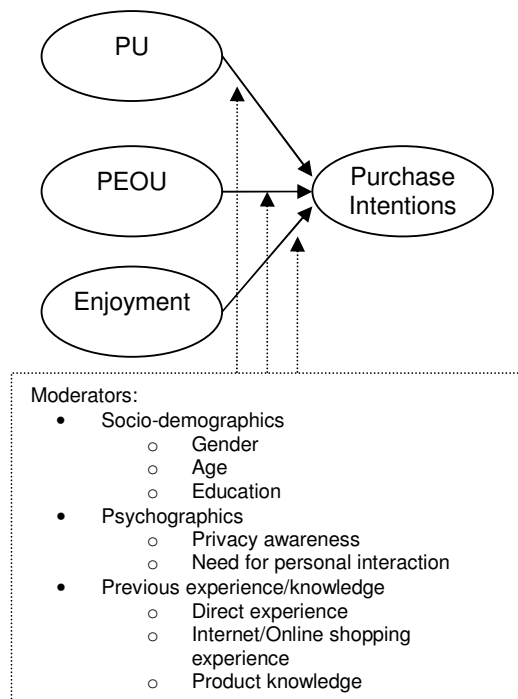


FIGURE 1: CONCEPTUAL MODEL

C. Scale testing

After performing exploratory factor analysis, the items were subjected to confirmatory factor analysis using AMOS 5.0. The scales demonstrated unidimensionality, convergent and discriminant validity, as well as reliability. The measurement model produced satisfactory fit indices, indicating that the model fitted the data reasonably well ($\chi^2/df=4.09$, GFI=.90, CFI=.95, NNFI=.94, RMSEA=.090).

IV. FINDINGS AND IMPLICATIONS

In a first step, the structural model for the TAM is assessed. The results show that a reasonable proportion of variance ($R^2=63\%$) is explained in customers' purchase intentions. Next, PU ($\beta=.42$, $p<.001$) and Enjoyment ($\beta=.47$, $p<.001$) are significant predictors of customers' purchase intentions, whereas PEOU ($\beta=-.08$, $p>.05$) is not. A possible explanation for insignificance of PEOU is the limited variance within the construct; most customers find the comparison website very easy to use, leaving little space to increase the intentions by making it easier. In addition to this, it seems that customers have acquired sufficient

experience in using websites for these activities, making PEOU less salient; for these customers intentions are only increased through improving PU and/or Enjoyment. An additional possible explanation is the increased professionalism of website design; as time has progressed defacto design standards emerged (e.g., regarding the use of buttons, the screen layout and the location and structure of menus).

In a second step, multi-group structural equation is used to testing for differences in the strengths of the structural relationships [2], [5]. In comparison to other methods, multiple group analysis is considered to be a good technique to test for interaction effects [7]. For each of the eight moderation tests, the dataset was split into two subgroups. Then, after establishing partial metric invariance, the increase in the Chi-square due to the constraining of a structural relationship was tested with one degree of freedom; a significant worsening of the fit indicates that the structural relationships are different between the two subgroups.

Socio-demographics

Socio-demographics (gender, age, education) clearly impact the importance of the TAM predictors. In contrast to findings of the literature [27], this study finds that women rely stronger on PU and less strongly on Enjoyment compared to men ($p<.05$); women appear to be more strongly affected by the outcome of the process, and tend to be less strongly influenced by the level of enjoyment offered by the website. This finding can be explained as women visit the comparison website more seriously, and really consider the actual purchase of a car insurance, whereas men appear to use the website more as a tool, and as a means to get an indication of the price offer. In this respect, men are more likely to be influenced by playfulness (i.e., Enjoyment).

Age also impacted the influence PU and Enjoyment; younger people (younger than 40) were more strongly affected by PU and less by Enjoyment in comparison with older people (40 years and older). Older people rely stronger on the process variable enjoyment; for them an increase in the level of enjoyment strongly increases future purchase intentions through the website. Younger people rely more on the outcomes of the process (saving time and effort, getting more value for money) rather than on the process itself.

Education was split into two subgroups (Primary/Secondary/College versus Graduate). Consistent with prior research [27], higher educated people tend to rely stronger on PU. They also appear to rely less strongly on the level of enjoyment. Lower educated persons are not so much affected by PU ($\beta=.02$, $p>.10$) but rely heavily on whether the purchase process is enjoyable.

Psychographics

Psychographics (privacy awareness, need for personal interaction) have a limited effect on the relative importance of the TAM predictors. In contrast to our expectations,

customers that had privacy concerns were not more strongly affected by the TAM-related predictors than people with confidence in the website's capability to protect the customers' personal information. The expectation was that customers with privacy concerns have to be compensated for this; thus, the relationships for PU, PEOU and Enjoyment should be stronger. However, we did not find evidence for these differences.

The need for personal interaction reflects the customer's need to have direct and personal contact with employees during the purchase process. Those with a strong need for interaction favor a smooth shopping process, and are expected to rely more strongly on the level of enjoyment provided by the website. If the website succeeds in providing a more enjoyable shopping process, it will strongly influence their purchase intentions. The results indicated that those with a strong need for personal interaction were more concerned with Enjoyment than those with a weak need ($\beta_{\text{strong}}=.66$ vs. $\beta_{\text{weak}}=.25$) $p>.10$), but the difference was just outside the .05 significance level ($p=.053$).

Prior experience

Finally, the moderating influence of direct experience with the service provider, Internet and online shopping, and product knowledge was investigated. Direct experience was measured as whether people had actually finalized the purchase process, or just made an inquiry. Customers who have finalized the purchase process have personally experienced each step in the process and acquired more experience with the service provider. In line with our expectations, customers who completed the online purchase process were more concerned with PU than customer who only used the website to get informed. However, although in the right direction, this difference was not statistically significant ($p=.11$). Customers with direct experience were significantly less concerned with Enjoyment ($p<.05$). These results indicate that customers with direct experience are more focused at improving their outcomes relative to improving the process; they have experienced the shopping process and become more directed at improving the instrumental outcome benefits (PU).

The level of both internet and general online shopping experience did not impact the relative importance of TAM predictors; all predictors were equally important for the low and high experience groups.

Product knowledge (i.e. knowledge about car insurances) moderated some key relationships. Customers with less knowledge of and experience with car insurances are more strongly influenced by the instrumental benefits offered (PU) by the website. For them, the website seems to function as an expert; they can improve their outcomes effectively as they themselves are uncertain about their own product knowledge. To them, the degree to which the website is perceived to be useful strongly influences their intentions. If the website is perceived to be useful they form strong intentions towards purchasing through the website.

V. CONCLUSIONS

In this paper we tested whether the Technology Acceptance Model (TAM) holds for different groups of customers by investigating the moderating effect of eight customer traits (socio-demographics, psychographics, and prior experience) on important relationships within TAM. The results show that in general TAM is quite capable of predicting customers' online purchase intentions.

For some moderators, however, the impact of a predictor is significantly different. In particular, socio-demographics and (to a less extent) prior experience are likely to affect the importance of PU and Enjoyment on purchase intentions. Acknowledging the nature and impact of consumer traits on important relationships enables e-tailers to tailor the design of their web sites according to the needs of specific groups of customers.

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Intentions	When I would need to renew my car insurance, I would use this website.	5.59 (1.41)
	There is a substantial chance that I would purchase my next car insurance through this website	5.74 (1.32)
	I recommend others to use this website	5.57 (1.37)

Moderators		
Privacy awareness	I believe the website keeps my personal information protected	4.05 (1.36)
Need for personal interaction	The personal contact with a live agent makes the shopping process more convenient	3.99 (1.74)
Online shopping experience	I have the knowledge and skills required to purchase a car insurance quickly and without hassles	6.01 (1.20)
	Compared to an average consumer, I am an experienced online buyer	5.15 (1.52)
Product knowledge	Compared to an average consumer, I am experienced in buying car insurances	3.99 (1.49)

Notes:

- a 7-point Likert scales were used, anchoring at 1= totally disagree and 7=totally agree.
- b Means and standard deviations were based on total sample, ranging with sample sizes from 391 to 399.

TABLE 1
ITEMS AFTER CONFIRMATORY FACTOR ANALYSIS

Construct	Item wording ^a	Mean (standard deviation) ^b
PEOU	I can purchase an insurance, whenever the time suits me	6.20 (1.20)
	The shopping process through this website runs smoothly	5.88 (1.35)
	Making a purchase at this website is very easy	5.98 (1.31)
PU	The insurance premium I have to pay is economical, for what I receive from it	5.21 (1.47)
	I spend my time efficiently, when purchasing a car insurance through this website	5.72 (1.25)
	This website gives me the feeling of being in control	5.31 (1.33)
	Given the time and effort required to purchase an insurance through this website, I receive a lot	5.37 (1.26)
	I receive a lot of value by using this website	5.38 (1.26)
	The selection of car insurances provided by the website satisfies my needs	5.78 (1.15)
Enjoyment	I find the shopping process through this website enjoyable	5.66 (1.33)
	It feels good, when I purchase my car insurance through this website	5.37 (1.36)
	Shopping for a car insurance through this website is interesting	5.15 (1.55)

Investing in New Technology – A Case Study of a Food Processing Company

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Abstract — The increased turbulence, complexity and competitiveness of organizational environments have made identification, evaluation and implementation of new technological investments critical determinants of organizational productivity, competition and survival. This paper examines new technology investment decision-making process on two levels combining traditional innovation adoption and diffusion approaches by network and interaction approach of IMP-Group. Conducting this we aim to cross-fertilize the chosen approaches and produce more comprehensive and integrated understanding to conceptualize investment decision-making processes on new technology. The empirical part of the study investigates an investment process in which a food processing company invested in a new microbiological quality assurance method. The internationalization of food processing industry combined with a growing amount of global raw material sourcing is posing increasing challenges for companies, authorities and governments in terms of guaranteeing the safety of food. Since improved food safety is both time consuming and expensive, food producers find it difficult to cover the resulting costs of testing. These circumstances offer an interesting and fruitful context in which to study investment decision-making process on new technology.

Keywords— technological innovation, investment decision-making, innovation adoption and diffusion, network approach, food processing industry

I. INTRODUCTION

Decision-making on new technological investment has been closely related to an innovation adoption and diffusion approach in the recent literature. But the literature on innovation can be described as fragmented, contradictory and beyond interpretation. From both theoretical and practical perspectives, our cumulative knowledge of why and how organizations adopt innovations is considerably less than the sum of its parts. Originally the adoption perspective derives from consumer markets particularly how consumers react to new innovations (see e.g. [1]). Studies in which organizational adoption has been scrutinized have concentrated on decision-making outcomes and factors affecting decision-making process not to a decision-making process itself.

As an attempt to fill this research gap and to consider and understand inter-firm dynamics and interactions during the investment decision-making process we combine *network and interaction approach of IMP-group* with this original innovation perspective. IMP stands for Industrial Marketing

and Purchasing that is an informal group of scholars interested to study industrial marketing, especially from a perspective of networks and interaction (see e.g. [2]). This idea of applying the network and interaction approach on a diffusion process in an industrial context has been suggested already by Robertson, Swan & Newell [3] which is a starting point for a deeper discussion about the issue for us here. This paper examines new technology investment decision-making process on two levels combining traditional innovation adoption and diffusion approaches by network and interaction approach of IMP-Group. Conducting this we aim to cross-fertilize the chosen approaches and produce more comprehensive and integrated understanding to conceptualize investment decision-making processes on new technology. In order to execute this we first briefly discuss these approaches, present the conducted case and methodology and then interpret the case through these chosen approaches. Finally findings and discussion are presented and ideas for further research are fed. Next we zoom into these approaches to understand the ideology they advocate.

II. TWO LEVELS – THREE APPROACHES

A. Innovation diffusion approach

Not all products, ideas or processes adopted are innovations. To be an innovation, there must be some newness or novelty involved or as Cumming [4] points out, it must be “the first successful application of a product or process” for a potential adopter. A perception of newness matters, not the absolute newness of a product [5], [6]. The terms technology, technological innovations, technological investments and products are considered as synonyms in this paper.

Swanson [7] sees innovation diffusion to refer to “the pattern of its adoption by an organizational population over time.” Following this general idea diffusion models can be divided into those considering a diffusion process as a whole on an aggregate level and models concentrating on determinants of individual adoption decisions. The former are known as diffusion models and the latter as adoption models [8], [9]. Innovation adoption is a part of an innovation diffusion process that refers to antecedents and timing of an individual adoption decision by an adoption unit and factors affecting that adoption decision. As a part of the innovation diffusion approach an individual adoption decision is interesting only in a sense that factors affecting it can be generalized also to cover other adoption decisions on that specific innovation within the same social system

and this way it gives insights of an aggregate level diffusion phenomenon that recruits mathematical modeling usually (see [10] for a review). The purpose in these research attempts within the field of diffusion has been to identify factors quantitatively that affect positively or negatively on a shape, rate and potential of a diffusion process (see e.g. [11]). These factors have been identified on a *micro-level* (what factors correlate with adoption decisions on an individual adopter level) as well as on a *macro-level* (what other than adopter related factors influence a diffusion process).

To inspect in more detail this communication flow, central in diffusion process, we can draw a distinction between different approaches. Rogers [12] define diffusion as a process in which innovation “is communicated through certain channels over time among the members of a social system”. His diffusion theory consists of four major interrelated constructs influencing the diffusion process: an innovation, relevant social systems, time and communication about the innovation. This approach accentuates importance of interpersonal networks within the social system during the diffusion process. Mahajan, Muller and Bass [10] extended further this idea of communication. They proposed that as being a theory of communication the main focus of diffusion theory lies in the communication channels and their use to transmit information about innovation within and into a certain social system. This crucial link between the social system and an environment is missing in a definition offered by Rogers [12] in his early work, even though it is considered by him implicitly. On the basis of information sources used by and available for a potential adopter, models can be put on categories of internal effect models, external effect models and combination models, each established well empirically. *Internal effect models* concentrate only on communication within a social system ignoring outsider sources of information. This means that only earlier innovation adopted organizations or some other units within the social system are able to share information and affect a decision of a potential adopter. Social system internal communication source that affects a decision of a potential adopter is called an “opinion leader” [12]. Similarly *external effect models* concentrate only on outside sources of information denying opportunity for internal communication within a social system. These sources are generally called “change agents” in the diffusion literature [12]. Finally *combination models* take the both sources of communication in the account and are also the most widely used of these models [13], [14].

B. Innovation adoption approach

Based on Mohr’s [15] distinction between variance and process approaches into organizational phenomena Langley and Truax [16] discuss technology adoption research. Variance models, carried out with a large sample of organizations and focusing on correlations between groups of variables and a specific outcome [15] have dominated the field of technology adoption research. The research has yielded organizational, environmental and managerial factors that separate technology adopters from non-adopters

or different variables such as sources of information used [12] or a role of a CEO [17] as predictors of adoption. These models are incapable to explain how these factors evolve and interact with other factors during the process finally producing adoption or rejection [18], [16]. On this basis we can recognize that the concept of innovation adoption is at least dual-meaning. The adoption as variance refers to the meaning as we considered adoption in the previous section it being a part of a diffusion process. In the latter sense the adoption seems to refer the decision-making process of a potential adopter.

Langley and Truax [16] put process-oriented technology adoption models into three classes: sequential models, serendipitous models and political models. In *sequential models* adoption is seen as a multilevel decision process composed of series of sequential phases involving different activities. This process approach is supported by an extensive empirical literature on strategic decision-making in general [19], [20] and was put forward in the innovation adoption context by Rogers [1] establishing a permanent approach and followed by a stream of research (see e.g. [21], [12], [22], [23] and [24]). A number and order of stages of different models varies but the basic idea remains the same.

Serendipitous models understand adoption as an outcome of a wide variety of organizational routines. Innovation adoption is included in these standard operating routines that are basically organizational responses to an environment. Under some conditions interplay between an organization and an environment produce innovation adoption [25], [16]. Langley and Truax [16] give the well-established garbage can model by Cohen, March and Olsen [26] of decision-making as an example of ideology advocated by serendipitous decision-making models in general. The garbage can model promotes an idea that organizational decision-making is not in reality as linear, mechanistic and sequential than the sequential models describe it to be: “Although it may be convenient to imagine that choice opportunities lead first to the generation of decision alternatives, then to an evaluation of those consequences in terms of objectives, and finally to a decision, this type of model is often a poor description of what actually happens.” [26].

Political models consider adoption as a political process where adoption decisions are fostered by technology advocates who have an influence on managerial level decision-makers. These models emphasize social interaction during the process. The participants of the adoption process can be grouped into champions, boosters and approvers of technology. Reasons for adopting a technology can be based, for example, on financial or strategic components, the credibility of advocates or political pressure. Political models take into account the different influences on adoption from outside and inside the organization during the process. Decision-making and the power of the organization are considered to be centralized and open to influences [16].

C. Bringing clarity to innovation diffusion and adoption approaches

It seems that innovation adoption has at least two different meanings. In a context of diffusion it is understood as a *choice* type decision and in a context of intra-firm decision-making it refers to a whole decision-making *process* (for a hierarchical classification of decisions see [27]). As a process, innovation adoption is not seen only as a vehicle producing innovation adoption or rejection that is interesting only as a part of an aggregate level cumulative pattern. Rather it is considered meaningful itself. This perspective brings innovation adoption close to organizational behavior and innovation adoption can be seen as an organizational action taken to change somehow the relationship between the organization and its environment [28], [5]. This process perspective has been manifested for example by Drury and Farhoomand [29] who claim that innovation adoption should not be treated as dichotomous organizational choice decision but rather there is a need for integrative theories considering adoption as a chronological process (see also [30]).

In addition to duality of a phrase “innovation adoption” recognition of a process nature of industrial innovation adoption has led to various interpretations for the term adoption in this process context. Consumer adoption decisions differ in many ways from industrial market adoption decisions. Unlike consumer durables, organizational innovations need to be implemented as a part of value adding activities of an adopter organization. This lack of a concrete implementation phase or a process in a consumer innovation adoption context has led to difficulties and various interpretations when researchers have tried to apply conceptualizations into the organizational innovation adoption context. Sometimes these terminological pitfalls have been tried to avoid by using other, in common language quite similar meaning possessing concepts for adoption in order to distinguish a piece of research from the fuzzy innovation adoption approach, even though the underlying idea has been drawn from the innovation adoption context. This has created even more disorder.

Intra-firm diffusion, implementation and *organizational acceptance* are closely related concepts that generally refer to actions that are taken in order to take the adopted innovation in full use at the adopter company and after that to use it by the employees (cf. [31]). The concepts of *authority decision* as organizational adoption decision on an innovation that is targeted to be used by individual employees and that following *end-user's adoption decision* as a decision taken by an end user to take the innovation in his use have been used by Leonard-Barton and Deschamps [32]. Both these approaches advocate an idea that for some type of innovations an organizational adoption decision process is followed by implementation and individual decision processes within an adopter company. Meyer and Goes [17] define *assimilation* as “an organizational process that (1) is set in motion when individual organization members first hear of an innovation's development, (2) can lead to the acquisition of the innovation, and (3) sometimes comes to fruition in the innovation's full acceptance,

utilization, and institutionalization.” The process of assimilation is divided further into three sub-processes (a knowledge-awareness stage, an evaluation-choice stage and an adoption-implementation stage) each consisting of three episodes. This term covers widely an adoption decision process, its outcome as an innovation adoption choice decision and a phase of implementation and intra-organizational diffusion after that. Woodside and Biemans [33] have described comprehensiveness of assimilation using terms breadth of use (cumulative number of users) and depth of use (extent of use and its impact on the firm).

To conclude we state that adoption as a process refers to an organizational decision process from its outset until the decision to adopt an innovation (see e.g. [34], [33]). The processes that follow this organizational adoption decision process are not included into our definition, but should be named rather as suggested above (see [35]). This ideology has its roots on an idea that underlies the whole adoption and diffusion literature that originally adoption refers to acceptance of change and episodes before this acceptance and is finished when the decision has been made. Episodes and processes that follow the adoption process are seen as concrete conduct of this accepted change.

D. Network and interaction approach of IMP

The network approach brings marketing close to organization theory and more precisely to resource dependence view (e.g. [36]) that accentuates an interplay and mutual dependence of environment and organization. The industrial network perspective (see e.g. [2]) focuses on the space between organizations. The focus of IMP research has evolved from dyadic relationships to networks of interrelated relationships. The underlying philosophy is the recognition of various actors that are engaged into continuous interaction that is shaped by interdependence, prior experiences and current expectations with other actors. (see e.g. [37]). The following discusses the key features and concepts of network and interaction approach of IMP.

In the context of business-to-business marketing the concept of *embeddedness* has a key role. Halinen and Törnroos [38] have stated that the idea of firms being embedded in wider, far extending business networks is the major argument of the IMP approach to industrial markets and has been manifested by an expression “no business is an island” [37]. The concept refers to companies' dependence on and relations with different kind of networks [38]. Ritter [39] consider the concept of *interconnectedness* that can be seen to relate actors' structural positions more closely whereas embeddedness describe dynamics in overall context. Ritter [39] illustrates a situation where two actors (A and B) are connected to the same focal actor F that mediates the effect of acts on relationship FB to FA and vice versa. Nine different kinds of effects are exposed having negative or positive effect on another or both of the actors A and B and one situation where the effect is neutral.

The concept of *network position* results from a view of embedded and interconnected nature of business-to-business markets. Network position can be seen as a

relational setting between individual actors in a network structure in terms of individual actor's function, role and identity defined by other actors within the network [40], [37].

ARA-model [41] is constructed of three factors; actors, resources and activities that are closely related and in a large scale form a framework to conceptualize industrial networks. *Actors* control *resources* and are linked to another actors via different *activities* they perform. The actor may be a single individual, group of individuals or a company. Actors control the resources directly or indirectly. The indirect control refers to other companies' resources that can be reached by an actor through relationships and interdependencies that connect the actors (see also [42]). The activities are divided into *transformation activities* that are used to generate resources to new resources and *transfer activities* that transfer control over the resources within the network. Transfer activities enable transformation of other companies' resources through relationships.

Relationships can be seen as interrelated acts and episodes taken place in the past shaping and forming the relationship (see e.g. [43]). *Acts* are the smallest ingredients of interaction and relationships (e.g. phone call) and as linked they form coherent *episodes* (negotiation process for example). Håkansson and Gadde [44] have considered episodes in terms of complexity and in relation to history of the relationship between parties. This basis they form a matrix consisting four situations; simple episode or complex episode taking place within well-developed relationship or in a context lacking of a previous relationship. A relationship can be seen as different kinds of bonds between the interacting organizations. Turnbull and Wilson [45] argue for complementary needs of organizations to lead to social and structural bonding. Social bonds refer to strength of the relationship in terms of soft measures and structural bonds to social and economic factors that develop to tie the parties together. Halinen [46] has studied dyadic dynamics and presented three types of bonds: attraction, trust and commitment. Of these, *trust* can be separated further into specific and general trust. General trust is based on indirect information provided by other parties and known reputation of another. Specific trust is generated within the dyadic interactions and is thus based on direct experiences of the other. *Attraction* is attached on the early phases of the relationship development and *commitment* refers to continuity dimension of the relationship based on mutual attraction.

E. Analytical framework of the study

The discussed approaches on technological investment decision-making are presented in Figure 1. The innovation adoption approach is named more specifically as *innovation adoption process* to accentuate the approach distinguished from the adoption as a part of the diffusion approach.

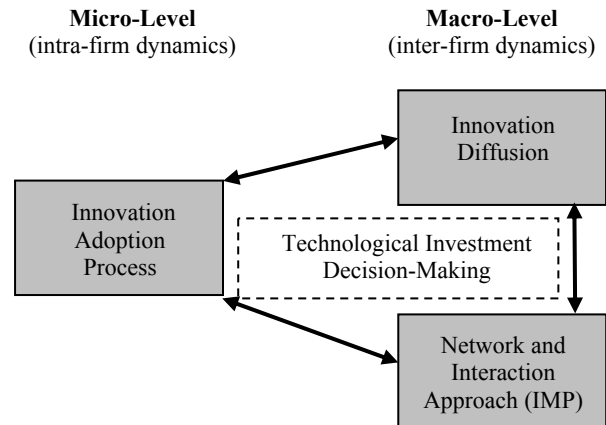


Figure 1. The Analytical framework of the study

Perspectives are classified into micro- and macro-levels on a basis of focus on intra-firm or inter-firm dynamics during the process. The following will present the case and methodology and then discuss the approaches with reference to conducted empirical case.

III. EMPIRICAL CASE STUDY AND METHODOLOGY

The investment decision-making process took place during 2002-2003 at one production plant of FoodCo that is one of the biggest food processing concerns in Finland. To respect the wish of anonymity of the seller and the buyer in this case we name the buying company as FoodCo and the selling company as TestCo. The product to be invested in was a quality testing method to assure the microbiological safety and purity of final products. The method consists of a testing machine and chemical reagents that are used to perform test by the machine.

The methodology used was thematic interviews with the participants of the investment decision-process at FoodCo and at TestCo. The project was formally based and those individuals named to the project which made them easily identifiable. Themes of the interviews have arisen from the chosen theoretical fields but their role has been more supportive than compulsive or restrictive in order to structure interviews but also to leave room for new topics to be arisen. The interviews were transcribed in order to facilitate comprehensive analysis.

The data consists of eight interviews that have been collected between 27.9.05-17.3.06. Length of the interviews varies between thirty minutes to two and half hours. Total number of informants was six. Five of the informants composed a project group at FoodCo and the sixth informant was the CEO of TestCo and the person who sold the method and did the project together with FoodCo. Two (He and She) of the informants at FoodCo were specialized in microbiology and worked at the central R&D laboratory of the concern. Both of them were phone interviewed twice. The rest three at FoodCo worked at the production plant. The laboratory worker who did all the practical testing and the project manager were interviewed together. The third

person who worked as quality development manager was phone interviewed. The CEO of TestCo was interviewed twice.

A. Antecedents of the investment project

The examined project was a half part of a bigger project that aimed developing the production plant's microbiological analytic procedures. This part under scrutiny here included a concrete investment and was particularly a part in which a company searched a solution to cut down storage time before products are sent to markets in order to avoid constructing a new storage. The production at this plant was known to rise due to FoodCo concern level decision to close down the other one of concern's two special production plants and concentrate all this type of production to this examined site. The production plant needed to find a solution to adapt to increasing production. The microbiological analytics of final products to assure their quality was especially a bottleneck in this new situation.

At the production plant they were aware of faster microbiological quality analyzing methods already since 2000 mainly because of active providers who had approached the plant. Before this shut down decision of the other production plant this option was not considered seriously even though it might have been beneficial investment. Due to the expected rise in production amounts the factory was more sensitive to respond as the CEO of TestCo contacted the production manager who agreed to meet him at autumn 2001. The method felt promising from the very beginning and the benefits it could bring in sounded lucrative. After some weeks of preliminary investigation they agreed to get into a more serious testing that required a formal establishment of a project. The production manager made a project plan which specified him as a project manager, the aims of the project, project personnel, the supervisory body and schedule. The project outline derived from the requirements of the internal technology development process as which this project was specified according the ISO 9001 quality system the company has. The plan was proposed to FoodCo central administration and then a license to start the project was given.

Two microbiologists (He and She) possessing high organizational status at central R&D laboratory was specified in the project plan as participants. Also these persons had known the technology platform since late 1970's. The central laboratory had tested another application of this technology already in the beginning of 1980's to another purpose but results then was not satisfying. After that the central lab had not examined this technology and in the beginning they were doubtful about it. The other of the microbiologists (He) said that in the beginning of the project he used to put this suspiciousness into a phrase that "*Do we try again a long forthcoming, promising new method.*"

B. The testing phase and decision to invest

After the establishment of the project at FoodCo in March 2002 TestCo performed a testing period in order to

adapt and fine-tune the method for the products to be tested at the production plant. During TestCo's testing period FoodCo sent them their products to be analyzed. In parallel with this testing at TestCo FoodCo found out other possibilities and suppliers. In addition to TestCo another supplier whose product was based on a different technological platform was considered preliminary, but never tested due to a high price and lack of references. After TestCo method was adjusted for the FoodCo products the testing period started at the production plant in August 2002. In the beginning of this testing period at the plant TestCo had to assure the microbiologists that it is worthwhile to engage into a deeper testing phase. For that purpose TestCo visited the central lab in September 2002 and performed a set of tests to demonstrate the method.

The new method was run in parallel with the old one in order to do comparisons until January 2003. The number of tests as being 10 000 was so high that the results could be statistically generalized and analyzed. After the testing period it seemed that the method is enough specific and sensitive for the purpose. The results were then presented to the supervisory body of the project that made sure that the project was done following the formal internal guidelines and the results are satisfying for that purpose. Supervisory board accepted the project and then the production plant was capable to do a proposal of investment to the FoodCo central administration. After the approval the machine that was leased until this far was bought and then started to be used in analyzing final products without the older method as a backup since April 2003.

C. The Role of different actors during the project

The project group at production plant formed a core for this project. As this project was initiated there in order to meet the need to adapt to increasing production the project group was highly motivated to find a solution to avoid constructing a new storage and to gain the possible benefits of the faster analyzing method. The project manager and the quality development manager did the project in parallel to other responsibilities but the laboratory assistant was dedicated on full time basis to this project. The quality development manager made calculation comparing the method by TestCo with the method currently in use and another fast analyzing method provided by another supplier. He was also mostly in contact with TestCo. The project manager had established the project and was a communication link to microbiologists on issues concerning the project on a more general level. The laboratory assistant did the practical testing and in these issues was in contact with the other microbiologist (She) at central R&D lab.

The microbiologists at the central R&D possessed an expert role. They brought in expertise needed to arrange the testing and implementation procedures, to make sure they qualify for the restrictions set up by authorities. Another task was to interpret the test results of the method. Their role was also crucial in the final examination by advisory board as they were asked to confirm that the interpretations of the results are correct and the method performs as it has been claimed.

In addition to traditional role of *seller TestCo* possessed also co-operative and expert roles. They brought in their contribution to validation and implementation in terms of expertise and experiences they have gained through earlier customer validation and implementation processes and also through their own use of the testing method as it had been used by the own laboratory of *TestCo* to produce commercial laboratory testing services. The CEO of *TestCo* was the key person who possessed various roles in this case as *TestCo* is a quite small company. In addition to him the laboratory staff at *TestCo* was involved on practical testing and user training. *TestCo* gave user training for the machine, installed it and supplied the needed chemicals.

D. The results of the project

After implementing the method the production plant was able to cut down the microbiological quality assurance time from 6-5 days to 3 days. This tremendous spare of time cut down storage costs and saved the plant from recruiting new personnel or constructing a new storage. This spare of time also improved certainty of delivery because time span to react and start replacement production shortens if some problems arise. The new method is less labor intensive and reduces the amount of work at quality assurance laboratory.

These benefits were clearly recognized in the beginning of the project making it very attractive but the in-depth testing period was necessity to assure that there is not trade-off between a level of quality and these gained benefits. The method was considered an important tool to help the production plant to meet the settled goals. It was totally different way to do the analysis compared to the older method. However the method has not fully replaced the older one as it is still being used to analyze some but not all production lines. A wider use has been considered but the plant wants to evaluate and use the method longer before they are ready to replace the older one fully.

E. Sources of information

The microbiologists were the main communication links to occupy information about the different methods outside the company. The main channels used were academic community (journal publications of the technology), main competitor, *TestCo* and another technology supplier whose product was under consideration.

The method was not validated by any specific validation organization but it was widely used for similar purpose around Europe. According EU principles this whole range of references legitimized the use of the method but still implementation validation was needed to assure internally that the method is reliable to be used and also in order to learn to use it. The other function of references in addition for governmental bodies' approval was to demonstrate to *FoodCo* that it seems promising and worthwhile to be inspected more carefully. According to the other one of the microbiologists (He) a condition for considering more closely a new method is that it has to be validated by an official validation organization or then it has to be used for the same purpose by other trustworthy companies. Also already before the project started the R&D laboratory knew that these methods have been developed since they last tried

them. This knowledge was based on the information the supplier provided and also on the international academic journals on the field. This information made an impression that the method might work or at least is worth testing. The project manager thought that the general problem is the generosity of promising methods and potential projects but the problem is that how to screen effectively what are the most promising ones. The reference list in this case facilitated this screening process as evoking trustworthiness. The lack of references of the other supplier and also the much higher price gave a feeling that it is not even worth testing.

The main competitor of *FoodCo* at this area was consulted by the other of the microbiologists (She). She knew the quality development manager there at the competitor firm and contacted him during the testing process at the production plant. She characterized that it was mostly due to curiosity and kind of confirmation she asked but also she got some of their testing results. According to the other microbiologist (He) this was also important in a sense that authorities have accepted this testing method already in Finland for the same purpose and this way facilitates the validation process at *FoodCo*.

IV. ASSESSING THE CASE THROUGH THE THEORETICAL APPROACHES

A. Innovation adoption approach

The adopted microbiological testing method is an innovation from *FoodCo*'s point of view. It changed the analyzing procedure dramatically bringing in clear benefits. Although the technological platform was not concerned as new the application of this technology was clearly perceived new by all participants in the process. The innovation adoption approach can be then applied in order to exam and understand the investment project. There are clearly characters of presented types of different process models of adoption to be recognized here.

The adoption process followed a certain sequences or phases that can be recognized afterwards. *Sequential models* accentuating these stages are not although perhaps the best option to describe the occurred process. These models usually describe adoption as terms of phases of decision-making process. The original idea that it is more or less a matter of time when a new innovation become adopted (or rejected) by a certain unit of adoption and a linear path to this decision cannot be so straightforwardly confirmed. As *FoodCo* was aware of these faster methods since 2000 this awareness did not initiate a clear decision-process. *FoodCo* also considered other option supplied by another supplier to meet their need. Thus the process was more to find a solution to a problem not to decide on this specific product. Or as the other microbiologist (He) said: "If it would not have worked the ongoing search process would have continued."

Serendipitous models highlighting interplay between organization and its environment producing adoption as a result of this fits well with the empirical evidence here. Both the central R&D laboratory of *FoodCo* and this production plant had been aware of these faster methods for

analyzing microbiological quality but a concrete starting shot for the project was this production redesign decision on FoodCo concern level and then active marketing by TestCo at the same time. In this sense also the randomness typical for serendipitous models is accentuated over rationality. Although the benefits were known already before the redesign decision, the adoption was not concerned seriously even though it would have brought benefits in terms of time and labor saving in any case even without an increase in production.

Some characteristics of *political models* emphasizing the social interaction and power hierarchy during the adoption process can be found from the empirical evidence here. As FoodCo being a centrally administrated concern the examined adoption process at the production plant followed strictly the formal procedures for that kind of project. These guidelines for different types of projects are defined in certificated ISO 9001 quality management system. The power relations were shown particularly on the role of the central R&D laboratory in the project as it had a power to kill the project already before the testing phase if it would have seemed unpromising. In this sense the microbiologists were approvers of technology here. Also the limited resources of the production plant hindered their changes to start the evaluation-implementation process without support by the R&D laboratory. In this sense the microbiologists had a lot of potential power but they did not exercise it in a full scale. Also a need to establish formally the project and specify the details in project plan and name a supervisory body for the project and propose for the final investment represented certain power structures that shaped the process. In addition to the microbiologists as approvers of technology the roles within the plant also structured partly as these models suggest. The project manager can be characterized as a champion who in the very beginning understood the benefits and then started to lead the project. He was a kind of intra-firm sales representative of TestCo at FoodCo. An example of an outside influence is contacting to the main competitor whose role can perhaps be characterized as a technology booster.

B. Innovation diffusion approach and network and interaction approach of IMP

The innovation diffusion approach understands single adoption decisions with reference to other adoption units' adoption decisions within the social system and change agents' influence on these decisions from outside the community and finally demonstrates these cumulative adoptions retrospectively in a form of S-curve and Gauss-curve. Depending on the source of information the information sources can be put in social system internal sources (opinion leaders) and external sources (change-agents). In this case the main competitor was an opinion-leader for FoodCo as it was part of the social system and horizontally at the same level with FoodCo. TestCo represented a change-agent as promoting the change from the older method to the one it supplies. On the other hand TestCo was also an opinion leader in a sense that it was a user of the machine in the field of their commercial analytical services and so earlier adopter than FoodCo. The

other supplier was a change-agent pro another innovation. The information occupied through Internet and academic journals can be classified on the basis of their content. The internet or academic community is only a forum to provide information and according to who is a sender depends the classification to opinion-leaders or change-agents. In this sense these forums cannot be considered as sources of information and does not fall into the presented dichotomy. This approach being a theory of communication is powerless to understand reasons for communication and other type of interaction between the actors related to the investment process at FoodCo.

By applying the network and interaction approach of IMP we get a wider perspective to understand the investment decision process as embedded into its context. This perspective understands better the other types of interaction in addition to communication. The idea of embeddedness is shown in various links and dynamics between FoodCo and its environment. The motivation for the competitor to share experiences and give hints to FoodCo was based on informal personal links but also on their mutual benefit to avoid quality problems that would damage them both in terms of bad reputation and consumers' tendency to associate single actor's quality problems to the whole industry. In this sense the both firms are embedded into the certain environment and their actions are interlinked together causing direct and indirect effects for themselves, for another one or both of them. This can be understood as discussed interconnectedness [39] consumer markets being a factor mediating the effects between FoodCo and the competitor (FoodCo \diamond Customer \diamond Competitor).

Due to these interrelations the other one of the microbiologists (She) participates regularly in the meetings of an informal consortium of the industry on Nordic countries level. This exchange of experiences derives from an idea that quality is not an area where to compete but rather a prerequisite for the whole industry's welfare. These networking activities connect the actors together and to each others resources as ARA-model explains and as the other of the microbiologists (He) put it:

"Networking is a good thing because you can't do everything on your own. It is cheaper to all that we listen to the others' experiences and share them instead of everybody would try on their own."

The importance of references in this case can be understood through a concept of network position within IMP approach. The reference list gave to FoodCo a concrete hint or proof of TestCo's prestigious network position within different networks performing similar activities or on the same industry as FoodCo. On the other hand the TestCo's high commitment to the project derived partly from the reference value i.e. FoodCo as a reference would facilitate selling the method in Finland in a future.

The investment process was a relationship establishment process between FoodCo and TestCo. The companies did not have anything to do together before this project (see [44]). The relational bond *attraction* formed during the early phases of the project. The project manager understood

the benefits of the method and they seemed attractive. During the project the firms committed to each other through different ties (machine leasing contract, testing phase at TestCo) and that deepened after the implementation (continuous need for TestCo chemical reagents in order to do analyzing).

Both TestCo and FoodCo named couple of critical incidences during the process. The CEO of TestCo considered a general level discussion important in the very beginning of the project between him and the project manager about microbiological analyzing procedures. The CEO thinks that the project manager found his views based on wide experience useful and applicable and that way he's role as an expert was recognized. The project manager thought that during the testing period at TestCo the adjustment of reagents and the influence of TestCo on the principal company who produces the method to tailor the reagents to better fit with the FoodCo's products was a proof showing that TestCo although being a little firm is capable to meet the needs of FoodCo and also to adapt to meet them. These incidences facilitated the trust development between the parties.

Trust on the method can be put in subjective and objective trust. The laboratory assistant started to trust the method (having been quite suspicious first) after a test in which she did not recognize a failure that was done by purpose in a test product but the method did. The objective trust formed through the testing period in which the method was run parallel with the older one and 10 000 samples was gathered and analyzed. Because the method is not in full-scale use yet, rather intra-firm diffusion is still ongoing; the product specific trust could be higher.

V. FINDINGS, DISCUSSION AND CONCLUSIONS

On the basis of this study technological investment decision-making can be seen highly relational and embedded activity involving different actors and dynamics between them and thus should be considered by acknowledging these interconnections. As in this case and pointed out already by some other authors as well [3], [47], [48], [49], [50] technological investments need tailoring before they are ready to be used. This means that a supplier and a buyer will engage into some sort of relationship in order to adjust the product. Presented relational bonds [46], [45] sound a fitting conceptualization to capture this development of a relationship between a buyer and a seller. However in addition to the buyer and the seller there were also other actors who involved the process in this case. The main competitor of FoodCo delivered information about the product that facilitated the decision. On the other hand another competing supplier offered their method to be considered by FoodCo. Information was also acquired to be processed from academic journals and Internet. Process itself was shaped by restrictions of authorities.

The diffusion approach understands the communication flow between the different actors but fails to capture the other interactions and deeper motives for this interaction. Also there are problems to transfer these diffusion related concepts as opinion leadership and change agency and this

cumulative pattern of adoption to an industrial context. Problematic is to define the relevant social system in industrial markets. It is not so easy to define a group of potential adopters. We must define a relevant unit of adoption, is it a single company or a dyad, maybe a value-chain? The problem to define a relevant unit of adoption implicates that we cannot define what actually a social system is in an industrial context. Does it have to be an industry? To relieve this difficulty we could adopt a network view and try to identify different actors affecting the process from different networks. Robertson et al. [3] propose that collaboration based informal relationships between firms in an industry and universities, government agencies and professional associations might well represent the building blocks of diffusion networks. The collaboration over traditional industrial boundaries might yield surprising forms of cooperation and it could be interesting field of empirical research to identify what composes these diffusion networks and who participate them. This combining enhances a context-specificity of diffusion ideology to cope with a different area from the original field of application.

Although a role of a more holistic approach provided by the network and interaction approach has been emphasized in our discussion here, this is not to be interpreted that we ignore relevancy of intra-firm oriented approaches. There is a huge gap in our understanding of what happens within a firm when they decide on a new technological investment. The underlying stimulus-reaction idea of current adoption models seems to capture some features of the process but they are still too mechanistic or general to capture the complex nature of investment decision-making. In these models a starting point is an innovation that initiates a certain pattern of behavior. Instead of that a need or a problem to be solved in an organization could be a more relevant starting point. The lack of knowledge of what happens within a firm during an investment decision-making process hinders suppliers to influence on the process and also prevents them to include in the products certain attributes that are the most beneficial and valuable for the customer. On the other hand it reduces customer chances to enhance effectiveness and efficiency of the process as it is not understood explicitly.

In addition to empirical findings our discussion aimed to clarify the link between the innovation adoption approach (a word *process* is added to accentuate the approach distinguished from the adoption as a part of the diffusion approach) and the innovation diffusion approach as it has been unclear in the previous literature. We suggest the term *adoption process* to be used to describe an organizational decision process from its outset until the decision to adopt an innovation [34], [33]. The processes that follow this organizational adoption decision process are not included into our definition of adoption.

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Knowledge as a business opportunity – knowledge transfer practices in Finnish AEC industry networks

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Facing an increasing competition from their foreign counterparts Finnish Architecture, Engineering and Construction (AEC) industry is utilizing value networks in their operations and trying to make the most of their knowledge about the end users and the life cycle management of buildings. However, the knowledge management practices in the industry are still in its infancy in many respects and this creates possibilities for competitive advantage and new business opportunities. The focus of this paper is on the knowledge creation and transfer as a source of business opportunities in AEC industry. This paper is based on literature review and the viewpoints of the companies operating in different parts of the life cycle of buildings. These viewpoints were collected in 20 in-depth interviews during August 2005 and May 2006. A broad coverage of all the important interest groups, in the field of construction and maintenance of buildings, were fairly included in the interviews to construct comprehensive picture of the knowledge transfer practices and possible business opportunities related to them.

Keywords—knowledge transfer, value networks, AEC industry, emerging opportunities.

I. INTRODUCTION

The Finnish Architecture, Engineering and Construction (AEC) industry is facing an increasing competition from their foreign counterparts in the competitive bidding of construction projects. Facing this fierce competition, some of the companies working in this industry are trying to incorporate value adding services to their products or make the most of their knowledge about the end users and the life cycle management of buildings. These operational improvements usually require networking between construction companies and service companies operating in different parts of the life cycle of a building. However, according to literature, AEC companies have been slow to adopt new business models, working methods and technology in these respects [1]. Also practitioners have become aware that the industry does not – in terms of technological solutions for example – evolve as fast and flexibly as other industries. Especially the lack of efficient networking and knowledge management practices in the AEC industry has raised concerns among researchers and practitioners alike.

The focus of this paper is on the knowledge creation and transfer in interorganizational networks as a source of new business opportunities in AEC industry. This paper is based

on literature review and on the viewpoints of the industry representatives. These viewpoints were collected in 20 semi-structured interviews, conducted in two separate stages during the year 2006.

This paper is a part of an ongoing research project called DESNET that is a collaborative effort between VTT (Technical Research Centre of Finland) and TKK (Helsinki University of Technology, BIT Research centre). The research problem of this research effort is formulated in the following way: To identify the most advantageous model of networking, in respect to possibilities to support new information and communication solutions for the product specific knowledge management along the life cycle of a building. This paper reports the findings of these interviews that are related to knowledge transfer practices in interorganizational networks and knowledge driven business opportunities in this field.

This paper is structured in the following way:

- “Knowledge as business” paragraph places this paper within the broader research streams in knowledge management, network analysis and strategy,
- “The characteristics of the Finnish AEC industry” section describes the business and knowledge management environments the industry is facing according to literature,
- “The knowledge creation and transfer in AEC networks” section narrows the focus even further to the knowledge management issues in the context described in the previous sections.
- After the literature review sections, the viewpoints from the literature are contrasted with those of the practitioners (11 interviews), in order to construct new business opportunities in the networked AEC industry.
- As a conclusion this paper reports the results of the second round of interviews, in which these new business opportunities and the knowledge transfer practices related to these opportunities, were presented to practitioners (9 interviews).

II. KNOWLEDGE AS BUSINESS

Interest by social scientists in the firm as an institution has been stimulated by the question of why firms exist at all. The highly popular transaction cost theory focuses upon

the relative efficiency of authority-based organization (hierarchies) with contract-based organizations (markets). The resource-based view (RBV) perceives the firm as unique bundle of idiosyncratic resources and capabilities – and can be seen as a step towards institutional research stream from industrial organization and transaction cost theory [2]. RBV views the primary task of management is to maximize value through optimal deployment of existing resources and capabilities, while developing the firm's resource base for the future [3] - [5].

RBV emphasizes the fact that most products require the services of several resources (information, money, power, or material aid) and most resources can be used in several products. The emerging knowledge-based view is not, as yet, a theory of the firm, but to the extent that it focuses upon knowledge as the most strategically important of the firm's resources, it is an outgrowth of the resource-based view of the firm [4]. The greatest downfall of the knowledge-based view so far can be said to be the difficulties researchers face when trying to estimate the impact of knowledge on performance. However, looking outside single firm, and combining the ideas of resource-based view with those of transaction theory, situations where it is preferable to share knowledge resources in inter-organizational networks in contrast to building in-house resources can be described.

When broadening the perspective outside single firm, this paper takes the connectionist stream of network studies [5] as a starting point. In this perspective an actor is successful, because she or he can draw on the knowledge that is controlled by different networking parties - in contrast to structural viewpoint, where the emphasis is on the position the actor has in the network. Both these viewpoints in network studies can help the present discussion by providing a relative measure of the impact of knowledge resources. However, since knowledge isn't as easily warded as other resources [6] and effective knowledge transfer, especially from outside sources, is build on trust [7], connectionist stream of networks studies portrays more realistic view of the current knowledge markets as systems based on human interaction.

Another critically realistic ontology [8] is taken in the discussion of knowledge management. The length of this paper doesn't allow thorough discussion about different layers in knowledge transfer systems [9], but it is noteworthy that this ontology was present in the interviews conducted in this study. As a summary, this paper takes knowledge based view as a starting point and describes knowledge markets as social networks, where knowledge is transferred with dynamic processes and underlying structures shaping the transfer.

III. THE CHARACTERISTICS OF THE FINNISH AEC INDUSTRY

The Architecture, Engineering and Construction (AEC) industry in general creates and maintains the facilities for

every day living and economical activities – for example all the buildings and the infrastructure needed to support them. In Finland the products of this single industry comprises over 70% of the national assets and also the industry employ 500 000 workers, which is about 20% of the whole working force in Finland. [10]

However, at the same time AEC industry in Finland is also very heterogeneous group of companies in respect to resources available and specialized knowledge they possess and use [11]:

- Of the roughly 27 000 companies operating in this industry, only 157 can be considered large (over 250 employees or turnover over 43 MEUR) in Finland.
- Companies are usually highly specialized with workers usually belonging to equally specialized crafts (architects, structural engineers, consultants, contractors, facility managers, etc.).

The AEC industry on the whole has been criticized for inefficiency and for the lack on innovativeness in the construction process. Some of the characteristics of the industry act as underlying reasons for these industry-wide problems – for example, mainly due to the mandatory bidding of the projects, the AEC industry is highly competitive in nature and it is consequently characterized by low levels of trust between different actors [12]. This low level of trust affects horizontal networking in the industry, but also the development of long-term relationships between main contractors and key suppliers [13]. Together with the project-based nature of the industry, this lack of trust and lack of networking hinders standardization, innovation, and organizational learning in the industry [14].

At the same time the environment, where companies operate, is changing quite rapidly in Finland. According to industry's own analysis there are four trends shaping the environment and the industry operating in this environment [10]:

- Companies and their customers have become international even faster than anticipated, which has affected in many ways the market structure, business concepts and also the every day life of the local actors.*

Customers operating globally expect that Finnish AEC companies follow them abroad to support their activities – as an example, experts predict that the export of knowledge intensive design services double in ten years. As the markets converge in this industry, EU directives are increasingly affecting companies operating in different countries, but also the local actors in Finland. And of course, this trend is not one-way transition only – while Finnish companies go abroad, foreign companies and work force increases their presence in Finland. Especially international investors have increased their share in Finnish real estate trade to almost 50% in recent years.

B. The whole economy in Finland is turning into service economy – the increasing importance of networked services is one of the strongest trends in AEC industry.

Services constitute already 70% of the GNP in Finland today. Services and service business require different kinds of knowledge, competences and infrastructure than traditional industrial activity and this means that AEC industry is facing strong transformational forces. Companies in the AEC industry are focusing on their core competences. This has led these companies to outsource much of their supporting activities, and has increased the importance of network economy, partnerships and close interaction. Public sector is facing strong demands for increasing the productivity of their own services and this has also increased the use of networked service providers in the industry.

The new competences and knowledge needed in this transition has lead into a birth of a whole new business: service integrators or managers that manage the operational service procurement for their customers in this industry. Especially in the office building sector, the new found interest on user services and the increase in foreign investors in the sector have together increased the use of these service providers. This trend has also enforced the in-house development of competencies and knowledge associated with network management and with the life cycle management of a building.

In house building sector, especially facility management companies have reacted quickly and many knowledge and competence related development efforts have been initiated among these companies. This trend in house building sector has been strengthened by the increase in customer needs both in the building of new houses and renovating old houses. Entirely new knowledge and competences are needed within all the actors when customer base is segmented and targeted more precisely. At the same time, the share magnitude of future need for renovation in housing sector increases the need for networking between different actors.

C. The importance of knowledge management and knowledge transfer in the improvement of the service capabilities, quality and productivity increases. The digitalization of information management creates new possibilities to offer even better service solutions to customers.

Internet has changed the way procurement is done – products and services are offered and bought internationally and in real time. Also improvements in information and communication technologies (ICT) have changed the way work is done nowadays and so ICT have influenced the office building sector in AEC industry with increased user needs in this sector.

ICT is no longer seen as a driving force of the needed change in the industry, but as a tool and service instrument facilitating that change. Basic ICT technology is well used

in the sector and in the use of computer aided design and building information models (BIMs) Finland is one of the leading nations. However, the challenge is still to get the right information to right place at the right time – knowledge management and transfer practices have remained relative undeveloped, especially when networking between companies has become necessity for companies to stay in the leading edge of the progress. There are technological solutions for information and knowledge transfer in the form of technological standards and common product / project libraries, but even in this respect the picture is incomplete – only recently have actors in the industry started to think about the value that information and these technological solutions add to process and who actually pays the bill when developing these solutions.

D. The significant rise in the price of energy has increased the urgency to found new solutions, service concepts and business models that lower the life cycle costs and the environmental impact of the buildings.

As the price of energy rises, energy efficiency is increasingly important part of the eco-efficiency, which is about producing services, products and well-being with minimal use of natural resources. When thriving for long term cost improvements and eco-efficiency, the suitability and proper functioning of the buildings is one of the most important factors in AEC industry. This means yet another need to improve knowledge management and networking practices in the industry.

The incentives for change in these environmental issues have come so far mainly from outside of the industry, but there are indications that initiatives from inside the industry are also increasing. The interest of the public authorities on the matter can be explained with the fact, that built environment constitutes 40% of the total energy consumption in Finland. 20% of this energy consumption is produced during the building phase and the rest is produced during the operational phase of the building life cycle. International agreements oblige AEC industry to improve energy efficiency in, for example, heating, production and transportation. In addition, EU energy efficiency directive requires a special energy efficiency certificate to be created when houses are sold or rented – since the existing building base is mainly responsible for energy consumption, this energy efficiency certificate is hoped, in the longer run, to change attitudes and behavior of users and companies operating in the AEC industry. In any case, these regulations demand for new knowledge management and competence improvements from all the actors in this industry.

These four trends have awakened the companies operating in this field and several joint development projects have been initiated recently to answer these industry-wide challenges [10]. These development efforts focus especially on networking and knowledge

management practices in the industry, which are looked into next.

IV. KNOWLEDGE CREATION AND SHARING IN AEC NETWORKS

The construction industry is basically a knowledge-based industry which relies heavily on the knowledge input of different participants in the project team [15]. In this respect it is quite surprising, that information and knowledge management is still in its infancy in the AEC industry and there is need to understand how different industry sectors are devising and implementing knowledge management systems in order to learn from their experiences. The AEC industry is well-known for repeating costly mistakes because they have not leveraged knowledge held in other parts of the organization [15].

As noted before, a project in the AEC industry usually requires knowledge and competencies from specialists that belong to different professional backgrounds. Also, there is a desire and a need for originality and creativity in proposing design / construction solutions among the AEC companies. These tendencies are usually in odds with the need to reuse knowledge from past projects [16], [17]. Longer-term partnering between clients and suppliers is beginning to create a basis for the effective capture and reuse of project knowledge. However, there is often a lack of technological infrastructure within the companies and within the industry [18] and the lack of technological fit between existing solutions [19] may act as a barrier for this improvement in knowledge management practices.

In addition, it is common that a construction project consists of several phases, including bidding, planning, design, construction, commissioning and facility management. These phases require usually different competencies and the work done in one phase or by one party is normally the input for another phase or another party [20]. If the transition between phases doesn't go smoothly, there may be breaks in knowledge transfer during the life cycle of building [21]. Usually there is a larger construction company managing the process [22] and acting as an intermediary between different parties in different phases during construction, but after the building is assigned some of the information is usually lost and regenerated, in the worst case, many times during the rest of the life cycle of the building.

One example of systems that have been tried to implement in the AEC industry in response for these differing needs, is building information modeling (BIM) systems. Building information modeling integrates all the geometric model information, the functional requirements and capabilities of the building and product specific information into a single interrelated description of a building over its life cycle - including the design, construction and facility management stages of a project [23]. In addition to life cycle management of knowledge,

the visualization applications related to BIM can help designers, for example, work collaboratively and communicate ideas more efficiently during conceptual design, or can be used as marketing tools with clients [24].

It is already agreed upon by the different actors in the AEC industry, that BIM is inevitable, but there are conflicting views on how long the mainstream adoption will take - some estimate that widespread use of BIM is still 6-7 years away [1]. So far, the ideal case of a single building model that contains all information for all stages of the design and building process has given way to more limited applications [25]. Some researchers have gone so far as criticizing BIM as too rigid-structured schema to satisfy all AEC disciplines with specific needs [26].

One important aspect in the knowledge management in the industry is the ownership of the BIM or product specific data. For example, due to integrity and security reasons the main repository of BIM information is usually centralized. But as the AEC industry is comprised of disjoint disciplines and companies, distributed project databases are much more desirable than in many other industries. Furthermore, a centralized BIM database often requires a single organization to have control over the management of that database – a scenario that is quite confusing in most of the AEC projects given that the facility owners and the major companies involved would like to have control over parts of the information throughout the various phases of the life cycle [26]. The confusion as to who will own, distribute and take legal responsibility for the building data is lowest when architects and engineers work for the same company, when a building owner values the building model for proprietary use and when liability is shared in construction projects [23].

One of the challenges for future technological development and usage is to combine the so called “passive” and “active” knowledge. Much of the information about standard components provided by manufacturers for various AEC disciplines is now available in electronic format. These parts libraries represent “passive” information in contrast with the “active” information created and communicated throughout an AEC project [16], [26]. Also, the standard types of components found in product libraries have property values in the final design (actual dimensions, material, etc.). Such attributes are not represented in most of the current construction management solutions. Thus a realistic construction process model must use these detailed but otherwise disparate construction management data and link them to each another to form a comprehensive entity [27].

As a summary of the literature reviewed, it can be said that even though new systems and technologies for knowledge management and sharing have been slow to spread into wider use, they have been seen as holding future potential. The industry has already seen a birth of an entirely new business potential in “Service integrator” activities and also knowledge-based services are expected

to strengthen their position both abroad and in domestic markets. The biggest stumbling stone towards maximum utilization of knowledge management and sharing solutions in the AEC industry might not be technology, but rather the willingness of the AEC professionals to revise existing procedures [28]. The industry also needs to improve its practices in knowledge transfer and capturing tacit knowledge, if the companies are to prepare themselves for the loss of knowledge when employees leave the organization [17], [29].

V. INITIAL VIEWPOINTS FROM THE PRACTITIONERS

The first round of interviews was conducted between August 2005 and January 2006. The interviewed professionals (Table 1) were selected based on the suggestion of their networking partners or based on active contribution to industry related publications or seminars. Each interview was recorded, transcribed and later analyzed to construct a comprehensive picture of the knowledge transfer practices and possible business opportunities related to them.

TABLE 1
COMPANIES INTERVIEWED IN THE FIRST ROUND

Company	Division (if any)	~ Line of Business	~ Position of interviewee
SKH Kiinteistöhallinta		Facility Management	Director
Senate Properties	Office Premises	Property Management	Director
RAK systems Oy		Consulting	Director
NCC Construction Ltd	House building	Construction	Manager
Coor Service Management		User services	Director
Finnmap Consulting	Development	Consulting	Director
Ramboll Finland	ViaFM Facility Management	Facility Management	Director
Rautaruukki Oyj	Ruukki Construction	Building products	Specialist
Skanska Oy	Development and Marketing	Construction	Director
YIT Construction Ltd	Office Premises	Construction	Director
Parma Oy		Building products	Manager

In this initial round of interviews, representatives of selected companies were asked during semi-structured interviews about:

- Challenges and changes the industry is facing in the foreseeable future and the drivers behind these changes.
- Challenges and possibilities of value networks in the Finnish AEC industry. Topics included, for example, challenges related to the management of value networks and possibilities related to life cycle management of buildings and product specific information.

- Knowledge creation and transfer practices during and between different stages in the building's life cycle. Topics included possible pitfalls in current practices, promises of the new and old information technology solutions and interplay of different actors in value networks.

From the interviews it became clear that for example house-building sector is facing major changes in the future. In the words of one of the interviewee: *"Without a doubt the needs of the residents, or clients if you like, increases ... quality of buildings is at good level in here, but we could do much better ... and as the importance of home increases in the values of people, their needs [concerning residential building production] increase. And it is clear, that the renovation of building increases [especially pipe line renovations]. These are the two mega trends that make networking more and more important in this industry."*

Value networks were seen by the interviewees as more and more important aspect when knowledge required to design, construct and maintain buildings is becoming more complex. These value networks face difficult challenges, since knowledge intensive work is hard to value – or as one of the consultants said: *"Facility management will face big changes as good managers leave the markets – fees are quite low in the market and industry is facing difficulties in attracting new professionals. Already facility managers are managing considerable amount of properties and now that the amount of these renovations is going to be ten fold, they will face considerable turmoil ... there surely will be new operational models in there ... in my opinion, the big challenge in the industry is how to raise the valuation [of these knowledge intensive services]. For example, how to get the value of proper renovation visible and that way get our chin and morale up, and how to be able to commercialize the know-how [we have]."*

Concerning knowledge creation and transfer practices in AEC industry, interviews relieved quite surprising characteristics: *"There are many interruptions during the life cycle [of a building] and during construction projects. Custom is that information is given to customer only when that customer persuades - and sometimes not even then, but only after customer demands it ... it should be understood [by us], that what is self-evident to an engineer isn't necessarily self-evident to a customer ... and if you think about the life cycle of a building, too little knowledge is transferred from these different liability inspections and renovation projects back into new building construction."* *"Constructions firms have this practice that before the building is assigned, the general superintendent, responsible for the construction of the building, disappears from the construction site and is replaced by superintendent responsible for the assignment – many of the firms have this kind of system. These superintendents are specialized in customer complains ... assignment probably goes more smoothly for them, but they don't necessarily learn anything from the process."*

As a summary for the initial round of interviews it can be said that the industry's own analysis [10] has captured all the same challenges and trends that came up in this study. The only difference was that the professionals interviewed in this study emphasized the possible loss of expertise as more people are retiring every year. This is, of course, an important aspect from the knowledge management point of view. In addition, value networks were seen important and increasingly important in the future. But when the company representatives were asked to describe value networks they were participating (according to schematics presented in the interview), even companies in the same value networks described these networks differently. This implies that management of these networks is still quite vague, although companies in AEC industry have traditionally relied quite much on outside resources. Also the lack of model agreements and established knowledge transfer practices hindered knowledge sharing between companies. These problems with knowledge transfer practices were amplified even more when knowledge and information was transferred between parties operating in different parts of the life cycle of building - especially the transition from the construction project into maintenance of the property constitutes a major barrier in the transfer of life cycle knowledge. Current information technology solutions, build around BIM and IFC -standard, weren't seen as a feasible solution for these knowledge transfer problems, but they remain a promise for the future.

VI. TOWARDS KNOWLEDGE SHARING NETWORKS IN FINNISH AEC INDUSTRY

Combining the different needs and viewpoints we can construct a picture of different aspects of networking and knowledge transfer practices in the near future (Figure 1).

First, looking at the characteristics of AEC industry in Finland:

- Two different market sectors can be identified. Customers, who possibly lack the expertise for procuring services, will utilize the services of a specialized integrator, such as facility or property managers providing service packages to their customers ("Outsourcing" in Figure 1). Examples of such customers includes the housing sector, buildings owned by foreign investors in the office building sector and some of the municipalities in the public sector. Customers, who have in-house capabilities for service procurement or service production, will combine the services of specialized service providers to match their needs. Their interaction with service providers is characterized by more formal knowledge transfer from the BIM they own to the network of service providers ("Filtering" in Figure 1).
- BIM and IFC standard will be at the heart of the knowledge management in the future, and
- Life cycle perspective is an important aspect.

Looking at the possible networking practices in the industry, we can say that:

- The magnitude and importance of networking will increase, and
- The most efficient way of networking during the life cycle of the building is probably mixture of different network configurations (see [30] for full description). There should be an external organization providing product specific information to different actors (RaSi / RT in Figure 1), and depending on the capabilities of the customer, a service integrator may be needed.
- "Local networks" characterized by joint

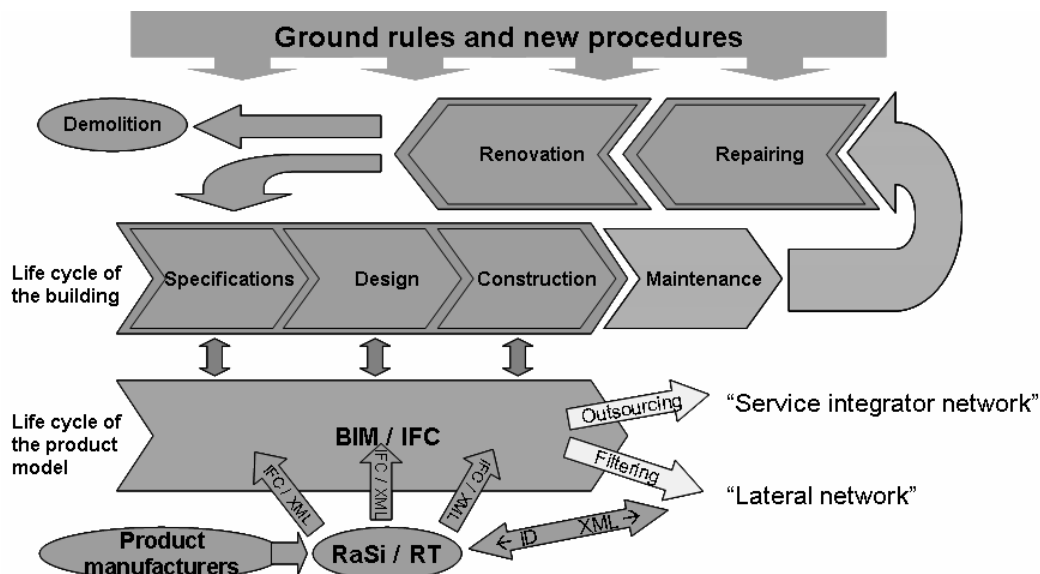


Figure 1 Different aspects of networking and knowledge transfer practices in AEC industry

geographical activities, common interests and common product- or resource pool will continue to exist – however, as a industry wide networking model they are less efficient than configurations described above.

Turning into knowledge creation and transfer practices, it is probable that:

- Specialized ICT solutions are still needed during the life cycle of the building (especially during maintenance), and it is not economically feasible to throw existing solutions to the waste bin. These solutions may or may not support IFC standard,
- The most efficient way of networking during the construction phase is based on common knowledge management technology (BIM), which enhances the interaction of different companies / disciplines, and
- Legal ownership of the BIM will be an important issue.

Looking at the different business opportunities of the situation presented above, a non-profit organization such as RaSi (Finnish Hardware Association) or RT (The Confederation of Finnish Construction Industries) is probably best suited for taking care of the product information libraries. However, commercial solutions may emerge if they add sufficient value to already initiated non-profit services. If neutral information representations (IFC / XML or similar) are used in knowledge transfer, existing technological solutions can still be used in the construction phase and especially later on in the building's life cycle. This, however, enhances new business possibilities too, according to the interviewees, as facility owners aren't restricted any more to legacy solutions and/or single service provider. In the commissioning phase of the building, as-built information or BIM is handed over to the owner of the building just like before, but the industry will probably see more and more outsourcing of the maintenance of BIM to specialized service providers.

SECOND ROUND OF INTERVIEWS AND CONCLUSIONS

The second round of interviews was conducted between May 2006 and June 2006. The interviewed professionals (Table 2) were selected based on the suggestion made by professionals in the first round of interviews or based on active contribution to industry related publications or seminars. Only one of the interviewees forbade the recording of the interview – all other interviews in this round were recorded, transcribed and later analyzed. Results of the first round were sent beforehand to interviewees as a food for thought and representatives of these companies were basically asked to disprove our findings or tell us additional insights regarding value networks and knowledge transfer practices in this industry.

TABLE 2
COMPANIES INTERVIEWED IN THE SECOND ROUND

Company	Division (if any)	~ Line of Business	~ Position of interviewee
The Association of Finnish Architects' Offices (ATL)		Architectural services	Director
Suomen Asumisoikeus Oy		Property Owner	Director
Olof Granlund Oy	Research and development	Consulting	Director
ISS Services Ltd		Facility Services	Director
Lujapalvelut Oy		Facility Services	Director
Hartela Property Development	Development	Construction	Director
City of Espoo	Technical and Environment Services	Property Owner	Director
Optiplan Ltd	Nonresidential design	Consulting	Director
Oy Halton Group Ltd	Office segment	Building products	Director

During the interviews it became clear that the clear cut market segmentation in the maintenance of the building, as it was presented in the picture 1, doesn't represent the market situation too well. "Service integrator networks" (Figure 2) are expected to become more and more popular / important in the future, but it's not the type of network that is important in the life cycle of product model – it is the sense of ownership and development responsibility of these building information models that supports the use of life cycle knowledge more than use of any particular networking practice.

Future: coordinating KIBS

multi-sectoral KIBS branch-specific KIBS and their networks

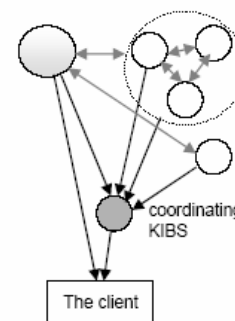


Figure 2 Development towards a two-layered structure in the knowledge intensive business service (KIBS) sector: specialists and coordinators / integrators [31]

The combination of "active" and "passive" information during the whole life cycle of buildings interested

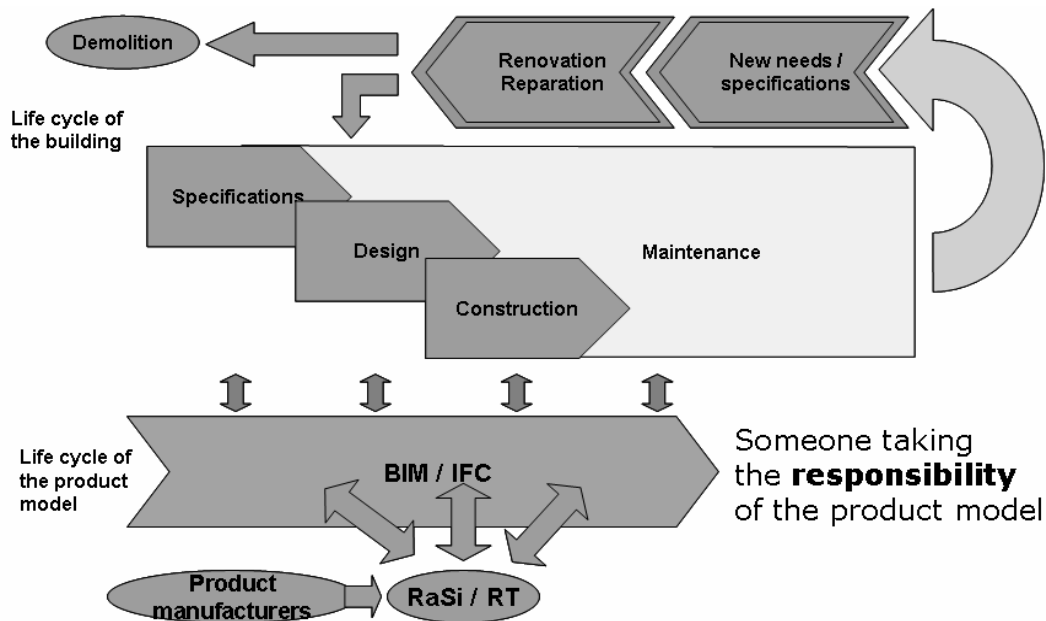


Figure 3 Updated picture of the different aspects of networking and knowledge transfer practices

professionals (RaSi / RT on-going project or other). Especially the possibility to store information about discontinued products was seen as important and feasible feature and possibility to collect feedback from the maintenance in the same information repository for the product manufacturers to use was seen as valuable feature if only it could be done somehow.

Some of the construction companies in the second round expressed growing interest in the end users and towards maintenance as a means to get more information about these end users. Lack of this feedback mechanism was considered the most serious flaw in picture 1. This tendency can also be seen from the industry's own Visio 2010 report [10], where the development in the common vision (related to trends such as described in chapter III) was estimated using expert panels and different competencies as dimensions. Competences related to customership and end users were estimated to have been developed the least in almost all of the vision targets since year 2002. Clearly there is a consensus in the industry that competencies and networking practices that address these issues should be developed. Figure 3 presents the picture of different aspects of networking and knowledge transfer practices updated according to these remarks from the second round.

As a summary from these 20 interviews it can be said that attitudes towards BIM and IFC -standard can be divided into two groups – technological believers and skeptics. BIM and IFC standard will be at the heart of the knowledge management – sooner or later. Concerning networking practices and business opportunities, “service integrator networks” presented as a possible future trend in Toivonen's thesis [31] can be found already in AEC industry. From the knowledge management perspective it is

interesting that these service integrators seem to utilize mainly knowledge and development of that knowledge as a business opportunity. Also networking partners serving the whole industry may emerge to facilitate the use of life cycle related knowledge. It is noteworthy that the situation presented in Figures 3 is based on the assumption that non profit organizations and governmental actors, as such facilitating actor, are successful in their supporting roles – if a dominant design or de facto application emerges as a commercial solution, either to the storage and sharing of product specific life cycle information or to the way services are produced in some part of the life cycle then this situation needs to be revised.

Current regulations in Finland and processes used in the industry don't support networking practices very well, but they allow networking to happen. Currently networking companies use free form ground rules or contract forms in situations where normal business contracts don't apply. According to the interviewees, these ground rules and contracts don't remove the need to build trust between different players in the network, but they act as nice safeguards and can help companies come to mutual agreements on the division of risks and rewards of the collaboration.

DISCUSSION

As a concluding remark for the future of networking in AEC industry, it may be necessary to refer to Gulati [32], who claims that firms enter new alliances more readily if more network resources become available to them rather than less. The only feasible way to courage the forming of AEC networks may be by ensuring that AEC companies are acquainted with the network approach and given

opportunities to engage in long-term strategic alliances – you cannot just tell the AEC companies to start networking and building trust in collaboration, since networking is established between people and only over longer periods of time. Having said that, this study shows that the magnitude and importance of networking will probably increase throughout the industry and especially “Service integrator” companies to become more and more common in the customer interface. In addition, while there is always a chance that truly new and radical innovation (product or service innovation) changes the business landscape, we anticipate that an external player, who stores and disseminates product specific life cycle information, is needed while waiting for the necessary IFC –standards to come true.

This study has several limitations – 20 interviews is very limited number, especially since this study tried to take into account all the different players in the life cycle of buildings. In addition, this study focuses closely on the situation in Finland and networks in AEC industry and can’t be generalized to other markets or industries too well. However, AEC industry being a knowledge intensive industry, we think that there is much to learn from the observed knowledge creation and sharing practices in other contexts as well. Based on the experiences from this study, a future step that could help AEC industry, along with all other knowledge intensive industries, could be a research effort focused on the valuation of knowledge work and expertise.

ACKNOWLEDGEMENT

This paper reports some of the findings of a research project DESNET, which is funded by the Academy of Finland (decision number 212038).

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Knowledge Management Challenges in Renewal of R&D Processes in Software Business

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Abstract — A software company operates in a dynamic, knowledge intensive business. To stay competitive in such a business, the R&D processes and their development play a significant role. Knowledge management becomes a factor when organizing knowledge work. This paper is based on a qualitative case study conducted in a software company moving to component based production. In addition to theoretical insights, the paper describes the KM challenges involved in this process and suggests solutions to these. Also some managerial implications are proposed.

Keywords — knowledge management, software business, R&D process development, component based production, case-study.

I. INTRODUCTION

A. Background

Software business is a dynamic industry, where the pressure to continuously develop business processes in order to stay competitive is great. Especially the development of R&D processes plays a key role in software companies, as the productivity of the companies in a technology intensive business is heavily founded on R&D activities.

Software business is also characterized by its knowledge intensity; a software product is based on the combined efforts and expertise of a group of experts. In addition, when developing and producing the software, these experts have to listen to the varying needs of the customers. In fact, a software company operating in the business-to-business markets with multiple products and customers, has to be able to effectively link the expertise of its employees with the requirements and the needs of the customers. Thus, the management of knowledge is particularly important to software companies and needs to be handled with special care, especially when renewing their R&D processes.

B. Objective and research methods

The objective of this paper is to identify the central

knowledge management (KM) challenges in different phases of the renewal of R&D processes in a software company. Moreover, this paper aims to present possible solutions to these challenges and in this way, the aim is to provide implications for managers dealing with the challenge of R&D process development and renewal.

This paper bases on a qualitative case study of a large software company operating in business-to-business markets. The research was conducted according to the principles of action-oriented research, utilizing qualitative methods [1] in gathering and analyzing the data. Altogether a series of over 30 interviews on various hierarchical levels was made during the time period of January to May 2006. All of the interviews were tape-recorded and typed as detailed interview memos. The interview data was analyzed by grouping and theme building.

We chose to conduct a qualitative case study [2], [3] in order to get an in-depth and holistic insight to the research phenomenon under study. The knowledge management challenges and practices in renewal of R&D processes are explored empirically through qualitative methods in order to conceptualize the phenomenon and to provide theoretical and managerial implications based on the analysis of the case.

C. Case organization

The case organization is a software company that provides large and complex ICT systems and solutions for its organizational customers. The company is quite dispersed; the operations of the company are based on independent teams, each responsible for their own product development, production and sales. This makes it difficult even for the team leaders to know what the others on an equal level in the organization are working on. Rather often the teams are making the produced software from scratch and too often the teams do overlapping program coding and R&D work. This unnecessary overlap in the R&D processes causes naturally extra costs for the company.

Consequently it is not a surprise, that as a result of a toughening competitive situation, the company is forced to renew its R&D processes and move towards a more

productized way of working. The company aims to root out redundancies from its operations and to improve its productivity. This will require the full utilization of the competence and workings of the teams across the organization. To be able to achieve this goal, improvements in the knowledge flows and closer co-operation between teams through-out the organization are a necessity.

The case organization has decided to tackle this problem by switching to decentralized component based production. A focal element in the new way of working is an entity called component library. The teams will do their day-to-day tasks as before but in addition to this they all, especially the team leaders, must try to identify potential components, i.e. products, subparts or features that could also be used in other teams and environments and entered into the component library. A dynamic, functional cross-team board is set up, that will critically monitor the actions and needs of the teams. From the motion of the team leaders, the board will scrutinize and decide whether a suggested part is suitable to be made as a component.

If accepted as a component the part ends up, in addition to the original product it was developed for, in the library from where every entitled member of the organization can use and reuse it. The component must be well documented according to carefully made specifications in order to be fully usable and even further developed, for and by other teams. However, this transition from a team-oriented way of working to a productized, more holistic R&D processes is a great challenge for the whole organization.

In addition to a change in organizational way of working, the case organization has decided to take an advantage of using a common technology, i.e. programming environment and language. This technology is already in use in few teams, but new to most.

II. THEORETICAL INSIGHTS

A. Software business characteristics

Software plays nowadays an important role in our modern society [4] as many of our every-life tasks are based on the utilization of software. However, measurements regarding the software industry and its size, importance, and growth rates are not easy to make when it is not always clear what can be labeled part of the software industry and what cannot.

One possible way to better capture the essence of the software industry is to divide the software industry into smaller segments, which helps to understand more clearly the different ways of doing business related to software and the position of the services in relation to them. One rather commonly used way to break down the business is to consider embedded software, professional software services, enterprise solutions, and packaged mass products as involving separate kinds of business, as suggested by Hoch et al. [5].

Embedded software refers to programs integrated as inseparable parts of system products that include also hardware other than standard computing platforms.

Professional software services refer to the work of the software project business (see e.g. [6]) or to tailored software (see e.g. [7]), for which the customer organization is usually charged an hourly rate, not a fixed price for the software products or components provided. Enterprise solutions include software that is produced for the needs of customer organizations, which usually are quite specific, based on general technological solutions and often also on standard application frameworks. Lastly, packaged mass-market software refers to software products that are provided as they are to several customers.

In this segmentation of the software industry, our case organization stands most in the segment of enterprise solutions. This segment consisting of enterprise solutions includes software that is produced for the needs of customer organizations, which usually are quite specific, based on general technological solutions and often also on standard application frameworks. Interestingly, enterprise solutions quite often have characteristics of both the software service business and the more standard software product business. This kind of position at the boundary of the customer-oriented service business and the more brand-driven product business creates challenges also for our case organization.

B. Organizing software componentization

Because of its special features, software business and production do not fit the traditional hierarchical or functional organizational structures. The different phases, e.g. production and R&D, are almost impossible to separate from each other. Also the development of software is based on the co-operation of multiple parties and even simultaneous with sales. Even in the team-based structure communication and interaction are a problem. They often rely on intermediaries. [8]

The implementation of software componentization and the component library in our case organization is organizationally challenging. The current organizational structure doesn't support the interactions required by componentization. Morisio et al. [9] found in their research on implementing software reuse, that third of reuse cases fail. The main reasons for failure were the lack of processes dedicated to reuse and the adaptation of existing processes. In such a case the processes do not support reuse, i.e. there is no means or time for reuse and componentization. Componentization requires careful planning and adjustments in an organization in order to work.

Also Jacobson et al. [10] emphasize that often componentization projects fail because it is thought to fit the existing structures with little motivation and technical training. The human factor has also often been neglected [9]. In our case organization work has been team- and project-based and there hasn't been time or motivation to make software code also usable for others. It is possible that independent or physically dispersed units even compete with each other (Lynex & Layzell according to [11]) when there is no willingness to share software code. The pressure coming from the customers and financial pressures takes attention away from componentization.

There are two main ways to organize for componentization: decentralized and centralized component based production. The difference between these two ways is the division to component users and creators [10]. In the centralized production these groups are different, specialized people. There is often a dedicated unit for production of components. Instead in the decentralized way of componentization every one can be a creator or user of software components in addition to normal responsibilities. Componentization can also be organized by some mixture of these two. The best way for an organization is dependent on the history and culture of that organization [12]. Still, according to Sherif et al. [12] an important enabler of componentization in any chosen model is the exchange of resources and interaction between the people using and developing reusable software.

In our case organization they have chosen the decentralized component based production. According to Frakes and Kang [13], the strengths of such a model are: a) the initial costs are small, b) the components are being developed for a real customer need and not just for storage c) the development costs of these components will be placed on the project in question. The weaknesses of the decentralized model include: a) the definition and delegation of responsibilities is difficult, b) teams and projects are very different and it is hard for the teams to grasp the total picture and understand the needs of other teams, and c) all the teams will have to be motivated and controlled and this requires a great deal of management resources.

Componentization and the choice of the proper organization model is a balancing act between components that are distant from customer requirements and the risk of not being able to produce components general enough in nature. In both cases the quality of the component could be questionable: can a component made in a hurry to a specific customer need be efficient and applicable in different projects, or can a component made outside a customer project be useful in reality.

C. Knowledge management

It is difficult to manage knowledge. Reasons for this are e.g. that knowledge is typically invisible, it can not be touched and it is hard to measure [14]. So it is fair to say, that we can not exactly know what there is inside everyone's brains. However there are areas related to knowledge which can be made visible and thus easier to manage. These are a) operations related to knowledge, b) results based on knowledge and c) investments in the creation of knowledge. [14] On the other hand, Nonaka and Takeuchi [15] have stated that every piece of knowledge, despite if it is visible or not, can be managed. Either way, it can be concluded that means to manage knowledge in an organization can be found.

Essential things in knowledge management are administration and goal oriented management of knowledge, skills, competence and communication [16]. To move knowledge and experience in the organization from its origin to places where those are novel can be seen as a

purpose of knowledge management [17]. Also the management of knowledge sharing and application and the improvement of knowledge creation can be seen as the aim of knowledge management [18].

Knowledge management is relatively new operation for organizations. The novelty is one reason for the challenges for organizations to apply systematical knowledge management in practice. Still knowledge management could produce answers for many of the open questions of modern organizations.

Knowledge management comprises of carefully designed operations to maximize organization's performance. These kinds of operations are creation and sharing of internal and external knowledge and experience. [18] Knowledge management can be seen as an inclusive operation where the management of people by different means and instruments is essential. Basically it can be said that the case in knowledge management is the effective diffusion and promotion of the reuse of existing resources [19] for channeling and governing the human capital and intellectual property of an organization [20].

One of the challenging questions for organizations is the difficulty to recognize what knowledge is needed in which situation (Lave 1988, Reeves and Weisberg 1994, Thompson, Gentner and Loevenstein 1998 according to [21]). Also one big problem often is that employees do not know enough about the knowledge already existing in the organization and therefore they cannot look for it or to utilize it in their own work. However the creation of new ideas would be most effective if old knowledge could be attached to new situations and in this way be cultivated and developed [21]-[23]. To be able to utilize existing knowledge in a best possible way for the help of an organization it is wise to execute systematic knowledge management actions.

There are already several studies that say that the support of management has an essential role in the success of knowledge management (see e.g. [24], [25]). Successful creation of knowledge depends on the answerability, justification and both economical and mental support by management [24]. The need for management both in strategic and operational management is undisputable. Managers and leaders are needed. There are different studies that claim that people need to be managed in general (see e.g. Popper and Zakkai 1994 according to [26]).

Katz and Kahn have stated already in 1964 that the need for managers is essentially great during change [26]. Based on this it is reasonable to say that nowadays when the pace of change is fast the need for good leadership is evident. Change requires leadership and leaders need tools to be able to lead in a changing environment. It would be important to find multiple instruments for these leaders to pilot their subordinates to success through change. Some of these instruments can be found in systematic knowledge management.

From knowledge management's point of view one of the challenging questions for managers is the definition of

strategy concerning knowledge management. One of the most common ways to consider knowledge management strategy is to divide it to personalization and codification strategy (see e.g. [27]). The key idea in personalization strategy is the promotion of the communication between people [27]. Personalization strategy is a very people oriented strategy. Effective information and communication systems create the core of codification strategy [27]. Codification strategy is a technology oriented strategy.

Through these strategic approaches, different knowledge management practices can be specified. These practices can be emphasized differently depending on the stage of a transition. In practice both technology and leadership based approaches should be considered.

III. RESEARCH FINDINGS

As argued above, the renewal of R&D processes and introduction of component based production comprises many challenges to knowledge management. One of the biggest challenges in our case organization is the need to share knowledge not only to make component library work, but also to enable this cultural and organizational change. Luckily, as stated above, there are means to be found in knowledge management.

Due to the confidential and partly heterogeneous nature of the individual interviews, their findings are summarized and presented in a generalized way, which enables us to do the conclusions presented in the chapter four.

In the renewal process in the case organization two stages of proceeding can be identified: *the design and preparation phase* and *the consolidation phase*. The design and preparations phase is the responsibility of the management or project team. This phase includes the preliminary assessment of the available, thus possible technologies; the analysis of the current processes; the remodeling of practices; division of responsibilities; a preliminary allocation of resources and finally the technological decisions. In the consolidation phase the planned practices are put into action and anchored into the organization. According to the study the management and project team should also be tightly involved in this phase to monitor the process and to support the correct actions. These two phases ensure the proper implementation of new practices and technologies.

Next this paper identifies the central knowledge management challenges in our case organization and also proposes solutions for their settlement. The challenges and solutions are divided into *technology-oriented* and *people-oriented*, because these are the two generally acknowledged main elements in knowledge management.

A. KM challenges

The main source of knowledge management challenges and uncertainty in the renewal of R&D processes in our case organization is the great diversity of the teams in their initial situation. It complicates greatly both the design and preparation phase and the consolidation face. The teams have different organizational backgrounds, different

technologies in use, different products and customers and also very different compositions. In addition to this they can be quite separated from each other even physically.

Table one introduces the challenges for knowledge management in the renewal of R&D processes in the case organization.

TABLE 1
KM CHALLENGES IN DIFFERENT PHASES OF THE RENEWAL PROCESS

	Design and preparation phase	Consolidation phase
<i>Technology oriented challenges</i>	<ul style="list-style-type: none"> · Different kinds of teams and demands · Usability and exploitability of the component library · How to find a viable technology for the future · Architectural design 	<ul style="list-style-type: none"> · Lack of competence for a new chosen technology · Attitude problems towards a new technology · Difficulty to integrate to mature products · Component interfaces that are general enough
<i>People oriented challenges</i>	<ul style="list-style-type: none"> · Information doesn't flow between teams · Prejudices for different technologies · Fear and/or uncertainty caused by not-knowing the future 	<ul style="list-style-type: none"> · Different kinds of teams and demands · Attitude problems towards change · Lack of time for training and experimenting

The technological challenges are knowledge management challenges as the case organization sells knowledge intensive products and services and the technology also affects the information flows and communications by being either the content of communication or means to it.

The heterogeneous nature of the teams in the case organization makes it challenging for the case organization to find a right technological solution that could fit all the teams. The same fact, the different state and nature of the teams, makes it difficult and trying task to find a technology to support the existing software products produced and maintained by the teams. This is also a factor, which made it rather difficult to find the right explicit descriptions of the challenges for the table.

As for the people oriented challenges the information flows, communications, are one key to the successful outcome. Other challenges seem less threatening if the organizational communications can be properly dealt with. With good communication the other areas may be elucidated and the uncertainties lifted. To put it simply, if the people know what's going on, they are less concerned and more confident and trusting for a better future.

B. KM solutions

The possible KM solutions provided by knowledge management are diverse. The interesting feature of knowledge management practices is that the effects of the actions taken are multiple and sometimes even difficult to point out. This is why the solutions for KM challenges introduced in table two cannot all be matched to a certain challenge introduced in table one. The purpose is that by applying these, the organization creates the right

circumstances for the challenges not to turn into risks or weaknesses in the renewal process.

TABLE 2
SOLUTIONS TO KM CHALLENGES IN DIFFERENT PHASES OF THE RENEWAL PROCESS

	Design and preparation phase	Consolidation phase
<i>Technology oriented solutions</i>	<ul style="list-style-type: none"> · Appoint a team responsible of the component library · An expert pool must find a "right" technology to adapt for component based production · Training of the new chosen technology 	<ul style="list-style-type: none"> · Intranet as a communication channel · The new technology must be agile enough to accommodate the needs of the teams · Clear architectural design and structure
<i>People oriented solutions</i>	<ul style="list-style-type: none"> · Consultant · A member of senior staff must announce the need for change · The board of controllers should consist of extensive and valued expertise from within the organization · Pilot cases to act as an example · Training for the chosen approach 	<ul style="list-style-type: none"> · Informative meetings with teams · Job rotation · Regular team leader meetings · A team member visits the meetings of other teams · Successful cases to act as an example

It is obvious that the solutions come from the commitment of the management and proper resources. There are no quick fixes, but the change must be gradually implemented in to the organization. To overcome the resistant of the personnel communication must be handled with especial care.

IV. CONCLUSIONS AND MANAGERIAL IMPLICATIONS

This paper discusses the knowledge management procedures in a case company as well as conclusions drawn from the literature. The chosen viewpoint is that of process development. Also the KM challenges in this case and their possible solutions were analyzed with some depth.

Renewing one's R&D-processes presents a major change and challenge for the whole organization. We still firmly believe that knowledge management practices and tools will facilitate and ease the change in organizational ways of working. Some of these methods are listed above in table two.

Already at this point it is fair to say that leading the change systematically is critical in this kind of an endeavor. The individual teams in the case organization all have their own business as usual -modes and now they must change them. All teams need to adjust their functions at least mentally, some even more drastically, and even change the technology that is being used. Some must learn and adapt to an altogether new technology and way of working. Leading and leadership in this kind of undertaking and setting are crucial for the successful outcome. Thus extra attention must be given to these functions.

Still the whole operation in the case organization is more than a try-out for a certain period of time and so it is also meant to be. The ultimate goal is a permanent change in the ways of working. This brings along the fact that a procedural change such as in the case organization may well take time up to two to three years or even be continuous, a sort of on-going change of things. This may well justify the discarding the term *project*, as a project has its start and ending.

What are required now, are short-term successes. The organization and its members need strengthening in their resolve to overcome the difficulties, and they also need a counterforce to the human resistance to change. Thus try-out or pilot cases are needed to show the employees that this kind of new way of working is possible and also functional. These successes should be promoted on the company level (i.e. via intranet) but it could also be wise to bring the message down to individual teams and groups within the case organization. In this way the opinions and notions could be better taken into account as well as a better and more caring picture of the process management may be given to the employees.

As important all the prior tasks and themes are, it would also be wise to assemble a body of experts to monitor and guide the operations. There was such an organ during the initial phases and stages of the project, but there was polarized opinion of its future. We feel that some such control is needed or even vital for a successful ending and for the new fashion to actually become the usual way of working. This is also due to the fact that this kind of change needs promotion through well-executed organization wide communication. Promotion is more likely to be taken care of and be functional if done by dedicated personnel, even if their main tasks would lie elsewhere. Obvious fact suggests that a known person of the organizational high command should be set to be a leading figure in the change. Also a way for this promotion could be to set a team leaders' meeting that could be (at least occasionally) visited by a member of the top management and they could in turn promote the message to the members of their own teams. In these middle level meetings also various training needs could be discussed.

As for the more technological side to the whole change, it should be considered that the chosen technology is, and must be, agile enough to enable the continuance of the work of the individual teams. The teams and their products are of so much variance that it may represent unexpected challenges or even difficulties to find such a technology. The other alternative is to make compromises in the way the new chosen technology is implemented and during how long a transitional period of time.

Thus the managerial implications of such a reform are significant. Qualifications and features required from a leader in this kind of situation are not necessarily easy to meet. To master the human side of the whole change process may be one thing and even a bit much to ask but there is also the organizational side to be considered. Are some organizational changes necessary, and if so, which

ones? There are questions that are still partly unanswered or the answers are still obscure. The answers to these questions must come from the management of the case organization drawn from the strategy and the organizational everyday life. Our current view of the case company is much like a snapshot, it describes the situation in a certain moment in time. However lightheartedly we may point out some factors to change and improve, the organizational reality is to be remembered. To answer these questions as well as to study how the change has set in would make an interesting part two in this research.

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Knowledge Sharing and Building in Succession of a Firm

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Abstract – Successful knowledge-based organizations have been portrayed as balancing on the edge of time: they are able to connect experience and lessons learned in the past with current activities and with a view to the future. Succession presents many challenges to this continuity of organizational knowledge. Traditionally, succession has been associated with transferring the existing knowledge from senior workers to newcomers. The paper examines succession as a knowledge-based process consisting both of transferring seniors' expertise to juniors, as well as using juniors' competencies for building knowledge that is new for a firm, i.e. succession is seen as a context where both continuity and renewal are produced. To examine succession from a knowledge-based view, we have implemented an empirical study on succession of a Finnish expert company. The objective of the research is to describe and understand how knowledge is used and modified in the context of succession. The theoretical and methodological basis of the study lies on sense-making. The preliminary results prove that in the studied firm, social interaction related with the succession leads not only to transferring the existing knowledge of the senior workers to the newcomers. In addition, new knowledge can be applied and created in the context of master-novice interaction. The newcomers bring in new ideas, standpoints and knowledge that are valuable to the firm, as well as apply and change the existing organizational knowledge. Thereby succession is not only a process of producing continuity of organizational knowledge, but also of renewing it.

Keywords – knowledge, organizational renewal, sense-making, succession

I. INTRODUCTION

As knowledge has become the major driving force of economic growth and corporate success, organizations need to direct increasing attention to managing knowledge and leveraging intellectual capital. In order to create sustainable competitive advantage, firms must be able to identify and leverage their current knowledge and capabilities, as well as to renew what the organization knows and to build new capabilities for the future [1]–[5]. Successful knowledge-based organizations have been portrayed as balancing on the edge of time: they are able to connect experience and lessons learned in the past with current activities and with a view to the future [6]. These firms create continuity,

routines and processes, while at the same time allowing for flexibility and emergence of new developments.

Succession presents many challenges to the continuity of organizational knowledge. For example, how can new employees learn to understand and adopt the firm-specific ways of working and doing business? How can senior employees' knowledge be passed on to newcomers? Is there a way to embed at least some of their skills and knowledge in an organization to remain after they have exited? As a consequence of the coming retirement of World War II baby boomers, succession will be accomplished in many companies around the world in the near future. Knowledge and advice for a successful completion of succession would help firms to maintain – or even to improve – their competitiveness during, and especially after, a succession process.

Traditionally, succession of a firm has been associated with transferring the existing knowledge from senior workers to newcomers [7]. “To transfer” implies that during the succession process, knowledge should be changed as little as possible. However, this paper argues that succession can also be seen as a context where new knowledge is created and thereby an opportunity for organizational renewal. It is not only seniors who have knowledge to be shared; newcomers are likely to have new knowledge, ideas or standpoints that can be valuable to an organization. We suggest that new knowledge brought in by newcomers is an important asset that can fuel organizational renewal through opening possibilities for creation of new organizationally valuable knowledge. Therefore, succession as a knowledge-based process consists both of transferring seniors' expertise to juniors, as well as using juniors' competencies for building knowledge that is new for a firm. Succession is a context where both continuity and renewal are produced.

In this paper, we use sense-making [8]–[10] as a theoretical lens and a methodological approach for examining organizational renewal in the context of succession. In the sense-making approach, an organization is understood as an inherently dynamic and renewing entity where communication and interaction are the focal elements. The sense-making approach studies how people survive in changing situations by focusing on the micro-

level social processes where knowledge is used and developed in every day interaction. Knowledge of an organization is renewed as people take care of their jobs and seek, use, apply and change knowledge in social interaction.

From the sense-making perspective, succession is interaction in which knowledge is used and constructed by junior and senior employees. The objective of this paper is to describe how knowledge is used and modified in this interaction. We specifically focus on what kind of knowledge is transferred or shared in succession process, and how or in what kind of interaction this takes place. The paper begins by delineating what types of knowledge are involved in succession processes. Then we focus on seniors and juniors as agents of renewal and how knowledge is modified in their interactions. This paper contributes to the literature on organizational renewal by demonstrating how succession processes influence continuity and flexibility of organizational knowledge.

II. KNOWLEDGE AND SUCCESSION

On a micro-level of an organization, succession can be understood as an activity happening in social interaction between two individuals within a firm. During this interaction knowledge is used: information, skills, experiences etc. are sought, transferred and shared in order to find mutual understanding, to get work done and to keep a firm productive and profitable. On an organizational level, the basic goal of succession is often seen to be the transfer of valuable organizational knowledge from senior workers to newcomers, and thereby assuring continuity of organizational knowledge and knowing.

To examine succession from a knowledge-based view, we studied a Finnish middle-size expert company which produces electrical devices and systems global markets. The company pairs new employees with senior experts to ensure that juniors learn from the seniors and are smoothly socialized into productive members of the organization. To understand how knowledge is transferred and created in the context of succession, we interviewed six pairs consisting of a "master" or a senior worker, and a "novice" or a junior worker. All interviewees were male white collar workers, working in product or production development, as work leaders or as sales managers. Five of the juniors were engineers with a university degree while the seniors' education varied. The case we studied is unique because, first of all, the interviewees going through the succession work as experts – though their work may include managing as well – while the previous research on succession has very strongly concentrated on managerial level succession [7]. Secondly, there are six pairs of seniors and juniors involved in the succession in the same firm and at the same time. This made it possible for us to gather an abundant and versatile data which spans many levels of analysis: individual, social and organizational.

In the interviews, it became evident that junior employees cannot learn the needed knowledge or their jobs simply by reading documents or instructions. "It is not possible to

exhaustively describe the inner life of devices on written papers or in computer files", as one of the juniors explained. Another told that to be able to understand "the soul" of devices you need to "experience the synergism of different laws of physics in different environments".

The juniors' interviews demonstrate that learning can not proceed only through codified knowledge, but needs to be connected with personal and practical experience. The problems that the juniors encountered with learning by reading and by experiencing are linked with explicit and tacit knowledge [11]. Explicit knowledge stands for that part of knowledge which can be expressed and codified relatively unproblematically, for example, in the form of verbal accounts, numbers, formulas, and theoretical models. However, most of human knowledge is in tacit form; we know more than we possibly can ever articulate. Tacit knowledge stands for that part of knowledge that is personal, context-dependent and based on practice and experience. Tacit knowledge is demonstrated in skilled action and unconscious judgments, and it is very hard to separate it from the activity in which it is demonstrated. Furthermore, most of tacit knowledge remains subconscious even for the individuals themselves: it is impossible to explain fully what one knows, and even more impossible to articulate how the act of knowing happens. Tacit knowledge is difficult to share and transfer. It is embedded in particular practices and experiences, and it is hard to understand and transmit outside the local context.

In their highly influential book, Nonaka and Takeuchi [3] claim that tacit knowledge can be converted to explicit and vice versa, and this process lies at the center of organizational knowledge creation. Later, a number of researchers have questioned the assumption that tacit knowledge can be converted into purely explicit knowledge. For example, Wilson [12] sees tacit knowledge as an inexpressible process that can be demonstrated only through our expressible knowledge and through acts. If a person can express the knowledge, it means the knowledge is implicit, not tacit. The fact he has not expressed the knowledge before does not make it tacit. Tsoukas [13] finds Nonaka's and Takeuchi's interpretation of tacit knowledge as knowledge-not-yet-articulated erroneous because it ignores the ineffability of tacit knowledge and reduces it to what can be articulated. According to him, tacit and explicit knowledge are not two ends of the continuum but two sides of the same coin: even the most explicit kind of knowledge is underlain by tacit knowledge. Pöyhönen defines knowledge as "something that is constituted in the social practices of actors embedded in a particular social context" [5]. To her, the most fruitful approach to knowledge is inter-subjectivity: knowledge exists between, not within individuals. This approach makes sense because it "includes" tacit knowledge to inter-subjectivity or social context – it is there, though we cannot express it or detach it from its context.

According to Spender [14], organizational knowledge is either explicit or implicit and individual or social. Explicit individual knowledge makes conscious knowledge while

implicit individual knowledge makes automatic knowledge. Explicit social knowledge makes objectified knowledge while implicit social knowledge makes collective knowledge. In his matrix, Spender does not mention tacit knowledge at all – presumably it is included in automatic and collective knowledge. To Spender, knowledge is dynamic which means that different kind of knowledge interact with each other in social relations within an organization. In these processes, collective knowledge helps the members to develop routines and learn.

Choo [10] sees tacit knowledge as individual knowledge which is derived from practice and experience and cannot be reduced to rules or recipes. Tacit knowledge cannot be articulated but it is needed when assimilating and applying new explicit knowledge. On organizational level, Choo calls tacit knowledge cultural knowledge which roots are in the tacit knowledge of the members. According to him, there are three kinds of knowledge within an organization: individual tacit knowledge, organizational explicit knowledge and organizational cultural knowledge. Choo's cultural knowledge comes close to Spender's collective knowledge.

On the basis of our observations, we identified four kinds of knowledge within the firm. In reality the four kinds of knowledge are intertwined and overlapping, but they are separated here for the sake of grounding the forthcoming analysis of knowledge use and creation in succession:

Tacit individual knowledge – cannot be expressed

“The knowledge is part of myself, I am not able to analyze it”, one of the seniors said.

Implicit individual knowledge – can be expressed

In the past, the seniors implemented many technical tests, planning projects etc. which were not documented in any way though the seniors would have been able to do that. Some of them are documenting the knowledge related to these events now, as are some of the juniors.

Explicit knowledge – individual and organizational

This includes reports, documents etc. in paper files or in intranet. Some of these are individual, i.e. “hidden in seniors' personal maps”, some are organizational, i.e. available to all who want to use them.

Cultural or collective knowledge – implicit and tacit

The interviewees seem to have common understanding of appropriate ways to act and work, of how and why the firm succeeds, of the firm's goals etc. Some of these understandings the interviewees were able to express very easily, some of them had to be “read between the lines”. So, it seems that part of the cultural knowledge in the firm is implicit and part of it might be tacit.

To conclude, our results support the idea that tacit knowledge is hidden and cannot be expressed [5], [10]–[12] while implicit knowledge is something a person knows he knows and he is able to express [10], [12]. A part of explicit knowledge is individual and a part of it is organizational

[10], [14]. Cultural or collective knowledge is shared with the members of an organization, it is partly implicit and partly tacit [10], [14].

III. SENSE-MAKING AND SUCCESSION

The theoretical basis of this study on succession of a firm lies on sense-making [9]. In the sense-making approach, organization is understood as an inherently dynamic and renewing entity where communication and interaction are the focal elements. People construct the world through sense-making, and sense-making is involved in all social interaction. Knowledge is both used and changed in sense-making processes.

We use sense-making as a theoretical lens for studying how succession process can function as a source of organizational renewal. According to the sense-making approach, renewal of knowledge in an organization happens in interaction when people take care of their jobs and seek, use, apply and change knowledge. Sense-making approach studies those interaction processes and how people through them survive in changing situations. In order to understand and develop organizational renewal, we have to understand these grass-root level social processes through which knowledge is used and developed. The idea of sense-making has been applied to individuals and their behavior [8], to interaction in groups [15] and to organizational actions [9], [10], [16], [17]. The question of how knowledge is sought, used and modified in succession can be examined on each of the three levels of analysis:

Individual view to sense-making: needs of a junior and a senior

In an individual approach to sense-making, information is seen from a user's point of view: sense-making is communication in which an individual seeks and uses information. Individuals need information to be able to survive in constantly changing situations, i.e. to solve problems and create meanings in order to understand the environment, its events and other people [8].

According to sense-making, information needs and use vary from one individual to another because previous knowledge, skills and experiences influence an individual's current behavior and understanding of things [8], [16].

In succession of a firm a newcomer or a junior needs and seeks information to learn his job, to get to know people, to know how to act at work etc. A senior needs and seeks information when he tries to figure out what he should teach to a junior and how he should do it.

Social view to sense-making: interaction between a junior and a senior

A social approach to sense-making defines it as social interaction in which people maintain and create common meanings and understanding [15]. When exploring knowledge, the social view to sense-making is not so interested in what we know. The main interests are in how we know and how we learn what we know, i.e. in inter-

subjectivity of knowledge.

In succession of a firm a senior and a junior construct mutual understanding of what knowledge – and why, how, when – needs to be shared, i.e. they create common meanings in sense-making. During their interaction a junior also learns about a senior's tacit knowledge and about a firm's cultural knowledge. It can be presumed that a senior learns something from a junior as well.

Organizational view to sense-making: a context for knowledge creation

Sense-making, as defined by Dervin [8] and Weick [15], provides the context where organizational knowledge is used and created, i.e. sense-making builds the frame of reference for knowledge creation. In sense-making, the tacit knowledge of individuals, the cultural knowledge of an organization and the explicit knowledge within an organization are combined. In this context, new knowledge can be created. However, this knowledge creation process does not work until it gets new knowledge outside of an organization – as “raw material” [10].

In interaction related to succession of a firm, a senior's tacit knowledge is connected to or combined with a firm's explicit and cultural knowledge as well as with knowledge coming outside of a firm with a junior. This means that, following Choo's idea of organizational knowledge creation, we can assume that it is possible to create new knowledge – and through that support organizational renewal – in succession of a firm, instead of just transferring the existing knowledge.

In an ideal situation, all the three levels of sense-making in an organization work and both individuals and an organization “win”: (1) individuals find easily the information they need, (2) interaction and cooperation get on smoothly and help people to get their work done, (3) an organization produces new knowledge according to its goals and needs.

IV. SENSE-MAKING AND KNOWLEDGE CREATION IN SUCCESSION

In succession of a firm, the sense-making process starts when a newcomer, i.e. a junior, needs and seeks information in order to learn and understand his new job and the firm new for him. He asks advice from someone who has worked longer in the firm, i.e. from a senior. This leads to interaction during which a junior and a senior transfer and share knowledge and create common meanings and understanding. As a result a junior gets the information he needed (or he does not, which means that he has to ask other people, look outside of a firm etc.). What does he do with this new information? He can start to use it as such, or he can change it first to make it fit better for himself or for his job and then start to use it. In both cases he can tell other members of a firm about the knowledge he has learned, modified or created – or he can choose not to tell about it.

On the basis of the preliminary results of the presented research, it seems that six different situations may occur during knowledge sharing in the succession of the firm. In

each situation, knowledge is used differently:

No knowledge is shared between the senior and the junior

The junior gets the knowledge he needs from someone else(s) in the firm, not from his mentor.

(Example from the firm: the junior and the senior have very few contacts with each other and the junior uses other sources of information.)

No new knowledge is created

After knowledge has been shared between the senior and the junior, the junior starts to use it. (Example: the junior uses old routines in implementing offers to customers though he realizes that the routines are inefficient and knows how to make them better.)

No new knowledge is created, existing knowledge is told to others

After knowledge has been shared, the junior starts to use it and tells about it to the other members of the firm – of course, some of them may already know the knowledge.

(Example 1: writing instructions for the planning team to help product planning, example 2: modernization of the production method.)

New knowledge is created but not told to others

After knowledge has been shared, the junior modifies or changes it – by himself or with the senior or with other people inside or outside of the firm – and then starts to use it. (Example: application of a simulation program for own use only.)

New knowledge is created and told to others

After the knowledge has been shared, the junior modifies or changes it – by himself or with the senior or with other people inside or outside of the firm – and then starts to use it. In one way or another, he tells about the new knowledge to the other members of the firm. (Example: building of a simulation program which helps system planning and dealing it out to everybody who might need it.)

New knowledge is brought to the firm by the junior

The junior has valuable “ready-to-use” new knowledge when he arrives to the firm, but the senior does not want to use the knowledge.

(Example: modernization of the working methods.

Eventually, this knowledge will be used since the junior tells the knowledge to the other members of the firm and they want to take it to use.)

It is, however, rather vague to talk about “new knowledge”, since the line between applied knowledge and new, created knowledge can be very blurred. Whether knowledge within the firm was applied or created, it is obvious that in the succession of the studied firm knowledge was changed in the ways that benefit the firm.

Leonard-Barton's [2] concept “expert intuition” describes well the tacit knowledge the seniors in the firm have. Expert intuition is based on accumulated knowledge and

experience that results in capacity to recognize and retrieve patterns from memory. This intuition is built upon the individual's immersion in a rich pool of personal knowledge about customers, technologies, markets, standards etc. Besides this tacit knowledge, which the seniors cannot express, they have implicit knowledge which seems to be easy to share with others.

In the studied firm, the knowledge applied or created by the juniors seems to be involved with the product planning for customers or with the modernization of the existing production methods, not with the development of products or production. The main reason for this is that the juniors do not have the know-how needed for development projects. Even the application or creation of the knowledge which helps product planning or current production happens in interaction between the seniors and the juniors, since the juniors do not know the products, the production processes or the customers' needs well enough. On the other hand, the juniors have high level and up-to-date know-how in technology which enables them to build simulation programs for system planning etc. It is obvious, though, that some of the seniors refuse these renewals, whether related to their own work or to production.

Within the firm, implicit knowledge is probably the most shared type of knowledge between the seniors and the juniors: it is the knowledge not written down on papers or in computer files but at the same time it is something so obvious or clear that the juniors find it is easy to make questions about it. And the seniors are happy to answer because during these discussions based on asking-and-answering they know that the juniors are learning something: "How can I know what he does not know if he does not ask me?", was a common comment from the seniors in the interviews.

According to Choo [10], an organization can create new knowledge only if it gets new incoming knowledge outside of an organization. However, Choo does not mention new employees as possible "new knowledge couriers" but suggests that new knowledge would be gathered from customers, subcontractors, experts etc. On the basis of the preliminary results of this study it seems that in the succession in the firm, new employees can be potential "couriers" of new incoming knowledge and potential "triggers" of organizational renewal – if they are treated as such and if their ideas are heard.

The term absorptive capacity [18], [19] refers to an organization's ability to evaluate and use knowledge coming outside of an organization. In absorptive capacity, the diversity of knowledge within an organization is essential, because it increases the probability of relating new incoming knowledge to what is already known. The preliminary results of this study prove that in the succession, new employees can bring, besides new knowledge, new standpoints and ideas to the firm – an intelligible result in this case where the age difference between the seniors and the juniors is, at most, 40 years.

All the interviewees explained how the most rewarding teaching and learning situations are "naturally" appearing

problem situations (problems in production devices, faults in products, customer reclamations etc.). In these situations they are pulled away from their safe and familiar every-day life. No one knows the right answer and in order to find it all possible knowledge and viewpoints are needed, everybody's input is valuable. The juniors spoke about these situations with deep enthusiasm: how great it is to see things happening in practice, how illuminating it is to understand reason-effect-relationships through experience. Also the seniors found these situations fruitful for learning since in them they can be sure that the juniors are learning. How can they be so sure? Because it is in this kind of situations they themselves did learn their work: "The only way to learn this job is by doing it.", "Back then we did not know what we were doing or what would happen, we just did – and learned".

V. CONCLUSION

The paper discussed organizational succession process from a knowledge-based view. Succession was approached as a context where senior and junior employees make sense of new situations and construct and modify knowledge. The purpose was to find out how and in what kind of interaction knowledge is used and changed in the succession of the expert company. We found that social interaction related with the succession leads not only to transferring the existing knowledge of the senior workers to the newcomers. In addition, new knowledge can be applied and created in the context of master-novice interaction. The preliminary results of our study prove that in the studied firm, the newcomers bring in new ideas, standpoints and knowledge that are valuable to the firm, as well as apply and change the existing organizational knowledge. Thereby succession is not only a process of producing continuity of organizational knowledge, but also of renewing it.

In order to make succession a part of organizational renewal process, firms – and especially managers – should understand succession as a two-way process of active knowledge co-construction instead of a one-way process of information transmission. Newcomers are willing, maybe even eager, to put their knowledge to the use of their firm if they are given an opportunity to do so. On the other hand, senior workers could be more motivated and less resistant of change if they knew that their current positions will not be threatened because of renewals. In this way, an organization could benefit both from transferring the existing valuable knowledge, as well as creating new useful knowledge.

The sense-making approach provides both a theoretical framework and a methodological tool that can deepen and enlarge our understanding of organizational knowledge. Sense-making focuses on real-life working processes where individuals seek and use knowledge. It can therefore open new paths for understanding the continuously renewing organizations.

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Literature Review: The Paradox of Social Network Ties in Creating Knowledge

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Abstract — Knowledge creation, as a salient concept in recent literature on business and strategic management, has been examined as one of the most valuable capabilities of firms. As the increasing impact of globalization and high competition challenge the firms to manage knowledge efficiently, social network ties among firms come to agenda. Network ties are beneficial in knowledge creation process since knowledge creation is a social process, in need of coordination and cooperation with partners who possess the knowledge the firm requires. Combination and exchange of knowledge is realized in social networks. The central argument in that context is which ties are more beneficial: Should firms forge strong or weak ties in their inter-organizational relations to strengthen their knowledge creation capability is the question that tried to be examined in this paper. According to weak-tie theory, distant and infrequent ties are proper since they provide novel and diverse information from disconnected actors. However, strong-tie theory provides that frequent and long-lasting relationships are more conducive to support knowledge creation since they include trust, reciprocity and willingness to share the resources. The aim of this conceptual paper is to examine the extant literature concerning social networks and knowledge creation to develop a tentative model which presents the conditions affect the decision of utilizing strong or weak ties. Different benefits are embedded in these ties, but the point is to get understand under which conditions a strong or a weak tie generate a better return in knowledge creation process.

Keywords — knowledge creation, social capital, weak ties, strong ties

INTRODUCTION

In view of increasing globalization and intense competition, knowledge is becoming more and more important for firms competing in a rapidly changing environment [1]-[2]-[3]. Firm competitiveness is mostly achieved by having the continuous ability of forming, disseminating and applying new knowledge [4]-[5]. Kogut and Zander (1996:503) define firms as social communities specialized in knowledge transfer and creation. What makes a firm predominant in markets is not the capacity for reducing costs, but the capacity for managing knowledge [6].

Researchers recently have pointed out that social network ties are a key factor in understanding and managing knowledge creation process. Forming network ties is a prevalent form of cooperation for gathering resources and gaining competitive advantage in international arena [7]-[8]-[9]. Knowledge creation conditions which are labeled as combination and exchange are directly affected by social network ties since these ties facilitate the flow of knowledge and other resources [10].

By accessing knowledge through networks, a firm can utilize its network partners' assets to create new knowledge and enhance its competitiveness.

The purpose of this study is to analyze the extant literature conducted on the relationship between social ties and knowledge creation process. The primary cause for this study is a theoretical controversy where the key concepts of networks, social capital and knowledge creation intersect. To fulfill the intentions of this paper, research databases including ABI Inform and EBSCOhost were used and also working papers and books were reviewed.

KNOWLEDGE CREATION

Knowledge creation results from new combinations of knowledge and other resources [4]-[11]

Shawney and Prandelli (2000:27-28) have studied the concept of knowledge: Knowledge is;

- socially spread and influenced by social settings,
- a social construction, embedding in lasting relationships,
- developed through participation in "communities of practice",
- catalyzed by the development of network organizational structures,
- continuously changing from individual to social, from tacit to explicit.

In this sociological approach, knowledge creation is "an emerging, dynamic and diffuse process" and "new knowledge is the output of a synergistic interplay between individual contributions and social interaction" [12]. Nonaka and his friends (2006: 1179) conceptualize organizational knowledge creation as "the process of making available and amplifying knowledge created by individuals as well as crystallizing and connecting it with an organization's knowledge systems" [13].

Knowledge creation, a path-dependent evolutionary process, is the result of changes and development of existing knowledge, know-how and experience [11]-[14]. Creating new knowledge requires combining elements previously unconnected or developing novel ways of combining elements previously related [15].

According to the knowledge-based view of the firm, firm acts as an institution for accumulating and integrating knowledge [1]. To gain organizational advantage on the market, it is critical to have a superior capability in creating and transferring knowledge. Although some firms have limited firm resources, they have the opportunity to survive and grow through forming and developing social ties.

Because of the fact that creating and transferring knowledge is a social process, social capital has a vital role in this process. Access to new sources of knowledge is one of the most important direct benefits of social capital [15]-[16]. It governs the flow of information and resources [17]-[18]-[19]-[20]-[21] and reduces the probability of opportunism [22]-[23]-[24]. Many of the researchers accept that intensive social interactions facilitate the process of knowledge creation [25]-[26]. When the transmission of knowledge from individual base to collective base is realized, then knowledge creation can be occurred [27]. It is a social process and resides in a network of individuals [28]-[5]. As Powell (1990: 304) states:

“Networks are particularly apt for circumstances in which there is a need for efficient, reliable information. The most useful information is rarely that which flows down the formal chain of command in an organization, or that which can be inferred from price signals. Rather, it is that which is obtained from someone you have dealt with in the past and found to be reliable. You trust information that comes from someone you know well” [29].

Networks can be developed between individuals, groups, organizations, as well as between collectives of organizations. The term network indicates the relationships between these actors. This paper focuses on the inter-firm networks as a core element of social capital in knowledge creation process.

SOCIAL CAPITAL

The emphasis on the significance of social relationships is summarized in the concept of social capital. Social capital is gaining prominence as a concept that describes and characterizes the set of relationships of actors. In view of the fact that various disciplines like economy, sociology, political science have examined and accept the concept of social capital, there remains widespread uncertainty about its meaning, sources and effects. While the concept's application in different areas brings the richness of the idea of social capital, but at the same time limits the development of the theory of social capital [30].

Social capital concept firstly placed in written literature in 1916, by Hanifan, in context of the importance of common participation in successful schools. Moreover the first systematic sociological analysis of social capital was accomplished by Bourdieu. Bourdieu (1986:248) defined the concept as “the aggregate of the actual or potential resources which are linked to possession of a durable network of more or less institutionalized relationships of mutual acquaintance or recognition” [31]. But also, adaptation and utilization of social capital in different areas were realized by Coleman, Putnam, Fukuyama and Burt. The common point of these various scholars is that social capital presents the ability of actors to secure benefits by virtue of membership in social networks [22].

Comprehensive review of social capital definitions enables to seize the various approaches used in studying social capital [32]-[33]. Fundamentally, two perspectives emerge from those definitions. Firstly, the analysis level of concept is changed due to which discipline examines the idea of social capital. Whereas some scholars examine the social capital of communities or nations, the others analyze individuals', teams' or firms' social capital level. How the direct benefits of social capital are managed form the second perspective. Some scholars like Coleman (1988), Putnam (1995) conceptualize social capital as a public good which means that it is owned by communities and they are the actors who firstly benefit from that [34]-[35]. The other scholars suggest that social capital is a private good. It is not a public good distributed in a social unit. Individuals access and gather that capital according to their positions or strategies that form the positions [10]-[36].

In this paper, a definition of social capital offered by Nahapiet and Ghoshal (1998:243) is accepted: “Social capital is the sum of the actual and potential resources embedded within, available through and derived from the network of relationships possessed by an individual or social unit.” [15]. This definition includes both the private and public good perspectives of social capital. This view of social capital possesses the proposition that social networks play a vital role in the actions of actors.

Nahapiet and Ghoshal (1998) have suggested three dimensions of social capital:

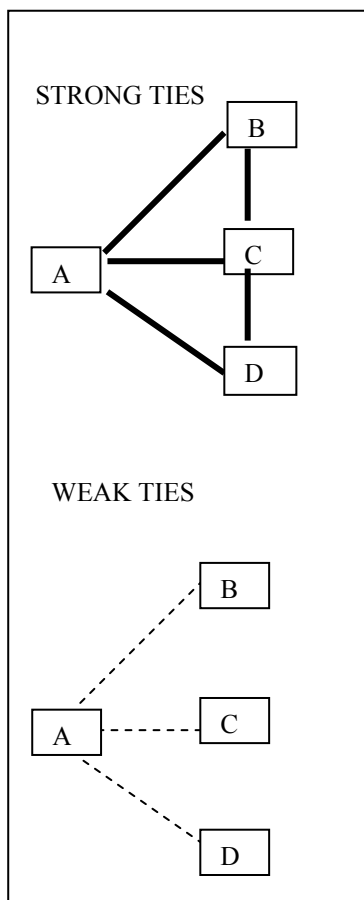
- Structural Dimension: The structural dimension of social capital involves the pattern of relationships between the network actors and can be analyzed from the perspective of network ties, network configuration and network stability.
- Relational Dimension: This dimension involves the relationship types which are developed through interactions among parties.
- Cognitive Dimension: Cognitive dimension refers to the resources which present shared representations, interpretations and systems of meaning among parties.

Due to the fact that this paper basically examines social network ties in context of knowledge creation, only structural dimension is taken into account. A key feature of networks is repeated and enduring exchange relationships between network actors [37]. Ties are a fundamental aspect of social capital, because they provide access to resources [15]-[33]-[38]. The social network ties facilitate intermember social interactions and provide channels for knowledge exchange.

The concept of tie strength has been considered as a basic feature of social relationships. Granovetter (1973) is accepted as one the scholars who have examined the strength of weak ties first. According to Granovetter, weak ties among interpersonal relations facilitate to reach particular aims by accessing more social capital. He identified the strength of ties as “the combination of mutual

obligations, intimacy, emotional intensity and the amount of time. Strong ties are the ties involve frequent interaction and intense emotional relationships; whereas weak ties are conceptualized as the ties involve less interaction and less emotional relationships. The basic argument of Granovetter was that to access more relevant new information a weak tie is more proper than a strong tie, because a weak tie is more likely to form a bridge between different social circles [39]. This bridge acts as a unique direct tie between two networks, which does not possess a tie between each other [40]. According to weak-tie theory, strong ties are less likely to act as a bridge, because strong ties make the actors familiar with particular qualifications, especially with the knowledge being transferred [39]. Figure 1 shows the differences between weak and strong ties; in extant literature strong ties are presented with solid lines and weak ties are with dashed lines [41].

Figure 1: The Images of Weak and Strong Ties



Source: Adopted from Boorman (1975: 218)

THE PARADOX OF TIE STRENGTH IN KNOWLEDGE CREATION PROCESS

Today a firm's alliance partners are the most important source of new ideas and information that result in innovations [42]-[43]-[44]-[45]. Ayvay and Jyrama (2005) and Nielson (2005) indicate that collaboration and alliances between researchers generate a synergy of knowledge that is greater than the knowledge that can be created by each researcher independently [46]-[47]. An individual creates new knowledge by forming social interactions. Social relationships include the ability to share and integrate different mental models and theories which form different areas of expertise; besides they also provide a mechanism for rapid feedback and capitalize on existing knowledge of other researchers [48]. External collaboration is used in every step of production process from discovery to distribution. When industry is characterized with complex knowledge, it is positively correlated with the intensity and the number of alliances in that industry [49]-[44]. Forming strategic alliances need to utilize network ties. Social networks create opportunity for collaboration; large and diverse networks provide firms with access to knowledge, enhance their innovation capability and learning speed. [49]-[50]-[38].

The optimal strategy for firms to use in building relationships with other firms involves the use of both weak and strong ties. The optimal network structure involves a mix of weak ties for flexible adaptation for market demands and embedded ties for enriching networks [51]-[40]-[52]-[53]. To follow a contingency approach is more conducive to utilize social ties in knowledge creation process. Some important factors have to be examined in building the optimal network structure:

A- The Process of Knowledge Creation

Knowledge creation process has to be analyzed in deciding whether weak or strong ties are used, because each process of knowledge creation has different requirement.

- Search of Knowledge:** In that process, the focus is on searching, identifying and noticing the useful knowledge exists in other firms [54]. Weak ties are important for searching novel, additional information; strong ties are not proper in searching for new knowledge since strong ties develop among the actors who have the same qualifications; then the flow of knowledge is redundant [55] and involves a high cost [54].
- Transfer of Knowledge:** The movement of knowledge from one unit to another is the result of being affected by the experience of that unit [56]. For knowledge transfer to occur in alliances, strong ties between the partners are necessary [57]-[27]-[58]. On the absence of strong ties, especially in alliances between the necessary relationships that allow managers to share knowledge willingly. Hansen and his friends (2005) analyze the knowledge sharing in three phases according to social network subsets. They find that weak ties are

required on the searching process; whereas strong ties are required on the transferring process [54].

- c) **Creation of Knowledge:** In this process, the focus is on jointly engage in knowledge development process. Discussing, sharing, brainstorming and engaging into joint discovery and experiences needs strong ties [59]. Strong ties are needed for reformulation and validation of new knowledge that requires trust and willingness [60]. For implement new ideas we need coordination and this requirement is fulfilled by dense, strong ties [61]-[62]-[63]. The important point in that sense is too high communication and interaction may hinder the creativity potential. Flexible thinking and diverse perspectives are essential parts of innovation [64]. This means that moderate level of strong ties are much more proper than so close, embedded ties which have a potential to hinder to form external relationships [54]-[65]-[66].

B- Type of Knowledge

The type of knowledge is considered as information and know-how. As information refers to knowing what something means, know-how refers to knowing how to do something efficiently. Complexity and codifiability are two dimensions determine the type of knowledge. Coded knowledge is structured into a set of identifiable rules and be easily accessed, stored and shared [11]. Knowledge complexity, which is the degree of codifiability, and the stage of knowledge creation have a major effect on determining the type of tie. The two basic stage of creation are searching (access to new knowledge) and transferring (to move and incorporate of knowledge). Hansen (1999, 2002) has analyzed the role of weak ties on knowledge sharing in a new product development projects in a multinational organization. Strong interunit ties provide the highest relative net effect when knowledge is highly complex, whereas weak ties have the strongest effect when knowledge is not complex [67]-[68]. Given that strong ties require a greater investment of time, Reagans and McEvily demonstrate it is inefficient to use strong ties to transfer codified knowledge [64], but conversely Kauffeld-Monz designates the opposite finding that strong ties are useful in transferring codified knowledge [69]. Weak ties are not proper for transferring tacit knowledge, since interaction is infrequent to interpret and modify the knowledge; moreover tacitness and complexity create ambiguity which has a negative effect on knowledge transfer [70]. Transfer of tacit knowledge may require the development of a shared code in a long-term, strong relationship and working closely [71]. Uzzi and Lancaster (2003) found that weak ties proper when the knowledge is public, such as company reports. Strong ties strongly promote the transfer of private knowledge which is called unpublished aspects of the firm's strategy, success plans; thereby since private knowledge needs trust and to be protected from misuse it is sensible to use strong ties in transferring private knowledge [19].

Table 1: The Relationship between Type of Knowledge and Weak/Strong Ties

	Codified	NonCodified
Search	Weak Ties	Weak Ties
Transfer	Weak/Strong Ties	Strong Ties

Source: Adopted from Hansen (1999: 89).

C- Knowledge Creation Strategy and Type of the Environment

Firms' behaviors are affected by the external environment. Firms in volatile or turbulent environments are conducive to alter their strategic orientations than firms in static environments [72]. Market turbulence, technological turbulence and the degree of competition signs the density of volatile environment [73]. The relationship between the firm and its environment points out how the firm develops its network [74]-[75]. According to March (1991) strategies linked to knowledge creation aim to explore new opportunities or exploit existing capacities. Complex search, innovation, variation, risk-taking, relaxed control, loose discipline are the concepts characterized exploration [76]. In exploratory strategy, the focus is gathering new information on many different alternatives. The emphasis is on identifying viable alternatives rather than fully understanding how to develop any one innovation. Thus, explorers concentrate on broad searches through weak ties. The returns of exploration are distant in time and highly variable [77]. Refinement, choice, production, efficiency, implementation are the concepts characterized exploitation [76]. In exploitative strategy, the emphasis is on refining an existing innovation by gathering specific information that will provide deeper knowledge in that particular area. In a local area, a deep search is needed through strong ties. Şimşek and his friends (2003) analyze the same knowledge creation strategy under the name of incremental and radical entrepreneurial behavior. Their findings indicate that weak ties promote the radical innovations due to diverse information obtainment; strong ties promote the incremental innovations due to tacit information [78]

Table 2: The Relationship between Knowledge Creation Strategy and Weak/Strong Ties

Knowledge Creation Strategy	Tie Strength
Exploration	Weak Ties
Exploitation	Strong Ties

This exploration-exploitation dilemma assumes a strategic choice according to environment turbulence. Firms require these two types of knowledge; exploitation brings the use of current knowledge, whereas exploration brings the use of historical knowledge that is unforgotten or uncovered. The sine qua non point is to balance these two

strategies in knowledge creation process [76]-[79]-[77]. Excessively conducted exploitation strategy could bring similar recombinations and it is more likely to be discovered and used by competitors. It means that the advantages of exploitation could be short-lived. Meanwhile, excessively used exploration strategy may cause to reach no longer relevant knowledge that do not offer the best solutions and may suffer from high costs resulted from so many experiments [76]-[14].

However, since resources are scarce, they have to invest them in respect of the environmental uncertainty. However, the extant literature involves controversial perspectives concerning which type of knowledge creation strategy is congruent with environmental uncertainty, some authors point out that environmental uncertainty is likely to be decreased by making coordination with repeated, old ties [80]-[74]-[81]-[7]-[8]-[52]. When environmental uncertainty is high, the partners are looking for trust and stability. Instead of forming new relationships with new partners, reinforcing existing relationships with older partners is less risky. Forming additional relationships with existing partners is a form of exploitation and creates strong ties [80]-[82] and develops trust between partners [7]. Kraatz cites that strong ties diminish uncertainty through providing in depth exchanges of knowledge [55].

Besides the above arguments, some authors indicate that when the environment is unstable and the rapid of change and innovation is swift, exploration, the environment for emerging innovations is required. Actors have to explore emerging know-how and innovations; new ideas gathered from diverse and broad scope are required to survive in high competition and diminish uncertainty [53]-[83]. Contrast, when the environment is stable, then exploitation, the degree to which firms' strategies are designed exploit existing technologies, information, is important for firms. So we can say that firms' decision to invest the type of knowledge is partly determined by the environmental context surrounding the firm. As the uncertainty increase, firms to be survived have to realize more innovations. Thus, gathering new information from many alternatives is required in exploration. Whereas, in exploitation, the emphasis is on refining on existing innovation by gathering specific information that will be provide deeper understanding. Different ties are required in different context. The strong tie argument is sensible when dealing with lower environment uncertainty which demands more exploitation. Although strong ties require more frequent interactions and commitment of resources, strong ties provide rich exchanges of customized information. The weak tie argument is sensible when dealing with higher environment uncertainty which demands more exploration. This is why exploration does not require a deeper knowledge of a specific innovation that is obtained through strong ties. Moreover, the time and resource obligations of strong ties diminish the number of a contact a firm can maintain and therefore restrict its reach into divergent sectors of the environment. This means that whether firms should form their networks through strong or weak ties depends on partly the environmental context. [84].

Koka, Madhavan and Prescott (2006) cite that not only environmental uncertainty but also the amount of resources (which is labeled as "munificence") are critical for forming new ties, which indirectly affects the strength of ties used in knowledge creation strategy. When munificence is decreased, the ability of firms to create new ties will be limited [85]. Under the conditions of high uncertainty, the other factor which has to be taken under consideration is the availability of resources in the environment. If resources are scarce, then using strong ties can be more suitable.

Larson (1992) has shown that strong ties promote and enhance trust, reciprocity, mutual interdependence and long term perspectives [82]. Kale, Singh and Perlmutter (2000) found a positive relationship between the strength of ties and the degree of learning in alliances. Relational capital based on mutual trust and interactions at the individual level between alliance partners create a basis for learning and know-how transfer [86]. A strong tie brings mutual trust through shared language and shared vision [87]-[88]-[44]. Dense, strong ties between partners are likely to help in curbing opportunism. In this type of network, opportunistic acts diffuse rapidly to other actors [89] and the result of these acts are being excluded from information networks [90]. As the strength of a relationship increases, the possibility of moral exclusion decreases [91]. Strong ties are needed to continue important cooperative relationships.

Hagedoorn, Cloudt, Kranenburg are analyzed the effect of inter-firm R&D network ties on the technological performance of companies in high-tech industries. They find that strong ties in terms of dimension time and depth, measured by length and multitude of partnerships, degree of cooperation and similarity of ties improve technological performance. However, the cultural closeness dimension, the degree which a company has established partnerships with companies from countries that are culturally similar, support a weak tie perspective [92]. International diversity is important in acquiring new and diverse ideas come from multiple markets and different cultural perspectives [93]. Their research suggests that a combination of stronger and weaker R&D ties, with elements of both social embeddedness and international diversity is most beneficial for the technological performance of companies. A similar result has been reached by Jack; strong ties link into wider social structure and draw benefits into the business [94]. Strong ties act as a mechanism for generating knowledge and resources and provide a mechanism to invoke weak ties.

Yli-Renko, Autio and Sapienza (2001) have analyzed the effects of social capital in key (single largest) customer relationships on knowledge acquisition and knowledge exploitation in 180 young technology-based firms in United Kingdom. By examining social capital in three distant dimensions, they found that social interaction and network ties are positively related to knowledge acquisition in young technology firms; whereas relationship quality which includes trust is negatively related to knowledge acquisition. Intense, repeated interaction facilitates not only knowledge acquisition, but also enhances the ability of a

firm to recognize and evaluate the relevant knowledge. Consistent with the result of social interaction, network ties which link the firm to broader set of ties enable to transmission of novel information from a variety of external relationships. Although the higher level of social interaction and network ties have a positive impact on acquiring knowledge, the higher level of trust has a negative effect. [95]. One possible explanation of this result can be made according to Uzzi's article. Uzzi (1997) posited that intense, close relationships restrict small firms to form external ties which are the sources of diverse information. [51]. To acquire novel and new ideas, weak ties are more appropriate since they enhance the ability of connect different and unique ideas. Molina-Morales and Martinez-Fernandez have also found social interaction and trust have a non-linear (inverted U-shaped) relationship with innovation [96]. A high degree of social interaction and trust can curtail to follow new opportunities due to strict obligations and lack of autonomy they embrace.

D- The Life-Cycle of the Firm

To analyze the relationship between strong and weak ties, it is vital to put emphasis into the stage of the life cycle of organizations. Emerging firms have less reputation and the other organizations don't perceive them as a potential tie; since they are small and new, they don't know where the knowledge resources are and how to access them. In that stage, strong ties will play an important role to overcome various challenges in terms of limited resource access and to welcome the need of frequent communication for flowing valuable information [97]. When emerging firms began to grow and come to an early grow stage, and then weak ties become important according to access a wide range of resources [98]. Each organizational life cycle stages has unique context that influences the extent and nature of resources; so this strategic context affects the benefits of network composition [99].

To analyze the relationship between strong and weak ties, the other factor may be the aims of network members. Competitors, in the same industry, look forward to share their knowledge and develop technological linkages. In this linkage, a collaborative milieu and overcoming opportunism are essential to success then closed networks are likely to be more beneficial [9]. The type of industry is also important since the aims of network members are shaped in parallel with industry characteristics. Walker and his friends analyze the relationship between network formation and social capital in biotechnology startups. Their findings assert that strong, embedded ties of startups are likely to have more relationships with new partners in the following time period. This industry has last long relationships, firms have mutual dependent, so far these inputs are covered strong relationships between partners. May be sparse, weak ties are more apt in industries which have short relationships and more market transactions [89]. Some industries are the base of competition; high competition requires to think and act speedy and efficiently. It is obvious that these characteristics may change the type of network ties [11].

E- The Optimal Network Structure

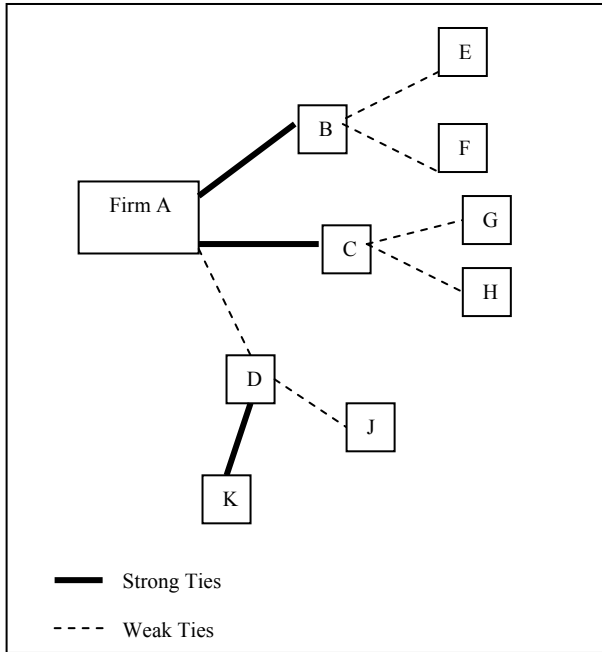
To sum up, according to the review of literature, neither weak nor strong ties are superior to one another in creating knowledge. Different benefits are embedded in different types of ties. (See Table 3)

Table 3: The Benefits and Costs of Weak/Strong Ties

	KNOWLEDGE	
	Benefits	Costs
Weak Ties	<ul style="list-style-type: none"> - Accessing novel/diverse information - Searching for new opportunities - Providing autonomy - Flexibility to shift exchange sources - Less Costly - Transferring of codified knowledge 	<ul style="list-style-type: none"> - Lack of mutual obligation - Lack of trust - Inhibiting the transfer of tacit knowledge - Restricting to build long-term relationships
Strong Ties	<ul style="list-style-type: none"> - Promote cooperation in an exchange - Include trust, reciprocity - Enhance knowledge sharing, joint-learning between firms - Transferring of tacit knowledge - Implement strategic initiatives 	<ul style="list-style-type: none"> - Inefficient for transferring codified knowledge - More costly - Brings redundant information - Constrain new knowledge flowing - Lack of opportunity to shift knowledge sources

According to Uzzi (1997), a firm should sustain mostly strong ties with its direct ties and both weak and strong ties with its indirect ties which are formed through direct ties (Figure 2). A mix exploitation of indirect ties with diverse tie strengths may enhance the opportunity of resource acquisition [51]. Especially, when the resource owner does not have a adequate prior knowledge about the firm, strong tie between resource owner and the common third party provides a knowledge-based trust [100].

Figure 2: The Optimal Network Structure



Source: Adopted from Uzzi (1997:60)

E- Development of a Tentative Model of Tie Strength and Knowledge Creation

Based upon the review of literature on strength of ties and knowledge creation, the integration of salient key

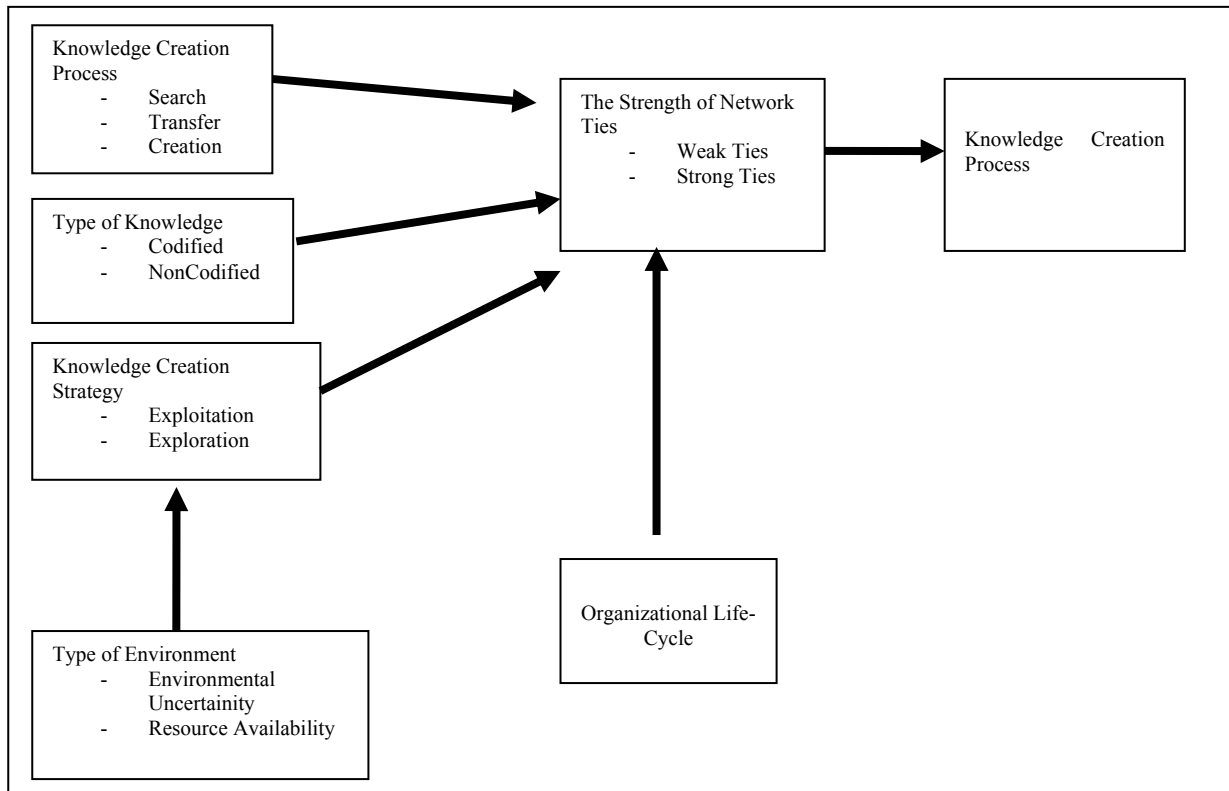
findings has enabled this study to develop a tentative model that further requires a more comprehensive, additional brainstorming and elaboration. (See Table 4)

IMPLICATIONS FOR PRACTICE AND RESEARCH

According to the literature of social networks and knowledge creation, network ties provide benefits associated with knowledge acquisition and creation. However, the relationship between strength of tie and knowledge creation has been exposed to contradictory findings. As some scholars suggest, weak ties are more beneficial in providing novel and diverse information; whereas strong ties are more beneficial in transferring tacit and specialized knowledge due to trust and reciprocity they consist of. Since different benefits are embedded in each type, to develop a model that shows the conditions to adjust the mix use of weak and strong ties can enhance the ability of performance of knowledge creation.

To sum up, the development of this tentative conceptual model provides gaining a perspective that affects a proper choice about the type of ties under certain conditions. These conditions are examined as type of knowledge creation process, type of knowledge and knowledge creation strategy.

Table 4: A Tentative Model of the Factors Affecting the Relationship between Tie Strength and Knowledge Creation Process



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Mapping Client Expectations for Better Business Design Innovation

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Abstract — This paper looks at the impacts of customer centricity (business models focused on understanding customer needs) and pull orientation (value chains whose output is dictated by end-user demand rather than producer capacity) on business design innovation in a new economy context. The key concepts are represented as client expectations. These are mapped over a business design framework, showing how they impact all aspects of the business in various ways. The result is a rich yet simple semantic network yielding relations, dependencies and synergies at a glance, based on the co-authors' Tetrahedral Business Design Framework.

Keywords — client expectations, business design, business models, innovation

I. INTRODUCTION

This paper looks at the impacts of customer centricity and pull oriented value chains on business design innovation in a new economy context. Customer centricity entails two basic premises: understanding customer needs and actually focusing the business model on reaping profits from the satisfaction of identified needs (Slywotsky & Morisson, 1998; Rayport & Jaworski, 2003). Pull orientation is the value chain configuration which most easily fits a customer centric business model, as it places customers in the driver's seat of value creation. In other words, value chain output is dictated by end-user demand rather than manufacturer capacity. A customer centric, pull oriented design relies on information and customer knowledge, something the new economy makes much easier to collect and use (Rayport & Sviokla, 1995). But how does one translate such customer knowledge into innovation? Design should be understood as the planned and emergent complexity which permeates a business endeavour. This holistic conceptualization of the new economy business helps put client centricity and pull dynamics in their larger perspective, making it easier the find leverage for innovation inside and outside the business (Hamel, 2000).

The key concepts underpinning customer centricity and pull-oriented value chains are represented as client expectations, obtained through rich business leader feedback and literature reviews. The key concepts underpinning business design are represented through the authors' Tetrahedral Business Design Framework (Caisse

& Montreuil, 2006).

By anchoring client expectations to the Tetrahedral Business Design Framework, this paper suggests a novel way to understand how customer centricity and demand driven value chains impact businesses as a whole. These insights, bound together as a nexus of interrelated and interdependent concepts, provide the seeds of better business design innovation.

The paper is structured as follows: New economy client expectations are presented and mapped generically in section II. Business design is presented and conceptualized through a framework summarized in section III. Client expectations are conceptually anchored to the business design framework in section IV, and are shown to impact all aspects of the business in various ways. The result is a rich yet simple semantic network yielding relations, dependencies, synergies and seeds for business design innovation. The paper concludes with major insights and venues for future research.

II. CLIENT EXPECTATIONS

What is an institutional buyer actually aiming for when choosing a supplier? What lurks in the mind of a Web surfer looking for a deal on the Internet? Whether in business-to-customer or business-to-business relationships, clients expect their needs and desires to be fulfilled in different ways (Pine & Gilmore, 1999). These expectations vary according to various circumstances, but common traits can be observed.

Figure 1 graphically models client expectations in a generic way, cutting across culture and industry (Montreuil 2004). What lies at the center of the figure represents expectations which need to be fulfilled first in order for the purchase evaluation process to continue. As one gradually moves to the periphery of the figure, one finds expectations which may linger well beyond purchase, but still echo those first expectations.

In the core circle of Figure 1 lie the three basic expectations which underpin the mere existence of a client-supplier relationship: Fit, Competency and Integrity. Whenever their fulfillment is felt to be lacking, the customer will likely not even consider entering into a business relationship with the supplier or will terminate the relationship already engaged. Fit refers to basic face value fulfillment: it is about function, form and style. For example, someone looking for a portable computer may see a fit with notebooks and PC tablets, but not with palmtops or handhelds. Fit allows one to weed through the market's

offers and focus one's attention on a shortlist of offers. Competency refers to the customer's evaluation of the business' ability to create the offer it presents. It is about the client's subjective evaluation of the supplier's know-how, attitude and ability. Keeping the example of the portable computer, a customer may have faith in brands which he has previously experienced with related products, or might doubt a new manufacturer's ability to make a reliable notebook. Integrity refers to one's trust in the business to actually deliver the offer it professes to be able to provide. For example, a customer might have doubts about a retailer's confidentiality statement or shipping policy. Even though part of the offer may be a fit in terms of competency, a lack of integrity is likely to stifle any business exchange.

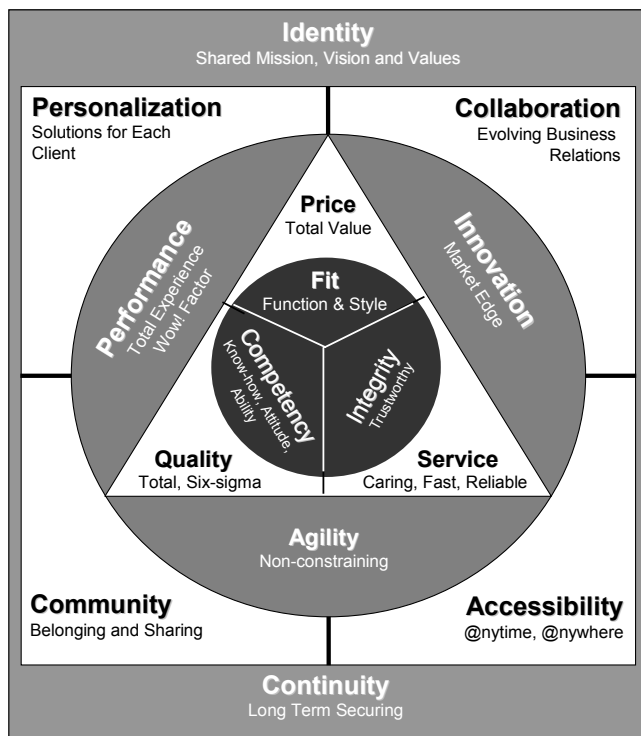


Figure 1. Client Expectations Model

In a triangle encased within Figure 1's largest circle lie the three most widely acknowledged client expectations: Price, Quality and Service. Price is a value meter, stating how much fungible value is expected from the customer in exchange of an offer. At the basic level it is a price tag comparison. At higher levels it is about total cost of doing business with the supplier and about business value propositions. Quality refers to craftsmanship and how well the offer conforms to what the customer knows to expect from similar offers. This expectation lies at the heart of business movements such as Total Quality Management and Six Sigma. Service is about how the client is dealt with by the supplier. It is about care and empathy, as well as speed and reliability. It applies prior to sale, during sales delivery and after a sale. Service expectations involve the basic evaluation of risk in an offer: if the client needs help in the future, will he find it and under which conditions?

The largest circle in the client expectation model encompasses expectations of Performance, Innovation and Agility. These can be promised, but can only be met, missed or surpassed after the customer's purchase. Performance refers to how well the value offering actually does when used. This is in sharp contrast to quality, which depends on perception and knowledge. For example, a tool of great quality may remain unused and meet the customer's expectations because he likes to own the prestigious object. Performance requires more: meeting, failing or surpassing this customer expectation requires actual use. Performance is not simply about the product or service; it is about the entire business. It is about the total experience lived by the client. It is about the Wow factor, how easy and fun it is to do business with the supplier. It is about how those little details and attentions sum up to make a huge difference.

Innovation refers to an offer's empowering features: can it give its customer a market edge, now and especially in the future? Again, this is something which can only be revealed by action. Innovation is about a supplier becoming a key factor in the client's self-realization. Innovation is about the future; from the client's perspective it is a projection of the supplier's ability and willingness to contribute significantly to the competitiveness and originality of its future offering development.

Agility refers to the supplier's ability and willingness to absorb changes and fluctuations, to meet emergent needs. It is about the supplier not being a constraint, but rather an enabler. Is the supplier capable of handling significant surges and downfalls in demand and important migrations in product mix demand repartition without complaining? Is he capable and willing to follow the client's pathway through a turbulent and competitive business environment?

The fourth group in the client expectation model is represented by a rectangle housing four expectations which the new economy makes ever easier to fulfill: Personalization, Collaboration, Community and Accessibility. These are not new; they have been the routine trade of local craftsmen for centuries, but have been somewhat muffled by industrialization. Personalization refers to tailoring offers as customer specific solutions. It is about focusing on the individual client. Personalization is widely encompassing in terms of product, service, price, financing, etc.

Collaboration represents the temporal element of information sharing and interaction between the supplier and the client. Can the offer be the foundation of richer value created in synergy over time? The more important a supplier is from the client's perspective, the more the client wants the supplier to become a partner in his value creation network. Community represents common wealth, or the belonging and sharing of expertise and wisdom. The client does not want to become isolated through his choice of supplier. Rather, he wants his relation with the supplier to grant him access to a community within which he can find help, support, comprehension and leverage. Accessibility refers to the abolishment of constraints of space and time. In other words, thanks to the Internet, the local village

craftsman can now be the global village craftsman. In fact, the aim is for anytime, anywhere accessibility to the supplier's attention, resources, products and services, be it physically or virtually depending on the client's needs.

In the fifth and last group, the outer envelope of the client expectations model includes two high level expectations: identity and continuity. These two latter expectations come to play especially in high stakes relationships with a supplier, yet they permeate ever more into everyday practice.

Expectations of identity represent value brought to play on shared mission, vision and values. Can the offer enhance who the client is now, as well as who he wants to become? Does the client want to do business with or to be associated with the supplier given its fundamental essence, its worldview and its strategic intent? Where does the supplier stand relative to his social and environmental role, and relative to salient ethical issues?

Expectations of continuity represent value brought to bear on long term safety and stability. Will the supplier be there next year? In three years? In ten years? When contracts involve infrastructural investments, long term guarantees and long lasting technological alignment, continuity of existence and persistence over the long run become very important.

The client expectations model of Figure 1, with its five-tiered fifteen generic types of client expectations has been introduced to and discussed with hundreds of business leaders. There is unanimous consensus on its thoroughness and logic. The model makes sense to them.

Unfortunately, the relations, synergies and dependencies among the expectations are less clear. How do they impact an offer's design? How do they impact the creation of the offer over time? How do they impact the stakeholders who need to be networked to provide the offer which can best meet these expectations? Above all, how do customer expectations impact the overall design of one's business?

III. TETRAHEDRAL BUSINESS DESIGN FRAMEWORK

To answer the last question, one must first conceptually represent what goes into the holistic design of a business endeavor. The authors' Tetrahedral Business Design

Framework does this by asking four basic questions: who is the business; who has a stake in the business; what do they do in the business, and; why do they do what they do? The questions and their answers are represented as poles, which impact each other in various ways. That which one pole conceptually brings to another is called a flow. The overarching concept binding a pair of poles is called a dyad, and that which sums up the relationships between three poles is called a face.

Since all poles impact one another in no particular order, the abstract geometry of the concepts and their interrelationships takes the form of a tetrahedron, with no pre-established top, center or bottom. Put in a 3D viewer, the Tetrahedron could be rotated and observed from any angle without alteration to the meaning and insights it conveys.

The current paper focalizes on client expectations. Yet in the Tetrahedron, clients are but one type of stakeholder. Expectations of employees, entrepreneurs, or investors could also be represented and discussed. Similarly, expectations are but one way to look at flows. The flows of interest for understanding client expectations are those six which run back and forth between the Stakeholders pole as Client pole and the other three poles, namely Alignment, Contribution, Engagement, Gain, Network and Role. These are bound to three dyads: Exchange, Trust and Web. Client expectations impact the other three dyads just as they impact the Tetrahedron's faces, but do so indirectly for the sake of conceptual analysis. For example, it seems obvious that understanding client expectations impacts business prosperity. The point is that such impact is felt by how other conceptual components are designed in response to such insight – how offers attract or deter clients, how creation enables client centricity, and what place is given to clients in the shaping of business character. In this example, prosperity does not come from understanding client expectations, but rather comes from business design innovations enacted upon such knowledge.

Below are described the business design concepts represented by the four poles, six flows and three dyads of direct interest in regard to deciphering customer expectations, as presented in Figure 2.

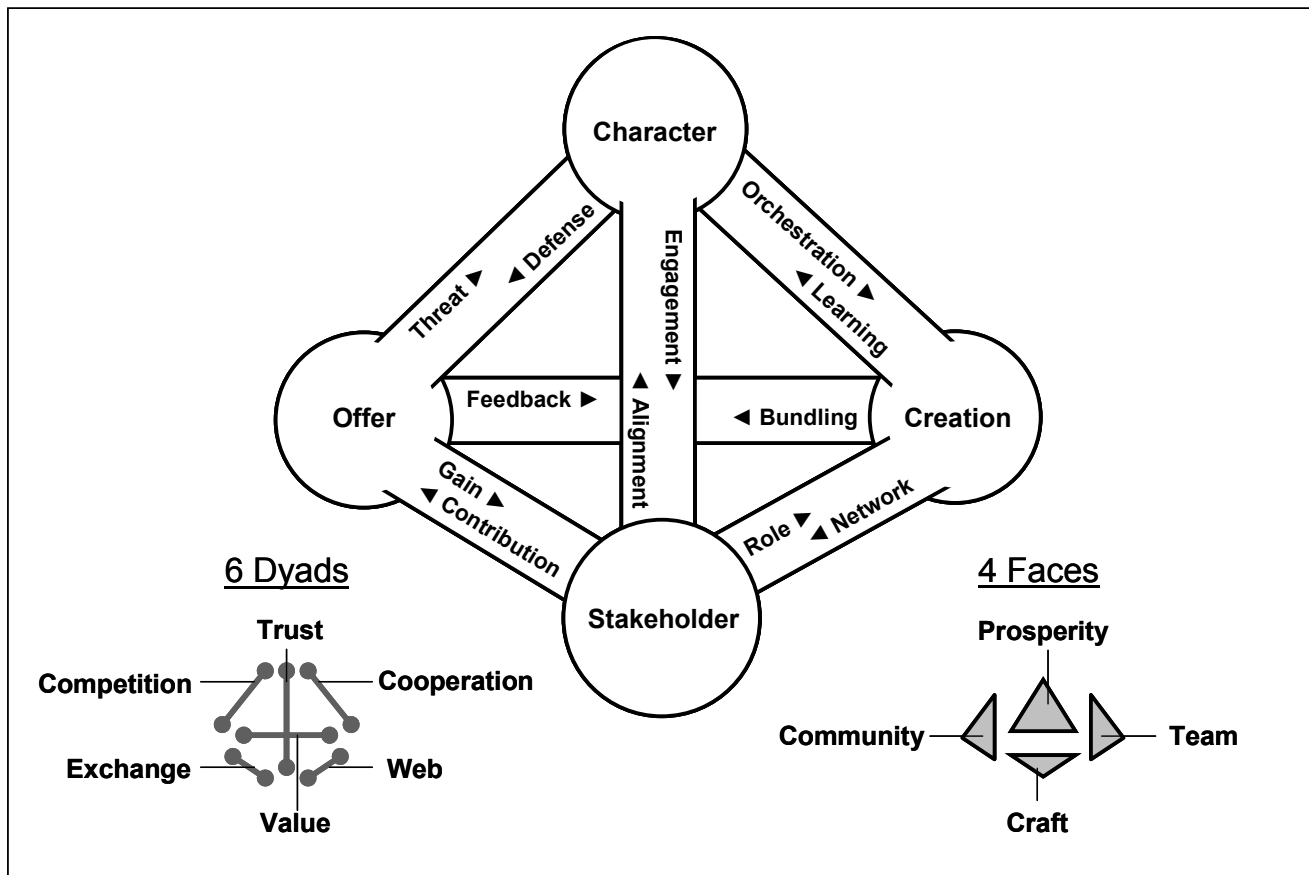


Figure 2. Tetrahedral Business Design Framework

A. The Poles: Character, Creation, Offers, Stakeholders

Character is the collective actor and its praxis. The collective actor is a constructed entity, like a multinational or an e-retailer. Both are dependent on their stakeholders to exist – they are hollow shells kept alive by human action and perceptions. Character is the seat of elusive notions like culture, will, personality, identity, and soul (Collins & Porras 1994; Collins 2001). Customers can actively mould and transform character as part of what they create when dealing with the business.

Creation is the process through which past, present and future contributions are transformed into new value potential. For customers, this can mean anything from one-time money contributions to proactive co-design and collaboration in bringing new value to the market. In a sense, the level of participation sought by customers can be conceptualized as part of the offer.

Offers are the polished, coherent result of creation, and serve as the basis upon which third parties choose to become customers. Offers are not the sum of business creation, but rather a distillate of it. Businesses only bundle part of the potential value they create in certain forms called offers (Shapiro & Varian, 1999). For every client, there exists an offer that links him to the business.

Clients are individuals, groups or organizations who participate in the business to achieve their goals and on

whom the business is depending for its existence (Näsi & Näsi 2002). Clients are but one type of the business' individual actors, like the individuals acting as employees, investors, suppliers, etcetera. What distinguishes them is their key conceptual contribution: they provide expectations. Meeting those expectations is the fundamental rationale invigorating the design of all customer centric business models. If stakeholder contributions are not reaped by the offer interface and properly channeled as feedback to the creation process, bundling value into coherent offers is essentially guesswork.

B. The Flows: Alignment, Contribution, Engagement, Gain, Network and Role

Alignment, the flow from clients to character, is how individual customer gain enhances collective stakeholder gain. For example, continued and enhanced gain are sought by most stakeholders, which is why survival and prosperity are often described as the only real goals indigenous to organizations; they are goals on which most, if not all, stakeholders share alignment.

Contributions, flowing from clients to the offer pole, are past, present and future customer inputs in the business, like money, time, talent, skills, etcetera. This flow explains why businesses seek customers – they depend on customer contributions for their existence.

Engagement, flowing from the character to clients, is how the collective actor binds customers to itself, from

informal trust to formal contracts. For example, the promotion of customer identification with the business – attributes perceived as shared by both the individual and the collective actor – is a form of engagement.

Gain, flowing from the offer pole to clients, is enabling or relieving client value creation (Normann, 2001). When offers fail to provide gain, the customer has no incentive to pursue the business relationship. This explains the motivation behind customer participation in the business.

Networks, flowing from the creation pole to clients, describe how stakeholders are related in their various roles, specifying the responsibilities of each stakeholder in relation to creation processes (Poulin, Montreuil & Gauvin 1994; Martel & Oral 1995). Networks can take many metaphorical forms, including value chains (Porter 1985, Porter 2001), virtual value chains (Rayport & Sviokla 1995), value webs (Tapscott, Ticoll & Lowy 2001), and be the subject of countless categorizations, such as formal vs. informal, internal vs. external, etcetera.

Roles, flowing from clients to the creation pole, are the masks worn by stakeholders in relation to creation networks. Such taxonomy brings clarity and insight as to what contributions are expected of each stakeholder. For example, Y Inc. could be a *supplier* of X Inc., while Mr. Z is one of its *customers*.

C. The Dyads: Exchange, Trust and Web

Exchange, the offer-client dyad, is the arrangement of the many flows of contribution and gain which permeate the business. Temporal concerns are very salient, with cash flows, delivery times and warranties as obvious examples. Time permeates this dyad because it is a universal and ubiquitous form of contribution and gain. For example, entrepreneurs may contribute large amounts of time and money to their start-up business while accepting to defer gain to a long-term future, while customers may be looking for instant gratification. Money is nearly as universal and is another form of contribution and gain, with the advantage of being fungible.

Trust, the character-client dyad, is a covenant between

stakeholders, the essence of what transforms individual actors into a collective actor. Trust can be expressed as a wide spectrum, with the absence of trust on one end and absolute trust on the other. Trust also varies between groups of stakeholders. For example, a client who relies on a given brand to promote certain attributes of his own values and identity may trust the business not to radically alter the brand's meaning along the way, even though no contractual obligation ensures that the brand will continue to embody the values that it does.

Web, the client-creation dyad, is a network of networks which evolves through time, as networks dissolve and mesh with each other and stakeholder roles are accordingly redefined and transformed. The business web extends well beyond the firm and its current creation processes. Markets and industries can be represented as portions of the web, and the "environment" as a gestalt reticular representation, encompassing all stakeholders, past, present and future. Scoping inward or outward allows for new configurations to be gleaned; "competitive radars" are metaphorical examples of this, focused on stakeholders as close, remote, or potential competitors.

Mapping customer expectations presented in section II over these conceptual business design anchors provides a novel way to understand how customer centricity and demand driven value chains impact businesses as a whole.

IV. MAPPING CLIENT EXPECTATIONS

A systematic anchoring of concepts from section II to those presented in section III reveals deep insights. Beyond a simple enumeration of expectations, Figure 1 provides a client evaluation process cascade from blunt to sharp. Figure 3 maps customer expectations to the Tetrahedron of Figure 2 with this gradation represented as customer "takes". Take 1 is a first glance at the business relation in terms of offer fit, creation competency and character integrity. Take 2 is the sharper look at salient expectations, while Take 3 embraces longer term expectations which, if met, have a deeper impact on the customer.

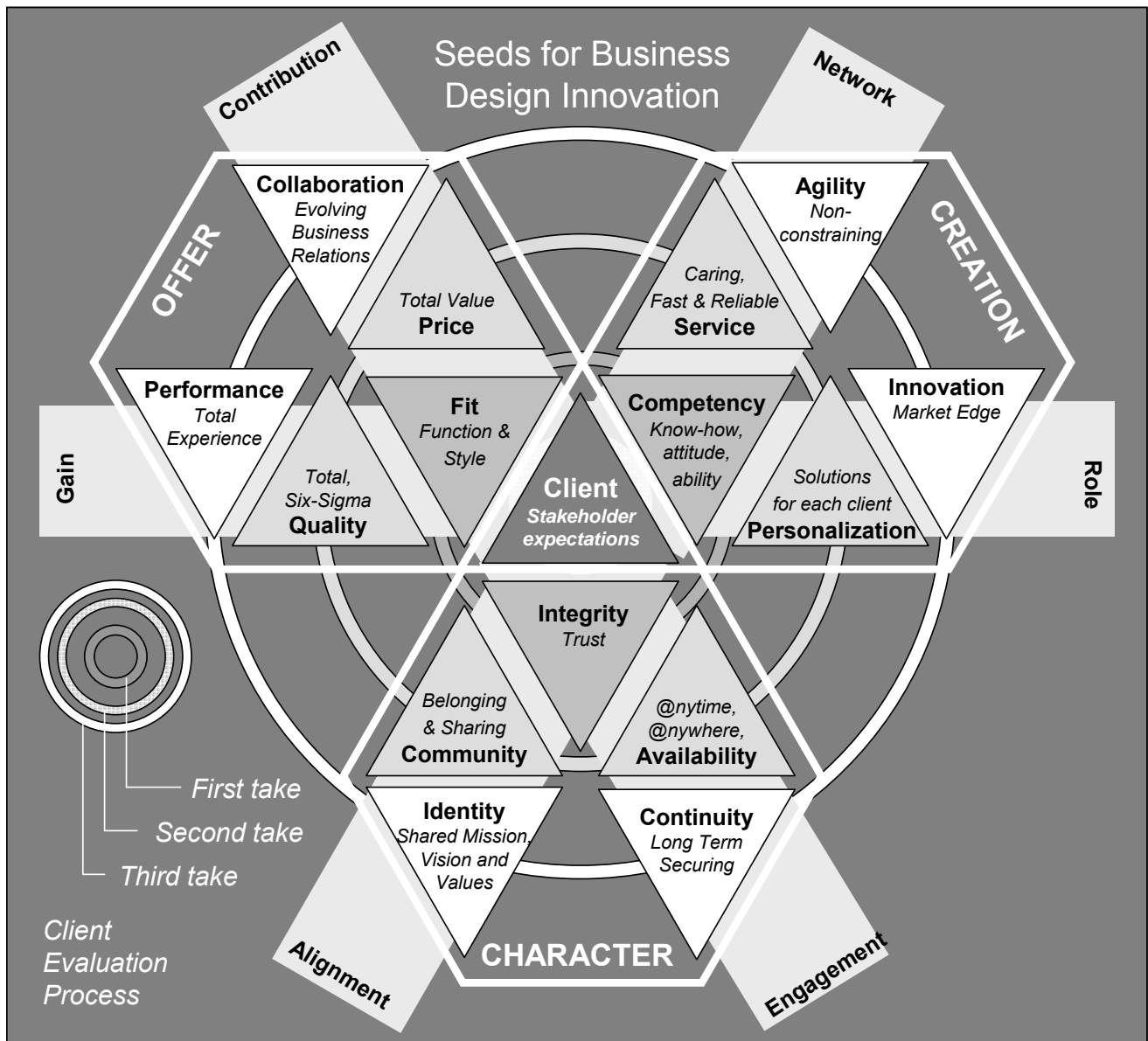


Figure 3. Mapping client expectations into the Tetrahedral Business Design Framework

A. Pole Anchored Client Expectations at Each Take

Figure 3 presents the Stakeholder pole as a Client triangle in the center of the figure, one side toward the Character pole (down), one side toward the Offer pole (left) and one side toward the Creation pole (right). Each side connects with a group of expectations. In the first take, an expectation is associated to each pole. In the second and third takes, there is an expectation related to each of the flows in the pole-client dyad.

The first take expectations are fit, competency and integrity. Fit relates to the offer pole. Is the offer a match? Competency is related to the creation pole. Is the business able to create and deliver what it promises in its offer? Integrity is related to the character pole. Is the business of trustworthy character?

In the second take, the flows with the Offer pole each have an associated type of expectation. From the

contribution and gain flows respectively arise price and quality expectations. Does the asked price reflect the potential value offered? Does the offer's quality insure that such potential value is not a mere facade? In other words, beyond the offer's fit in terms of function and style, does the price/quality ratio make sense to the client?

Beyond the competency expectation from the Creation pole, in light of roles assumed and networks accessed come the service and personalization expectations. Is the network which supports the offer able to provide caring, fast and reliable service? Is the role of client empowering enough so that solutions can be personalized and created to fit each customer? Put another way, can the client play a role in the business' value creation network if he wants to?

Under the light of alignment shared and engagement provided, trust expectations about the Character pole are extended, leading to community and accessibility expectations. Is the business relationship so compelling that the client wants to belong and share in the business?

larger stakeholder community? Does the existence of an active stakeholder community around the supplier make a compelling argument in favor of establishing or maintaining a business relationship? Relative to the expectation of accessibility is the engagement flow. Is the relationship constrained by time and space or is availability up to new economy standards of “anytime, anywhere, online or offline”?

In the third take, the design logic of each flow is taken further. Beyond offer fit and quality, clients expect an outstanding performance, a great total experience. Beyond offer fit and price, the next contribution which goes beyond money is any object of collaboration, from shared resources to transparent information flows, effectively tying both client and business together in evolving business relationships over time. In effect, a new economy client expects a great price/quality ratio to have the potential to evolve into a great collaboration/performance ratio. Herein lays true innovation: what does one’s business design provide to move from price/quality to collaboration/performance?

The same conceptual dynamic goes for the Creation and Character poles. From a creation competence perspective, a business has the know-how, attitude and ability to create great offers and service them. The deeper expectation is one of unrestrained agility. That means having access to competency not just for the offer as it is now (ex.: troubleshooting), but also as an adaptable, evolving, improving creation process capable of facing foreseen as well as unforeseen challenges. For the role flow, the challenge is about pushing personalization and competency further: if an offer can be tailor-made to one’s needs now, can it be made to help tackle one’s needs tomorrow? Can the offer be a driver for client innovation? Can the offer give him a market edge? In essence, the seeds of business design innovation presented here are about delivering empowering offers which leave the client unconstrained to pursue his own innovation agenda. The corollary is deep knowledge of the client’s own business design and a likely meshing of value creation networks.

For the Character pole and its Alignment and Engagement flows, the third take is respectively about expectations of identity and continuity. If an offer satisfies expectations of integrity and community, the opportunity is in ever deeper client appropriation and integration. Can the offer help the client affirm his identity, achieve his mission, follow his vision and enact his values? In the engagement flow, if an offer satisfies expectations of integrity and accessibility, can the client hope for long term safety and stability? The seed for business design innovation is in the development of long term and deeply rooted commitment. Customer relationship management and relational marketing are tools to achieve such design changes.

Looking at Figure 3, it should be clear that meeting the deepest and most potent client expectations requires intent and knowledge, even though emergent value can sprout from good fortune. It requires business design

innovation on three basic fronts, each anchored to one of the Tetrahedron’s poles. It does so because all of the fifteen client expectations discussed here are actually different ways of looking at what a client expects from a business’ offer portfolio, its creation engine, and its overall character.

B. Business Design Innovation Seeds

From the supplier business perspective, all this translates into three basic seeds for business design innovation. Seed 1 starts with the client in the Stakeholder pole, then links to the Offer pole through the Contribution and Gain flows. This is summed up in the Exchange dyad as follows: *What business design can offer an outstanding collaboration/performance exchange beyond the classic price/quality fit exchange?*

Seed 2 starts with the client in the Stakeholder pole, then links to the Creation pole through the Role and Network flows. This is summed up in the Web dyad: *What business design can create agility and innovation in the client’s own creation web once the design achieves and masters competency, service and personalization?*

Seed 3 starts with the client in the Stakeholder pole, then links to the Character pole through the Alignment and Engagement flows. This is summed up in the Trust dyad: *What business design can best foster enduring trust to cement business-to-client relationships in continuity and client-to-client relationships in prosperous communities?*

Answering these questions does not come freely. It requires time, resources and competency. On one hand, every client is different. For each and every client, the fifteen expectations presented here will find unique instantiations. And for every one of them, these expectations will change over time. Moreover, thresholds of necessity, desirability and perfection in meeting expectations will also vary according to the client and unfolding circumstances. In the face of such complexity, knowledge is bound to be fragmentary and imperfect, even if the client can, wants and is able to express his expectations.

On the other hand, no business can be all things to all people. It simply lacks the time, resources and competency to satisfy everyone’s entire expectations profitably. Reaping information, gathering knowledge and nurturing wisdom about clients and their expectations requires choices to be made. One such choice concerns knowledge aggregation. Unless a business has only a few customers, clients are usually grouped in segments and markets, making knowledge more manageable but also less precise. Another choice concerns focus: Which client is worthy of the expenses of time, resources and competency required for business design innovation? What are the business’s own expectations regarding its clients?

Gaining a thorough understanding of client expectations for those who truly matter to the business thus requires outward and inward assessments: which clients does the business want to serve, and what do

these clients expect from the business, keeping in mind that lumping clients in segments and groups will come at the expense of precision and insight? The outward assessment also requires information, knowledge and wisdom about the competition. The competition should be understood as all significant alternatives available to the client to meet or to surpass one or more of his expectations. To think that competition is defined by the business is to misread Figure 3. It is client expectations which shape the competitive landscape, and it is from the aggregation of their perceptions that the business builds its worldview of competition. When the business fails to understand competition through its clients' expectations and instead presumes to know where true competition lies, the business runs a serious risk of being blindsided by competitors it does not even realize it has.

Assessment is a first step. With a clear view of key client expectations and their varying thresholds of satisfaction (ex.: unmet, met, surpassed), what can be done to surpass any given client expectation? Action aimed at leveraging improved satisfaction of client expectations in order to achieve better business performance can be taken at multiple levels (Mitchell & Bruckner Coles, 2004). A first basic level is to optimize the current business design as best as possible to meet key client expectations. This requires disciplined focus and determination.

The next levels of action are varying degrees of business design innovation aimed at better meeting and surpassing one or more client expectations, ranging from localized continuous improvements to radical transformations bringing the business into unexplored territory.

The three seeds of innovation presented above dealt with the Tetrahedron's dyads: innovation in how the client relates to the offer, how he relates to creation, and how he relates to character. Transformations enacted upon these seeds encompass more than one business design element, and more than one expectation. They radically alter an entire system of interlinked expectations. Such innovations seek far reaching improvements in how clients and a business conduct their affairs, given that the business has assessed what are the expectations of its clients and that it knows which clients it wants to delight. These innovations seek to yield a design which enables outstanding collaboration/performance exchanges; which enables agility and innovation to take place in the client's own creation web, and which enables enduring trust to cement business-to-client relationships in continuity and client-to-client relationships in prosperous communities.

These business design explorations need to run their course in order to find validation or invalidation, providing rich and precious feedback which may lead to better design and client expectation assessments and innovations. Such explorations, whether incremental or radical, need to be done because businesses are highly complex systems prone to varying stakeholder perceptions; cause-and-effect chain of events can prove

to be less than clear (Senge, 1990). The outcomes of changes to a single design element are thus seldom predictable, and even more so where multiple elements are transformed together. Effectual and causal thinking must both be allowed to enlighten the actions of entrepreneurial contingencies in the face of business design transformation (Sarasvathy, 2001; Magretta, 2002).

V. CONCLUSION

This paper shows that client expectations are varied, but logically connected to business design. They can be mapped and anchored to design elements in a progression of ever deeply rooted concepts which reinforce one another. Business design innovation can be pursued if expectations can be uncovered and understood, both in terms of what clients expect from the business and what the business expects from its clients. This paper identifies three basic seeds for business design innovation: innovation in how the client relates to the business' offers, to its creation processes and processors, and to its character.

A similar research focusing on the expectations of other stakeholder types such as investors and human resources might yield interesting results. Such research could also be a first step in order to detect deeper patterns of human action, such as understanding what people expect from collective commercial action.

Another venue for future research is matching client expectations to the conceptualization of offers, such as the interplay of commodities, goods, services, brands and product portfolios.

Business knowledge representation is a complex endeavour, most notably when dealing with twenty-eight distinct concepts as is the case here (fifteen expectations and thirteen design elements out of the Tetrahedron's twenty-six). This is but one possible way to represent client expectations and business design to uncover conceptual seeds of innovation.

ACKNOWLEDGEMENT

This research has been made possible through support from the NSERC/Bell/Cisco Business Design Research Chair.

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Maturity of electronic commerce : A review of the principal models

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Abstract — The object of this article is to present the most cited maturity models and the organizational evolutions, instigated mainly by Internet and electronic commerce. We will observe with these theories, how companies become progressively more flexible, more externalized, less centralized within a network, due to e-commerce.

Keywords— Internet, e-commerce , maturity stages, integration, new organization

I. INTRODUCTION

Recognized and adopted by academic and professional circles, the maturity models in electronic commerce allow to understand the progression of information technologies and systems of companies. They anticipate the evolution of the organization and enable it to better study the changes caused by these new technologies.

Indeed, electronic commerce and Internet are at the origin of new, inter-organizational relations and have imposed major changes within companies while offering important opportunities for growth.

Purpose:

This article is a useful analytical framework for describing the company position on electronic commerce. It will allow to understand in what way the company must reconsider its organization with regard to electronic commerce and how it can anticipate major organizational changes in the future.

II. FROM NOLAN'S MODEL...

Long before the emergence of Internet and electronic commerce, the developing stages of computers have been studied by researchers such as Nolan [1], Gibson and Nolan [2], Earl [3], Hirschheim et al. [4], Bhabuta [5], Earl [6], Galliers and Sutherland [7, 8]. Theories on the stages of growth, developed during the mid-70s, were studied due to the increasing importance of information systems within organizations.

Richard Nolan is considered to be the first researcher to provide a structured outline to explain the computing evolution within organizations [9]. He is also the first to have presented a theoretical description of the phases dealing with the planning, the organization and the control

of activities in association with the management of computer resources in the organization [1, 2, 10].

Nolan developed a model which permitted to determine the degree of computing maturity of a company by taking into account the evolution of information technologies as an organizational learning process.

Nolan's model has undergone several improvements and is presented under different forms and versions. Indeed, the original model [1, 2] consisted of 4 phases (Initiation, Contagion, Control and Integration). Later, due to the emergence of new applications such as database systems, the initial model was altered to include new phases : Data

Administration and Maturity [10]. In general, these stages of computer development show how information technologies along with organizational and managerial strategies evolve with time [11]. Organizations progress therefore through a number of successive and identifiable phases and each phase reflects a particular level of maturity in terms of use and management of information technologies within the organization [12].

The model relies on the organization's computer and information technology budget to determine the different stages of the computer evolution. Indeed, according to Nolan, the penetration and usage model of TI in the organization very much resembles the growth model of the computer budget. He has, moreover, used the latter as a substitute for developing his model of computer maturity [12] :

- Initiation phase : after one computer acquisition, slow annual increase of computer budget ;
- Contagion phase : growing annual increases of computer budget ;
- Control phase : decreasing annual increases of annual computer budget ;
- Integration phase : slow annual increase of computer budget.

Despite the theoretical contribution of Nolan's model, Galliers and Sutherland [13] as well as Swatman [14] find that is incapable of representing the reality of the implementation of information systems.

Galliers and Sutherland [13] add, that the model developed by Nolan is inadequate and does not focalize on the organizational and managerial aspects. They criticize

the fact the model does not insinuate in what ways the organization could evolve towards maturity phases. For his part, Earl [6] argues that the organizations could have various learning curves for different types of information technologies.

III. ...TO E-BUSINESS STAGES OF GROWTH

Nolan's model was frequently adjusted and adapted to the managerial reality of the 90s and to the information technologies' evolution during the last ten years. These adjustments were necessary since the initial model, even though it still allowed for the determining of the level of computing maturity of the organization, did not take into consideration new elements such as micro-computing or Internet [15].

Gallier and Sutherland [7] suggest a maturity model describing the phases through which organizations use information systems and technologies. The uniqueness of their model is in the fact that it gives particular attention to interrelations that exist between information technologies of the company and the rest of its functions [16].

New maturity models, better adapted to the realities of electronic commerce, have been developed by other researchers and practitioners. Recent research on growth phases and electronic commerce has shown the usefulness of these models in describing the company position in terms of electronic commerce development and of its possible development in the future [16-21]. Furthermore, besides its descriptive aspect, studies on maturity models help companies choose adequate strategies for moving into new, more advanced phases [16]. Likewise, Rao et al. [21] compare these maturity stages to roadmaps, leading to the sophistication of electronic commerce. They define each stage as an ensemble of signs that characterize the evolutionary nature of electronic commerce.

Among recent models, the following can be mentioned : the electronic commerce maturity model [22], the Matrix Engagement-Execution [23], the levels of electronic commerce [24], the life cycles of electronic [25], the Intranet Maturity model [26], the growth model of electronic commerce [19], the typologies of models for electronic business [27], the technological maturity of B2B electronic business [28], the maturity model of McKay et al. [17], the model of Rayport and Jaworski [20] that is specific to the adoption of B2B Internet technologies, the model of Rao et al. [21] and that of Chan and Swatman [29] based on the use of technologies and applications of B2B e-commerce. However, in spite of these numerous propositions and their strategic contribution to the company, little research has been focused on their pragmatic value and on their validation from an empiric point of view [30].

A. Earl's model[19]: Toward a learning organization

Earl [19] developed a model which permitted to situate a company's degree of ebusiness maturity. This suggests that all companies should go through 6 "standard" stages. These are learning phases for the adoption and the support

of electronic business. Earl sustains, however, that these phases are not necessarily definitive and that companies can maintain activities on several neighboring stages simultaneously. Earl [19] suggests the following stages :

Stage 1: External communication

By creating websites, the main goal of companies was purely promotional. Their websites were rarely interactive. These sites remained a kind of virtual brochure for external communication without interaction with the internaut.

Stage 2: Internal Communication

After using the web as the external communication media, companies began, from 96-98, to introduce Intranet, using Web and Internet technologies. At this point, information technologies are deployed to facilitate the use of and access to certain systems within the organization and to prepare the latter for the future integration of electronic commerce.

Stage 3: Electronic Commerce

This stage is marked by the use of Internet for the sale of goods and services and not just as a means of communication. During this phase, Internet is adopted as a new distribution channel to complement the other traditional channels.

Stage 4: Electronic Business

During this stage (electronic business), the company effort was focused on the construction of new business models, suitable to the new economy through adjustments and reengineering of the business process.

Stage 5: E-Enterprise

Organizations redefine the way the process is managed to be in tune with the new business process. A new conception of organization emerges with new information technologies that render decision making possible, in real time.

Stage 6: Transformation

Arriving at this stage of maturity, implies that the company successfully accomplished the different adoption phases of electronic business. It has also accepted the challenges of the previous stages and incorporated new business and management models required by the new economy.

Along the same lines as Earl's model [19], researchers at the Centre francophone d'informatisation des organisations [27], studied the different technological applications used by companies (the goal being to derive a typology of electronic business models). Their typology was elaborated taking into account the degrees of integration of the internal and external processes of the company and the degree of complexities of its business relations. This study led to the deduction that the level of integration of technological applications increased with the complexity of the company's business relations. From informational web sites containing no company function and where the business relations are hardly complex, we go to transactional and extranet web sites, portals (vertical or horizontal), electronic business markets and finally, towards the integration of a client/supplier value chain where the integration degree is

optimal and the complexity of the business relation is at its maximum.

B. The McKay et al. [17] model : towards the complete integration of the organization

McKay et al. [17] suggest the organizations implicated in electronic commerce can be evaluated and categorized according to six phases which vary from a very low to a very high level of maturity. These stages can be summoned up as follows [31]:

Stage 1: No presence (observation and waiting phase). No use of Internet or e-mail. The company is still hesitating on whether to invest in electronic commerce.

Stage 2 : Experimental online presence. One-way communication from the company to the client and/or supplier through a static website. The information available on the website deals mainly with the company and its products and/or services.

Stage 3 : Interactive online presence. Two-way communication between the company and its clients and/or suppliers through the website and e-mail. The possibility to pay online is, however, not yet available.

Stage 4 : Electronic commerce. Online financial transactions are now possible. The system is, however, not fully integrated with the "back office".

Stage 5 : Internal integration. All the functions of a transaction can now be done electronically. The back and front office systems are now totally integrated.

Stage 6 : External integration. Creating of a strategic business network between the company and its partners using web technologies. The business process and the network technologies between its given members are integrated through an extranet.

C. The Model of Rayport and Jaworski [20]: towards inter-company e-collaboration

Rayport and Jaworski [20] suggest a development model for electronic commerce specifically for the adoption of inter-enterprise (B2B) Internet technologies. They propose that electronic business using Internet be managed separately from other initiatives. Their model outlines the following stages :

1- Broadcast: The company begins by creating an informational website for its clients;

2- Interaction : Internet technologies are used by the organization to interact with clients;

3- Transaction : The company integrates Internet for making, managing and supporting transactions with its clients;

4- Collaboration : The company uses Internet on an inter-organizational level and within the framework of its relations with commercial partners.

C. The SOG-e McKay et al. [17] model : towards a perfectly integrated organization

According to Prananto et al. [18], one of the limits of classic information technology maturity models is in the fact

that they concentrate only on the problems dealing with traditional (or back-office) systems without taking into consideration the impact of Internet technologies within the organization. Furthermore, these models were developed well before the advent of Internet and electronic commerce. However, the new maturity models (those that are specific to electronic business) deal primarily with the aspects of the organization which are specifically tied to Internet and electronic commerce (or front-office). They do not really take into consideration traditional information technologies and systems [17, 18].

Prananto et al. [18] maintain that it is necessary to integrate all these models, while taking into account traditional information systems as well as Internet technologies in order to better study the sophistication of electronic business within an organization. Moreover, McKay, Prananto and Marshall [17], propose another maturity model specifically for electronic commerce. Named SOG-e (Stages of Growth for EBusiness), the integrated model takes into account activities based on the organizations Internet technologies as well as their traditional information and technology systems.

The SOG-e model is based on the system information maturity model developed by Gallier and Sutherland [7] combined with the electronic commerce maturity model elaborated by McKay et al. [17]. As with the other maturity models, the SOG-e presumes a progression of levels through time. This progression means the accumulation of knowledge, experience, qualifications and expertise within company [16, 18].

The SOG-e contains six phases of maturity :

In the first phase, the company has no implantation or development strategy for electronic business. Management's electronic commerce projects lack clarity and direction. No precise member of the staff is designated for electronic commerce initiatives. Moreover, the company's traditional business process is not affected by electronic business.

During the second phase, electronic business begins to increase in importance within the organization (despite the lack of a clear and official strategy). The responsibilities of certain members of the staff are extended to the development and maintenance of the electronic business activities. Initiatives on the part of the company with regard to electronic business are perceived as having a limited impact on the process of traditional business.

The third phase is characterized by an increased awareness with regard to electronic business and its role with the organization. The company's electronic business initiatives take on a clearer, more definitive direction. However, this direction is essentially centered on the technological perspectives and not on the company's business strategy needs. A staff, possessing technical expertise, is put exclusively in charge of the company's

development of electronic business. The impact of this development on the existing business process is increasingly visible within the company.

In the fourth phase, the adoption and development of electronic business are mainly focused on the company needs in terms of business strategy. This stage is characterized by the integration and coordination between the components of electronic business (such as : SI/TI and Internet) and the business process of the organization. Furthermore, the technical staff, in charge of electronic business development, works together with (and with the support of) a staff more oriented towards the company's business strategy. Company initiatives, with regards to electronic business, are perceived as a force behind the reengineering of the business process.

The fifth phase is characterized by the integration between the activity and process of the company's traditional business with those of its electronic business. The electronic business initiatives' goal is to bring strategic value to the organization. These initiatives imply the involvement of various company departments. The information technologies and systems are highly integrated within the company. During this phase, electronic business plays an essential role within the company by improving the organizing of its operations and functions.

The final phase marks the total integration of electronic business and the business process, at the heart of the different levels within the organization, internally as well as externally (with business partners and suppliers). The electronic business initiatives create and maintain a strategic advantage for the company. One can also witness a dynamic and strategic group effort between the information technology staff and the managers who are directly concerned by the company's business. The organization has, furthermore, access to all the internal qualifications and knowledge required for electronic business initiatives. Electronic business plays a vital role in the restructuring of the process connecting the different members of the external business network (of the company) and the inter-organizational systems.

The SOG-e model is a useful analyzing tool which helps specialists to understand and describe a company's position with regard to electronic business, including its degree of maturity with regard to information technologies and systems. The particularity of the SOG-e model resides in the fact that it allows for different levels of maturity within the same organization: those that are specific to traditional systems and technologies and those that concern only Internet. However, during the model's two final phases (5 and 6), the company enters the maturity level which incorporates the traditional systems with Internet technology. The different phases that the model offers, allow the company to understand, diagnose and evaluate its current position as well as plan and manage its future strategy for electronic business. Furthermore, Prananto et al [16] prove that the model also helps to understand and study the different forces (factors, facilitators) and barriers

to the implementation of electronic business at each maturity stage.

D. The model of Rao et al. [21] : towards a perfectly integrated organization

Rao et al. [21], maintain that it is beneficial to have a maturity model that describes a logical evolution of electronic commerce and which involves various stages of development. This model would be a guide which helps the company progress towards more advanced maturity stages. The authors propose a model composed of four phases: Presence, portal, transaction integration followed by total integration of the company. They add that the costs, the technology demand and the the complexity increases progressively during the last phases of the model. Rao et al. [21] specify that their model does not require that the company progressively accomplish each stage successfully. They allow that the company could begin with any phase, skipping certain stages of the model. Indeed, a company that is increasingly aware of the importance of information technologies and electronic commerce could begin with a later maturity phase, bypassing the others, in order to accelerate its development process in electronic commerce.

Furthermore, Rao et al. [21] take an interest in the factors that facilitate the implementation of electronic commerce and the barriers that hinder its development at a given maturity stage. The facilitating factors are the elements which have a positive impact on the implementation of electronic commerce such as the company's commitment to attaining certain goals as a result of the web. With regard to the barriers, they consist of the elements which hinder or delay the implementation such as important financial investments or the company's lack of experience and know-how on information technologies.

The model of Rao et al. [21] suggest the following stages :

Stage 1: Presence

During this first maturity phase, the on-line presence of the companies consists of an information web site with one-way communication : with no intention to receive information from internauts [32]. The site is a virtual company brochure with its products and services [28, 33] as well as some general, invariable information. This Internet presence is mainly to attract new clients and does not include any internal or external company process. Boisvert et al. [32] add that these sites generally require little investment.

Stage 2: Portals

Unlike the first phase, this phase includes two-way communication. Indeed, with an informational web site, clients and suppliers can make offers, send comments on the products or service and participate in on-line surveys.

Furthermore, the company uses cookies¹ in certain pages in order to gather information on each visit and better understand the internaut's profile.

Stage 3: Transaction integration

This phase allows for on-line financial transactions, involving the buying and selling of goods and/or services. It implies high structural and technical abilities. The company can create virtual communities which allow participants to share information based on common interests. In addition, the transactional web site can also offer a platform for electronic auctions or a virtual business marketplace for buyers and sellers. At this stage, however, the level of cooperation between the partners is still low. In this maturity phase, the company implements the web only at the level of the organization's internal processes.

Stage 4: Company integration

At this advanced stage, web technologies are perfectly integrated at the level of its internal and external processes. This integration uses the electronic commerce systems to manage its dealings with clients (CRM) and the supply chain. This implies an intensive partnership between clients and suppliers. To arrive at this final maturity stage is ideal for a company who has chosen extensive integration of electronic business with the business processes, internal as well as external.

IV-CONCLUSION

All the above mentioned maturity models describe a logical evolution of the TIC within the company. They demonstrate that its entire organization revolves around the use of information technologies [34]. In more advanced maturity stages, one refers mainly to integration (internal and external), network and inter-organizational cooperation. With these advancements, companies tend to turn towards less centralized models, externalized and network operated [35]. Moreover, since the beginning of the 90s, various researchers have taken an interest to virtual organization and its development phases such as Davidow and Malone [36] or Frery [37]. Others have integrated new notions such as agility [38] or the network of companies electronically connected.

The new models mentioned in this article take into account the reality of Internet and electronic commerce. They show that the company organization is largely influenced by its implementation of electronic business. The latter represents a major stake which requires major organizational, strategic and functional changes [39]. All these maturity models, even though they differ on some points (such as the number of phases or on whether to take into consideration or not, the traditional systems), allow to understand and describe the implementation of the company's electronic business. At the most advanced maturity stage, the company has reached a high degree of

sophistication which allows it to consider the business process reengineering, disintermediation and virtual collaboration [28].

What's more, these models demonstrate that the organization must constantly evolve, at the same pace as the evolution of electronic commerce. Even if the company can have varied learning curves for the different types of information technologies, it must constantly innovate and adapt itself to its environmental changes. It must also have dynamic business and management models, adapted to the new economy, which provides as many opportunities and dangers. The key to success will be the building of a learning organization that encourages the involvement of all its members [6].

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¹ A collection of information, usually including a username and the current date and time, stored on the local computer of a person using the World Wide Web, used chiefly by websites to identify users who have previously registered or visited the site. Source : <http://dictionary.reference.com/search?q=cookie>

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Measurement of team knowledge: transactive memory system and team mental models

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Abstract — The paper addresses an issue of measurement of team knowledge. Different, though related, views on team knowledge, namely transactive memory system and team mental models, are discussed. Transactive memory system is a concept of a group memory. It consists of individual expertise of team members as well as their knowledge of “who knows what” and is based on communication. Team mental model is a shared organized understanding of team’s environment. The emphasis in the paper is given to measurement of transactive memory system. Research on team mental models is considered as supplementary. Reviews of approaches to measurement of team knowledge as well as research to date on transactive memory system in organizational settings are presented. An example that reveals contradiction between results of measurement of transactive memory system and team mental model is provided. The paper finishes with the discussion of research gaps identified in the literature and discovered in the example presented.

Keywords — team knowledge, measurement, transactive memory system, team mental model.

I. INTRODUCTION

Teams play important role in modern economy [1]-[4]. Common goals and interdependence of the members distinguish teams from other organizational units such as groups. The interdependence and need to accomplish tasks collectively are both a curse and a blessing. On the one hand, teams can accomplish tasks that require competence which is beyond abilities of any individual. On the other hand, experts in different areas may experience difficulties with understanding each other [5]. Thus there is a need in studying teams in general and team knowledge in particular in order to improve their performance.

Number of publications on knowledge management has grown recently. Knowledge measurement, though less discussed in the literature, is an essential part of knowledge management, because one cannot manage what cannot be measured. However, intangible and multifaceted nature of knowledge makes its measurement difficult. This paper addresses a tricky question of knowledge measurement by discussing two team-level concepts: transactive memory system and team mental models. Transactive memory system is a concept of a group memory that consists of individuals’ knowledge, knowledge of “who knows what” in the team and is based on communication. A team mental model is defined as organized shared understanding of

knowledge relevant to team performance. Transactive memory system stresses heterogeneity of teammates’ task-related knowledge whereas research on team mental models emphasizes homogeneity. Both concepts reflect some (though, not all) facets of team knowledge, and both are said to have positive impact on team’s performance. Primary emphasis in this paper is given to transactive memory system; research on team mental models is considered as supplementary.

The paper discusses current state and identifies research gaps and problems in measurement of transactive memory system in real organizational teams. The outline of the paper is as follows. First, team knowledge and, specifically, concepts of transactive memory system and team mental models are described. Then general approaches to measurement of team knowledge are discussed and a review of the studies on transactive memory system in organizational settings is presented where existing approaches to its measurement are assessed along several dimensions. Measurement of team knowledge is illustrated by measurement of transactive memory system and team mental model in a distributed team. Contradictory results obtained with different measurement scales indicate that application of some measurement approaches to distributed organizational teams requires caution. The paper finishes with the discussion of the research gaps identified in literature review and discovered in given example.

II. TEAM KNOWLEDGE

A. General considerations

Research on team knowledge belongs to a stream of research on group cognition [6], [7]. A group is a broader concept than a team: while all teams are groups, not all groups are teams because, unlike in teams, members of a group may not have common tasks [6]. A general assumption of research on group cognition is that group knowledge is more than the sum of group members’ knowledge. Researchers agree on its multifaceted nature [7], [8], but hold different, though related, views on how it should be explained.

B. Transactive memory system as team knowledge

To describe team knowledge Fulk et al. [9] use the term “knowledge resource structure” which refers to distribution of knowledge resources across locations, team members and data repositories, as well as knowledge sharing processes that allow to achieve such distribution.

Knowledge resource structures are described by the extent of centralization and the degree of redundancy. The extent of centralization denotes knowledge location: it may reside in one person or repository, or, alternatively, several (or all) team members may possess it. Degree of redundancy describes the content of knowledge resource structure. Situations when everyone knows the same things are examples of total redundancy. The opposite ones are that of differentiation, i.e. team members are experts in different areas. To explain knowledge resource structures Fulk et al. [9] use a theory of transactive memory.

A theory of transactive memory was developed by Wegner [10]-[12]. It evolved out of the observation that people may, instead of memorizing information themselves, use others as memory aids. Wegner defines transactive memory system as “a set of individual memory systems in combination with the communication that takes place between individuals” [10]. Individual memory systems, in which information on individual areas of expertise as well as knowledge on “who knows what” are stored, constitute a structural (“knowledge”) component of transactive memory system. Communication processes among group members constitute a process component. According to Wegner [11], these components distinguish transactive memory system from a concept of group mind because in the former thought processes are easily observable and communication is taken into account.

Transactive memory system is not imposed on a group. It develops over time. At the early stages of group existence the expertise judgments may be based on stereotypes. Since these judgments are often erroneous, transactive memory systems in such groups are poor. When people stay together for a longer time, they learn each other better and expertise judgments become more accurate. Transactive memory system is said to be developed when group members possess different expertise, are accurate in recognition of expertise of the others and can freely communicate to combine their expertise when necessary. Advantages of a developed transactive memory system are two-fold. On the one hand, it allows group members to reduce individual information burden by dividing cognitive labor. On the other hand, since people in a group are experts in different areas, they may provide answers to questions that are far beyond their individual expertise. Mohammed and Dumville [8] note that the theory of transactive memory has been developed for groups; however, nothing precludes its application to teams.

C. Team mental model as team knowledge

Cooke et al. [7] use different approach to explain team knowledge and define it “as the collection of task- and team-related knowledge held by teammates and their collective understanding of current situation” (fig. 1). Task- (e.g. expertise in a certain area) and team-related knowledge (e.g. understanding of task procedures and knowledge of what teammates know) comprise team mental model. Collective understandings of the current situation are called team situation model. The former is static; the latter is fluid. Team situation model builds on

team mental model but, unlike the latter, incorporates characteristics of the current situation. Team situation model is not yet well conceptualized and new methods are needed to approach its measurement [7]. Thus, the following discussion is limited to team mental models only.

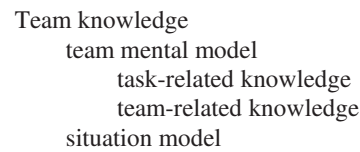


Figure 1. Team knowledge according to Cooke et al. [7].

Team mental model “refers to an organized understanding of relevant knowledge that is shared by team members” [8]. Klimoski and Mohammed [6] stress that it is a construct, not a metaphor, and it allows to capture a real life phenomenon. Discussion of team mental models often revolves around their content, form and function.

A content of team mental models can be grouped into knowledge related to situations (what goes on with a team including mental representations of equipment, knowledge of others, environment, etc.) and knowledge related to actions (what to do about those situations, for example behavioral routines for action) [6]. Alternatively, four content domains can also be recognized [1], [13], [14]:

- equipment model (equipment-related knowledge);
- task mental model (task-related knowledge);
- team member mental model (team members-related knowledge, including “who knows what”)
- teamwork schema (process-related knowledge).

A form of a team mental model refers to the fact that a mental model is not any but organized knowledge [1], [14]. Meaningful patterns of organized knowledge can be, for example, cause-effect relationships or categorical membership [6].

In connection with the function, it is said that shared mental models improve team performance. There is no clarity, though, on the meaning of the word “shared”. It can mean (a) identical (having in common) knowledge; (b) “divided” or “distributed among team members” (individuals possess different knowledge; no overlap); (c) overlapping knowledge (some of the knowledge is different, some is held in common) [1], [6], [7]. Though researchers are generally vague in specifying what the term “shared” means [6], most of the studies are focused on measuring homogeneity of mental models held by individual team members. The general thesis of team mental model research is that knowledge held in common improves team performance.

D. Relationship between transactive memory system and team mental models

Though team mental models and transactive memory system are different concepts, Mohammed and Dumville [8] notice that research streams on both concepts can benefit from cross-fertilization. Transactive memory system

concept stresses heterogeneity in relation to task-related expertise possessed by team members; team mental models emphasize homogeneity of any part of the whole spectrum of knowledge (not only task-related).

Both knowledge heterogeneity and knowledge homogeneity are important for team performance. On the one hand, knowledge heterogeneity is important because teams are created specifically to fulfill tasks that a single individual can not accomplish [7]. On the other hand, teammates require some shared knowledge as well in order to be able to understand each other: "overlapping teamwork knowledge is necessary to provide adequate coordination" [8]. However, totally overlapping knowledge makes teams dysfunctional: it leads to sing-minded view on tasks, so called "groupthink" [1], [15]. Thus, it can be suggested that for successful team performance heterogeneity of task-related and homogeneity team-related knowledge are required.

Heterogeneity and homogeneity, both are present in the structural component of transactive memory system. Differentiation of individual expertise describes heterogeneity of task-related knowledge while awareness of "who knows what" represents homogeneity of team-related knowledge (cf. [1]). Research on team mental models may assist in measuring structural component of transactive memory system, especially its homogeneous constituent [16], [17]. Similarly, team mental models research can benefit from the studies on transactive memory system by examining techniques for measuring heterogeneity [8].

III. MEASUREMENT OF TEAM KNOWLEDGE

A. General considerations

Measurement of team knowledge is not a trivial task. Firstly, its multifaceted nature prevents emergence of a uniform measure. Moreover, different measurement targets (e.g. homogeneity vs. heterogeneity) call for different measures [7]. Furthermore, Mohammed et al. [14] mention, with regard to mental models, that a choice between different mental models that one wants to study is, actually, determined by the nature of a team's cognitive task. Generally, researchers agree that the lack of parsimony in conceptual development of team mental models precludes development of empirical research on the topic. This can be fully applied to team knowledge in general as well since, at least according to some conceptualizations, team mental models can be conceived of as representations of team knowledge [7].

To complicate things further, there is also confusion over how to measure group-level cognitive phenomena [7], [8], [14]. Klimoski and Mohammed [6], when talking about mental models, note that measurement at the group level is "complex and problematic". Generally, two basic approaches to measurement of group-level phenomena are recognized: collective and holistic [7], [14].

According to collective approach, individual measures are aggregated into a group-level measure. Individual measures can be collected during observations, interviews

and surveys or by using other methods [7]. This approach is easily feasible and most of the research to date uses aggregation. However it underestimates the importance of team members' interactions [7] and simplifies relationships within a team assuming that every member's contribution to team knowledge is of equal importance [14].

Holistic approach appreciates importance of team process behaviors and treats a group (or a team) as a whole, allowing collectivity to "speak for itself" [14]. Observations of group's performance or interviewing of key informants are possible group-level techniques [14]. However researchers agree that there is a need to develop new holistic measurement methods [7].

Approaches to measurement of team knowledge can also be divided into direct and indirect [16]. If it can be said in advance what knowledge is required for a team to fulfill a certain task and a cognitive content of a study is provided by researchers [14], a measurement approach is called direct. While this is feasible for certain types of tasks (e.g., well structured tasks, like in aviation team example in [7]), it may be difficult for tasks of high complexity and uncertainty (complex R&D projects aimed at development of new knowledge). To overcome this problem, team members can be asked to provide cognitive content by themselves. However, in this case a difficulty lies in interpreting peculiar responses [14]. Furthermore, task specificity of direct measures precludes either comparison between different cases or quantitative research in field settings [16]. Alternatively, it is possible to measure manifestations of a studied construct. Manifestations are indirect behavioral measures that allow to detect existence of a studied construct [18]. Approaches that are aimed at measurement manifestations of constructs are called indirect and generally recommended for measuring conceptual abstractions [19].

Given complexity of the nature of team knowledge and approaches to its measurement, the best tactics is to focus on a particular research question and look at how different viewpoints and techniques may help to answer it [7], [14]. Following this line, this paper focuses solely on the measurement of team knowledge in the form of transactive memory system in organizational settings and looks at how research on team mental models can support studies in this area.

B. Review of measurement approaches to transactive memory system in organizational settings

Research on transactive memory systems in real organizations is scarce. Tables 1 and 2 present a summary of the studies conducted on the topic to date. From a brief overview it is clear that these studies differ in terms of both measurement approaches and content (i.e. interpretation of transactive memory system).

Though all the studies refer to works of Wegner as a founder of transactive memory theory, transactive memory system is defined in these studies in different ways (table 1).

TABLE 1
A LIST OF STUDIES ON TRANSACTIVE MEMORY SYSTEM IN ORGANIZATIONAL SETTINGS

Authors	Type of a team	Definition of transactive memory system
Rau [20]	Top management team	"Transactive memory is the set of knowledge possessed by members of the team, combined with an awareness of who knows what within the team"
Rau [21]	Top management team	"Transactive memory is the set of knowledge possessed by the members of a team, combined with an awareness of who knows what within the team"
Austin [17]	Continuing groups	"Wegner's definition of transactive memory includes two parts: (a) a combination of individual knowledge and (b) interpersonal awareness of others' knowledge."
Lewis [16]	Consulting teams; teams in high-technology companies	"Transactive memory ... consists of metaknowledge about what another person knows, combined with the body of knowledge resulting from that understanding. ... A transactive memory system describes the active use of transactive memory by two or more people to cooperatively store, retrieve, and communicate information".
Yoo and Kanawattanachai [22]	Virtual team	"...transactive memory system is the team members' meta-knowledge about who knows what in the team"
Akgün, Byrne, Keskin, Lynn, & Imamoglu [23]	New product development team	"...a TMS consists of the memory stores of particular individuals and any social interactions in which they participate"
Akgün, Byrne, Keskin, & Lynn [24]	New product development team	"... a TMS depicts the "awareness of who knows what in a group"

TABLE 2
CHARACTERISTICS OF MEASUREMENT APPROACHES

Authors	Direct/indirect	Data collection	Aggregated/holistic	Number of dimensions	What was measured	Measurement of awareness (complexity, accuracy, agreement)
Rau [20]	Direct	Questionnaires	Aggregated	2	(1) knowledge possessed by team members; (2) awareness of "who knows what"	Agreement
Rau [21]	Combination	Questionnaires	Aggregated	2	(1) composition of expertise (diversity and depth) (2) awareness of :who knows what"	Agreement
Austin [17]	Combination	Questionnaires	Aggregated	4	(1) knowledge stock (combination of individual knowledge) (2) consensus about knowledge sources (agreement) (3) specialization of expertise (4) accuracy of knowledge identification	Accuracy, agreement
Lewis [16]	Indirect	Questionnaires	Aggregated	3	(1) specialization (2) credibility (3) coordination	
Yoo and Kanawattanachai [22]	Indirect	Questionnaires	Aggregation	1	awareness of "who knows what"	Agreement
Akgün, Byrne, Keskin, Lynn, & Imamoglu [23]	Indirect	Questionnaires	Aggregation	3	The same as in Lewis [16]	
Akgün, Byrne, Keskin, & Lynn [24]	Indirect	Questionnaires	Aggregation	1	The same as in Yoo and Kanawattanachai [22]	

Some researchers talk about two dimensions (individual expertise and knowledge of "who knows what") while others use only one dimension (awareness of "who knows what"). The latter are conceptually very close to research on team mental models. In these "one-dimensional" studies the focus is on agreement of recognition of the expertise of the others (table 2). At the same time, Moreland [18] identified altogether three aspects of the awareness constituent of transactive memory system. They are (1) complexity (how detailed knowledge about "who knows what" is), (2) accuracy of the recognition of the expertise of the others, (3) agreement about expertise of the others.

Accuracy is measured in only one study [17]; complexity in the reviewed studies has not been addressed at all.

All the studies use aggregation method for measurement of transactive memory system. Most of them employ indirect measures or a combination of direct and indirect approaches (table 2). With regard to indirect measures, Lewis [16] has developed a 15-item scale based on three manifestations of transactive memory system identified by Moreland and colleagues [18], [25], [26]. These manifestations are (1) differentiation (how different task-related knowledge possessed by teammates is), (2) credibility (how deeply team members trust each other)

and (3) effective coordination. The scale developed by Lewis [16] is not the only one indirect measure used by researchers (cf. [22]), but the only one that undergone thorough validation.

Lack of parsimony in definitions and measurement approaches precludes development of empirical research on transactive memory system. To illustrate the difficulty of its measurement in organizational setting, results of a pilot study are presented in the next section. These results reveal a contradiction between two different measurement approaches.

C. Example of team knowledge measurement in a distributed team

This example is a part of a larger doctoral research project described in detail in Kitaygorodskaya et al. [27]. The studied team consisted of eight people. Its members were physically distributed. The study was undertaken at the final stage of the project. Tenure differences were assumed to be negligible. To measure team knowledge, two approaches were used. Transactive memory system was measured with the indirect scale (“specialization-credibility-coordination”) developed by Lewis [16]. Team mental model, namely awareness of “who knows what”, was measured by checking for agreement of teammates reports on expertise of the others [16], [20].

Results of the measurement of transactive memory system with Lewis’s scale indicated that transactive memory system was developed more than average (specialization score was 3,9; credibility was 3,5; coordination was 3,4 (all the scores are arithmetical means)). Given that, it might have been expected that team members would have had little difficulty in reporting on others’ expertise. However it was not the case. Only three out of eight team members could identify expertise of the others. The rest ones either didn’t answer the question at all or identified expertise of only one or two members. This result is surprising because Lewis [16], when developing the scale, conducted similar analysis in test groups and results of measurement of transactive memory system and awareness of others’ expertise converged. Thus, results of the presented study have revealed controversy between results of measurement of transactive memory system with the scale developed by Lewis [16] and awareness of “who knows what” in the examined organizational setting. Possible explanations include influence of centralized communication network in the team and lack of face-to-face communication due to physical distance. This controversy points also to the fact that researchers should be careful in taking existing scales and applying them blindly to all organizational settings.

IV. DISCUSSION AND CONCLUSIONS

In this paper, a review of literature on team knowledge and its measurement in general and transactive memory system in particular is presented. Research on team mental models is considered as supplementary. Building on this review, following gaps and directions for future research on

measurement of team knowledge in the form of transactive memory system are identified:

- (1) there is a need to come to an agreement on how to conceptualize transactive memory system for measurement purposes. It seems that measuring solely awareness of “who knows what” reflects only one aspect of transactive memory system while what actually team members know and how this knowledge is differentiated do not receive proper attention;
- (2) all of the studies used aggregation approach to measurement of transactive memory system. While it is the easiest way to date to measure group-level phenomenon, it is necessary to develop holistic approaches that will treat a team as a whole;
- (3) given importance of awareness of “who knows what” for transactive memory system, there is a need to pay more attention to its two other characteristics: accuracy and complexity. So far only agreement between team members on expertise recognition is measured in all the studies. However, agreement by itself may be not enough: individuals may agree on the recognition of the expertise of the others but be inaccurate in that. Such agreement may make a team dysfunctional [7];
- (4) furthermore, since awareness of “who knows what” is one of the team mental models that represent *organized* understandings, it would be useful for the purposes of research on transactive memory system to develop measurement approaches that will allow to map “who knows what” in a group. Similarly, Mohammed et al. [14] note that a good measure should provide a mechanism for both elicitation of a mental model content and representation of how these components are connected (structure of mental model). Visual representation of knowledge distribution in a team may be of practical value and help managers to better assess knowledge abilities of the team;
- (5) application of existing measurement scales to different organizational settings requires caution. Controversy between results of two measurements illustrated by the example indicates that more studies are needed to fully understand the phenomenon and calls for more research on indirect measures in diverse organizational settings.

The contributions of the paper are as follows. First, different conceptualizations of team knowledge, scattered before across different sources, are described. Second, approaches to measurement of knowledge on a team level and problems associated with it are discussed. Third, a review of empirical research to date on transactive memory system in organizational settings as well as an example of team knowledge measurement is presented. The example illustrates a controversy between results of two measurements. Building on the literature review and discovered controversy, gaps and directions for future research are presented.

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Methods of Defining Business Information Needs

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Abstract — Business information, which is commonly understood as essential information related to a company's operations, activities and business environment, is an essential resource for managers. Managers make decisions relying on the information they receive from different sources inside and outside their organization. The use of information and communication technology has made information acquisition and dissemination easier, but at the same time it has increased the risk of information overload.

Although appropriate information is considered to be one of the premises for achieving a competitive advantage there is a large amount of information which brings no advantage to an organization. The incorrect or inappropriate information may even misinform managers, thereby hindering rather than helping decision making. The defining of business information needs aims to diminish the gathering of needless information as well as to promote the use of appropriate information.

When assessing the information needs of managers, the method should be chosen carefully by comparing those available. The method of choice should be the most suitable for the particular task. In the literature, several methods for defining information needs are presented. A group of these methods are discussed in this paper. The methods under discussion include among others interviews, questionnaires, Key Intelligence Topics (KITs) and Critical Success Factors (CSFs). The methods are discussed and evaluated from the point of view of defining business information needs.

Keywords — Information needs, methods, business intelligence.

I. INTRODUCTION

A. Background

The hype about information bringing competitive advantage has led to the false assumption that the more information a company has the better it succeeds in competition. When in fact, a great amount of information may encumber the personnel having to wade through it, as well as waste other resources. The advances in and use of information and communication technology (ICT) have made the information acquisition and dissemination easier, but at the same time it has increased the risk of information overload. In the end a great mass of information can handicap the company's essential functions such as decision making.

To get information to act in favour of a company, the

distinction between information as such and essential information should be made clear. The information actually needed in decision-making should be defined and the actions should be focused in acquiring this information.

Information needs and the methods of defining them have been discussed at least since the 1920's (see e.g. Wilcox, 1922 and Wyer, 1930 in [1]), but for a long time the research mainly focused on librarians and other traditional information workers. The development of executive information systems (EIS), that begun in the 1960's, also expanded the research on defining of business information needs.

Business intelligence aims to provide accurate and timely business information for both operative and strategic decision-making. In other words, business intelligence aims to satisfy the managers' information needs, and by doing so business intelligence enhances the organization's decision-making and creates competitive advantage. The defining of information needs is an essential part of the business intelligence process. It is, however, a complex task and the method should be chosen carefully to suit the particular situation and objectives.

B. Objectives and method

There are various methods of defining information needs. They differ from each other, for example, concerning the benefits, downsides, costs and other resources demanded. In order to get the best results from the study, the methods should be carefully evaluated. It should be noted that not all methods are suitable for every situation or organization. The purpose of identifying the business information needs, i.e., what will be done with the results, should also be kept in mind when choosing the method.

The objective of this paper is to discuss some main methods of defining information needs that are presented in the literature and evaluate their pros and cons. The research is approached through an overview of the literature.

II. BUSINESS INTELLIGENCE

A. Defining the concept

The term business intelligence is quite new and its definitions vary. In addition, the term itself varies; in addition to business intelligence the function is called competitive intelligence, market intelligence, competitor intelligence etc. depending on the author and region. For example, competitive intelligence is the prevailing term in

Northern America, whereas in Germany market intelligence is a common term for the function and in the Netherlands and Finland the same activity is called business intelligence. In this study the term business intelligence is seen as an umbrella concept and the aforementioned terms as its sub terms.

In addition to the disparate use of terms to describe business intelligence, the content of the term also varies. For example, Collins [2] recognizes business intelligence as a process in which information about competitors, customers, and markets is gathered by legal means and analyzed to support decision-making. Sawka [3], too, defines business intelligence to be focused on gathering specifically external information and predicting changes in the market situation, whereas Barndt [4] also points out the role of internal information. Prior [5] sees business intelligence as a combination of any data, information, and knowledge concerning an organization's operational environment and which leads to decisions that create competitive advantage for that organization.

To stress the multifaceted nature of the concept, some authors (see e.g. [6], [7]) present business intelligence as solely a technological tool or application that serves as an aid in information management. The function of these technological business intelligence solutions is usually to process and store the data and information gathered and to provide it to managers.

In spite of different terms and approaches, there seems to be a fairly general understanding of the fact that the ultimate objective of business intelligence is to help the organization's decision-making, although the scope of information and means of delivering it may differ. The ethics and legality of information gathering is also stressed (see e.g. [2], [8]), likewise the quality and accuracy of the information (see e.g. [9])

In this study business intelligence is considered to be a process by which an organization systematically gathers, manages, and analyzes information essential for its functions. Business intelligence aims to provide accurate and timely information for both operative and strategic decision-making. In other words, business intelligence aims to satisfy the managers' information needs and by doing so business intelligence enhances the organization's decision making and creates competitive advantage.

B. Business intelligence process

The literature introduces several different business intelligence process models (see e.g. [10]–[12]) and the models seem to be quite similar. According to Pirttimäki and Hannula [10] the most significant distinctions between business intelligence process models occur in the number of phases, structure of cycles and sources of information, among others. Most of the business intelligence process models discuss at least phases that include information needs analysis, information acquisition, information storage, information distribution and information use. It is also typical to the process models to function as a continuous cycle, so that the last phase of the process leads to the very first phase, and thus the cycle continues.

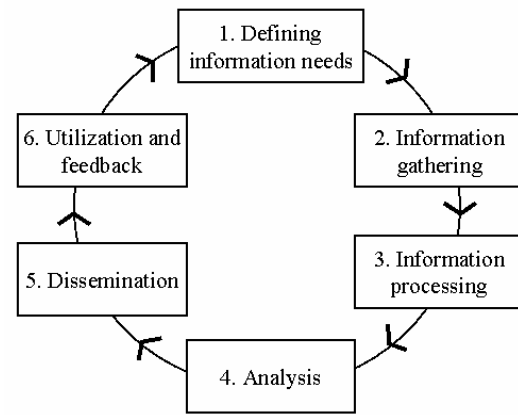


Figure 1. A generic business intelligence process model.

Defining information needs is the starting point of an effective intelligence cycle. The identification of information needs is the first phase in both Miller's intelligence cycle and Choo's process model of information management [13]–[15]. Defining information needs as a starting point is also the connecting factor in different process models of business intelligence presented in the literature [10].

In many organizations, a business intelligence unit or a practitioner or some other business intelligence function acts as a buffer between overload of information and managers by preventing the entry of unneeded information into the decision-making process. In order for a business intelligence function to select what is relevant from such an overload of information it should know which information is needed and which is not. In other words, the proper defining of the managers' information needs is essential in order to effectively manage information in an organization.

III. INFORMATION NEEDS

A. What is information?

In spoken language the word information can have many different meanings. It may as well refer to data, knowledge or intelligence, whereas the academic approach distinguishes between these concepts according to their contents. However, it has to be considered that in academic world, too, the terms and their contents are not coherent and the interpretations depend on the author. Figure 2 illustrates the different degrees of information and the factors which bring out the conversion to the next level of the hierarchy.

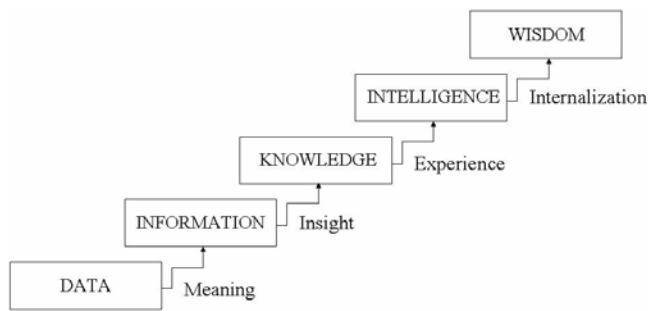


Figure 2. Information hierarchy and the factors which bring about conversion to the next level.

Data is static text, numbers, code or other marks or signals that do not necessarily include any other meaning and do not necessarily lead to anything, whereas *Information* has a meaning, purpose and value for its receiver and it is usually new to him (see e.g. [16], [17]). When information is enriched with insight and values it becomes *knowledge*, and adding personal experience to knowledge converts it into *intelligence* (see e.g. [18], [19]). The next level in information hierarchy is *wisdom*, which can be approached from a philosophical viewpoint: Thierauf [18] states that wisdom begins when a person understands that the present truth does not necessarily remain forever.

In this paper, to avoid confusion, the term information is used as an umbrella concept including all the aforementioned subterms data, information, knowledge, intelligence and wisdom.

Business information is information regarding the company's own operations, markets, customers, competitors, and other actors and variables in the company's business environment. Like the umbrella concept of information business information also runs the gamut from data to wisdom. Business information can be seen as a manager's fundamental resource [9], because managers make decisions based on the business information they receive.

B. Information needs and wants – what are we looking for?

Managers benefit only from information that they regard as useful and meaningful, because they tend to ignore information they consider to be irrelevant. It makes no sense to spend resources to acquire information that is not to be used in decision-making. The organization can reduce the gathering of excess information by identifying the managers' information needs i.e. what information they really need, when they need it, and in which format to make optimal decisions and thereby gain the organization a competitive advantage.

A need is generally defined to be something that people "must" have. Maslow's hierarchy of needs (see e.g. [20]) is a well-known academic theory, which divides needs into such categories as, for example, deficiency needs and being needs. These include among others self-actualization and need to be loved. From the perspective of information need, view Maslow's categorization is seen as problematic due to

its generality [21].

Information need arises when a gap between the existing information and the information called for is recognized. Case [22] defines information need to be recognition of the existing knowledge being not enough in order to reach the target. Nicholas [23] states that it is the information a person should have in order to perform his tasks or solve a problem in a satisfactory way.

Carter (in [24]) has categorized information needs according to the types of questions the person in need asks:

- *Orientation*: the questions aim to find out what is happening.
- *Reorientation*: the questions aim to check if the course is right.
- *Construction*: the questions aim to get an understanding of things or to solve a problem.

Wilson [25] completes the list with:

- *Extension*: the questions aim to complete the existing knowledge.

According to Höglund and Persson [26] information needs can be divided into objective and subjective needs: An objective information need is what is usually thought to be needed to solve a given problem whereas a subjective information need is something an individual himself thinks he needs to solve the problem in question.

According to Line [27] information needs consist of five categories:

- *Need*: the information one has to have to carry out the task regardless of the actual need been sensed.
- *Want*: the information that is wanted although there may have been no attempt to purchase it.
- *Demand*: such information that inquiries are made in order to acquire it.
- *Use*: when a middleman, such as an information system or a business intelligence worker, is used to purchase the information.
- *Requirement*: need, want, demand, use, or all together lay a claim to the information.

Nicholas [23] defines information want to be "what an individual would like to have" and information demand as "a request for an item of information believed to be wanted". It should indeed be noted that information needs can be questioned, that is to say that, if a person says he needs a specific piece of information, it can be argued whether he actually needs it in order to act on it or if he merely wants it (see e.g. [22]).

It is important to acknowledge the difference between wants and needs due to the costs of information gathering, processing, analysing and dissemination. There is no sense in lavishing resources on acquiring nice-to-know information that does not actually benefit the manager and the company in any way. In addition, it is pointless to spend

a lot of time in processing and analysing information in detail or into a specific form, when its efficiency, that is the benefits to be had from it compared to its costs, are poor. Figure 3 illustrates the differences between wants and needs.

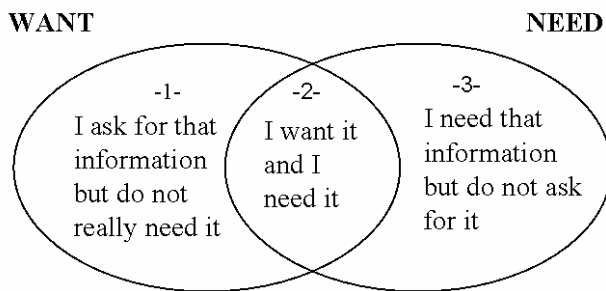


Figure 3. The difference between information want and information need. [28]

Marti [28] distinguishes needs in three categories (represented in Figure 3): 1) *Information that is wanted but that is not really needed*. This information is usually mainly a waste of money or other resources. For example, this information is wanted because of its status quality or it is processed to an unnecessarily high level due to a poor understanding of prioritization. 2) *Information that lacks and that is recognized to be needed*. This is the essential work of a business intelligence unit; to obtain the information that is known to be needed. The effort and money spent on this is seen to be acceptable and useful allocation of resources, because it is considered to benefit the company best. 3) *Information that is needed but not known to be needed, wanted nor asked for*. These blind spots can cause big surprises and cause a lot of confusion when the information is revealed. A common blind spot is to monitor only the few biggest competitors and ignore the smaller ones, even though they might be the very ones threatening the company's success in some way. [28]

It is often difficult to determine whether a need or want is in question. Even if one succeeds in narrowing down the needs, they have to be prioritized as well. As stated earlier, the costs of fulfilling an information need should be balanced against the benefits gained from that information. Not all information needs can or even should be satisfied: despite the fact that the information is considered to be essential to decision making the acquiring of it may be impossible or far too expensive. For example, a personnel manager would surely need to know which employees will be on sick leave the coming week in order to recruit the necessary stand-ins or allocate the assignments, but there is no way of knowing who will fall sick and when.

C. Difficulties and challenges related to defining information needs

The complexity of defining information needs is also commonly acknowledged in the literature. It is often very hard for managers to articulate their information needs and a frequent reason for this is that managers do not know

what information is available or they do not understand how it is obtained or used [29]. One of the problems in defining information needs is that the information needs of a manager may also be subconscious [30].

Harmon and Ballesteros [1] state that if only the conscious and explicit information needs are addressed the actual need is ignored or only partially satisfied. This leads to only partially solving the problem or making the decision for which the information need is related. According to Pirttilä [30], these subconscious needs cannot be assessed even with the best methods because they usually surface only in a decision-making situation. The fact that decisions are made inside a person's head and therefore the information needs are also generated in human brain makes their defining challenging. Consequently Wilson [25] states that no-one but the person himself can know his information needs unless the person articulates them. This indicates that no-one can identify a manager's information needs on his behalf.

Even so, it is not self evident that managers are even able to identify their own information needs, as stated earlier by Butcher [29] and backed up by Herring [31]. Herring [31] has detected three classic problems concerning managers' personalities effecting the defining of their information needs:

- a) The reticent manager, who is not good at asking information or expressing his needs in any way.
- b) The manager who wants to know everything, because he is not able to describe his needs and believes he will know what he needs once he sees it.
- c) The manager who asks the business intelligence unit what he needs to know. [31]

In many situations is it more important to find the right questions to ask than to find the right answers to the questions posed. The difficulties that managers may have in expressing their information needs demand proficiency from the person carrying out the process. In addition, the person has to be familiar with the method in use.

IV. ABOUT THE METHODS

A. Choosing a method

When conducting an empirical study, such as defining managers' information needs, choosing a suitable method is essential. The methods should be carefully evaluated to ensure the best results from the study. The benefits, downsides, costs and other resources demanded vary depending on the method.

It should be noted that not all methods are suitable for every situation or organization. The reason for defining the business information needs, i.e., what will be done with the results, should also be kept in mind when choosing the method. Several authors conclude that using different methods together may be more successful than using just one method (see e.g. [29], [32]–[34]).

B. The methods under discussion

The compilation of methods presented in this paper is not comprehensive, but the methods discussed are the ones generally and mainly used in defining information needs. It is also important to emphasize that the methods presented are not mutually exclusive. Actually, many of them can be used simultaneously, complementing each other. For example, as discussed later, questionnaires are often used as tools in interviews. On the other hand, most of the methods utilize interviews in one way or another.

The next part of the paper discusses five methods which are often used in defining managers' business information needs. After every section the pros and cons of the method are summarized in a table.

V. CONTEMPLATION OF METHODS OF DEFINING BUSINESS INFORMATION NEEDS

A. Questionnaires

The main benefits of a questionnaire are its easiness and economy. Answers can be analyzed swiftly and "tick blank-sheets" can be analyzed quantitatively. A questionnaire is filled in independently by a respondent thereby consuming less of the researcher's time. The respondent also has more time to consider the questions, thus the answers can be well thought out. According to Valli [35], the absence of the researcher also prevents his persona from influencing the answers. Nicholas [23] points out that because of its impersonality a questionnaire is also a good way to get answers from shy and timid persons, who probably would not be as frank in an interviewing situation. In addition, a large number of people can be reached quickly by a questionnaire.

Kunz et al. [32] stress that although a questionnaire is a popular method in assessing information needs it is not the best suited for this purpose. New or subconscious information needs cannot be assessed by a multiple-choice questionnaire. Open-ended questions provide wider, more spontaneous and more unforeseeable answers and allow respondents to express their information needs more freely, but, as Valli [35] points out, answers to open-ended questions are often vague and imprecise or the questions are left unanswered. In addition, a respondent may misunderstand the questions. Nicholas [23] also acknowledges the difficulty of producing a good questionnaire. He lists the main challenges to be formulating understandable questions, avoiding biased and leading questions and not to make the questions too lightweight and simple [23].

Another downside of a questionnaire is usually its low response rate. According to Kunz et al. [32] the factors affecting the response rate are the length and the structure of the questionnaire, the clarity of the questions, and how important a respondent considers the issue to be. Stamped addressed envelopes, good timing and rewards for those who answer can also improve response rates [23]. The response rate may possibly also be raised by sending an informing letter to respondents beforehand and making

motivating phone calls after the questionnaire has been sent out.

Kunz et al. [32] do not consider a questionnaire to be sufficient for assessing information needs. A low response rate lowers the credibility, but often, results are also skewed by answers because only the truly concerned respond. Valli [35] adds that a researcher cannot be sure that the right person has answered the questions or if someone else has filled in the form for him. Kunz et al. [32] suggest that the best way to make good use of a questionnaire in assessing information needs is to use it in conjunction with some other method, and Nicholas [23] corroborates this by noting that often interviews are required to pilot a questionnaire.

The focal pros and cons of questionnaire as a method of defining business information needs are summed in Table 1.

TABLE 1
PROS AND CONS OF QUESTIONNAIRE.

QUESTIONNAIRE	
ADVANTAGES	+ Economy.
	+ Answers can be analyzed quantitatively.
	+ Does not take a lot of the researcher's time.
	+ Gives time to think out the answers.
	+ Large number of people can be reached.
	+ Getting answers from timid persons.
DISADVANTAGES	- New or subconscious information needs cannot be assessed.
	- Risk of un-answered questions.
	- Risk of misunderstanding the questions.
	- Risk of low response rate.
	- Risk of wrong person filling in the questionnaire.
	- Difficulty of producing a good questionnaire.

A questionnaire is best suited for defining the business information needs of a large group of people related to an information system development. A questionnaire is also a valid method when the aim is to find out averages, majorities or some kind of a compromise or a consensus. For example, if the objective is to define the information that is needed most commonly among the managers as opposed to managers' individual information needs.

B. Interview

Interview is one of the most used methods of information gathering, and Nicholas [23] states that interviewing has the fewest problems of all research methods. Hirsjärvi and Hurme [36] define interview as a scripted way of information gathering that has a certain goal and direction. Patton [37] states that by an interview things which cannot be observed from the outside can be discovered. There are different kinds of interviewing techniques and their names and definitions vary. For example, Hirsjärvi and Hurme [36] list structured and semi-structured interviews, thematic interview and form interview and Nicholas [23] adds group interviews and telephone interviews to the list.

In the structured interview, the questions and response alternatives are strictly defined in advance, whereas in the semi-structured interview the questions are the same for

everyone but the interviewer may vary their order and the interviewee may answer in his own words. In the thematic interview questions are divided into different themes and the questions are open-ended. This facilitates the discussion between the participants and furthers their understanding of the issue. A form interview is simply a questionnaire from which an interviewer reads the questions aloud and then marks the interviewee's answers on the form. [36]

Group interviews are carried out with multiple interviewees and telephone interviews are made, as the name implies, by telephone. The role of the interviewer also changes in different types of interviews from active examiner to passive observer. The choice of the type of interview is determined by the subject and the aim of the study [36].

Unlike when using a questionnaire in an interview, a researcher can usually change the order of questions and ask additional questions. Kunz et al. [32] find that this reduces the risk of misunderstandings. Hirsjärvi and Hurme [36] state that an interview is a good method when researching a little known or uncharted area or when it is known in beforehand that answers are likely to be elaborate and dissimilar. When assessing personal information needs, the purpose is not to elicit identical or homogeneous answers but to identify individual and genuine information needs no matter how much they differ from each other. Personal information needs are rarely identical and therefore interview would seem to be the most suitable method for identifying managers' information needs. The interaction between a researcher and interviewees may elicit subconscious information needs and the discussion may enhance the interviewee's awareness of his information needs.

The direct question "What do you want to know?" is not always the best way to find out the information needs of a manager. Sometimes it may be wise to approach this question indirectly. For example, the interviewer could ask what in the manager's opinion his company's competitors should never find out about the company. Further, one could ask what the company's competitors should not find out about the company's customers or partners. This approach requires more creativity than do direct questions, but it can provide new and more valuable results and even open new insights on important business problems.

The downside of interview as a method is its costs. According to Hirsjärvi and Hurme [36] the expenses include the recording systems, materials, and possibly the travel and accommodation costs of a researcher. Kunz et al. [32] add that besides the costs, interviewing takes time and a researcher should be well versed in the subject.

The salient pros and cons of interview as a method of defining business information needs are summarized in Table 2.

TABLE 2
PROS AND CONS OF INTERVIEW.

INTERVIEW	
ADVANTAGES	<ul style="list-style-type: none"> + Discovering things that cannot be observed from the outside. + Discussion raises understanding and

	awareness. <ul style="list-style-type: none"> + Possibility of adapting questions to suit the situation. + Possibility of asking additional questions. + May elicit subconscious needs.
DISADVANTAGES	<ul style="list-style-type: none"> - Expensive. - Time-consuming. - The researcher's persona and poor social skills may affect the answers.

Interview is a method that can be used in various ways and contexts, and because it is so versatile, it can be adopted in many different kinds of situations. When the aim is to define individual and detailed information needs or there is no preconceived idea of what the needs could be, interview is the best way to "get inside peoples' heads".

C. Observation

Using the observation method the information needs are clarified by observing the individual and reviewing the documents he uses ([38], [39]). In this method the information needs are therefore deduced from the person's information use. Observation is often used in situations in which there is not a lot of knowledge about the target of the examination [33]. In such situations, questions cannot be formulated beforehand. When defining information needs, the situation is usually very similar: guesses can be made about what kind of information needs a person has, but the answers may be as well just the opposite. It can also be very difficult to articulate information needs, especially subconscious needs. Kunz et al. [32] see observation as a suitable method when one wants to know all the information needs, not only those that the person is able to express.

It is important to note that observation is used to identify the prevailing state of the phenomenon but it cannot clarify its past state [36]. Therefore, it is also impossible to assess a person's information needs at some other point in time, such as some point in the future. Future information needs cannot therefore be predicted by observation.

Observation can be divided into participatory observation and concealed observation: in participatory observation a researcher makes observations as a part of the system under observation, whereas concealed observation is carried out unbeknown to the object (see e.g. [32]–[34]). Slater [34] points out that in participatory observation the presence of the researcher always has some degree of influence, and therefore the results may not be authentic.

Observation is indeed a troublesome method in assessing information needs. Decision-making and the processing of information take place inside a person's head; therefore it is very difficult or even impossible to observe them from outside. To learn about the information use of a manager, his actions would have to be monitored at every turn. However, as mentioned earlier, this could affect the manager's behavior and so also, the results. According to Kunz et al. [32], observation is not suitable for examining a large group of people. Grönfors [33] states that observation as a method is laborious and time-consuming, and Kunz et al. [32] conclude that it is far more expensive than, for

example, a questionnaire, but to compensate the costs observation produces more accurate answers. Hirsjärvi and Hurme [36] stress that a researcher has to be thoroughly trained to carry out observation. Both Grönfors [33] and Kunz et al. [32] consider that observation functions best when it is used in conjunction with other methods.

The salient pros and cons of observation as a method of defining business information needs are summarized in Table 3.

TABLE 3
PROS AND CONS OF OBSERVATION.

OBSERVATION	
ADVANTAGES	<ul style="list-style-type: none"> + Accurate answers. + Does not require a lot of preliminary information about the subject. + Defines the persons information needs through his information use.
DISADVANTAGES	<ul style="list-style-type: none"> - Expensive. - Not appropriate for studying a large group of people. - Laborious. - Time-consuming. - Validity of the results. - Requires thorough proficiency and competence from the researcher. - Describes only the prevailing information needs, not the forthcoming ones.

Observation is probably the most adequate method when the aim is to define business information needs through information use, i.e. what information the manager actually uses in his actions. Observation is therefore a good method when assessing managers' prevailing information needs.

D. Critical Success Factors (CSFs)

The concept and method of Critical Success Factors (CSFs) was presented by Daniel in 1961 and popularized by Rockart in 1979 [40]. Bullen and Rockart [41] define the CSFs as "the few key areas of activity in which favourable results are absolutely necessary for a particular manager to reach his goals". The method provides a structured technique which in the form of an interview aims to help managers to define their CSFs and as a result their essential information needs. It aims to investigate which key management activities require attention of the management by looking at the managerial goals and priorities. [41]

Bullen and Rockart [41] stress that the CSFs are always related to a specific industry and a particular company or a certain individual and they are tied to the current situation. In other words, there are no general CSFs; every manager and company have their own individual CSFs depending on their unique features and the prevailing situation. Therefore one manager's CSFs cannot be generalized to all managers of the same company, not can the company's CSFs be given to be a particular manager's CSFs as such. A company's CSFs are investigated considering managers that represent company's different functional areas and integrating their different personal CSFs. [42]

The CSF method uses interviews in order to expose the

manager's CSFs. In the interview the manager is asked to list his CSFs. Questions such as "what would impede the performance the most?" or "where would you the least like something to go wrong?" aim to bring subconscious CSFs to light. [41]

Although the CSF method seems to be well understood and accepted by the senior managers [43], [41], Loughridge [43] states that it may not necessarily be used at all managerial levels. This seems only logical, because in order to determine CSFs the manager has to have a clear understanding not only of the company's and his unit's and personal goals but also of "the big picture". Usually the lower level operators are too focused on the particular task in hand and cannot therefore define concrete success factors.

As always when using an interviewing technique, in the CFS method, too the skills and preparation of the interviewer play a significant role and impact on the quality of the results. The interviewer should have a thorough understanding of the industry, company and the interviewee's job in order to get the best results.

The salient pros and cons of CSFs as a method of defining business information needs are summarized in Table 4.

TABLE 4
PROS AND CONS OF CSFs.

CSFs	
ADVANTAGES	<ul style="list-style-type: none"> + Can elicit subconscious information needs. + Focuses on the most critical information needs. + Raises the managers' awareness of their most important information needs.
DISADVANTAGES	<ul style="list-style-type: none"> - Cannot be used at all managerial levels. - The researcher's persona and poor social skills may affect the answers.

CSFs are best suited for defining the information needs of managers at the top level dealing with strategic decisions.

E. Key Intelligence Topics (KITs)

The Key Intelligence Topics (KITs) process was introduced by Herring in 1999 [31]. The KITs process is specified for defining and prioritizing in particular senior management's i.e. strategic managers' information needs rather than operative managers' information needs. The method aims to train managers to ask for information, and thus to promote the interaction between business intelligence unit and the managers.

KITs are assessed by interviewing managers and asking them open-ended, non-directive questions [44]. Herring [31] has divided KITs into three categories: 1) Strategic Decisions and Issues, 2) the Early-Warning KITs, and 3) the Key Player KITs. In the KITs interview the managers are asked to specify the strategic decisions they will take during the next six months, the unwanted surprises that might occur in the business environment, and to identify actors such as competitors, on whom the company should have better information. The managers should also try to

articulate their information needs concerning these topics. [31]

Herring and Francis [44] state that besides revealing individual information needs KITS describe the company's competitive situation and management's blind spots. On the other hand they acknowledge that the KITS interviews usually produce far too many KITS for a business intelligence unit to handle, and therefore prioritization of the KITS is essential. Francis and Herring [31] also noticed that regardless of the interviewer's ample experience in business intelligence, if he is not properly trained to use the KIT method the results may not be as useful as they should be.

The focal pros and cons of KITS as a method of defining business information needs are summarized in Table 5.

TABLE 5
PROS AND CONS OF KITS.

KITS	
ADVANTAGES	<ul style="list-style-type: none"> + Trains managers to express their information needs. + Promotes interaction between the managers and business intelligence unit.
DISADVANTAGES	<ul style="list-style-type: none"> - Elicits usually far too many information needs. - The researcher's persona and poor social skills may affect the answers.

The KIT method is quite similar to CSF method, and is therefore adaptable in same kinds of situations. KITS are also suitable to be used to aid the business intelligence unit to get the managers in future to better define and communicate their own information needs.

VI. CONCLUSIONS AND DISCUSSION

Information overload is nowadays a virtual menace due to the amount of information and its easy availability through, for example, ICT. Effective business intelligence functions are one way of harnessing and putting to use the ample amount of information that, in the worst case, could harm the company's operations. In order to effectively scan and filter the essential information out of the mass, the business intelligence unit has to know what information they should be taking into processing. Therefore, the managers' business information needs should be defined.

The literature presents several methods for defining information needs, and this paper introduced some of the most common methods of: questionnaires, interviews, observation, CSFs and KITS. The first three are common research methods used universally in different context of information science, while CSFs and KITS are for defining business information needs by design. Some of the methods are in some way overlapping. For example, CSFs and KITS utilize interviews. In addition, some of the methods are used simultaneously. For example questionnaires can be utilized for preparing an interview. The methods are not equally applicable in all situations, and therefore the choice of method should always be carefully considered in order to get the best results possible.

For further research it would be an interesting subject to

test these methods in practice and thus compare their functionality in different situations. In addition, an intriguing theme of research would be to study how organizational culture influences the success of using a particular method.

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Mobile Broadcast Business Dynamics

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Abstract—Mobile broadcast technology has matured to a point where commercial launches are either taking place or being delayed by issues related to regulation, content IPR or business models and revenue sharing. There are several competing radio technologies, mobile broadcast service platforms and numerous handset vendors are producing—or ready to start producing—mobile television capable terminals. In this situation we need to clarify the service concepts and operator roles so that both the academic and industry participants can formulate their views on a common ground, which is namely the purpose of this paper. In addition, the aim is to point out the features rising from the technologies used and the existing business environment, that have most significant consequences to the mobile broadcast value chain and revenue sharing.

Keywords—Mobile broadcast, revenue sharing, value chain, DVB-H, operator roles.

I. INTRODUCTION

This year, 2006, we have seen mobile television systems being piloted and launched and several TV-capable mobile handsets have been introduced. Internationally there are about 20–30 pilot projects ongoing where mobile broadcast and namely mobile television services are being tested, with both technology and business issues under investigation. At the same time, the standardization and integration processes related to mobile broadcast—covering content encoding, IP datacast techniques, electronic service guide (ESG), content protection, purchase, and trust models—have proceeded, however not yet into a fully finalized status. In this context Nokia, world's largest mobile phone manufacturer, has chosen a market enabler strategy in mobile broadcast system integration by developing an IP-based end-to-end mobile broadcast platform, the Nokia Mobile Broadcast Solution (MBS) [1], which is likely to be used in many DVB-H-based (Digital Video Broadcasting – Handheld) mobile broadcast service launches in the near future. The terminology, platform structure, and the operator role definitions of the Nokia MBS are referred to as a starting point in this paper, in order to connect the findings to a relevant real-life example. The purpose of this paper is to define the basic structure of the mobile broadcast business environment, and propose a model on top of which future research on this topic can be accumulated. This paper concentrates on business dynamics,

revenue sharing and company roles in the mobile broadcast service market.

A. Research Methods

Research methods used in this study range from case study approach to action research and literature study. In addition to the thoroughly studied case of Nokia Mobile Broadcast Solution 3.0 and its industry and market impacts, the findings have a strong base in writer's field work as a course lecturer for Nokia MBS server system at Teleware Oy and close co-operation with the Nokia mobile broadcast crew in Helsinki.

II. MOBILE BROADCAST OPERATOR ROLES

A. Content Provider (CP)

Content providers, also known as content aggregators, are the mobile broadcasters that run one or many mobile television or radio channels. In the value chain, content providers buy content from content owners (content producers, media houses, movie industry etc.) or produce content in-house. Content providers fund their operations either by pay-TV fees, advertisements or in the case of public broadcasting companies in some countries, television license fees. Within the mobile broadcast platform, the content provider is responsible for producing an encoded audio-video stream, and sending it to the mobile broadcast system [1] run by the datacast operator, and providing the platform with schedules and program information. In the Nokia MBS case, the encoded A/V streams are sent as IP multicast packets over a multicast network, covering the country or area where mobile broadcast services are available. There can be several content providers on one mobile broadcast platform, limitations coming only from the total broadcast bandwidth available in the system. In DVB-H systems using 16QAM modulation total bitrates close to 12 Mbps can be achieved, resulting in a channel count of 15 to 50 depending on the audio and video quality and the amount of bandwidth used for MPE-FEC error correction (Multi-Protocol Encapsulation – Forward Error Correction).

B. Datacast Operator (DCO)

Within the Nokia MBS operator role definitions, a datacast operator is the company responsible for the central

management of a mobile broadcast platform i.e. generating the ESG, orchestrating the IP datacast system (content stream control and management), and provisioning content providers and service operators. In the value chain the datacast operator buys mobile broadcast capacity from the broadcast network operator and re-sells that capacity to content provider companies. Broadcast capacity is a term for having a certain bitrate available for mobile broadcast services in a certain geographical area for a certain time.

C. Network Operator (NO)

The network operator is the owner of frequency licenses. NO operates the IP multicast network carrying the content streams from broadcasters' encoders to the transmitter sites. NO also operates the DVB-H modulators and transmitters in self-owned or leased transmitter sites. In addition, network operators own and operate the IP encapsulators [1] bridging the IP-based multicast traffic (the encoded A/V stream) to the DVB realm, practically transforming a stream of IP packets to a DVB transport stream (TS). The roles of DCO and NO can be assumed by different companies, but the tasks of DCO and NO can perfectly well be carried out by one single company. A Finnish example is Digita Oy, which received Finland's first DVB-H license in March, 2006 [2] and is taking both the NO and DCO roles, providing Finnish broadcasters with DVB-H capacity and platform services.

D. Service Operator (SO)

Service operator is the company responsible for content pricing and selling, as well as primary end-user support. Looking at the Nokia MBS technical architecture, a service operator would be running the Broadcast Account Manager (BAM), a platform component for selling channel bundles and pay-per-view programs to end-users and generating charging details for the purchases made [1]. On a Nokia MBS platform, BAM accepts purchase requests and sends related DRM (Digital Rights Management) rights objects to mobile terminals. Both the purchase requests and the DRM rights object delivery are realized using an HTTP connection, over GPRS, 3G data, WLAN or any available IP return channel.

The day-to-day tasks of service operators include price setting for those pay-TV sellable items (channel bundles, channels and pay-per-view programs) to which content providers have assigned the particular SO as the service operator. This is probably preceded by negotiations and content retailing contracts between the service operator and one or many content provider companies.

III. MOBILE BROADCAST VALUE CHAIN

In principle the value chain of mobile broadcast services is very straightforward. As stated, service operators are the ones who take care of selling, pricing and charging of mobile broadcast services. In addition, services can be branded for each service operator so that end-user gets the look-and-feel

created for the service operator company. Because the service operator takes care of all end-user interactions (purchases, charging etc), the users are likely to see the mobile broadcast service as a product provided by a particular service operator.

On the other hand, content providers are responsible for providing the actual content streams, which is what end-users are interested in and probably are willing to pay for. In between, the roles of DCO and NO are also very important and they have their respective business decisions to make, but for the considerations made in this paper their role is not emphasized. The tasks of DCO and NO are about providing a technical platform for mobile broadcast, and the end-users do not necessarily even know which DCO and NO is providing the mobile broadcast service used. Hence the roles of DCO and NO in the mobile broadcast value chain are confined to the business-to-business context. In this paper we concentrate on revenue sharing, pricing, and perceived end-user value, and for that reason we emphasize the content provider and service operator roles in the value chain. However, the investment decisions related to DVB-H network building are in the very core of the mobile broadcast business logic, and as such they should not be overlooked in future research.

FIGURE 1
MOBILE BROADCAST PLAYERS & REVENUE SHARING

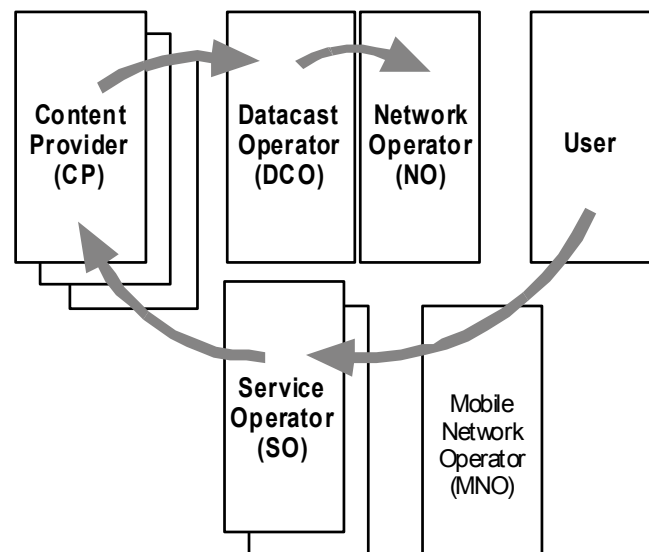


Figure 1 shows how subscription fees are paid by the end-user. Payments are collected by the service operator, which in turn buys content from one or many content provider companies. Content providers buy broadcast capacity and mobile broadcast platform services from the datacast operator. DCO buys physical DVB-H network capacity from the network operator, the owner of the frequency license. Some external money flows are missing from the picture, such as the network investment made by the NO, content procurement costs for the CP companies, and end-user's mobile network usage costs. In a scenario where SO is not a mobile network operator, the cost of end-user billing service should also be added.

A. Revenue Sharing and Asset Ownership

Important factors affecting the mobile broadcast revenue sharing model are content ownership and customer ownership. Content providers—mobile television broadcasters—are the content owners, and hence they have a key role in the value chain. Their broadcast content is what end-users may decide to pay for, and for that reason they have a strong say on mobile broadcast revenue sharing. The more end-user appeal the provided content has, the more bargaining power that content provider company has in negotiating contracts with one or many service operators willing to include the content (typically television or radio channel) in the SO's service offering.

Customer ownership, however, lies in the hands of service operators: SOs take care of all end-user transactions, customer support, pricing and selling services. In addition, the task of SO may be assumed by a mobile network operator (MNO), in which case the SO has a direct access to mobile subscriber records.

IV. DIGITAL RIGHTS MANAGEMENT

A key point in mobile broadcast business is how pay-TV purchases are reliably accounted to a particular end-user, a person ready to actually pay the bill, and how to ensure that the delivery and use of the viewing rights is secure. In principle one could implement any kind of online subscription mechanism, users filling in their contact details and subsequently receiving some kind of digital keys or rights for viewing the content. However, in this scenario we would have to rely on the terminal devices (and users) not to distribute the purchased keys, or viewing rights, to others.

A. CMLA

In order to establish trust between content owners, service operators and end-users, a company called CMLA (Content Management License Administrator) [3] has been founded to function as a trust authority for digital content delivery services. According to CMLA webpage, founder companies Intel, Nokia, Panasonic and Samsung are aiming at providing a trust model for Open Mobile Alliance (OMA) DRM 2.0 technical specification [4]. In short, the main task of CMLA is to certify the DRM implementation robustness of the devices (both end-user terminals and the server side) used in digital content delivery. An example would be a scenario where CMLA gives licenses to DVB-H enabled mobile phones and the service operator's server system, or namely the Broadcast Account Manager (BAM) in the Nokia MBS case. This licensing results in setting up a public key infrastructure (PKI) where CMLA generates a private key—public key pair for each individual terminal, and functions as the key repository and trust provider.

B. OMA DRM 2.0

OMA DRM 2.0 is one of the contemporary digital rights management standards, created by the Open Mobile Alliance organization. It is described here because OMA

DRM 2.0 is the DRM specification of choice in the Nokia MBS platform, together with the CMLA trust model.

In OMA DRM 2.0 the digital content is protected with encryption, but the decryption keys are separated from the content to rights objects (RO) which are received separately. In the Nokia MBS case the protected content is delivered over a broadcast medium (DVB-H network) whereas the rights objects are requested and received over an IP-capable return channel such as GPRS, 3G data or WLAN.

The rights object contains a key for decrypting the broadcast content, but the key (CEK, Content Encryption Key / OMA DRM 2.0) is further protected by encrypting it with the terminal's public key, using the public key infrastructure backed by CMLA.

V. TERMINALS AND USERS

In order to convince the content owners and content providers of the content protection mechanisms used on a particular content delivery platform, we have to implement a DRM system and somehow enforce it. Adopting OMA DRM 2.0 and CMLA is a real-life example of this, resulting in trusted devices and secure DRM rights object delivery.

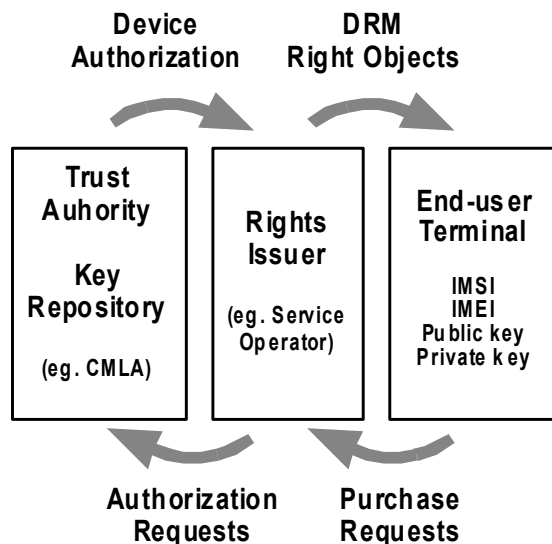
However, the end-users have to be recognized as well. A rather straightforward way of identifying a mobile TV user is to use his/her mobile subscriber identity, the IMSI (International Mobile Subscriber Identity). IMSI is stored on the SIM card, accessible to the terminal whenever a purchase request is made. In addition to IMSI, each mobile phone has an IMEI code (International Mobile Equipment Identity), a unique code identifying the individual device. These two codes, IMSI and IMEI, can be reliably used for recognizing the user and the terminal. The IMSI, in addition to uniquely identifying the mobile subscriber, also contains MCC (Mobile Country Code) and MNC (Mobile Network Code) codes. By looking at the MNC terminal knows the mobile network operator of the user, which makes it possible for the terminal to decide which parts of the available broadcast services are shown for the particular end-user.

A side effect of using IMSI for recognizing the users is that the IMSI must eventually be mapped to a real person with a name and a billing address. This mapping is only available in the MNO's subscriber register where IMSI is mapped to a phone number (MSISDN) and personal contact details.

If IMEI and IMSI are used for recognizing users, as is the case on the Nokia MBS platform, MNOs are given an important role in the mobile broadcast value chain: either MNO companies would have to take care of the SO role, or non-MNO companies as service operators should make contracts with MNOs for getting the mapping of IMSI to subscriber contact information. If a non-MNO company would want to be a mobile broadcast service operator and stay independent from the MNOs, IMSI could not be used for subscriber identification. Instead a separate subscriber

register should be created, using eg. an online registration system. However, also in this case the terminal would have to be trusted by the trust authority (such as the CMLA). This example shows how two different approaches—two different systems—are needed: one for content protection (DRM, trusted devices, a trust model) and one for end-user billing (recognizing users, billing and charging, subscriber registers).

FIGURE 2
MOBILE BROADCAST TRUST MODEL AND RIGHTS DELIVERY



VI. BUSINESS DYNAMICS – INCUMBENTS IN NEW ROLES

Thus far we have discussed the different roles and their respective strengths in the ecosystem, but the interesting point is how to map these roles (CP, SO) to real-life companies such as television broadcasters and mobile network operators (MNO). From these premises we can arrive into three different basic scenarios: the broadcaster approach, the mobile network operator approach, and the co-operation approach [5], [6].

A. Broadcaster Approach

In the broadcaster approach, the mobile television broadcaster company not only provides the channel content but also takes care of end-users. In this scenario the broadcaster company acts both as content provider and service operator. Technically this means that in addition to producing an encoded content stream, the broadcaster has to run the selling, charging and customer support functions as well. In Nokia MBS terms, the broadcaster should run the Broadcast Account Manager [4] for pay-TV service fulfillment (key delivery, charging etc.). MNO networks would only be used for opening an HTTP connection (e.g. over GPRS) from the terminal for the purchase requests and DRM rights object acquisition. In value chain terms this

scenario would be very simple, the challenging part being how to map mobile TV subscribers to real persons, the users of the mobile TV terminals.

In principle the broadcaster company would have three options: to establish a connection to MNO billing and charging system and outsource the end-user billing part; start acting as a virtual mobile network operator (MVNO) with SIM card issuing capability; or implement a billing and charging system totally independent from mobile subscriber information. In the latter case IMSI could not be user for recognizing customers, and a subscriber register system would need to be built up from scratch.

B. Mobile Network Operator Approach

In the MNO approach both the roles of service operator and content provider are taken by an incumbent MNO. A natural benefit of this model is the existence of mobile subscriber base and billing and charging systems. A challenge for the mobile operator would be to establish the processes for providing the channel content, to function as a content aggregator (or producer), which would be an act of significant diversification for most of the existing MNO companies. The value chain would remain simple, especially if DCO and NO roles were taken by a single company.

An extreme of the MNO approach would be a situation where all the roles (CP, DCO, NO, SO) would be assumed by a single company. Real-life examples of this can be seen in the U.S. and Italy, where MediaFLO and DVB-H based mobile television services are planned to be offered by companies like H3G Italy/RRD and Verizon Wireless. In Italy the services have been launched as of June 2006.

C. Co-operation Approach

In the co-operation approach the existing companies would more or less stay in the areas where they have the best existing leverage: broadcasters in content aggregation and mobile network operators in subscriber management and charging. Revenues would be shared between the service operator (MNO), content provider (broadcaster) and the datacast and broadcast network operators. From a real-life process viewpoint the co-operation approach is clearly the easiest to implement, but from revenue sharing viewpoint it is probably the most challenging.

In the co-operation approach the steps needed before mobile broadcast service launch are minimal compared to the previous approaches, because most of the infrastructure and systems is already in place (CP's content aggregation mechanisms, broadcast stream production, content schedules and program information systems, MNO's billing and charging systems, subscriber base, customer care functions).

D. Pricing

A key goal in many of the recent mobile television pilot projects [7] has been to find out about end-users' willingness to pay for mobile broadcast services [8]. Some initial results [9] indicated that monthly payments of 5 to 10 euros per

month would represent a realistic average for mobile broadcast spending, creating a 10-20% increase to current ARPU figures [10] in many European countries.

However, very recent experiences from Italy are showing that customers are in some cases ready to pay surprisingly high monthly payments for mobile television. With already more than 140 000 users [11], the WalkTV service (provided by 3 Italia) has gained popularity despite monthly fees in the range of 20 to 30 euros.

A special question in mobile TV pricing is the availability of clear-to-air channels, either advertisement funded or publicly funded. For example how to treat the viewing rights of channels provided by public broadcasting companies remains an unresolved question in many countries. In Great Britain a normal television license (a license for fixed television viewing in the homes) will also be required for mobile TV viewers [12], and the same applies in Finland.

Another factor influencing the mobile broadcast ecosystem is the IPR (intellectual property rights) for the content that is broadcasted over e.g. DVB-H. In many countries this as well remains an unresolved question. In Finland a law was passed in June 2006 stating that simulcasting the same content in DVB-H as in DVB-T would not require additional IPR payments, but new "only-for-mobiles" broadcasting would [13].

VII. CONCLUSIONS

In addition to the DVB-H frequency licensing and content IPR issues, the revenue sharing mechanisms for the different scenarios is among the most important issues to solve. The three scenarios model presented in this paper works as a starting point, leaving all three on the table as viable choices, suited for different market situations in different countries and regions, in different business environments.

Overall, there seems to be a big momentum in the market moving mobile television closer and closer to mass market adoption. Technical issues have been solved; remaining ones deal with business models and regulation. All competing mobile broadcast standards (DVB-H, DMB, ISDB-T, MediaFLO) are on their own behalf bringing mobile TV to the end-user's wish list worldwide, while it seems probable that only a couple of standards will become truly global.

The first commercial DVB-H launch was seen in June 2006 in Italy [14], and in Finland the commercial DVB-H launch is anticipated to take place in the beginning of 2007 [15], still among the first countries in Europe.

Looking at the revenue sharing models, the presumption of using mobile phones and mobile subscriber identities as the basis for billing and charging has evident effects on the value chain: in this scenario MNOs or MVNOs must have a role in revenue sharing. However, neither CMLA nor OMA DRM 2.0 forces the terminals to be mobile phones. On the other hand, in order to make mobile TV service purchases, the terminal needs to have a return channel—a triviality for

modern mobile phones, but not too easily implemented for other kind of devices. Accessible WLAN hotspots do not exist ubiquitously, and the mobility of the mobile TV experience is hence easily compromised. However, unconnected (that is, without return channel) devices for clear-to-air mobile TV reception may well appear in the future.

VIII. RELATED ISSUES AND FUTURE WORK

Issues of great importance but no coverage in this paper include DVB-H transmitter network investment calculations, and quantitative modelling of the presented revenue sharing scenarios.

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Multi-Behavior Agent Model for Supply Chain Management

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Abstract — Recent economic and international threats to occidental industries have encouraged companies to rethink their planning systems. Due to consolidation, the development of integrated supply chains and the use of inter-organizational information systems have increased business interdependencies and the need for collaboration. Thus, agility and the ability to deal quickly with disturbances in supply chains are critical to maintain overall performance. In order to develop tools to increase the agility of the supply chain and to promote the collaborative management of such disturbances, agent-based technology takes advantage of the ability of agents to make autonomous decisions in a distributed network. This paper proposes a multi-behavior agent model using different decision making approaches in a context where planning decisions are supported by a distributed advanced planning system (*d*-APS). The implementation of this solution is realized through the FOR@C experimental agent-based platform, dedicated to the supply chain planning for the forest products industry.

Keywords—Supply chain management, agent architecture, agent-based planning systems, lumber industry.

I. INTRODUCTION

Recent economic and international threats to occidental industries have encouraged companies to rethink their planning systems in a way to quickly react to and correct deviance from established plans, respond to demand, reduce inventory and exchange information promptly throughout the supply chain [20], in other words become more agile. Agility can be described as the association of flexibility, which is the ability to react to changes by presenting different solutions, and high responsiveness, which is the ability to react in a timely fashion. Global organization forces have recognized that performance is not the feature of a single firm, but the complex output of a network of interconnected firms [27]. Efforts have been deployed to increase supply chain performance as a way to stay competitive with international consortiums. Developed mainly to improve efficiency between partners by increasing coordination and communication, supply chain management has been studied in multiple ways.

For years supply chains have been (and are still mostly) managed in a hierarchical way, where demand plans

(customer orders in a context of dynamic demand) are calculated locally and transmitted to suppliers. This sequential planning gives full autonomy to each company and organizational unit involved, but no effort is invested in synchronizing plans and using partner capacity. In fact, the only synchronization tool is the actual demand plan sent to suppliers in order to improve demand forecast and reduce the bullwhip effect. In a context where agility is put forward, where the need to react to changes in a fast manner is increasingly important, exchange of information between partners is crucial to insure plan synchronization and a high degree of agility when faced with disturbances.

The distributed decision making paradigm provides an interesting approach to both increase agility and permit local correction of the plan. This is done by keeping planning decisions distributed, yet use close collaboration mechanisms between organizational units to insure coherence and synchronization of actions. Agent-based technology provides a natural platform that takes advantage of the autonomy of agents and their ability to make decisions in a distributed context, using collaboration and goal-driven decisions. A distributed agent-based Advanced Planning and Scheduling system (*d*-APS) could maintain a real-time plan by re-planning locally and allow for collaboration between agents to deal with disturbances. Plan adjustment in a short period of time leads the way to agile supply chains and increased global performance.

In this paper, we provide a literature review on supply chain planning and how disturbances are handled in such complex environments. We present different uses of agent-based technologies in supply chains and different agent architectures proposed in literature. Then, we describe the experimental agent-based planning platform developed by the FOR@C Research Consortium, which is dedicated to supply chain planning for the forest industry. Our contribution in this paper is to propose a multi-behavior agent model geared with tools designed to improve agility in supply chains. We detail a Multi-behavior agent meta-model, which represents the different behaviors available to the agent, to plan manufacturing activities and deal with disturbances in a distributed collaborative context. Finally, we present a behavior scenario involving a specific disturbance and we suggest an implementation strategy into the FOR@C experimental platform, with the double

objectives to prove feasibility and increase supply chain performance.

The North American lumber industry represents a perfect context for this technology. In fact, this industry is already highly distributed, where many business units interact in all production levels. The main advantage of this industry is the large amount of stochastic disturbances in many aspects of the supply chain, mainly due to the highly heterogeneous aspect of the resource, uncertain process output, production of co-products and by-products, price variation in the spot market and demand variation in commodity markets.

II. LITERATURE REVIEW

A. Planning in supply chains

Global supply chains involving different companies represent an important planning challenge. Partners do not exchange private information easily and are reluctant to share a common database [42]. When organizational units are part of the same company, which can be called an internal supply chain or intra-organizational supply chain, centralized information and planning systems are sometimes used. Gathering information in a centralized management system and redistributing plans can insure synchronization and optimization of plans. Decision support systems, such as Advanced Planning and Scheduling (APS) systems are sophisticated sets of decision support applications using operational research (OR) techniques to find optimal solutions to complex planning problems [18]. However, even in an internal supply chain, when the number of organizational units grows, planning problems become more complex and hard to handle. Also, because of the quantities of information only available locally and the time it takes to plan the entire supply chain, plans are sometimes not feasible and the supply chain shows low reactivity. In fact, currently available software solutions generally do not provide the necessary support to network organizations and are clearly insufficient in planning and coordinating activities in heterogeneous environments [6, 41a]. Moreover, planning, scheduling and traditional control mechanisms are insufficiently flexible to react to rapid changes in production modes and client needs [26]. In fact, traditional systems have not been developed to work in decentralized, dynamic and heterogeneous environments.

In recent years there has been a new trend of management systems emerging. Because coordination cannot be implicitly transmitted from a top level, collaboration and coordination mechanisms are needed to insure synchronization and consistency throughout the supply chain. This opened the way to an entire new research domain, which is supply chain management (SCM), where researchers are interested in coordination and decision making between supply chain partners to optimize the supply chain performance [44].

B. Dealing with disturbances in supply chains

A major difficulty in supply chain planning is dealing with disturbances in an efficient way. In fact, disruptions and uncertainties have been a problem since the beginning of systemized manufacturing and remains an important subject [5]. Disturbances can take different forms, such as change in demand, machine breakdown, late delivery, employee sickness, etc. In a dynamic environment, as in a production plant, as soon as a plan is released, it is immediately subject to random disruptions that quickly render the initial plan obsolete [2].

The traditional way to avoid disturbance related problems is to keep large inventories. In fact, inventory exists more or less as an insurance against uncertainty [13]. While costly, this approach considerably reduces flexibility, because stocked products must be sold even if demand has changed. In contrast, less stock means reducing the overall inventory investment, freeing up available cash flow and improving end-customer service [13].

Keeping low inventory requires close collaboration with partners to ensure precise information on needs. These companies develop business interdependencies since the behavior of one can influence another. In a highly dependent network of entities, when activities are tightly planned, disturbances can have important repercussions throughout the supply chain. For example, a major mechanical breakdown in a strategic third-tier supplier can reduce supply availability for several days, which can have tremendous impacts on the whole supply chain translating in a delay for the final client. Another example is a quick change in demand pattern. When such change happens, every demand plan exchanged between each partner must be updated. If it is not done in a very short period of time, inventories will pile-up and money will be wasted. To counter these problems and their repercussions on the supply chain CPFR (*Collaborative Planning, Forecasting & Replenishment*) methodologies are used and forecasts are prepared jointly.

Much work has been done for dealing with disturbances and uncertainty in a production context. Aytug et al. [5] present a literature review on production scheduling facing uncertainties in the context of a shop floor. Some researchers have presented works on Reactive Scheduling [e.g. 24], which is dedicated to the continuous adaptation of the schedule in a real-time context, with the objective of minimizing perturbations to the initial schedule. Confronted with disturbances, other researchers have worked on finding approaches to modify plans while minimizing impacts on performance using OR techniques [e.g. 2, 3, 7] and artificial intelligence (AI) techniques [e.g. 38]. Replanning is about repairing or starting a new plan in order to adapt to a new context.

Robust scheduling is another approach to deal with disturbances, where the objective is to build a schedule with the best worst-case performance [e.g. 12]. Publications have also presented classifications, management frameworks and the system requirements of disturbances [11, 13, 32, 17].

C. Agent-based system in supply chains

The new trend of distributing decisions resulted in the development of planning systems with agent-based architectures. These approaches are rooted in multi-agent technologies, coming from the AI domain [45]. Agent-based systems focus on implementing individual and social behaviors in a distributed context, using notions like autonomy, reactivity and goal-directed reasoning [9]. The emergence of agent-based systems has represented a real breakthrough in the research world, including researchers from various domains, such as biology, sociology, transportation, management, production, logistics and the military. Agent-based systems are computer systems made of a collection of agents, defined as intelligent software with specific roles and goals, interacting with each other to make the most appropriate decision according to the situation, in order to carry out their part of the planning task [25]. Distributed planning demonstrates many advantages over central planning. For complex problems, sub-problems are easier to solve than centralized problems. Also, because decisions are distributed to different entities, reactivity to changes is increased and the feasibility of plans is likely to improve. The challenge here is that plan performance is linked to agent collaboration capabilities to find acceptable compromises.

Agent-based technology has already been applied to different areas in supply chain management. Parunak [30] presents industrial applications and case studies of agent-based systems, and Shen & Norrie [40] describe more than 30 research projects addressing scheduling, planning and control. More recently, Caridi et al. [10] present a survey and a classification of the different application domains of published multi-agent projects, denoting their degree of maturity.

More specifically, agent-based planning systems have been proposed to manage supply chains and deal with disturbances. Montreuil et al. [27] present the NetMan architecture, an operation system for networked manufacturing organizations that aims to provide a collaborative approach to operations planning. Although the authors created an architecture able to manage unplanned events, they do not present specific behaviors to solve problems following disturbances. Based on intelligent holons, Fletcher et al. [16] present a conceptual architecture of a lumber processing system to improve flexibility and fault tolerance. The ProPlanT multi-agent platform [31] gives decision-making support and simulation possibilities to the manufacturing process. With meta-agents and production agents, they use negotiation, job delegation and task decomposition instead of classic planning and scheduling mechanisms. Building on these research works, we propose to extend the representation of coordination mechanisms in order to increase supply chain agility.

D. Agent architectures

Agents can be designed in various ways, following the internal description of their functions and the connections

between them. The architecture of an agent has a direct impact on its behavior and how it reacts when confronted with different situations. Several classifications of architectures are proposed in the literature [e.g. 9, 41]. Basically, three main architectures are prominent: reactive, deliberative and hybrid agents. Reactive and deliberative agents represent extreme cases of behaviors, whereas hybrid agents are positioned somewhere between the two.

A reactive architecture basically links specific inputs to specific outputs. For example, for a specific observation in the environment, the agent has a pre-determined action. These agents have no internal representation of their world and no symbolic representation of knowledge. Although this architecture can perform very well in simple environments, an agent can show a lack of intelligence and adaptability in a more complex world. An evolved reactive architecture is presented by Brooks [8], which is the *subsumption architecture*, also called *behavior-based architecture*. Instead of a single specific reaction to an input, the reactive agent is decomposed into behaviors which are small independent processes that can be triggered, and where some cancel others. Instead of implementing a simple reactivity mechanism, the agent shows an emergent intelligent behavior, resulting from adaptation to its environment. The main advantage of this architecture is the fast adapted response, because no complex processing is needed and different behaviors are available. The disadvantage is the difficulty in creating objective oriented behaviors that follow long term goals and strategies.

In contrast, deliberative agents use their knowledge about their environment and their internal goals to plan and execute actions. They translate information from the world into symbolic knowledge, which they use to update their internal data base. The BDI (Belief-Desire-Intention) architecture [33] is a well-known example of a deliberative architecture, where the agent uses its knowledge about the world (belief) and its goals (desires) to build a plan of action (intention). The advantage of this architecture is the possibility to plan a sequence of actions, in order to meet long term goals. The agent can understand a complex environment and take an appropriate decision following a set of specific inputs. The disadvantage is the slow reaction time in dynamic environments, where situations can change while the agent is processing to find a suitable action. Also, the problematic of knowledge representation is highly complex and is an entire research domain where researchers study new approaches for decades [e.g. 29].

Hybrid agents fit in between these extremes to find an optimal balance of these behaviors. Many authors presented such architectures. The InteRRaP architecture [28] is a layered-based model, composed of three different layers: a behavior layer, a plan layer and a co-operation layer. For a new situation, the agent first tries to find a rule in the behavior layer, that represents the reactive part of the agent. If no rule is known, the agent uses its second layer, the plan layer, where deliberations are executed to build a plan to solve the problem. If no solution is found, the agent uses its last layer, the co-operation layer, where it collaborates with

other agents to find a feasible solution. Hybrid agents try to compile advantages of both reactive and deliberative architectures, using the best behavior in each situation. The main disadvantage is the difficulty for the designer to coordinate the different layers in order to see an emergent coherent and intelligent agent behavior [9].

E. Hybrid agent architecture in supply chain planning

Several architectures and agent models have been adapted in supply chain context, specifically to improve supply chain performance by planning activities and reacting to disturbances. The variety of possible disturbances, their stochastic distribution and their interactions make this environment highly complex. This is why it is necessary to use deliberative behavior to react to a situation with the best action possible. Also, because the context of supply chains necessitates immediate reaction to changes, fast replanning and instant reply to customer, there is a need for agility only available through reactive behaviors. This is why hybrid agents exhibit the most potential in a supply chain context.

As presented earlier, the InteRRaP architecture provides an interesting approach able to react and deliberate when confronted with disturbances, using different capability levels. The agent can build action plans, depending if an event requires a reactive response, local planning or collaboration for planning. The Agent Building Shell (ABS) [17] is a collection of reusable software components and interfaces needed for any agent involved in a supply chain management system. The ABS is geared to handle perturbations caused by stochastic events in a supply chain. In this architecture, most of the efforts have been focused on defining communication and collaborative aspects. This is done through timely dissemination of information and coordinated revision of plans across the supply chain. The tri-base acquaintance model (3bA) [25] is a collaborative wrapper added to an agent. It provides the possibility of dealing with events in a global perspective instead of resolving problems only in a local view. This is accomplished by using information about other agents without the need of central facilitator. The authors present an example of applications in supply chains and they define the social knowledge needed to increase the efficiency of agents.

From this review, we intend to propose a new hybrid agent model able to deal with disturbances and increase agility in a supply chain context. Our objective is to present an agent model able to use different behaviors following different types of situations, in order to react in the more efficient way and to improve the global supply chain performance. This Multi-behavior agent model is particularly designed to be implemented in a d-APS system, such as the FOR@C experimental platform.

III. FOR@C EXPERIMENTAL PLATFORM

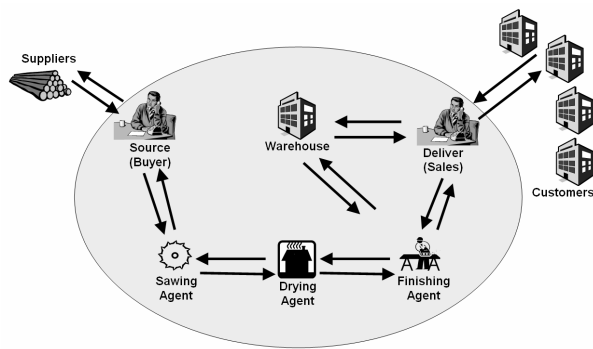
For many years, the planning processes in the North American lumber industry have never been questioned. Due to the highly heterogeneous nature of the resource (i.e. trees) and the inherent complexity of forecasting production throughput, the dominant thinking was to produce the maximum volume with the resource available (push production). Because of the commodity nature of the final product and the standards of sizes and grades, production is oriented towards large batches [19] to take advantage of economies of scale. This industry can be characterized by large inventories, low flexibility and low agility. The recent economic and international threats to the lumber industry have encouraged companies to rethink their planning processes to be able to react quickly to deviance from the plan, respond to demand, reduce inventory and exchange information promptly throughout the supply chain [20]. In order to compensate for the lack of control over the stochastic elements relevant to lumber production, an increase in the exchange of information between the different production centers is necessary, as is to the ability to react quickly in a coordinated manner to changes.

With the purpose of developing a new planning approach for the lumber supply chain, the FOR@C Research Consortium of the Université Laval (Quebec, Canada) has developed an experimental planning platform built on an agent-based architecture for APS, with interaction mechanisms inspired from FIPA (Foundation for Intelligent Physical Agents) standards. This architecture combines agent-based technology with OR techniques to take advantage of the ability of agents to integrate distributed decision problems, and the ability of OR to solve complex decision problems [19]. Because of the distributed context of the supply chain and the use of agents, this platform can be described more precisely as a distributed APS (or *d-APS*), where the first issue is to plan and coordinate all supply chain operations. This platform allows the different production centers to plan and correct deviance independently in line with their proper needs, all the while maintaining feasibility by collaborating with partners.

A. Description of a planning unit

The agent-based architecture presented by FOR@C is based on the natural division of the planning domains. Planning units divide activities between specialized production planning agents: a sawing agent, a drying agent and a finishing agent. This functional distribution is inspired by the SCOR model proposed by the Supply Chain Council [43]. Each of these agents is responsible for supporting the planning of its production center in terms of production output each day. Other agents are also part of the architecture, such as the deliver agent, source agent and warehouse agent. This paper focuses particularly on production planning agents. Figure 1 presents an example of a planning unit, including external exchanges with suppliers and customers.

FIGURE 1
PLANNING UNIT FROM THE FOR@C PLATFORM



The workflow used in a planning unit to plan the internal supply chain upon the receipt of a new demand plan (from outside the PU) is divided in two distinct planning phases: the infinite supply plan and the finite supply plan. During the first phase, deliver agent receives a demand plan from one or many customers. These customers can be part of the same company or different companies. Upon reception, the deliver agent sends a demand plan to the warehouse agent to verify if products are in stock. For non-available products, it sends a demand plan to finishing agent. Using this demand plan, along with resource constraints and lead times the finishing agent builds its plan considering infinite supply and transmits it to the drying agent. Again, using the demand plan, local constraint and considering infinite supply, the drying agent transmits its preferred plan to the sawing agent.

This process continues until suppliers outside the planning unit receive the infinite demand plan. When suppliers answer the demand plans, the source agent receives a supply plan and starts a return loop. This represents the second phase of the planning process, the finite supply plan. The process is largely the same, however plans are built with finite supply, which is the information transmitted by the immediate supplier. For further information the reader is invited to read [19].

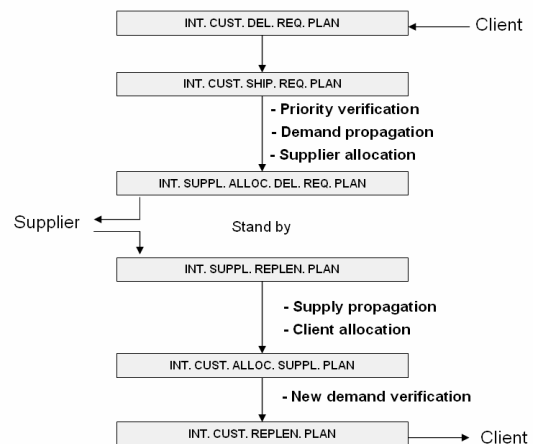
If an event occurs in the internal supply chain operations, any agent can initiate a collaboration with its internal clients and suppliers by sending a revised demand or supply plan. This can be triggered by an agent who needs some products to fulfill inventory, lost production or new demand. This explains why agents are also responsible for continuously monitoring their environment and reacting to disturbances. Because of the interaction context, an agent's environment is also made up of all messages received from other agents specifying a new or modified requirement plan, a new or modified replenishment plan, a contingency situation, or a high priority requirement to process.

B. Actions and task flows

Each planning agent disposes of objects which can be modified by local actions or actions from other agents. Actions are made possible by task flows, which are sequences of tasks, usually triggered by specific events. A

planning agent's standard task flow is the planning protocol (see Figure 2), which is triggered upon reception of a new demand plan from a client. Here, objects are represented by boxes and actions are presented in bold characters. This protocol is divided in two segments. The first concerns modifying a requirement plan, creating a production plan with resource constraints and infinite supply, allocating demand to different suppliers and waiting for an answer. The second concerns receiving supply propositions, updating the production plan with a finite supply, allocating production to clients and modifying a replenishment plan. Optimization algorithms are deployed in the production planning (demand and supply propagation) and allocation tasks to suppliers and clients.

FIGURE 2
CURRENT PLANNING PROTOCOL



Validation of the model was carried out with the collaboration of a forest products company in Canada and real data was used. A supply chain configuration has been developed in order to address the planning of drying and finishing activities inside one plant. This configuration included different types of data, such as production processes, products, orders, on-hand inventory, selling prices, resource costs, forecasted supply, capacity and on-going work. This test covered 100 products, distributed on two dryers and one finishing line, in a planning horizon of 6 weeks. Fifteen agents, more than 600 products, approximately 80 exchange protocols, 100 tasks and 50 task flows were involved. This architecture is a major step toward an improved coordination process for planning requirements.

The current implementation is composed of agents mainly using reactive task flows. These task flows normally in a waiting position and are "fired" when a specific event is noticed. Our objective is to give the agent the possibility of choosing between task flows, by adding specific abilities and knowledge. The agents envisioned in the proposed approach can also exhibit proactive behavior by not only reacting to changes in their environment, but by realizing actions to improve its performance, the performance of a group of agents or the entire supply chain. In this context,

we suggest that the notion of goals is fundamental for an agent to adopt the best behavior, following specific situations.

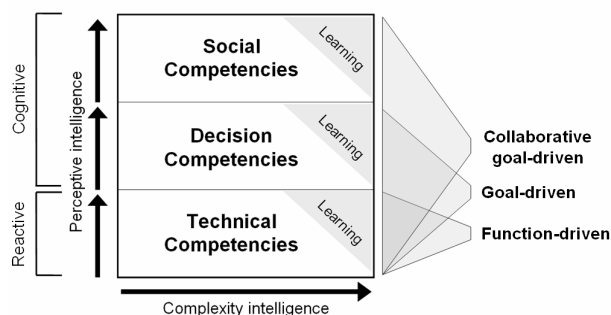
IV. MULTI-BEHAVIOR AGENT MODEL

A. Agent conceptual model

Agent-based planning systems, such as the FOR@C experimental platform, represent a promising way to develop new planning systems in the supply chain. The next step is to develop an agent model to describe the characteristics needed to enhance current production planning agents. Facing disturbances, these agents use reactive task flows, triggered by specific messages (from partners or disturbances). To deploy agents with behaviors adapted to different situations and environments, we must give the agent the ability to make choices and the capability to evaluate these choices following its goals and the state of its environment. The agent conceptual model must present the competencies needed in order to show behaviors adapted to a dynamic supply chain context. Inspired by [23] and [35], we define competency as the underlying attributes of an individual determining his capacity to complete successfully a task within a given environment. All competencies can be classified into three categories, which are *attitudes*, *abilities* and *knowledge*. Attitudes are the tendencies to act in a consistent way, following how an individual thinks and feels. Abilities are capabilities to perform specific tasks with the appropriate tools or techniques. Knowledge is defined here as the explicit understanding of information. In other words, the agent knows what the impact of the information is and how this information can be used, both having a direct impact on its behavior [29].

Integrating agent technology and OR tools, the conceptual model (Figure 4) is composed of three distinct layers, describing the different competencies required for supply chain planning. Other agent architectures present a three-layer approach, such as InteRRaP, but the model presented here is a conceptual model. The objective of this conceptual model is to describe the basics capabilities in order to serve as a guideline for further developments, instead of a precise arrangement of functionalities.

FIGURE 4
AGENT CONCEPTUAL MODEL



The bottom layer of the agent model is the *Technical competency layer*. This decision layer includes all reactive tools, tasks and existing task flows, such as OR tools and algorithms, conversation protocols, negotiation protocols and queries. Goals in this layer are related to minimizing effort (computer processing) while maximizing results (optimization functions included in tools). Usual planning processes and reactive corrective actions to face specific disturbance are known and used when needed. An agent strong in this layer but weak in the others would show *function-driven* behavior. Current agents deployed in the FOR@C platform exhibit such behavior. When they face an event, they send a new demand plan to suppliers and then a new supply plan to clients. At this point, a superior reasoning behavior could be achieved by giving new possibilities to deal with disturbances, other than just starting a global re-planning protocol. Sometimes, different tools can be used to deal with the same situation. The agent would be greatly advantaged to have capabilities of analyzing the situation more deeply allowing it to make a clever choice.

This is where the *Decision competency layer* permits the evolution from the reactive behavior to a cognitive behavior. It includes the explicit knowledge of local goals and the progress toward these goals at any time. Geared toward the optimization of the goals it has been assigned to, the agent is primarily concerned by a set of performance metrics that represents what the systems designer has developed. In brief, the agent only knows the impacts of its decisions in terms of this set of metrics. Here, when a disturbance occurs, the agent has the capability to choose which task, task flow, optimization algorithms or complete plan could fit better, according to its own goals. The agent must have a representation of its goals and mechanisms to update and measure the achievement toward these internal goals.

An agent strong in the decision layer and technical layer would present a *goal-driven* behavior. This additional competency clearly gives some advantage to the agent, but it is still unaware of the impact of its decisions on its partners, or on the supply chain. It needs a broader conception to be able to take decisions in the interest of the majority.

The *Social competency layer* fills this gap by integrating the welfare of the collective through collective goals. The agent is now aware of the impacts of its decisions on other agents and on the whole supply chain. While choosing actions to correct deviations from plan, we want the agent to possess the ability to capture the entire potential of the network and be able to minimize impact on others. This layer includes mechanisms to obtain and update collective goals. Collective goals include other agent goals and network tactical goals (i.e. specific product, client selection, supplier selection). If the agent cannot have direct access to other agent goals or collective goals, it must be able to anticipate them. It needs to have the ability to use collaboration protocols with anticipation of other agent reactions. With this competency layer, the agent can choose

which task, task flow or plan responds best to collective goals. Agents covering the three previous layers exhibit a *collaborative goal-driven* behavior.

Imbedded in each layer, the learning competency gives the agent the potential to increase its knowledge in each competency layer. A specific action or sequence of actions that showed positive results in a situation could be learned and remembered for the next occurrence. The idea is to further push the articulation of the human decision-making process in our agent model. Various works have presented learning in agent-based systems as a way to improve the performance of manufacturing systems and supply chains. Shen et al. [39] present an interesting literature review on the subject and propose learning techniques adopted in the MetaMorph project. They distinguish learning from history (case-based reasoning) and learning from the future (by simulation). Alonso et al. [4] argue that learning is the most crucial characteristic of intelligent agent systems and present different learning perspectives and techniques. Although this subject is not detailed in this article, it will be studied in the near future, with the objective to be fully implemented in new FOR@C agent architecture.

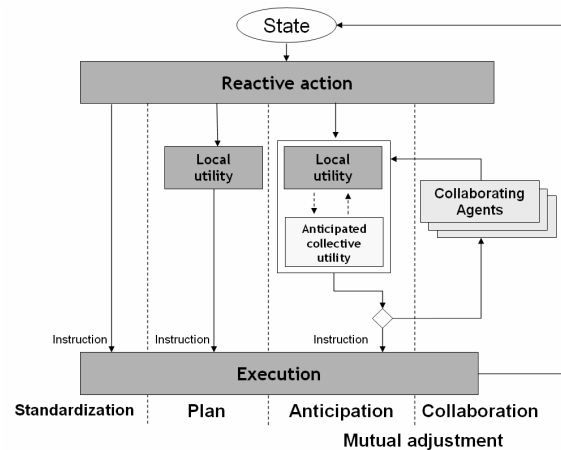
B. Multi-Behavior Agent Meta-Model

The agent conceptual model presented in the above sections gives the basic requirements we believe are necessary in a planning agent involved in a dynamic supply chain. These competencies are quite general and there is need to clarify how they interact to describe a global behavior able to complete the planning tasks. Pursuing this objective, we developed a behavior meta-model (Figure 5). The meta-model presents four basic behaviors to react to a new state in a planning context. Inspired by coordination mechanisms presented in [20], these planning behaviors are *Standardization*, *Plan*, *Anticipation* and *Collaboration*. The two last behaviors are both *Mutual adjustment* behaviors. Depending on the type of disturbance and on the context of the environment, a different behavior can be suggested.

When the system reaches a new state (top of Figure 5), the agent evaluates the situation and selects the appropriate behavior. This reactive action concerns recognizing the type of disturbance and choosing, depending on the type (i.e. new demand requirement, low inventory report, machine breakdown, etc.) and on the context (i.e. short delay of respond, low machine occupancy, etc.) the preferred behavior. It searches in a protocols repository, where events, task flows and protocols are linked together.

If a standardized action is known, a reactive instruction is chosen and executed. This is the simplest reaction available, where a single action or sequence of actions is required for correcting the situation. We call this the *Standardization behavior*. In many situations, humans do not make decisions about what to do, as they just act in a natural way [22]. The same principle is applied here, where a routine behavior is implemented to insure fast reaction time to standard input.

FIGURE 5
MULTI-BEHAVIOR AGENT META MODEL

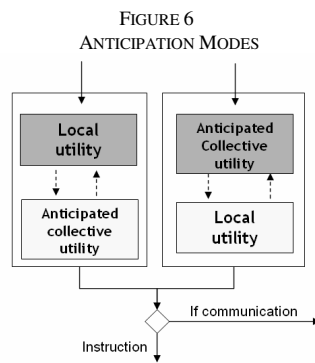


For specific disturbances, more than a standardized action is needed. When the agent recognizes such a situation it must build a plan adapted to the context, where the utility of the different possibilities of actions or sequences of actions is evaluated. Utility can be defined as the degree of usefulness of a state to an agent [15, 34]. When alternative actions are possible to an agent, it must choose the action leading to the state with the highest utility. Utility theory is used to represent and reason about preferences. At this stage, the agent reasons about its utility, using its goals, as defined by its designer. The agent calculates the contribution of choosing a specific action over another. This is *Plan behavior*.

The utility evaluation capability is basically about comparing choices and selecting the best among them. Different characteristics of each action can increase or decrease utility, i.e. probability of success, execution time, perturbation among partners and optimality of solution. Depending on the environment and on goals, utility for an agent can vary.

Other disturbances necessitate an even more complex approach to decision making, especially when the decision will impact other agents in the network. Such situations call for mutual adjustment from the planning agent, where it must take care of the utility of its collectivity (sets of interrelated agents, part of the global supply chain), not only itself. When no full disclosure is possible amongst agents, they can use an approximate anticipation of the impact of its decision on the collective utility. This is the third behavior called *Anticipation behavior*. Anticipation is the conception of a partial or complete model of the partner's reasoning. By taking into account a partner's decision model, the agent can improve its outcome by being closer to the optimal solution. The agent chooses an action following its local utility and then uses an anticipation of the collective utility of the same decision, in order to check if the action is desirable for the collectivity of agents (or the entire supply chain). Anticipation of partners in supply chains has been studied in a hierarchical relation [37] (also called upstream planning).

It is possible to invert the importance of local utility versus collective utility, by changing the anticipation mode (Figure 6). In this way, an agent becomes totally dedicated to the collectivity. The agent first searches for an action that is the best for the collectivity, then it checks the local utility of this decision, to make sure the decision is desirable. If it is not the case, the agent must find another solution. As the first model could be compared as a *realistic behavior*, the latter can be viewed as an *altruistic behavior*. Readings on anticipation can be found in [36, 37].



When communication is possible with the collectivity, the agent can adopt a collaboration behavior. This fourth behavior, the *Collaboration behavior*, includes a feedback loop provided by a communication channel between the planning agent and collaborating agents. Collaboration between planning partners in supply chains has been studied in distributed relations [1, 43]. After the anticipation mechanism has been used, a message including the decision for action is transmitted to the agent collectivity for feedback. Therefore, corrections can be made on real opinion or simulation from other agents and not depending only on anticipation of the impact of decisions. When a negotiation loop is introduced in distributed networks such as supply chains with no concrete hierarchy, convergence mechanisms must be followed to insure a potential solution. Dudek and Stadtler [14] propose a negotiation-based scheme between two supply chain partners with exchange of proposals and local associated costs.

This Multi-behavior agent meta-model represents the general case where an agent has to face a new state in its environment. Because the agent has to meet specific objectives, like production rates, client satisfaction, etc, it must react to correct the situation. This model covers all kinds of disturbances met in supply chains and describes what kind of reaction can be taken.

C. Advantages of the Multi-behavior agent

Compared to a reactive agent, the Multi-Behavior Agent presents many advantages. Although reactive behavior is still available for quick standardized well-known reactions, it is possible to use a deliberative decision process to apply the best action possible. One of the main advantages is the possibility to deal with actions that have impact on more

than one goal. For example, it could allow for reaching a compromise between two different local goals (i.e. minimize inventory vs. maximize production output) or between a local goal and a collective goal (maximize local performance vs. maximize client satisfaction). Also, mutual adjustment behaviors permit agent decisions to confront its anticipation of the collectivity reaction or with direct negotiation to find a compromise profitable for the supply chain.

Another advantage is the possibility to adjust the behavior following external factors. For example, when a client sends a demand plan and requests an acceptance or a refusal in a short time frame, the agent is able to use its standardized behavior fastest respond. In this case, instead of replanning the production plan (that would take a certain amount of time); it would just check available time in the current schedule. In contrast, if a large amount of time is available, the agent would take time to send new demand plans to suppliers to check the possibility of a positive response to the new plan. This example is detailed in the next section.

Moreover, the possibility to anticipate collective goals when communication is not possible (or too long to achieve) represents an appreciable advantage, as better decisions can be taken with limited knowledge. Otherwise, when communication is permitted, negotiation protocols permit a convergence to a compromise that would increase collective performance instead of only individual performance.

Although this description of advantages seems promising, it is still based on a conceptual model. A proof of concept is needed and performance measurements must be accomplished to claim any real advantages. This requires the implementation of the Multi-Behavior Agent in a real-world supply chain context, where manufacturing activities must be planned and confronted with stochastic disturbances.

V. IMPLEMENTATION OF THE MULTI-BEHAVIOR AGENT

In order to implement the Multi-behavior agent, it is necessary to develop different scenarios where a production planning agent is confronted to a specific disturbance. Examples of these scenarios are inspired from the lumber industry, i.e. a major kiln breakdown, out of stock report, unmet harvest and new demand plan. In a supplier/client relationship, we detail the actions of these agents to solve the problem. Only then will it be possible to design and implement an agent able to reproduce the behaviors denoted in the scenarios.

A. Behavior scenario

The scenario we retain here is the reception of a new demand plan to the planning agent from a client. A demand plan is formed of different product orders, requested at

different dates. Because the planning agent must respond to his client in a very short delay (because he may lose the sale), he gives a delay of one hour to provide the client with an offer. Following this new state, the planning agent must decide if the fulfillment of the new demand is possible or an alternative proposition can be produced, considering the modifications needed in its own production plan, the availability of resources and the delivery dates requested.

According to the agent Behavior Meta-Model (Figure 5), the first action taken by the planning agent is to evaluate which behavior is the most appropriate depending on the situation. With this short delay, the agent clearly does not have time for mutual adjustment (anticipation or collaboration). The standardization behavior has only a single method to answer question and this is to replan the entire production plan incorporating the new requirements. Because this process takes a few hours to complete and necessitates sending information messages to suppliers and waiting for answers, it is not a feasible solution. The behavior to put forward in this case is planning using local utility evaluation. The agent can now choose between different options. During the time left, the agent can check production resource availability to try to fit the new demand plan into the current production plan. Also, it can find a sub-contractor who would be willing to do the job. Here, a message must be sent with a shorter respond delay than asked by the client. Another possibility is to reassign stocks or on-line productions promised to another client to accommodate the new client. Sometimes, these supply reassignments, applied using OR tools, can find optimal solutions while minimizing delivery delays. Between these choices, the agent must perform a utility evaluation of the options, following the percentage of change of success and the profitability of each. Also, if time permits, more than one action can be successively performed. In this example, by reassigning supplies, the agent finds a way to fit in the client's new demand plan. It updates its production plan and sends an acceptance message to its client. In order to select the best action, researchers have proposed approaches using a shop floor context, using case-based reasoning and heuristic search techniques [5].

This example demonstrates the advantage of this design over reactive and deliberative agent architectures. A purely reactive agent would not have time to send a proper answer to the client because its new production plan would not be completed and the sale would be lost. On the other hand, a purely deliberative agent would send a supply plan different from the client demand plan, requesting a negotiation. This process is not adapted to short delay situation.

B. Simulation plan

In order to prove the concept of the multi-behavior agent and test its performance, implementation and simulation must be undertaken. Implementation will be gradual, and behaviors will be developed successively. As the current implementation of the planning agent is mainly the standardized behavior mentioned previously, little work will

be needed for this behavior. The first implementation is the plan behavior, using local goals. This step includes the capability of recognizing situations and matching them to the best possible behavior, the environment context taking in account. It also encompasses the design of a utility evaluation function, where the agent can classify actions following its preferences. At this stage, it will be possible to simulate this *Goal-driven agent* (GD) on the FOR@C experimental platform, by designing a supply chain made of GD planning agents. Performance tests will be possible by comparing key performance factors (i.e. resource use, rapidity of answer, etc.) of the GD supply chain with a reactive agent supply chain.

The second implementation will be the anticipation behavior. This includes the introduction of collective goals in the utility function. Also, the anticipation function must be designed with updated mechanisms. Here, testing will be possible by comparing an *Anticipated Goal-driven* (AGD) supply chain with a GD supply chain or a reactive supply chain. In addition, it will be possible to compare both anticipation mode, stating the realistic behavior (local goals as top-model) and altruist behavior (collective goals as top-model).

The final implementation will be the collaboration behavior. Collaboration protocols will be developed, including convergence mechanisms to insure compromise. Again, comparison of performances will be possible between a Collaborative Goal-driven (CGD) supply chain and other previously implemented supply chains.

VI. CONCLUSION

Supply chain planning agent models using the advantage of reactivity, utility evaluation, anticipation and negotiation, such as the Multi-behavior agent, can be a powerful tool to reach appreciated gains when implemented in a distributed planning system such as the FOR@C experimental platform. Following the conceptualization of the intelligent behaviors and their implementation, future work is needed. For example, we intend to test different agent configurations in real-world planning situations to determine the different situations where specific behaviors react well and those where they react badly. In a different perspective, it will be of great interest to increase research efforts on the learning competency, with both its implications and impacts. A Multi-behavior agent geared with learning abilities would be able to update its utility functions to modify its preference for an action which gave good results in the past. This is highly promising and should lead to an even more agile and performing supply chain.

ACKNOWLEDGEMENT

This work was funded by the FOR@C Research Consortium and the Natural Sciences and Engineering Research Council of Canada (NSERC).

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Multi-Behavior Agent Model for Supply Chain Management

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Abstract — Recent economic and international threats to occidental industries have encouraged companies to rethink their planning systems. Due to consolidation, the development of integrated supply chains and the use of inter-organizational information systems have increased business interdependencies and the need for collaboration. Thus, agility and the ability to deal quickly with disturbances in supply chains are critical to maintain overall performance. In order to develop tools to increase the agility of the supply chain and to promote the collaborative management of such disturbances, agent-based technology takes advantage of the ability of agents to make autonomous decisions in a distributed network. This paper proposes a multi-behavior agent model using different decision making approaches in a context where planning decisions are supported by a distributed advanced planning system (*d*-APS). The implementation of this solution is realized through the FOR@C experimental agent-based platform, dedicated to the supply chain planning for the forest products industry.

Keywords—Supply chain management, agent architecture, agent-based planning systems, lumber industry.

I. INTRODUCTION

Recent economic and international threats to occidental industries have encouraged companies to rethink their planning systems in a way to quickly react to and correct deviance from established plans, respond to demand, reduce inventory and exchange information promptly throughout the supply chain [20], in other words become more agile. Agility can be described as the association of flexibility, which is the ability to react to changes by presenting different solutions, and high responsiveness, which is the ability to react in a timely fashion. Global organization forces have recognized that performance is not the feature of a single firm, but the complex output of a network of interconnected firms [27]. Efforts have been deployed to increase supply chain performance as a way to stay competitive with international consortiums. Developed mainly to improve efficiency between partners by increasing coordination and communication, supply chain management has been studied in multiple ways.

For years supply chains have been (and are still mostly) managed in a hierarchical way, where demand plans

(customer orders in a context of dynamic demand) are calculated locally and transmitted to suppliers. This sequential planning gives full autonomy to each company and organizational unit involved, but no effort is invested in synchronizing plans and using partner capacity. In fact, the only synchronization tool is the actual demand plan sent to suppliers in order to improve demand forecast and reduce the bullwhip effect. In a context where agility is put forward, where the need to react to changes in a fast manner is increasingly important, exchange of information between partners is crucial to insure plan synchronization and a high degree of agility when faced with disturbances.

The distributed decision making paradigm provides an interesting approach to both increase agility and permit local correction of the plan. This is done by keeping planning decisions distributed, yet use close collaboration mechanisms between organizational units to insure coherence and synchronization of actions. Agent-based technology provides a natural platform that takes advantage of the autonomy of agents and their ability to make decisions in a distributed context, using collaboration and goal-driven decisions. A distributed agent-based Advanced Planning and Scheduling system (*d*-APS) could maintain a real-time plan by re-planning locally and allow for collaboration between agents to deal with disturbances. Plan adjustment in a short period of time leads the way to agile supply chains and increased global performance.

In this paper, we provide a literature review on supply chain planning and how disturbances are handled in such complex environments. We present different uses of agent-based technologies in supply chains and different agent architectures proposed in literature. Then, we describe the experimental agent-based planning platform developed by the FOR@C Research Consortium, which is dedicated to supply chain planning for the forest industry. Our contribution in this paper is to propose a multi-behavior agent model geared with tools designed to improve agility in supply chains. We detail a Multi-behavior agent meta-model, which represents the different behaviors available to the agent, to plan manufacturing activities and deal with disturbances in a distributed collaborative context. Finally, we present a behavior scenario involving a specific disturbance and we suggest an implementation strategy into the FOR@C experimental platform, with the double

objectives to prove feasibility and increase supply chain performance.

The North American lumber industry represents a perfect context for this technology. In fact, this industry is already highly distributed, where many business units interact in all production levels. The main advantage of this industry is the large amount of stochastic disturbances in many aspects of the supply chain, mainly due to the highly heterogeneous aspect of the resource, uncertain process output, production of co-products and by-products, price variation in the spot market and demand variation in commodity markets.

II. LITERATURE REVIEW

A. Planning in supply chains

Global supply chains involving different companies represent an important planning challenge. Partners do not exchange private information easily and are reluctant to share a common database [42]. When organizational units are part of the same company, which can be called an internal supply chain or intra-organizational supply chain, centralized information and planning systems are sometimes used. Gathering information in a centralized management system and redistributing plans can insure synchronization and optimization of plans. Decision support systems, such as Advanced Planning and Scheduling (APS) systems are sophisticated sets of decision support applications using operational research (OR) techniques to find optimal solutions to complex planning problems [18]. However, even in an internal supply chain, when the number of organizational units grows, planning problems become more complex and hard to handle. Also, because of the quantities of information only available locally and the time it takes to plan the entire supply chain, plans are sometimes not feasible and the supply chain shows low reactivity. In fact, currently available software solutions generally do not provide the necessary support to network organizations and are clearly insufficient in planning and coordinating activities in heterogeneous environments [6, 41a]. Moreover, planning, scheduling and traditional control mechanisms are insufficiently flexible to react to rapid changes in production modes and client needs [26]. In fact, traditional systems have not been developed to work in decentralized, dynamic and heterogeneous environments.

In recent years there has been a new trend of management systems emerging. Because coordination cannot be implicitly transmitted from a top level, collaboration and coordination mechanisms are needed to insure synchronization and consistency throughout the supply chain. This opened the way to an entire new research domain, which is supply chain management (SCM), where researchers are interested in coordination and decision making between supply chain partners to optimize the supply chain performance [44].

B. Dealing with disturbances in supply chains

A major difficulty in supply chain planning is dealing with disturbances in an efficient way. In fact, disruptions and uncertainties have been a problem since the beginning of systemized manufacturing and remains an important subject [5]. Disturbances can take different forms, such as change in demand, machine breakdown, late delivery, employee sickness, etc. In a dynamic environment, as in a production plant, as soon as a plan is released, it is immediately subject to random disruptions that quickly render the initial plan obsolete [2].

The traditional way to avoid disturbance related problems is to keep large inventories. In fact, inventory exists more or less as an insurance against uncertainty [13]. While costly, this approach considerably reduces flexibility, because stocked products must be sold even if demand has changed. In contrast, less stock means reducing the overall inventory investment, freeing up available cash flow and improving end-customer service [13].

Keeping low inventory requires close collaboration with partners to ensure precise information on needs. These companies develop business interdependencies since the behavior of one can influence another. In a highly dependent network of entities, when activities are tightly planned, disturbances can have important repercussions throughout the supply chain. For example, a major mechanical breakdown in a strategic third-tier supplier can reduce supply availability for several days, which can have tremendous impacts on the whole supply chain translating in a delay for the final client. Another example is a quick change in demand pattern. When such change happens, every demand plan exchanged between each partner must be updated. If it is not done in a very short period of time, inventories will pile-up and money will be wasted. To counter these problems and their repercussions on the supply chain CPFR (*Collaborative Planning, Forecasting & Replenishment*) methodologies are used and forecasts are prepared jointly.

Much work has been done for dealing with disturbances and uncertainty in a production context. Aytug et al. [5] present a literature review on production scheduling facing uncertainties in the context of a shop floor. Some researchers have presented works on Reactive Scheduling [e.g. 24], which is dedicated to the continuous adaptation of the schedule in a real-time context, with the objective of minimizing perturbations to the initial schedule. Confronted with disturbances, other researchers have worked on finding approaches to modify plans while minimizing impacts on performance using OR techniques [e.g. 2, 3, 7] and artificial intelligence (AI) techniques [e.g. 38]. Replanning is about repairing or starting a new plan in order to adapt to a new context.

Robust scheduling is another approach to deal with disturbances, where the objective is to build a schedule with the best worst-case performance [e.g. 12]. Publications have also presented classifications, management frameworks and the system requirements of disturbances [11, 13, 32, 17].

C. Agent-based system in supply chains

The new trend of distributing decisions resulted in the development of planning systems with agent-based architectures. These approaches are rooted in multi-agent technologies, coming from the AI domain [45]. Agent-based systems focus on implementing individual and social behaviors in a distributed context, using notions like autonomy, reactivity and goal-directed reasoning [9]. The emergence of agent-based systems has represented a real breakthrough in the research world, including researchers from various domains, such as biology, sociology, transportation, management, production, logistics and the military. Agent-based systems are computer systems made of a collection of agents, defined as intelligent software with specific roles and goals, interacting with each other to make the most appropriate decision according to the situation, in order to carry out their part of the planning task [25]. Distributed planning demonstrates many advantages over central planning. For complex problems, sub-problems are easier to solve than centralized problems. Also, because decisions are distributed to different entities, reactivity to changes is increased and the feasibility of plans is likely to improve. The challenge here is that plan performance is linked to agent collaboration capabilities to find acceptable compromises.

Agent-based technology has already been applied to different areas in supply chain management. Parunak [30] presents industrial applications and case studies of agent-based systems, and Shen & Norrie [40] describe more than 30 research projects addressing scheduling, planning and control. More recently, Caridi et al. [10] present a survey and a classification of the different application domains of published multi-agent projects, denoting their degree of maturity.

More specifically, agent-based planning systems have been proposed to manage supply chains and deal with disturbances. Montreuil et al. [27] present the NetMan architecture, an operation system for networked manufacturing organizations that aims to provide a collaborative approach to operations planning. Although the authors created an architecture able to manage unplanned events, they do not present specific behaviors to solve problems following disturbances. Based on intelligent holons, Fletcher et al. [16] present a conceptual architecture of a lumber processing system to improve flexibility and fault tolerance. The ProPlanT multi-agent platform [31] gives decision-making support and simulation possibilities to the manufacturing process. With meta-agents and production agents, they use negotiation, job delegation and task decomposition instead of classic planning and scheduling mechanisms. Building on these research works, we propose to extend the representation of coordination mechanisms in order to increase supply chain agility.

D. Agent architectures

Agents can be designed in various ways, following the internal description of their functions and the connections

between them. The architecture of an agent has a direct impact on its behavior and how it reacts when confronted with different situations. Several classifications of architectures are proposed in the literature [e.g. 9, 41]. Basically, three main architectures are prominent: reactive, deliberative and hybrid agents. Reactive and deliberative agents represent extreme cases of behaviors, whereas hybrid agents are positioned somewhere between the two.

A reactive architecture basically links specific inputs to specific outputs. For example, for a specific observation in the environment, the agent has a pre-determined action. These agents have no internal representation of their world and no symbolic representation of knowledge. Although this architecture can perform very well in simple environments, an agent can show a lack of intelligence and adaptability in a more complex world. An evolved reactive architecture is presented by Brooks [8], which is the *subsumption architecture*, also called *behavior-based architecture*. Instead of a single specific reaction to an input, the reactive agent is decomposed into behaviors which are small independent processes that can be triggered, and where some cancel others. Instead of implementing a simple reactivity mechanism, the agent shows an emergent intelligent behavior, resulting from adaptation to its environment. The main advantage of this architecture is the fast adapted response, because no complex processing is needed and different behaviors are available. The disadvantage is the difficulty in creating objective oriented behaviors that follow long term goals and strategies.

In contrast, deliberative agents use their knowledge about their environment and their internal goals to plan and execute actions. They translate information from the world into symbolic knowledge, which they use to update their internal data base. The BDI (Belief-Desire-Intention) architecture [33] is a well-known example of a deliberative architecture, where the agent uses its knowledge about the world (belief) and its goals (desires) to build a plan of action (intention). The advantage of this architecture is the possibility to plan a sequence of actions, in order to meet long term goals. The agent can understand a complex environment and take an appropriate decision following a set of specific inputs. The disadvantage is the slow reaction time in dynamic environments, where situations can change while the agent is processing to find a suitable action. Also, the problematic of knowledge representation is highly complex and is an entire research domain where researchers study new approaches for decades [e.g. 29].

Hybrid agents fit in between these extremes to find an optimal balance of these behaviors. Many authors presented such architectures. The InteRRaP architecture [28] is a layered-based model, composed of three different layers: a behavior layer, a plan layer and a co-operation layer. For a new situation, the agent first tries to find a rule in the behavior layer, that represents the reactive part of the agent. If no rule is known, the agent uses its second layer, the plan layer, where deliberations are executed to build a plan to solve the problem. If no solution is found, the agent uses its last layer, the co-operation layer, where it collaborates with

other agents to find a feasible solution. Hybrid agents try to compile advantages of both reactive and deliberative architectures, using the best behavior in each situation. The main disadvantage is the difficulty for the designer to coordinate the different layers in order to see an emergent coherent and intelligent agent behavior [9].

E. Hybrid agent architecture in supply chain planning

Several architectures and agent models have been adapted in supply chain context, specifically to improve supply chain performance by planning activities and reacting to disturbances. The variety of possible disturbances, their stochastic distribution and their interactions make this environment highly complex. This is why it is necessary to use deliberative behavior to react to a situation with the best action possible. Also, because the context of supply chains necessitates immediate reaction to changes, fast replanning and instant reply to customer, there is a need for agility only available through reactive behaviors. This is why hybrid agents exhibit the most potential in a supply chain context.

As presented earlier, the InteRRaP architecture provides an interesting approach able to react and deliberate when confronted with disturbances, using different capability levels. The agent can build action plans, depending if an event requires a reactive response, local planning or collaboration for planning. The Agent Building Shell (ABS) [17] is a collection of reusable software components and interfaces needed for any agent involved in a supply chain management system. The ABS is geared to handle perturbations caused by stochastic events in a supply chain. In this architecture, most of the efforts have been focused on defining communication and collaborative aspects. This is done through timely dissemination of information and coordinated revision of plans across the supply chain. The tri-base acquaintance model (3bA) [25] is a collaborative wrapper added to an agent. It provides the possibility of dealing with events in a global perspective instead of resolving problems only in a local view. This is accomplished by using information about other agents without the need of central facilitator. The authors present an example of applications in supply chains and they define the social knowledge needed to increase the efficiency of agents.

From this review, we intend to propose a new hybrid agent model able to deal with disturbances and increase agility in a supply chain context. Our objective is to present an agent model able to use different behaviors following different types of situations, in order to react in the more efficient way and to improve the global supply chain performance. This Multi-behavior agent model is particularly designed to be implemented in a d-APS system, such as the FOR@C experimental platform.

III. FOR@C EXPERIMENTAL PLATFORM

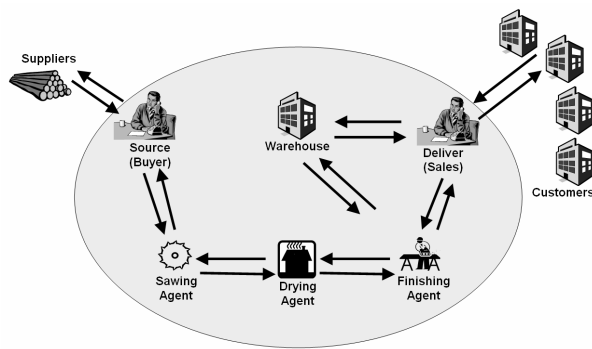
For many years, the planning processes in the North American lumber industry have never been questioned. Due to the highly heterogeneous nature of the resource (i.e. trees) and the inherent complexity of forecasting production throughput, the dominant thinking was to produce the maximum volume with the resource available (push production). Because of the commodity nature of the final product and the standards of sizes and grades, production is oriented towards large batches [19] to take advantage of economies of scale. This industry can be characterized by large inventories, low flexibility and low agility. The recent economic and international threats to the lumber industry have encouraged companies to rethink their planning processes to be able to react quickly to deviance from the plan, respond to demand, reduce inventory and exchange information promptly throughout the supply chain [20]. In order to compensate for the lack of control over the stochastic elements relevant to lumber production, an increase in the exchange of information between the different production centers is necessary, as is to the ability to react quickly in a coordinated manner to changes.

With the purpose of developing a new planning approach for the lumber supply chain, the FOR@C Research Consortium of the Université Laval (Quebec, Canada) has developed an experimental planning platform built on an agent-based architecture for APS, with interaction mechanisms inspired from FIPA (Foundation for Intelligent Physical Agents) standards. This architecture combines agent-based technology with OR techniques to take advantage of the ability of agents to integrate distributed decision problems, and the ability of OR to solve complex decision problems [19]. Because of the distributed context of the supply chain and the use of agents, this platform can be described more precisely as a distributed APS (or *d-APS*), where the first issue is to plan and coordinate all supply chain operations. This platform allows the different production centers to plan and correct deviance independently in line with their proper needs, all the while maintaining feasibility by collaborating with partners.

A. Description of a planning unit

The agent-based architecture presented by FOR@C is based on the natural division of the planning domains. Planning units divide activities between specialized production planning agents: a sawing agent, a drying agent and a finishing agent. This functional distribution is inspired by the SCOR model proposed by the Supply Chain Council [43]. Each of these agents is responsible for supporting the planning of its production center in terms of production output each day. Other agents are also part of the architecture, such as the deliver agent, source agent and warehouse agent. This paper focuses particularly on production planning agents. Figure 1 presents an example of a planning unit, including external exchanges with suppliers and customers.

FIGURE 1
PLANNING UNIT FROM THE FOR@C PLATFORM



The workflow used in a planning unit to plan the internal supply chain upon the receipt of a new demand plan (from outside the PU) is divided in two distinct planning phases: the infinite supply plan and the finite supply plan. During the first phase, deliver agent receives a demand plan from one or many customers. These customers can be part of the same company or different companies. Upon reception, the deliver agent sends a demand plan to the warehouse agent to verify if products are in stock. For non-available products, it sends a demand plan to finishing agent. Using this demand plan, along with resource constraints and lead times the finishing agent builds its plan considering infinite supply and transmits it to the drying agent. Again, using the demand plan, local constraint and considering infinite supply, the drying agent transmits its preferred plan to the sawing agent.

This process continues until suppliers outside the planning unit receive the infinite demand plan. When suppliers answer the demand plans, the source agent receives a supply plan and starts a return loop. This represents the second phase of the planning process, the finite supply plan. The process is largely the same, however plans are built with finite supply, which is the information transmitted by the immediate supplier. For further information the reader is invited to read [19].

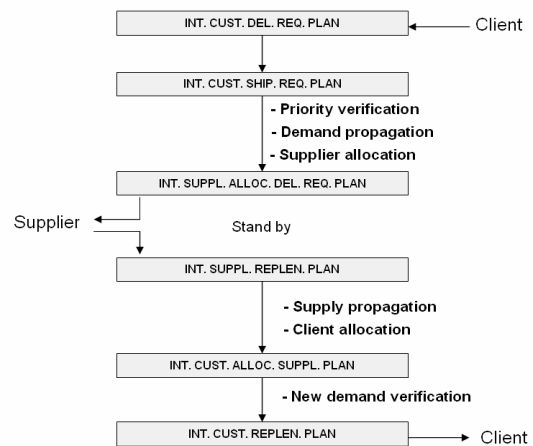
If an event occurs in the internal supply chain operations, any agent can initiate a collaboration with its internal clients and suppliers by sending a revised demand or supply plan. This can be triggered by an agent who needs some products to fulfill inventory, lost production or new demand. This explains why agents are also responsible for continuously monitoring their environment and reacting to disturbances. Because of the interaction context, an agent's environment is also made up of all messages received from other agents specifying a new or modified requirement plan, a new or modified replenishment plan, a contingency situation, or a high priority requirement to process.

B. Actions and task flows

Each planning agent disposes of objects which can be modified by local actions or actions from other agents. Actions are made possible by task flows, which are sequences of tasks, usually triggered by specific events. A

planning agent's standard task flow is the planning protocol (see Figure 2), which is triggered upon reception of a new demand plan from a client. Here, objects are represented by boxes and actions are presented in bold characters. This protocol is divided in two segments. The first concerns modifying a requirement plan, creating a production plan with resource constraints and infinite supply, allocating demand to different suppliers and waiting for an answer. The second concerns receiving supply propositions, updating the production plan with a finite supply, allocating production to clients and modifying a replenishment plan. Optimization algorithms are deployed in the production planning (demand and supply propagation) and allocation tasks to suppliers and clients.

FIGURE 2
CURRENT PLANNING PROTOCOL



Validation of the model was carried out with the collaboration of a forest products company in Canada and real data was used. A supply chain configuration has been developed in order to address the planning of drying and finishing activities inside one plant. This configuration included different types of data, such as production processes, products, orders, on-hand inventory, selling prices, resource costs, forecasted supply, capacity and on-going work. This test covered 100 products, distributed on two dryers and one finishing line, in a planning horizon of 6 weeks. Fifteen agents, more than 600 products, approximately 80 exchange protocols, 100 tasks and 50 task flows were involved. This architecture is a major step toward an improved coordination process for planning requirements.

The current implementation is composed of agents mainly using reactive task flows. These task flows normally in a waiting position and are "fired" when a specific event is noticed. Our objective is to give the agent the possibility of choosing between task flows, by adding specific abilities and knowledge. The agents envisioned in the proposed approach can also exhibit proactive behavior by not only reacting to changes in their environment, but by realizing actions to improve its performance, the performance of a group of agents or the entire supply chain. In this context,

we suggest that the notion of goals is fundamental for an agent to adopt the best behavior, following specific situations.

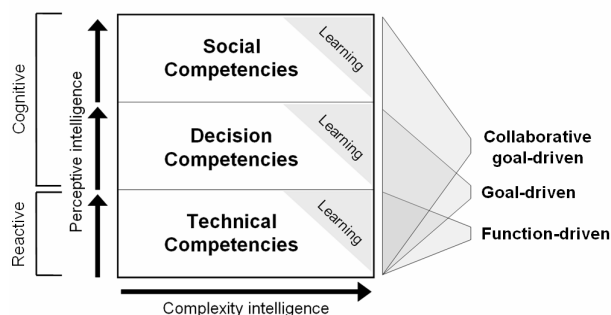
IV. MULTI-BEHAVIOR AGENT MODEL

A. Agent conceptual model

Agent-based planning systems, such as the FOR@C experimental platform, represent a promising way to develop new planning systems in the supply chain. The next step is to develop an agent model to describe the characteristics needed to enhance current production planning agents. Facing disturbances, these agents use reactive task flows, triggered by specific messages (from partners or disturbances). To deploy agents with behaviors adapted to different situations and environments, we must give the agent the ability to make choices and the capability to evaluate these choices following its goals and the state of its environment. The agent conceptual model must present the competencies needed in order to show behaviors adapted to a dynamic supply chain context. Inspired by [23] and [35], we define competency as the underlying attributes of an individual determining his capacity to complete successfully a task within a given environment. All competencies can be classified into three categories, which are *attitudes*, *abilities* and *knowledge*. Attitudes are the tendencies to act in a consistent way, following how an individual thinks and feels. Abilities are capabilities to perform specific tasks with the appropriate tools or techniques. Knowledge is defined here as the explicit understanding of information. In other words, the agent knows what the impact of the information is and how this information can be used, both having a direct impact on its behavior [29].

Integrating agent technology and OR tools, the conceptual model (Figure 4) is composed of three distinct layers, describing the different competencies required for supply chain planning. Other agent architectures present a three-layer approach, such as InteRRaP, but the model presented here is a conceptual model. The objective of this conceptual model is to describe the basics capabilities in order to serve as a guideline for further developments, instead of a precise arrangement of functionalities.

FIGURE 4
AGENT CONCEPTUAL MODEL



The bottom layer of the agent model is the *Technical competency layer*. This decision layer includes all reactive tools, tasks and existing task flows, such as OR tools and algorithms, conversation protocols, negotiation protocols and queries. Goals in this layer are related to minimizing effort (computer processing) while maximizing results (optimization functions included in tools). Usual planning processes and reactive corrective actions to face specific disturbance are known and used when needed. An agent strong in this layer but weak in the others would show *function-driven* behavior. Current agents deployed in the FOR@C platform exhibit such behavior. When they face an event, they send a new demand plan to suppliers and then a new supply plan to clients. At this point, a superior reasoning behavior could be achieved by giving new possibilities to deal with disturbances, other than just starting a global re-planning protocol. Sometimes, different tools can be used to deal with the same situation. The agent would be greatly advantaged to have capabilities of analyzing the situation more deeply allowing it to make a clever choice.

This is where the *Decision competency layer* permits the evolution from the reactive behavior to a cognitive behavior. It includes the explicit knowledge of local goals and the progress toward these goals at any time. Geared toward the optimization of the goals it has been assigned to, the agent is primarily concerned by a set of performance metrics that represents what the systems designer has developed. In brief, the agent only knows the impacts of its decisions in terms of this set of metrics. Here, when a disturbance occurs, the agent has the capability to choose which task, task flow, optimization algorithms or complete plan could fit better, according to its own goals. The agent must have a representation of its goals and mechanisms to update and measure the achievement toward these internal goals.

An agent strong in the decision layer and technical layer would present a *goal-driven* behavior. This additional competency clearly gives some advantage to the agent, but it is still unaware of the impact of its decisions on its partners, or on the supply chain. It needs a broader conception to be able to take decisions in the interest of the majority.

The *Social competency layer* fills this gap by integrating the welfare of the collective through collective goals. The agent is now aware of the impacts of its decisions on other agents and on the whole supply chain. While choosing actions to correct deviations from plan, we want the agent to possess the ability to capture the entire potential of the network and be able to minimize impact on others. This layer includes mechanisms to obtain and update collective goals. Collective goals include other agent goals and network tactical goals (i.e. specific product, client selection, supplier selection). If the agent cannot have direct access to other agent goals or collective goals, it must be able to anticipate them. It needs to have the ability to use collaboration protocols with anticipation of other agent reactions. With this competency layer, the agent can choose

which task, task flow or plan responds best to collective goals. Agents covering the three previous layers exhibit a *collaborative goal-driven* behavior.

Imbedded in each layer, the learning competency gives the agent the potential to increase its knowledge in each competency layer. A specific action or sequence of actions that showed positive results in a situation could be learned and remembered for the next occurrence. The idea is to further push the articulation of the human decision-making process in our agent model. Various works have presented learning in agent-based systems as a way to improve the performance of manufacturing systems and supply chains. Shen et al. [39] present an interesting literature review on the subject and propose learning techniques adopted in the MetaMorph project. They distinguish learning from history (case-based reasoning) and learning from the future (by simulation). Alonso et al. [4] argue that learning is the most crucial characteristic of intelligent agent systems and present different learning perspectives and techniques. Although this subject is not detailed in this article, it will be studied in the near future, with the objective to be fully implemented in new FOR@C agent architecture.

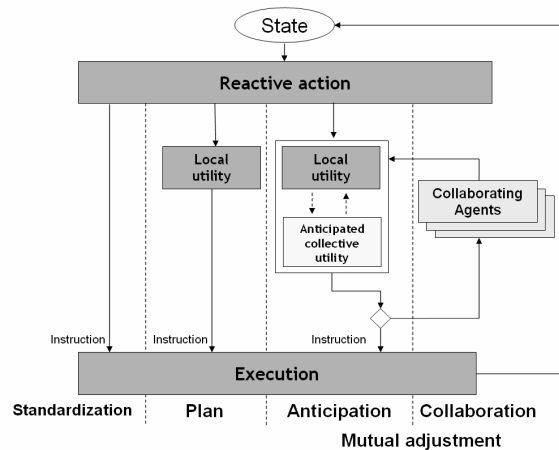
B. Multi-Behavior Agent Meta-Model

The agent conceptual model presented in the above sections gives the basic requirements we believe are necessary in a planning agent involved in a dynamic supply chain. These competencies are quite general and there is need to clarify how they interact to describe a global behavior able to complete the planning tasks. Pursuing this objective, we developed a behavior meta-model (Figure 5). The meta-model presents four basic behaviors to react to a new state in a planning context. Inspired by coordination mechanisms presented in [20], these planning behaviors are *Standardization*, *Plan*, *Anticipation* and *Collaboration*. The two last behaviors are both *Mutual adjustment* behaviors. Depending on the type of disturbance and on the context of the environment, a different behavior can be suggested.

When the system reaches a new state (top of Figure 5), the agent evaluates the situation and selects the appropriate behavior. This reactive action concerns recognizing the type of disturbance and choosing, depending on the type (i.e. new demand requirement, low inventory report, machine breakdown, etc.) and on the context (i.e. short delay of respond, low machine occupancy, etc.) the preferred behavior. It searches in a protocols repository, where events, task flows and protocols are linked together.

If a standardized action is known, a reactive instruction is chosen and executed. This is the simplest reaction available, where a single action or sequence of actions is required for correcting the situation. We call this the *Standardization behavior*. In many situations, humans do not make decisions about what to do, as they just act in a natural way [22]. The same principle is applied here, where a routine behavior is implemented to insure fast reaction time to standard input.

FIGURE 5
MULTI-BEHAVIOR AGENT META MODEL

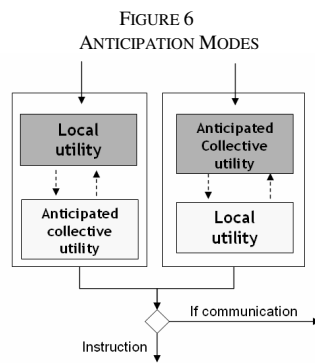


For specific disturbances, more than a standardized action is needed. When the agent recognizes such a situation it must build a plan adapted to the context, where the utility of the different possibilities of actions or sequences of actions is evaluated. Utility can be defined as the degree of usefulness of a state to an agent [15, 34]. When alternative actions are possible to an agent, it must choose the action leading to the state with the highest utility. Utility theory is used to represent and reason about preferences. At this stage, the agent reasons about its utility, using its goals, as defined by its designer. The agent calculates the contribution of choosing a specific action over another. This is *Plan behavior*.

The utility evaluation capability is basically about comparing choices and selecting the best among them. Different characteristics of each action can increase or decrease utility, i.e. probability of success, execution time, perturbation among partners and optimality of solution. Depending on the environment and on goals, utility for an agent can vary.

Other disturbances necessitate an even more complex approach to decision making, especially when the decision will impact other agents in the network. Such situations call for mutual adjustment from the planning agent, where it must take care of the utility of its collectivity (sets of interrelated agents, part of the global supply chain), not only itself. When no full disclosure is possible amongst agents, they can use an approximate anticipation of the impact of its decision on the collective utility. This is the third behavior called *Anticipation behavior*. Anticipation is the conception of a partial or complete model of the partner's reasoning. By taking into account a partner's decision model, the agent can improve its outcome by being closer to the optimal solution. The agent chooses an action following its local utility and then uses an anticipation of the collective utility of the same decision, in order to check if the action is desirable for the collectivity of agents (or the entire supply chain). Anticipation of partners in supply chains has been studied in a hierarchical relation [37] (also called upstream planning).

It is possible to invert the importance of local utility versus collective utility, by changing the anticipation mode (Figure 6). In this way, an agent becomes totally dedicated to the collectivity. The agent first searches for an action that is the best for the collectivity, then it checks the local utility of this decision, to make sure the decision is desirable. If it is not the case, the agent must find another solution. As the first model could be compared as a *realistic behavior*, the latter can be viewed as an *altruistic behavior*. Readings on anticipation can be found in [36, 37].



When communication is possible with the collectivity, the agent can adopt a collaboration behavior. This fourth behavior, the *Collaboration behavior*, includes a feedback loop provided by a communication channel between the planning agent and collaborating agents. Collaboration between planning partners in supply chains has been studied in distributed relations [1, 43]. After the anticipation mechanism has been used, a message including the decision for action is transmitted to the agent collectivity for feedback. Therefore, corrections can be made on real opinion or simulation from other agents and not depending only on anticipation of the impact of decisions. When a negotiation loop is introduced in distributed networks such as supply chains with no concrete hierarchy, convergence mechanisms must be followed to insure a potential solution. Dudek and Stadtler [14] propose a negotiation-based scheme between two supply chain partners with exchange of proposals and local associated costs.

This Multi-behavior agent meta-model represents the general case where an agent has to face a new state in its environment. Because the agent has to meet specific objectives, like production rates, client satisfaction, etc, it must react to correct the situation. This model covers all kinds of disturbances met in supply chains and describes what kind of reaction can be taken.

C. Advantages of the Multi-behavior agent

Compared to a reactive agent, the Multi-Behavior Agent presents many advantages. Although reactive behavior is still available for quick standardized well-known reactions, it is possible to use a deliberative decision process to apply the best action possible. One of the main advantages is the possibility to deal with actions that have impact on more

than one goal. For example, it could allow for reaching a compromise between two different local goals (i.e. minimize inventory vs. maximize production output) or between a local goal and a collective goal (maximize local performance vs. maximize client satisfaction). Also, mutual adjustment behaviors permit agent decisions to confront its anticipation of the collectivity reaction or with direct negotiation to find a compromise profitable for the supply chain.

Another advantage is the possibility to adjust the behavior following external factors. For example, when a client sends a demand plan and requests an acceptance or a refusal in a short time frame, the agent is able to use its standardized behavior fastest respond. In this case, instead of replanning the production plan (that would take a certain amount of time); it would just check available time in the current schedule. In contrast, if a large amount of time is available, the agent would take time to send new demand plans to suppliers to check the possibility of a positive response to the new plan. This example is detailed in the next section.

Moreover, the possibility to anticipate collective goals when communication is not possible (or too long to achieve) represents an appreciable advantage, as better decisions can be taken with limited knowledge. Otherwise, when communication is permitted, negotiation protocols permit a convergence to a compromise that would increase collective performance instead of only individual performance.

Although this description of advantages seems promising, it is still based on a conceptual model. A proof of concept is needed and performance measurements must be accomplished to claim any real advantages. This requires the implementation of the Multi-Behavior Agent in a real-world supply chain context, where manufacturing activities must be planned and confronted with stochastic disturbances.

V. IMPLEMENTATION OF THE MULTI-BEHAVIOR AGENT

In order to implement the Multi-behavior agent, it is necessary to develop different scenarios where a production planning agent is confronted to a specific disturbance. Examples of these scenarios are inspired from the lumber industry, i.e. a major kiln breakdown, out of stock report, unmet harvest and new demand plan. In a supplier/client relationship, we detail the actions of these agents to solve the problem. Only then will it be possible to design and implement an agent able to reproduce the behaviors denoted in the scenarios.

A. Behavior scenario

The scenario we retain here is the reception of a new demand plan to the planning agent from a client. A demand plan is formed of different product orders, requested at

different dates. Because the planning agent must respond to his client in a very short delay (because he may lose the sale), he gives a delay of one hour to provide the client with an offer. Following this new state, the planning agent must decide if the fulfillment of the new demand is possible or an alternative proposition can be produced, considering the modifications needed in its own production plan, the availability of resources and the delivery dates requested.

According to the agent Behavior Meta-Model (Figure 5), the first action taken by the planning agent is to evaluate which behavior is the most appropriate depending on the situation. With this short delay, the agent clearly does not have time for mutual adjustment (anticipation or collaboration). The standardization behavior has only a single method to answer question and this is to replan the entire production plan incorporating the new requirements. Because this process takes a few hours to complete and necessitates sending information messages to suppliers and waiting for answers, it is not a feasible solution. The behavior to put forward in this case is planning using local utility evaluation. The agent can now choose between different options. During the time left, the agent can check production resource availability to try to fit the new demand plan into the current production plan. Also, it can find a sub-contractor who would be willing to do the job. Here, a message must be sent with a shorter respond delay than asked by the client. Another possibility is to reassign stocks or on-line productions promised to another client to accommodate the new client. Sometimes, these supply reassignments, applied using OR tools, can find optimal solutions while minimizing delivery delays. Between these choices, the agent must perform a utility evaluation of the options, following the percentage of change of success and the profitability of each. Also, if time permits, more than one action can be successively performed. In this example, by reassigning supplies, the agent finds a way to fit in the client's new demand plan. It updates its production plan and sends an acceptance message to its client. In order to select the best action, researchers have proposed approaches using a shop floor context, using case-based reasoning and heuristic search techniques [5].

This example demonstrates the advantage of this design over reactive and deliberative agent architectures. A purely reactive agent would not have time to send a proper answer to the client because its new production plan would not be completed and the sale would be lost. On the other hand, a purely deliberative agent would send a supply plan different from the client demand plan, requesting a negotiation. This process is not adapted to short delay situation.

B. Simulation plan

In order to prove the concept of the multi-behavior agent and test its performance, implementation and simulation must be undertaken. Implementation will be gradual, and behaviors will be developed successively. As the current implementation of the planning agent is mainly the standardized behavior mentioned previously, little work will

be needed for this behavior. The first implementation is the plan behavior, using local goals. This step includes the capability of recognizing situations and matching them to the best possible behavior, the environment context taking in account. It also encompasses the design of a utility evaluation function, where the agent can classify actions following its preferences. At this stage, it will be possible to simulate this *Goal-driven agent* (GD) on the FOR@C experimental platform, by designing a supply chain made of GD planning agents. Performance tests will be possible by comparing key performance factors (i.e. resource use, rapidity of answer, etc.) of the GD supply chain with a reactive agent supply chain.

The second implementation will be the anticipation behavior. This includes the introduction of collective goals in the utility function. Also, the anticipation function must be designed with updated mechanisms. Here, testing will be possible by comparing an *Anticipated Goal-driven* (AGD) supply chain with a GD supply chain or a reactive supply chain. In addition, it will be possible to compare both anticipation mode, stating the realistic behavior (local goals as top-model) and altruist behavior (collective goals as top-model).

The final implementation will be the collaboration behavior. Collaboration protocols will be developed, including convergence mechanisms to insure compromise. Again, comparison of performances will be possible between a Collaborative Goal-driven (CGD) supply chain and other previously implemented supply chains.

VI. CONCLUSION

Supply chain planning agent models using the advantage of reactivity, utility evaluation, anticipation and negotiation, such as the Multi-behavior agent, can be a powerful tool to reach appreciated gains when implemented in a distributed planning system such as the FOR@C experimental platform. Following the conceptualization of the intelligent behaviors and their implementation, future work is needed. For example, we intend to test different agent configurations in real-world planning situations to determine the different situations where specific behaviors react well and those where they react badly. In a different perspective, it will be of great interest to increase research efforts on the learning competency, with both its implications and impacts. A Multi-behavior agent geared with learning abilities would be able to update its utility functions to modify its preference for an action which gave good results in the past. This is highly promising and should lead to an even more agile and performing supply chain.

ACKNOWLEDGEMENT

This work was funded by the FOR@C Research Consortium and the Natural Sciences and Engineering Research Council of Canada (NSERC).

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Ownership Management in Presence of Fuelling Business Growth by Investing Knowledge and Experience

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Abstract — This study examines the role of knowledge in the venture growth process, ranging from the research and innovation stage to the established firm. First, it addresses the typologies of knowledge and expertise and the means of knowledge based value adding in diverse stages of the new business growth. The complexity of contributing business growth, both with structured intellectual assets, such as the patents, and especially with unstructured knowledge and expertise as assets, has been the source of the research questions of this study; it is understood that a proper guidance model is required to enhance the growth process. Thus, the elements for managing and governing the interests of the stakeholders derived from the venture-to-capital theory have been adopted in this paper as a starting point for creating a more robust view of managing knowledge and expertise in the venture growth process.

Finally, the aim of this study is to conceptualise the ownership management of emerging business from the research stage to viable business start-up firm, and to go even beyond this by evaluating the feasibility of the model considering SMEs' growth strategies. The search for a new model actually involves exploring change management that is outlined by risk taking and rewarding mechanism, social issues, and the investment of both capital and immaterial intellectual properties where the key resources are the founder team, the other key persons, and investors.

Further, this model is characterized by four determinants, and it denotes the dynamism of the entire model.

Keywords — venture capital, venture-to-capital, knowledge investing, knowledge management, innovation management, entrepreneurship

I. INTRODUCTION

Governments the world over are today increasingly being forced to improve their public-funded and public-private-funded research commercialization measures while the interest of private investors and corporations has lessened in regard to ventures still in their early stage, i.e. capitalizing prospective pre-seed business embryos or seed-phase business ventures.

This phenomenon is well known and documented, e.g. in publications by the Finnish Ministry of Trade and Industry [23]. It is not unusual for lucrative innovations embedded in technology research projects, as well as knowledge-

based entrepreneurial activity involving prospective business opportunities, to fail to meet up with the capital market.

Not surprisingly, SMEs also lack the stimulating power of the innovativeness renewal process and injection of knowledge and business expertise that could speed up their new growth and offer a remedy for the threat of shrivelling of their businesses. Approximately 48% of Finnish SMEs (in total, 225 582 firms less than 50 employees) [10] manifest either strong or some interest in growth. Some 6-9% of them are powerfully growth-orientated companies actively seeking opportunities for growth [ibid]. Moreover, one of the cornerstones of the sustainable growth of big corporations is their ability to exploit innovations.

A. Research setting and questions

The objective of this study is to examine the demand for knowledge and business expertise in the area ranging from research to the established firm, and secondly to search for sound ownership management able to capture the unique features of the governance structures reaching far beyond the present standards.

Although defining the concept of knowledge is complex, it is a key element of this study, and therefore requires thorough theoretical consideration. In business economics, knowledge can be valued according to its relevance to business objectives, in which case the value of knowledge is specified by its contribution to the venture as it strives to enter its intended market and to increase its capital value. Therefore, the study extends beyond this by examining structural and non-structural knowledge as an asset that can be invested in, probably together with capital.

Following the theoretical discussion, analyses of three sample spots are produced in terms of the multiple case study research strategy. The first two sample sets are taken from the Measurepolis Network. The third sample set belongs to the category of SMEs and is based on the author's experience in participatory consultant work and co-entrepreneur activity with SMEs in the fields of electronics, process control, ICT, and specialised metal construction. Therefore the study concentrates on knowledge intensive businesses whose technology orientation is high.

The building of the Measurepolis Network is in progress and the planning process is being carried out by the research project; it was launched in April 2006 and is due to last until August 2007. It involves seven universities carrying out research in the area of measurement technology. The present status of Measurepolis is equal to that of the National Centre of Expertise for Measurement Technology held by the Centre of Technology in Kajaani, which is closely linked with “*Idänkaari*”, the Eastern Arc, a co-operation body between measurement-technology research institutes located in Eastern and Northern Finland, which is also co-ordinated by Kajaani. These institutes are as follows: the Universities of Oulu, Joensuu, Turku, Kuopio, Jyväskylä, and Lappeenranta, as well as the State Technical Research Center of Finland (VTT).

In brief, this paper endeavours to determine whether there is room for knowledge investing as separate from investing money, or in a such a way that the role of pecuniary investment is subordinated to knowledge investing.

Even more so, the assessment of the concept of knowledge venturing is discussed as the paper introduces a framework for ownership management that represents at least a promising attempt at capturing the complexity of the ownership of investable knowledge in its various forms. Thus, the focus here is in the arena of consulting, business co-operation, and co-entrepreneurship that implies the opportunity side as well the risk element involved in typical investment activity. Moreover, the concept of knowledge investing is here linked to the venture capital context.

The research questions are as follows:

- What kind of business expertise do early-stage business embryos need to become prospective ventures?
- How does the process of the knowledge and business expertise interaction between parties function?
- What are the contributors and retarding forces of the teaming process of a technologically-orientated researcher team reinforced with business expert(s)?
- Are there some guidelines for the ownership management framework that can be applied in each of the three areas of observation?
- Does knowledge investing comply with the concept of venturing?
- Is it possible to define a knowledge investor, or even further to define a knowledge venture actor? Or it is correct just to speak of co-entrepreneurship, business consulting or board working?

B. Research method

The empirical part of the study was carried out following the principles of multiple case study research logic [35], which implies using multiple data sources, not only multiple cases. Accordingly, observations, interviews,

narratives, and literature were collected, thereby fulfilling the triangulation requirement of case study research study logic.

II. IN THE SEARCH FOR INVESTABLE KNOWLEDGE ASSETS IN VENTURING

Considering the theoretic approach selection, the technology management discipline could be one promising theory for the purposes of this study as it concentrates on the early stages of developing business. However, it does not fully explain the characteristics of the risk in capital investment and the reasoning in intellectual capital sourcing. Therefore, a more robust theory, the venture capital theory, was selected, and from within that theory the venture-to-capital framework [1, 28, 30], which discusses the venture growth process from a prospective to an investable venture. However, venture-to-capital literature leaves room for thorough understanding of what is involved before the birth of a venture.

The ideal business formation process ranging from the stage of basic research to a new business operation is depicted in Fig. 1 next page [12]. Not only creating a new technology business firm, as is pointed out below in the picture, the model involves different ramification options for the business embryo to implement technology transfer or patent trading in the portfolio of an existing company (these ramifications are not shown in the figure).

The model is derived by extending the Venture-to-Capital process [28] with models available in technology and innovation management literature [32]. Similarly, the need of diverse knowledge and business expertise qualities are required depending on the phase in question.

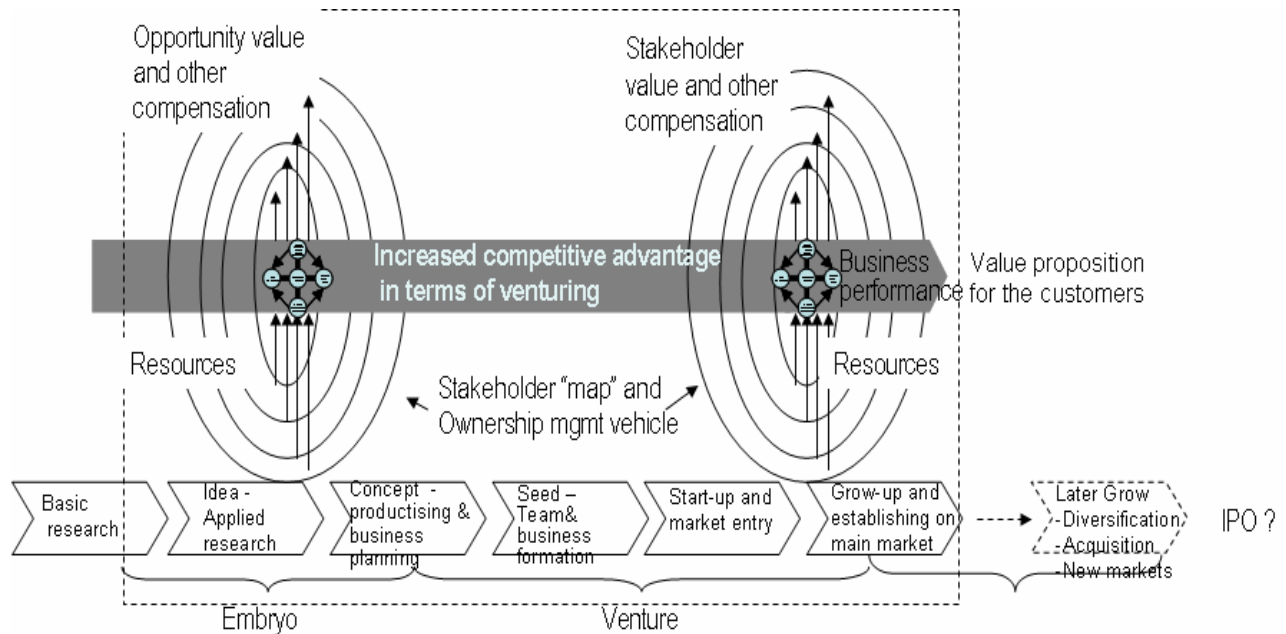


Fig 1. Research to capital framework

A. Venture growth

The concept of venture growth is relatively young. Among the basic theoretical approaches paving the way to understanding the challenges of emerging new business is the resource dependency theory [24]. An enterprise's successful growth is dependent on the availability of resources from its environment. The resource-based view depicts companies as collections of resources and capabilities. Capabilities reflect the ability to combine resources in a meaningful way to promote the company's performance. The actual driving force of for the growth of the firm is especially the managerial capability that realizes the business opportunities and link the resources for creating new growth [ibid].

The driving force needed for growing the venture is articulated in terms of entrepreneurial activity or capital. The capability to utilise scarce resources, project management skills, and a strong will to win barriers are among the traits of the entrepreneurial capital [7]. Therefore, the significance of a committed good leader for a business project is more important than the high quality of the innovation. "A grade A man with grade B idea is better than a grade B man with a grade A idea" was the famous rule of the first leader of American Research and Development Corporation, G.F. Doriot expressed the very same principle [30, p.141].

In the corporation context, the nature of entrepreneurship is also recognized to be a renewing force, although it is complex to maintain and meets resistance from existing businesses and their business area owners [1]. Especially managerial forces committed to serving key customers bringing major revenues into the company are representatives of enterprise stagnation [5]. Therefore an

intrapreneur or an intrapreneur-team creating a new business action very seldom gets support from their colleagues or superiors because their operation may threat the position of the others. The present situation regarding big companies is getting better, although voices of secret and unofficial projects are still heard indicating the existence of stagnation.

Although lack of the first mover, a committed business project leader or champion, can be successfully resolved, there are still two gaps to be crossed. The recent research on the venture capital theory highlights the nature of the funding gap that comprises both capital and knowledge funding. The need for human capital is synonymous with the lack of the diverse skills and competences, which are interpreted more generally as managerial skills and business knowledge or intelligence.

The second, the equity gap, is an obvious and problematic for new ventures seeking small-sized initial investment to be met by a lack of interest on part of capital investors [28, 30]. The equity gap can also be seen as the distance between the venture and the capital market (in terms of both knowledge and money). Reaching the capital market requires a professionally organized ownership management.

As is already illustrated in Fig. 1, the phases are almost the same as those proposed in the venture-to-capital theory; namely, Idea, Concept, Seed, Start-up, Growth, and Maturity [30]. However, here the nomination of Idea is replaced with the terminology found in the technology management literature.

B. Knowledge and expertise in venture growth process

The venture growth process implies a strategic view since managing growth undeniably involves strategic thinking. However, in order to promote other frontiers of

the venture, which are more operative by nature than strategic planning, there is a need for an input of the diverse knowledge qualities. In practice, the venture requires people having not only with different knowledge qualities, but people possessing a particular mindset or logic of thinking [2].

The outlining process of the business concept at the early stage of the venture growth process comprises three main dimensions: organization, product system, and market segmentation [22]. In fact, articulating the business concept manifests the presence of strategic thinking that is the fourth required mindset, and comprises the pivotal questions of strategy planning: What is the market? What are the products for it? What are the resources available in order to gain the intended market with the chosen products?

The incubation and venture capital firm models reveal some other elements, e.g. need for core group competence, drive and commitment of the team, customer relations, and networking [15, 28]. However these additional requirements do not change the basic setting stated by Normann. Customer relations require management skills, although knowing one's customers and understanding their expectations represent both knowledge as well as having a marketing-minded approach. Accordingly, the networking capability is more a matter of a skill than of a mindset. Therefore, the concept of mindset remains the same however much it may be augmented by capabilities and skills.

The growth process model of General Electric – The Execute for Growth – introduces six elements: Customers (i.e. relationship management), Innovation (i.e. the innovation management), Great Technology (i.e. superior products), Commercial Excellence (i.e. sales and marketing), Globalization (i.e. capability to create opportunities and entry to markets everywhere), Growth of Leaders (developing new core group members) [11]. So far, there are no new pieces for the puzzle of characterizing the mindsets and capabilities involved in the growth process. However, when a more detailed understanding of the research and innovation-to-capital process is needed, examining the business platforms and growth process models of big corporations implies a sound foundation for the mapping those requirements.

An emerging business venture, on the other hand, is mainly dominated by skills, experience, and business knowledge, and the role of capital investment money can be even secondary to the role of human resource. Human, not financial, capital must be the starting point and on-going foundation of a successful strategy [3].

Depending on the growth phase, diverse qualities of knowledge and experiences are required. The number of people that can be involved in an emerging business is limited, and thus human capital, i.e. the business experience, the skills, and the knowledge qualities of the core team members, must be in place. Due to the growth process reasons, getting new human capital necessitates

replacing the current workforce with a new workforce; which, though painful, is imperative. The demand for fresh thinking and new knowledge and expertise is pervasive vertically throughout the all firm's layers from top to down. Accordingly, changes in the dominance of the firm's leadership may occur repeatedly. Based on observations made of start-ups in Silicon Valley, Komisar [16] described 'three CEOs' reflecting the different challenges facing the leader of a young venture. The first CEO puts together the team and manages early growth, the next one paves the way to the main market, and finally the third CEO brings strategic wisdom actualising the later growth. In other words, first, as the technology team is being built up, business managerial skills are added to it, next it is complemented by sales and marketing excellence, and finally it is strengthened by strategic wisdom.

Briefly put, as intellectual property is always human-related, the human-related aspects become even more important in the launching phase than they are in an established company. Management and entrepreneurship, in addition to their other characteristics, involve the human aspect since they are based on individual persons' experience and the business knowledge they have accumulated during their career.

Innovations are mainly rooted in their origin, which is of two kinds: 1) Marketing-and-customer-relations rooted, and 2) Research-and-design-orientated rooted innovations [34]. In their breakthrough book on tacit knowledge, Nonaka et al. introduce two case stories, one concerning a bread machine R&D project and the second one concerning sales and marketing people's power in the 3M Company [21]. Both cases underline the principle of two wells of innovations.

Categorizing innovation in terms of its flaming point, other typologies have also been suggested, e.g. innovation that can be related to various drivers such as changes in legislation, cost efficiency based process improvement, hard technology inventions, etc. Moreover, on examining the birth of innovations in diverse industries, Keith Pavitt (1984) found three dominant innovation management styles that are related to a particular type of industry to some degree. The research results claimed categorization by the domination of the following factors: (1) Supplier relationship, (2) Production development intensiveness, and (3) Research and development. Accordingly, an innovation leads to minor product improvements, improvements in the production process, and organization learning, and specialization, and research-grounded innovation can reveal significant new business opportunities.

C. From knowledge assets to competitive advantages

The growth of economic wealth in pace with the growth of the firm is dictated by several contributing factors. Identifying knowledge as an asset is complex and almost incapable of being captured as a separate object. The concept of knowledge found in post-war scientific literature

up to the beginning of the 1990s is discussed in terms of know-how, e.g. Polanyi (organizational learning), and P. Senge (business intelligence), just to name two authors. The literature on strategy, in turn, looks at knowledge as an organic part embedded in competitive advantage, e.g. Porter [25].

The first attempts at defining the typology of intellectual asset categories were conducted by Sveiby and Edvinsson concerning the Skandia Corporation's intangible goodwill value that explains the difference between book value and market value. In their model, on the lowest level, the fifth level, is to be found innovation capital belonging to organizational, then structural, and further in intellectual capital, which is the second of the two denominators together with financial capital, defining the intangible asset value of the Skandia Corporation [31]. Further development of the model adds elements not present in the Skandia model, e.g. relational, social, and technological capital.

The research done by Sveiby et al. and the subsequent research completing their work leaves two major question open. The first is that of how human capital assets are born and developed and the second is that of what knowledge they are built up of and whether some qualities of knowledge are more valuable than others. The aspect of knowledge embedded in the technology management value chain involves three stages at the beginning: (1) Basic research, (2) Applied research, and (3) Product development. Similar stages are available in knowledge transformation process: (1) Knowledge and expertise as an asset, (2) Meaningful knowledge, which is applicable to the business firm in question and articulated sometimes as know-how, (3) Intelligence in resolving customer needs [19]. However, pointing out transformation as a process from the typologies of human capital asset into the customer value, which is the goal and mission of knowledge and expertise in business, is beyond the scope of this study.

The question of matching available knowledge in the most suitable way to meet the criteria of value adding of the venture is of pivotal importance. Further, this study suggests that, under certain conditions where the risks, incentives, human capital offerings and trustworthiness are in place in an adjusted way, the transformation process is embedded, and thus no separate management effort is needed.

The capability to resolve customer problems, the mission of knowledge asset, arises from competitive advantages that form the foundation of a firm. Available knowledge is then brought together by the technologically-orientated founder team and co-founders with more recent knowledge qualities, and other personified knowledge and expertise at the later stages, which contributes to creating competitive advantage and thereby through that the value of the venture. Finally, the secret of value adding is not only in the high grade knowledge and people, but in the way it is

structured. The process of structuring knowledge and protecting it leads to the concept of fully-structured knowledge, e.g. patents and semi-structured knowledge and experience tied with it that can be expressed as core competence [26]. Similarly, the relationship between the research team's research work, their innovation, and the patent can be expressed in terms of the structuring process where the researcher team's knowledge is transformed into a patent, a fully-structured form of knowledge.

D. Valuating the knowledge

Once a co-founder or other value-adding actors are connected with the growth process, their knowledge venturing capabilities and personal experiences and knowledge form the best recommendation for creating a relationship between the parties.

The subject of discussion here is unstructured knowledge assets. Are there differences in the value of diverse types of knowledge? The answer is: "Yes and no." Depending on the context where we apply a particular piece of knowledge, it can be said that a certain type of knowledge is more valuable than another. Further, we have to consider the timely basis view and the circumstances that the type of the knowledge in question is involved in. A good piece of advice can quickly resolve a problem and contribute to decision-making in a business context. Wisdom related to strategic planning does not imply immediate results in the business actions, but it can significantly impact on the firm's future success in the long term.

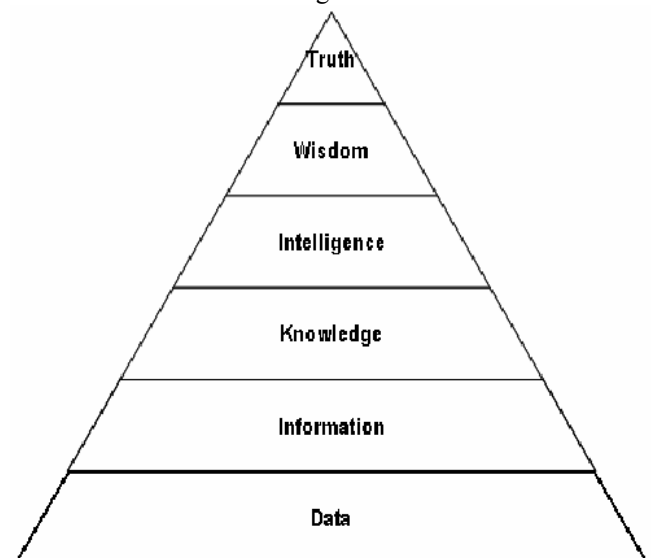


Figure 2. The knowledge typologies by Thierauf

The knowledge typology as defined by Thierauf suggests the following hierarchical order from top down (and it is illustrated in the following figure). The categories are as follows: Truth, Wisdom, Business Intelligence, Knowledge, Information, and Data. Truth is something universal by nature. Therefore, truth is difficult to harness for business purposes. "Wisdom is the ability to judge soundly over time, intelligence is a keen insight into

understanding important relationships, knowledge is obtained from experts and it is based on actual experience.” Business intelligence is knowledge of the business logic and market needs of a particular industry. However, the insight view from the past reaching into the future that captures the changes on the level of macro economy is relatively narrow [32].

Data represent the least cultivated form of the typologies of knowledge. Data are strings or sets of characters. Information is based on symbols, icons or a sound that has relevance with the actions of a human being, unlike data [18]. Data forms information when processed and understood. To make full use of information necessitates transforming it into knowledge. Unlike data and information, knowledge can be utilized and turned into action [31]. The interpretation here is that it is knowledge that offers the platform for action and meaningful operations of business.

The typology as shown here necessitates introducing skill and expertise. Skill is the result of education and training [31]. Many of the operations and hands-on activities of our daily life are based on skills. When combined with knowledge, skill becomes refined into a level of expertise. The requirement for learning skills and creating expertise is that one has the ability to adopt new ideas.

The difference between structured and unstructured knowledge can be illustrated using a patent as an example. Following intellectual asset categories, patents are structured knowledge assets, but they are very heavily dependent on unstructured knowledge. First, a researcher team or a single researcher produces scientific evidence of an innovation which is then confirmed by a team based on *a priori* knowledge and search focusing on the state-of-the-art situation. Then, after lab-scale testing, a proof of the concept is achieved and at the same time preparations for the patenting process are launched. Next, a patent agency produces a novelty study and explores the potential rival patents. Further on, before launching the actual patenting process, the innovation is considered in terms of market opportunities in order to confirm the magnitude of the commercialization potential, whether it is big or small. At this point, if the business potential is big enough and the innovation is worth patenting, the work necessitating the input of a highly skilled expert begins. And last of all, this illustration considers the results picked at the level of an applied research project. Thus, the sequence would be even longer if the starting point had been selected at an earlier stage of the process of basic research. In brief, creating structural knowledge assets necessitates a process involving different tasks, and thus each task requires diverse knowledge qualities, e.g. knowledge (scientific research), skills (lab-scale tests), expertise (creating patent), information (state-of-art search), intelligence, information (survey of actual market need), and perhaps a little bit of wisdom on part of the party deciding to finance the

patenting process. The situation is the same regarding any other structured knowledge involved in venture growth, e.g. a business plan.

E. Creating competitive advantage by intervening with knowledge

The foundation of the firm's success is based on competitive advantage. For established firms, sustaining competitive advantage is crucial. The anatomy of competitive advantage of a particular firm depends on the firm's lifecycle, size, industry, business concept, strategy, size of the market, and the prevailing competition [25]. The competitive advantages of a growing firm form a complex set of interacting factors comprising implicitly expressed elements that play a focal role in the success of the enterprise [6]. Therefore, examining the concept of competence creating the link between competitive advantage and knowledge is needed. The company's competitiveness derives from its core competences and core products. Core competence is the collective learning in the organization, especially the capacity to coordinate diverse production skills and integrate streams of technologies. [27].

The concept of core competence as defined by Hamel and Prahalad highlights five key competence management tasks: identifying existing CC, an abbreviation of core competence, establishing a CC acquisition agenda, building CC, deploying CC, and protecting CC. For example, the first one of identifying involves examining potential access to a wide variety of markets, making a contribution to the customer benefits of the product, and these are difficult for competitors to imitate. The building CC can be fulfilled in terms of reorganizing to learn from alliances [26].

OS, outsourcing (abbr.), strategies indicate the dividing line between core and non-core competences [19]. Not only services belong to infrastructure, such as IT office systems, but also business processes running on top of IT systems are commonplace objects of service providing [20].

Although the co-operation model originates from IT-OS literature, we accept the relationship model to be applied within business venture growth where the technologically-orientated founder team co-operates with knowledge investors.

The concept of value-adding knowledge and expertise claims to utilise the best resources available on the markets. However, it is not readily apparent that the market driven approach works in the early stages of the growth process [23]. Two practical consequences result from this: (1) the intervening process between the knowledge investor and the team representing a venture or a firm, depending on the stage, may be a loose one due to the lack of proper incentives, and (2) the early-stage venture fails to meet with the actors of best knowledge and business expertise.

On looking at the other side of the coin, teams developing new business assisted by an incubation platform can be characterised by two dimensions; namely,

willingness and maturity to accept outside assistance. Similarly, four archetypes are to be found based on the combinations. The intervention type regarding teams not willing to co-operate falls outside the scope of this study. Accordingly, one requirement for knowledge investing is strong bonding between the parties [29].

Considering a VC firm and their portfolio companies, the engagement is powerful in principle [30]. A glance at VCFs reveals at least three potential pitfalls causing the engagement to fail: (1) The contribution of the VCF available for the investee company does not make a match; (2) VCFs tend to be more involved in firms, which are relatively mature with their technology and with high growth rates [5]; and (3) the positioning of a VCF in the VC operators' value chain has pivotal influence on match making [5, 8].

III. CONCEPTUALIZING THE GOVERNANCE MODEL OF KNOWLEDGE-BASED VENTURING

The conceptualization of ownership management in the knowledge-intensive venturing process implies a brief look at the object of ownership, i.e. the property. The pecuniary objects have two major appearances considering venture capitalist intentions: (1) it satisfies our needs of arranging daily material consumption and (2) need of the esteem from others and self-actualisation. To becoming "rich" is obviously the prime motivator but soon the need of being 'somebody' among venture capitalist community comes through after the economical situation in private life is guaranteed. Here is also a point of risk taking that is embedded in the model next.

The Maslow's original presentation of the hierarchical nature of the needs comprised five stages which were later introduced by three new stages: Physiological, Safety, Belonging, Esteem, Need to know and understand, Aesthetic beauty, Self-actualisation and Transcendence [37,38]. Although the hierarchy introduces to understand the human motivation and it is relevant in Venture Capital-context, it doesn't reveal the nature of the risk-taking propensity and other factors as present in the model.

Apparently the motivation to undertake an entrepreneur or a knowledge investor co-entrepreneur is dictated by the private life situation. E.g. child-minding in combination with the entrepreneurs needs to self-actualisation establish the conditions for the firm strategy such as the investments and the growth in many of the businesses. Resource exchange between the household and the business are usual [39].

Entrepreneurial motivation and value selection by an individual person is thus dictated not only by business opportunity side but also in terms of the commitments in private life and personal needs. In terms of operationalising and building the model, motivation and decision making is placed in the middle of the ownership management model in fig 3.

A. Starting point for creating a proper model

The ownership management of innovations, structured property, implies applying immaterial protection methods, such as patenting or less powerful methods, e.g. copyright or trademark. However, innovation property denotes only one part of the competitive advantage of an emerging new business or firm.

As was earlier stated, the competitive advantage is a mix of diverse intangible and tangible assets, and therefore of people, this being of pivotal importance. For the further stages of venture growth, the Anglo-American corporate governance principles are widely applied in Europe [17]. These practices comprise a rich tradition of partnership agreements and financial instruments for managing venture growth and influencing indirectly on the behaviour, intention and motivation of the firm's key persons. Thus, the present venture-capital governance models place a fair amount of emphasis on sanctions and pecuniary rewarding mechanisms [ibid.]. Consequently, this study claims that the contract-based governance mechanism is satisfactory for application only when the pecuniary objects of owning dominate. Hence, the point that ownership mechanism needs to cover both structured and unstructured intellectual assets accumulated from the very beginning of the birth of the innovation is crucial. Moreover, this need is manifested more rigorously in the early stages of the venture growth rather than in the firm's start-up stage.

The remedy for ownership management offered by venture-to-capital suggests four dimensions to be taken into consideration: (1) Entrepreneurship, (2) Ownership, (3) Financing, and (4) Management [28]. There is no denying that entrepreneurship encompasses the intangible side of knowledge asset venturing, and that management covers the required four mindsets, and that ownership addresses managing the value-added either with pecuniary assets or knowledge-based assets. However, ownership management is explained in terms of the principal-agent theory, which is a powerful tool when considering structural property and stakeholder thinking accepting the existence of non-formidable relations bonding the interests of the stakeholder with the investee object [28].

B. Managing knowledge value adding

Judging the concept of knowledge venturing, knowledge as an independent 'fund', means knowledge investing as a venture capital process. If we take a look at the VCFs' three main value-adding approaches, we find: (1) Financial aspect and brokering dominating, not knowledge nor business expertise that much, but the investor offers his valuable network and chooses a passive investor role; (2) A VCF or a business angel concentrates on a particular industry and both business intelligence and money play important roles, and investors take active roles in investee companies; (3) Investing knowledge and business experience dominates and 'passive' money is acquired from multiple sources, not necessitating significant intervention

from VCFs. [30, 8].

The third alternative suggests a notion of the power play setting embedded into the growth process. Founder-team-driven firms may have a fear of losing their power when accepting risk money from venture capitalists. For example, a survey of Danish VCFs is inline with this view [5].

Actually, the thinking here introduces an evolutionary view for entry to the VC industry (3rd alternative) and the growth path of venture capital firms (2nd -> 3rd alternative). The concept of venture capital spiral [30] proposes the view of small VCFs tending to increase their size and funds and in turn increase the complexity of the governance of investee companies. Similarly, the distance between the gatekeepers of equity and prospective investee objects increases and thereby offers room for new players to entry on VC-industry.

Incubators may act as a competitor for private knowledge investors as their services are mainly knowledge-based. Incubators co-operate with business projects aiming to move on start-ups. The incubator service model ranges from (1) passive environmental intervention (such as providing facilities and indirect contribution offerings) through (2) service and contact brokering to more intensive forms of co-production such as (3) counselling [29]. However, as a rule, incubation models do not imply the presence of incentives for incubator managers to work perhaps more eagerly regarding a particular business case, and therefore incubators, as such, fall outside of the scope of this study.

C. Towards a growth model driven by ownership management

In actual fact, the framework shown earlier in Fig. 1 considers two major approaches fully in line with the venture-to-capital-process. The first is a vertical one and it determines stakeholder categories positioning on diverse levels with respect to the firm's core, which is the value of the firm. The farther away the circle's perimeter is from the horizontal line, with the arrow illustrating the increasing value of the venture, the looser the relationship of the stakeholder in question is considering contributing to the enterprise's growth process and the creation of competitive advantages, and ultimately to the enterprise's growth and to increase in its value. The second dimension is a horizontal one, a timely basic view drilling down to characterize the dynamism of the enterprise's growth, which is discussed in the theory part later on.

The shape and boundaries of the venture in the early stages are vague, and consequently the object of ownership is fuzzy. Due to this, venture-to-capital as such does not provide a sound foundation for ownership management.

The problem of managing and value-adding unstructured and structured property of a particular venture calls for an examination of the methods of sustaining competitive advantage, which are mainly made up of innovation capital assets and core competences, e.g. market intelligence,

customer relationship management expertise, product development, and technological expertise considering young companies. The firm's core competence is increased through learning from partners in the value chain and contacts in the business network [26]. Therefore, building an ownership management framework for knowledge-based venturing necessitates applying a theoretical foundation that considers the cross-border situation of transferring knowledge asset. Moreover, risk and rewarding views are focal building blocks. Finally, encouraging new talents directing towards the role of the entrepreneur, and subsequently connecting with the required new co-founders and financial investors, calls for a clear vision of the shape and the boundaries of the system formed by the venture, its core team, and value-adding actors.

D. Promising patterns

The transaction cost economics theory contributed by Oscar Williamson suggests four key nominators for explaining the governance of non-contract-based business relations: (1) Asset specificity, i.e. the specific characteristics of human capital and technology assets of the object of transaction where the value of the object is higher if the alignment with the customer's expectations is high; (2) Self-seeking interest or opportunism that is often favoured by knowledge asymmetry between the parties; (3) Bounded rationality; and (4) Risk-taking propensity outlined in terms of safeguards and incentives [35].

Recent network and sourcing theories suggest a fifth element, namely that of the trust and accumulated social equity proportional with the reputation and trustworthiness of the contracting body in question [14].

Especially research looking into contemporary Information Technology Outsourcing, IT-OS business has produced significant contributions to transaction cost and relationship theories. Outsourcing cases involve transactions connected not only to tangible technology assets, but also to intangible knowledge assets.

The setting involved in an OS case is actually a business venture. A vendor is not able beforehand to cover all risks, compensation logic comprises optional gain opportunities (i.e. profit sharing of the gained cost reduction), cost-benefit schemes follow the logic of the investment, and trust and commitment play significant roles in the bonding process. Only one outstanding element differentiates technology-based OS from venture capital setting; namely, growth potential, which is limited in the case of OS. Growth potential is then embedded in cost savings opportunity by business process re-engineering and as well by the vendor's ability to produce the service cheaper than the customer itself is able to do, which is based on the providers' economies-of-scale advantage.

The results of research on the formation of OS alliances between a service provider and a customer company reveal need for managing first of the contract-based issues that are services, for communication and information sharing and

mutually accepted compensation logic and secondly the embedded issues, a kind of hidden agenda, social and personal bonding, usage of time as investment, shared and adapted vision between parties and cultural adaptation. The alliance is either reinforced or retarded by behavioural issues such as commitment, co-operation expectations, trust, satisfaction, conflicts, power setting, and dependency [14]. In the background of success stories there is, without exception, a strong team [13]. Many of the behavioural issues mentioned here comply with the scope of high-performance teams [13]. Both in OS and venture-growth settings one needs to have cross-over team building until the uniformity of the team causes the border lines to fade away.

Finally, the most important topic that makes sense to elaborate within the IT-OS models is that of the pivotal role of knowledge and expertise in achieving success.

E. Four wheel vehicle with a steering wheel

The proposed determinants for the ownership management framework are shown below in Fig. 3. The model sums up the theory discussed in this paper and presents the logic model of knowledge investing in the venture and firm growth process beginning from the investment decision through to the stage of connecting to the process and team building and up to a coherent stage where all team members are aiming at a common goal – the growth of the business.²



Figure 3. Ownership management framework

The left- and right-most circles stand for risk and rewarding that are obvious components in the building of the model. It should be noted that both of the elements

impact directly on the decision-making process (the middle element) and they involve two sides with opposite impacting influences. For example, a low-rewarding scheme may appear as a retarding force. In turn, low risk can act almost like a rewarding factor.

The topmost element – knowledge value adding capabilities – is in line with the transaction action theory's concept of asset specificity. However, it is understood here using the terminology applied in the venture-to-capital theory. The main function of this particular element is to define one's business value and alignment considering the success of the venture. Secondly, it is a helpful tool in self-assessment (if necessary).

The upper diagonal arrows illustrate the logic of how a seasoned business advisor meets the potential risk of a venture failure, thereby making it less threatening. It is probable that he/she has access to new opportunities unlike a young and less experienced talent. In turn, a more experienced knowledge investor, a gold-finger, has a high standard of trust in his/her capabilities in accelerating growth, and this in turn increases his/her chances of future success.

The element at the bottom characterizes fears and suspicions that may be partly unconscious. Due to limited understanding, bounded rationality, a knowledge investor may hesitate in his/her willingness to join in on a business operation. An opportunistic atmosphere may even terminate the process. However, the presence of strong sanctions may mitigate the threat of self-seeking interest; in addition, powerful safeguards may also contribute to personal evaluation processes involved in knowledge investment's rationales and produce a positive end result.

Finally, the circle in the centre replicates the idea of one's self-assessment for assuming the entrepreneurial role. The selection points out the availability of other investment objects. A significant aspect of this is that the assessment is dictated by personal entrepreneurial characteristics and previous entrepreneurial experience. A lot of research focusing on the characteristics of an entrepreneur is ongoing.

IV. CARRYING OUT THE DATA COLLECTION

Data collection following the three sample areas is presented below.

The observation of the knowledge investor activity and the implications for the ownership management framework are carried embedded with another research project where the author is participating as a researcher and a management consultant following the participant observation ruling. The project is funded by the Finnish government focusing on examining the commercialization paths for the universities-driven applied physics research on the area of the measurement technology, i.e. the Measurepolis Network. Regarding the present study's purposes, it offers rich observation data covering two of the

² The model is built up of a more detailed set of evaluation criteria not presented in this paper

total of three sample areas: namely, (1) the commercialization innovations at the idea and concept stage dominated by applied research and prototyping activities, and (2) 3-5 year sold new technology start-up firms attained the maturity of investable firms either with a seed or an actual first round investment. Ten cases were selected from the first and four from sample areas, with one of them representing an in-depth-case.

The third sample set is composed of SMEs tending to absorb innovations and seeking growth. One in-depth case was studied and observation were made within the Measurepolis Network. The observation data are complemented with narratives, interviews and discussions within three consultant networks: namely, (1) Finnish Management Consultant Association, (2) Turn Around Management Consultant Association, and (3) Finnish Co-entrepreneur Association with the author being a member of all these three.

V. DISCUSSION AND CONCLUSIONS

A. Knowledge investing or venturing

The nature of a knowledge investor convergences on the concept of knowledge venturing when the following requirements are met: (1) Knowledge, experience and wisdom of the knowledge investor is considered by the parties as a distinctive value for increasing the wealth and the rate of success of the venture; (2) Knowledge investor bears a real risk either in a form of losing time (the opportunity cost view) or putting down his own money. The pecuniary investment in a secondary mode of investing may be needed for indicating the knowledge investor's commitment and further contributing to the increase in trust among the parties; (3) Knowledge investor has opportunities to engage in more than one venture. This requirement articulates a salaried employment with high rewarding schemes, e.g. CEO-contract, apart from knowledge venturing; (4) There is an exit for knowledge investor to move on towards new challenges; (5) The rewarding side includes, at minimum, a progressive rewarding mechanism tied to the success of the business project; (6) A true portfolio approach prevails (this is related partly to point 3). An experienced businessman, a highly skilled strategist provided with business wisdom, is able to work in many firms in terms of board memberships. However, the rewarding mechanism doesn't include a high upside scheme if any. Thus, the compensation logic is mostly build-up on fee basis. So, this doesn't meet our requirements of knowledge venturing where the participatory role must be stronger and accordingly stronger rewarding scheme is needed.

B. Ownership management framework – early stages

1) Technologically orientated researchers and academics

Considering the data collection within the first sample

spot area, the universities' research projects aimed at creating business, the foremost qualities of knowledge needed are technological and business intelligence and experience. The required capabilities are mainly the researcher's ability to derive industrial-scale pilots and therefore proof for the prototype. Also, there is the need for the capability to recognise business opportunities for the innovation. Knowledge and understanding of the markets was raised up in discussions with university representatives.

The ownership intentions of the researcher's were mainly targeted at writing publications and becoming a scientist of renown within the science community. Only a few researchers, as well academics, announced their willingness to participate as having a key role in the business operation; these people were mainly younger persons. Other participatory role, such as technology advisor owning shares was announced by elderly scientists and academics. Surprisingly, the opportunity to make money in terms of new business, and therefore engaging in the entrepreneur role, is not much valued by the academics. The interpretation here is that the ownership intentions among the young academics and researchers are still in the search mode. Industrial, entrepreneurial or researcher careers may appear as equally interesting options. However, senior researchers already have their reputations established and the so called "lock-in" phenomena has occurred, and the shift towards the role of an entrepreneurial knowledge investor (e.g. a CTO, Chief Technology Officer) needs significant rewarding and high safeguards.

Rather than undertaking an entrepreneur, on the contrary, trading of or licensing patents was a more interesting option for the university people. This is perhaps the optimum balance between avoiding entrepreneurial actions and gaining economical success. Going further from this point necessitates a higher involvement in creating business.

The midway position suggests the role of a technology advisor and a participatory role in applied research projects with the firm in question. This approach manifests low rewards, low risk, and high safeguards. This can be related to need of increase knowledge and understanding as discussed earlier regarding the Maslow's need hierarchy. For researcher the midway position offers a proper contact with firms and an opportunity to learning business.

2) Business experts

Business opportunities for knowledge investors in the early stages are very few. Either a top-class invention with a brilliant technology team behind it or a lot of work is needed by business expertise or both. Business opportunity assessment is mainly operated by incubators and science parks in Finland. Unfortunately, this leads to a relay model and ownership management becomes even more vague. The suggested remedy to overcoming this problem is to

arrange uninterrupted management relationships via a business expert, a champion, and the first mover, thereby leading the commercialization project as a business project up to the point of trading the innovation or creating the team aimed at running its own business firm.

For the champion, first mover, the rewarding scheme is mostly low or at most moderate. A committed team of techies and a vision of a technology roadmap that promise not just a fly by with a single innovation, but a product portfolio and R&D resources, represents a robust foundation for the firm. It is by these means that the risk is lowered and the business opportunity becomes apparent, and joining the business project becomes attractive for the business expert.

To cater for the business expert's living necessities financing in one way or another. If safeguards become high, e.g. one is salaried government money, then the attractiveness of rewarding becomes less efficient and the setting resembles more incubation than knowledge investing. However, if no safeguards, i.e. no monthly paid fee, are applied, then really experienced managers tend to walk on by. The model suggested here is to establish a co-operation model between the true venture capital firms offering seed money and corporate venturing bodies, as well knowledge investors that are served by forces capable of making top-notch technology and business feasibility evaluation formally and thus risks are mitigated.

C. Ownership management framework – Start-up and establishment stages

For the sake of compressing the text, both sampling areas are discussed here. The dynamism of the dominance and power setting involved in the growth process is expressed in terms of dilatation. After reaching the business proof level, the early stage embryo led by techno-founders, and possibly by a business-orientated knowledge investor, is searching for equity investment. In a case of the first round funding, the negotiations with VCFs suggest a major change on ownership of the firm. Loosing contact with the enterprise's steering wheel is a tough question for the founder team. The outline of the ownership-driven management model focuses on the area of managing ownership and key human resources and competences required for fuelling growth at the individual level and also of looking at the stakeholder level.

The early stage venture heading towards first round equity injection postulates an intermediating stage, i.e. seed funding. It impacts positively if no major ownership transitions happens, but the financial foundation of the venture is strengthened enough to increase preparedness for the first round's 'hard' funding by private equity investors and further alleviates the ownership transition and avoids threat of 'slavery money.'

The growth from the seed stage onto the further stages involving other investors, means seed funding agency exiting and recruiting the first actual marketing-minded

CEO may shift the ownership setting towards a triangle 'drama' where founder(s) are hit on the cheek as the CEO and the new investors shake hands. It is at this stage that a knowledge investor either of technology or business expertise may be forced to leave the company.

The role of seed funding with fair financing conditions is thus crucial for continuity and smooth transition. However, the experiences of private seed funding operations points to poor rates of the return, ranging from 0% to 5%. Thus, the role of the government is focal in this area to support prospective ventures so they can head smoothly towards the capital market.

D. SMEs

The knowledge investing opportunities considering growth seeking SMEs is more complex than the setting considering two other sample areas. SMEs tend to capture the business experience in a holistic way. In practise, the capturing can be a recruitment of a new CEO or sales expert attended with a new technology expert that are asked for creating new business or it can be a acquisition or both.

However, an individual knowledge investor, as a partner role, it may be possible to work within 1-3 companies in parallel more intensively rather than participating through board working. However, this claims for a very sophisticated portfolio management and role selection. Actually, this setting leads for a part-time entrepreneur mode. If the financial side plays important role, then the practical solutions are much the same as the role of the manager of a VCF. If the financial side is in a minor role thus a consultant or technology transfer firm or a mix of both is a more relevant model.

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Perceived Attraction of Online Communities among Elderly People

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Abstract — Amount of elderly people that visit online communities is constantly growing. However, there is a research gap considering elderly people as Internet users and online community members. Therefore, in this paper we scrutinized elderly people's perceptions of factors that encourage them to join online communities and, on the other hand, of factors preventing them from joining the communities. The empirical data was gathered by both posing questions and linking a web questionnaire in discussion forums aimed for elderly people.

The study at hand seems to verify the existence of the attraction factors identified in earlier studies. On the other hand, the study does not seem to support the suggestion that elderly people need any other special web services than focused communities. According to the study, elderly people prefer discussions with others from the same age group. At the time being, the number of online communities targeted at Finnish senior citizens is low. As a conclusion we propose that by offering elderly people more online communities their social well-being could be increased.

Keywords — online communities, attraction, non-attraction, elderly people

I. INTRODUCTION

A. Background of the study

In the research of Internet usage, elderly peoples' age groups have been neglected [1]. However, during the last years, the interest towards senior citizens has grown when both academics and business people have discovered that seniors constitute a growing group among the internet users. A survey by Wired/Merrill Lynch concluded that 15 per cent of the 50 million internet users in the USA are over the age of 50, compared with only 5 per cent a year earlier [2].

Online communities lack geographical and time-related limitations. Everyone having the access can visit online communities whenever they want. Therefore, online communities open new possibilities to interaction for, for example, elderly people who often feel lonely and wish to have more social contacts. They need both skills to use the technology and computers as well as internet access at home or in such public places as libraries and net cafes to be able to visit online communities.

To serve senior citizens, companies and other organizations aiming at designing, building and maintaining online communities for elderly people need information about the special requirements set for the equipment, the architecture as well as the content of the web sites. Device manufacturers and software developers have to take into account elderly people's special characteristics and needs. Therefore, it is important to study elderly people's perceptions of the factors that attract them to online communities.

B. Purpose of the study

In this paper we scrutinize elderly people's perceptions of the factors that encourage them to join online communities and, on the other hand, of the factors preventing them from joining the communities. The theoretical background of the study lies on the earlier studies of attraction and non-attraction of company online communities [3], [4]. The empirical study was focused on the respondents older than 55 years. When referring to them we use the terms 'seniors' and 'elderly people' interchangeably, which is in line with the practice in previous studies concerning seniors' web usage. However, the age limit in our study is lower than usually used in studies concerning ageing. [1], [5], [6]

C. Structure of the paper

The paper proceeds with the introduction of the concepts of online communities and attraction. Then we introduce earlier studies concerned with attraction and non-attraction in online communities. After that, the methodology and findings of the empirical study are presented. Finally, conclusions are drawn and future research paths considered.

II. ATTRACTION OF ONLINE COMMUNITIES

A. Online communities

From a very early age on, people move in groups: from the playgroup to the weekly drink with retired friends, social companionship is a key factor of human life. The communities thus formed have been studied by the fields of social psychology and anthropology for decades and their characteristics are rather well known [7], [8].

A new constellation of groups, online communities date back to the early seventies when the first news-groups emerged on Internet. At first, these groups consisted of

researchers with a common interest in research and also a need for co-operation. At approximately the same time the first multi-user dungeons (MUDs) appeared in Great Britain. A MUD is a virtual world where people play different kinds of role-playing games in an imaginative environment. They can also associate with other people, exchange ideas etc.

By 1980 e-mail capabilities had developed significantly. Bulletin boards were regularly used and Finger and WHOIS programs were developed to help people to find e-mail addresses. These improvements of the initial communication tools were made due to the demand of users. Once they were sufficiently developed and structured enough users began to form a community. [9], [10], [11], [12]

More recently, the early static web sites that appeared in the mid 1990's have shifted to highly interactive web sites allowing the communication not only between the site and the visitors but also between visitors. As a result, online communities have swiftly appeared on the World Wide Web. As both the numbers of online community sites and visitors have grown quickly; both the popular press and researchers of different sciences have become interested in them as a subject of study. [13]

Online community sites are said to be one of the fastest growing category of web-sites [14]. Already in 1999 Gross stated that there are over 25 million members of online communities. In 2001 the Pew Internet & American Life Project reported that 90 million American have participated in an online group [15].

The rapid evolution of technology has influenced the development of online communities significantly. The first bulletin boards were designed based on the metaphor of a physical bulleting boards. Nowadays people are able to send messages to the boards where they are displayed in various ways. Usually the messages are threaded so that the first message forms the beginning of the thread and later responses are stacked beneath the first one. [16]

From the beginning of 1990s services have developed rapidly enabling visitors to use advanced search facilities, create own profiles with personal data and pictures, see other's profiles, have private conversations and use avatars, for example. In addition to asynchronous communication technologies such as discussion forums (bulleting boards), where messages can be read and responded to hours, weeks or months later, also synchronous services that require that communication partners are co-present online, have been added. These synchronous services include chat systems, instant messaging and texting systems. [16]

Nowadays, online communities appear in a variety of web sites which were gradually integrated into single environments, for example graphical, three dimensional environments such as Habbo Hotel (<http://www.habbohotel.com/>), a virtual hotel where people can meet their friends and furnish their own rooms. Also highly sophisticated gaming worlds, for example Battlefield, Counter-Strike and Unreal Tournament 2004 attract a large amount of enthusiastic users. In these games,

users may conduct at least two kinds of actions almost simultaneously: play and chat with others.

One of the most spoken community technologies is MP3, which makes it possible to facilitate distribution and share music. This technology has enabled online communities where visitors may effectively share and get the newest music, pc-games and console games by free.

Rapid technological development of software has increased the demands set to the users' device technology. Computers have to be equipped with fast processors, effective display controllers, large memories and high-bandwidth Internet connections.

B. Attraction

Traditionally, attraction is seen as an interpersonal phenomenon. As such, it has been studied in social psychology and in marketing. Attraction received the greatest attention within *the social exchange theory* where Homans [17] and Thibaut and Kelley [18] depicted the interaction between people as an exchange, in which feelings like devotion or love are exchangeable. Because of that, attraction's determinants have been viewed as primarily social in nature. In social psychology attraction is defined to mean devotion or love towards another person or group. Attraction is seen as an important element in group formation, because attraction power increases cohesion in groups and also defines their limits. Furthermore, attraction has been studied as a tool of sociometry research [19].

Within the (virtual) network theory, the concept of *competency* is used in describing the factor that explains, for example, a company's ability to attract new customers and retain old customers. Competency may also refer to a website's ability to attract people to visit the site. Competency can be based on, for example, the products of the company or the website's content. In the network theory, the knots may be given a competency rate that describes the knot's ability to compete on the links. [20] All in all, the concept of competency approaches the same phenomenon, attraction, from the perspective of the (virtual) network theory.

The concept of attraction in marketing science is often related to the acquisition of new customers as well as to the distinction from competitors. In this study we approach attraction from the relationship marketing perspective emphasising the importance of attraction in maintaining and enhancing relationships with customers and other stakeholders.

The dynamic nature of marketing relations recognises that they evolve and change over time, as a result of interaction between parties as well as the parties' interaction with their environment. In the literature, such issues as trust and commitment, adaptation, co-operation, interaction, interdependence, mutual goals, social and structural bonds, promises and shared goals have been considered as key factors to successful relationships [21], [22], [23], [24]. It has been suggested that attraction even has a more fundamental role in the continuity of a relationship than, for instance, commitment and trust [25], [26]. According to Kelley and Thibaut [27], attraction

explains why relationships are initiated and developed. Some degree of attraction is a necessary precondition for the commencement of interaction, while ongoing attraction determines whether parties are motivated to maintain a relationship or not [26], [28]. Already the first definition of relationship marketing by Berry [29] stresses the importance of attraction:

Relationship marketing is attracting, maintaining and – in multi-service organisations – enhancing customer relationships. Servicing and selling to existing customers is viewed to be just as important to long-term marketing success as acquiring new customers.

Despite the above, attraction has been studied less than the other relational bonds. According to Harris, O'Malley & Pattersson [30], one explanation could be that because attraction is so essential to the formation and maintenance of relationships it is considered as basic practice of marketing that is taken for granted. Harris et al. [30] point out that further explication of the concept may provide a much-needed explanatory framework for a relationship development.

In marketing, attraction has been studied in the context of personal selling and negotiations where the main focus is in the attraction between two persons. However, attraction can be seen as an inter-firm phenomenon as well. Attraction may be viewed as a company's interest in exchange with another based on the economic and social reward-cost outcomes expected from a relationship over time [31]. According to Mittilä [32], in business relations, attraction is first based on expectations and references and presumed satisfaction. In older relationships, the experiences and the involvement as well as factors outside the relationship also affect it. As we can conclude from above, attraction is a very strongly future-oriented concept.

In business relations it is recommendable to consider both collective and *individual* attraction. At the collective level attraction can be seen as a company's interest in co-operation with another actor(s). At the individual level attraction is an individual's interest in personal intercommunication. When considering businesses, attraction can also be directed towards the product (goods/service) itself. [32]

Here, attraction is studied in an online community context that has its own characteristics. Members of an online community form various kinds and levels of relations. Online environment allows the company's websites to represent the company as a personalised entity. Therefore, members may communicate with the maintainer using the sites as a media or they may interact with the websites. Online context also allows the members to communicate with each other, which enables us to study attraction in a c-to-c context too.

Drawn from the literature review, attraction is defined in this study as *an online community's ability to draw members*. Since we study attraction from the online community visitor's point of view we study online communities' *perceived attraction*.

C. Earlier studies of attraction

1) Attraction factors

Earlier studies have shown that modest price [31] and both functional and imaginary factors [26] have an influence on creating attraction in business relations. Price and functional factors are very concrete and easy to compare with others, but imaginary factors are dependent on the ideologies and attitudes of relationship parties.

Social exchange literature suggests that attraction is based on individuals' physical attributes [33], their abilities [34] and their personality [35], [36]. If we think about these elements in an online community context, physical attributes of other visitors are usually not seen. Furthermore, it is hard to evaluate other members' abilities as well as their personality due to possibility of a fake identity in the online environment. On the other hand, the physical attributes of a web site are easily evaluated. Ability of a web site may refer to the maintainer's skills and wants to respond to visitors' needs. Personality of an online site may refer to its content and the atmosphere of, for instance, the online community.

Eskola [19] mentioned three factors that influence attraction among people. These are geographical proximity, similarity, and complementarity. In an online environment geographical proximity between individuals is not an issue. Yet, the geographical proximity may be an important attraction factor indirectly as it may reflect similarity between members. Furthermore, similarities between two individuals may occur if they share similarities in their backgrounds [37], demographics [38], education [39], attitudes [40], [41], and goals and values [42]. In addition, also the degrees to which they are exposed to one another [43], affect the level of attraction. Another issue in online communities is the identification between the maintainer and the visitors. Either the values of the maintainers have to meet visitors' values to attract them to the site or they may greatly differ from those of the visitors. Because visitors online do not have to personally involve (e.g. lurkers, fake identities) they may be attracted to communities they would never dare to join in real life.

According to O'Shaughnessy [44], the ideology between relationship parties is one of the attraction factors. The similarity in attitudes between partners has the same kind of effect, but not as strong as the similarity of ideology does. Also Campbell et al. [45] stated that the similarity in ideologies and attitudes between partners results in the better output from the both partners' views. Nevertheless, the company's openness and kindness can replace the differences between attitudes and ideologies. In this case, attraction is more based on other things (e.g. social intercommunication) than having a same kind of values [44]. In an online community context the similarity may occur between members and the maintainer, between members, or between the value of the community and the member, for example.

Harris et al. [30] studied attraction in b-to-b relationships by conducting 54 interviews among barristers and solicitors. Their research suggests that while legal

professionals are motivated to seek relationships with those who can supply work and to gain access to lucrative clients (economic attractiveness), they also forge relationships to help overcome short-term difficulties (resource attractiveness). According to their research, social attractiveness has an important role as legal professionals prefer in working with colleagues that create a positive working environment, provide access to social networks, enhance self-esteem and/or adopt similar working styles. They concluded that determinants of attraction may go beyond the simple characterisation of relationships in terms of economic, resource and social content. Further, they suggested that familiarity is a necessary condition for attraction to occur.

Furthermore, Harris et al.'s [30] perceptions regarding which parties are attractive and which are not are influenced by (i) socialization process, (ii) similarity, (iii) compatibility, and (iv) knowledge of alternatives. Finally, based on their empirical study, attraction in the context of their study is comprised of four elements: (i) complementarity of performance domain, (ii) legitimate and reward power, (iii) reputation, and (iv) socio-sexual attraction. As a conclusion of their study Harris et al presented a conceptual model of attraction, its determinants, and its consequences. Harris et al's study (2003) made a considerable contribution in defining the concept of attraction. Factors that have been found to influence attraction in earlier studies are presented in Table1.

Table 1. Factors influencing attraction

Attraction factor	Author
Complementarity (of performance domain)	Eskola 1984; Harris et al. 2003
Familiarity	Harris et al. 2003
Functional and imaginary factors	Dwyer et al. 1987, p. 16
Geographical proximity	Eskola 1984
Individuals' abilities	Senn 1971
Individuals' personality	Boyden, et al. 1984; Carli et al. 1994; Caspi and Harbener 1990; Evans 1963
Individuals' physical attributes	Byrne, London and Reeves 1968; Dion et al.1972
Knowledge of alternatives	Harris et al. 2003
Legitimate and reward power	Harris et al. 2003
Modest price	Halinen 1994a, p. 272 ; Dwyer et al. 1987, p. 16)
Reputation	Harris et al. 2003
Similar goals and values and degrees they are exposed to one another	Gupta 1983; Moreland and Zajonc 1982
Similar ideology	O'Shaughnessy 1971-1972, p. 33, Campbell et al. 1988, p. 52; Dwyer et al. 1987, p. 16
Similarity in attitudes	Byrne 1971; Byrne et al. 1968; Griffit et al. 1972; Dwyer et al. 1987, p. 16; Campbell et al. 1988, p. 52
Similarity in backgrounds	Powell 1990
Similarity in demographics	Byrne et al. 1968
Similarity in education	Evans 1963
Socialisation process	Harris et al. 2003
Socio-sexuality	Harris et al. 2003

2) Reasons to visit online communities

Researchers in the online community research field have considered reasons for people to join and visit online communities. Although these studies do not approach online communities from the attraction theory perspective, some of them tackle the issues similar to our study. Therefore, these studies offer interesting insights. Previous studies about members' reasons to visit online communities are gathered in Table 2.

Table 2. Reasons to visit online communities

Author	Reasons/ motivations to visit or join in	Main emphasis in the study
Bagozzi and Dholakia 2002; Dholakia et al. 2004	Individual motives, social influences and social identity	Motivations to join, psychological perspective
Gruen et al. 2005	Factors that are divided into motivation, opportunity and ability	C-to-c knowledge exchange
Hagel and Armstrong 1997	Interest, relationship, fantasy games, transactions, many needs simultaneously	The economical benefits of online communities
McKenna and Bargh 1999; McKenna and Green 2002	Self-related: stigmatised and constrained identities Social related: social anxiety, loneliness, hectic lifestyle, safety issues	Motivations to join, psychological perspective
Ridings and Gefen 2004	Exchange information, social support, friendship, recreation, common interest, technical reasons	Reasons why people visit online communities
Wasko and Faraj 2000	Tangible returns, intangible returns and community interest	Knowledge exchange

Hagel and Armstrong [46] argue that while online communities aggregate information and other kinds of resources, above all they are about aggregating people. According to them, people are drawn to online communities because of an engaging environment in which to connect with other people, but more often in an ongoing series of interactions that create an atmosphere of trust and real insight.

According to Hagel and Armstrong [46], the first reason to join in communities is *interest*, because many of the first communities focused on connecting people who shared same kinds of interests. The second reason is *relationship*, because independence of time and place helps people to build significant and interactive relationships. However, it needs to be pointed out that there still remain cultural differences in people's behaviour and language barriers between them. Thirdly, *fantasy games*, which are offered by communities, help people forget their routines for a while. The fourth reason to join online communities, according to Hagel and Armstrong [46], are *transactions*. Before the internet, commercial actions between consumers mainly happened with the fellows or by writing an ad to newspapers. Since the internet allows selling and buying globally and around the clock it has revolutionised the possibilities.

Above transactions are not only commercial transactions but also for giving and receiving information. In addition to these four factors argued by Hagel and Armstrong [46], the infrastructure of the community affects the attractiveness as well [10]. Finally, to be able to really engage people and to make them come back it is important that the community is pleasant and attractive addressing several of the needs a person might have. For this reason, the most successful online communities meet more than one need simultaneously. [46]

Approaching motivation from a psychological perspective, McKenna and Bargh [47] built a conceptual framework of internet's social interaction. In their framework they divide the type of motivation into *self-related* and *social related* types. As self-related motivators they mention stigmatised and constrained identities. According to them, the behaviour deriving from self-related motivators are disclosure of secret aspects of self and becoming the ideal self. As social motivators they mention social anxiety, loneliness, hectic lifestyle and safety issues. Moreover, the behaviour deriving from the social motivators are disclosure to gain intimacy, presenting the ideal self to gain approval and acceptance and forming relationships. [47]

Bagozzi and Dholakia [48] and Dholakia et al. [49] have as well been interested in participants' motivations visiting online communities. They have built a *social influence model* of consumer participation in online communities, which consists of three parts: *individual motives* for participation in the online community, *social influences* on member participation in the online community and *social identity* in the online community. Furthermore, individual motives are divided into purposive value, self-discovery, maintaining interpersonal interconnectivity, social enhancement and entertainment value.

Wasko and Faraj [50] explored reasons why people participate and help each others in online communities. They concentrated on *knowledge exchange* and therefore, they empirically explored three technical communities in their study. They asked participants an open-ended question by e-mail, about why they participate and help others and got 342 answers. In analysing data they utilised content analysis and divided the results into three general categories *tangible returns*, *intangible returns*, and *community interest*. Firstly, by tangible returns they meant access to useful information and expertise, answers to specific questions, and personal gain. Secondly, intangible returns refer to intrinsic satisfaction and self-actualisation. Thirdly, they said that the majority of comments received (41.9%) reflect a strong desire to have an access to a community of practice. According them, these comments indicate that people are participating in order to exchange knowledge pertaining to practice, and they value the exchange of practice related knowledge within a community of like minded members. In addition, Wasko and Faraj [50] stated that these comments indicate that people do not use the forum to socialise, nor to develop personal relationships. According to their study giving back

to the community in return for help was by far the most cited reason for why people participate.

Furthermore, Wasko and Faraj [50] suggested that members are not simply interested in a forum for questions and answers, but appreciate the online dialog, debate and discussion around topics of interest. Members help each other due to the possibility of *reciprocation* [49], [50]. In other words, they expect that interaction will be available in the future. People feel that the community provides access to knowledge rather than just information.

Finally, Wasko and Faraj [50] argued that communities are especially critical for workers who do not have direct access to others in their practice. Therefore, they pointed out that online communities should use technologies that keep track of the structure of the interaction, archive discussions in a searchable format, and display the identities of group members.

Gruen, Osmonbekov and Czaplewski [51] proposed a conceptual model to examine the key factors that drive c-to-c exchanges as well as the outcomes of the exchanges. They used *the theory of motivation, opportunity and ability* [52] to explain levels of c-to-c know-how exchange. They suggested that companies can impact the company-customer relationship by helping their customer build productive relationships among themselves. In their model Gruen et al. [50] also present the factors influencing on three elements suggested in the MOA theory: motivation, opportunity and ability. However, as in the other earlier studies considering this area, Gruen et al.'s perspective is different with the one used in this study, since their model derives from the customer as the attraction concept derives from the online community.

Ridings and Gefen [13] studied the importance of the reasons in assessing why people come to online communities. Hence, they asked directly from the members why they joined. They asked an open-ended question "Why did you join?" in discussion forums of 27 online communities. They divided online communities to five categories: health/ wellness communities, personal interest communities, pet communities, professional communities and sport recreation communities. As a result, they got 569 different reasons from 399 people.

Ridings and Gefen [13] categorised the results to four initial categories by two judges who worked independently of each other. These categories were selected based on the earlier literature and labelled exchange information, social support, friendship and recreation. In addition, the judges were able to use other category if the result did not fit into the given ones. After the coding process common interest and technical reasons were added to the given categories.

According to Ridings and Gefen's [13] results, most people sought for either friendship or exchange of information and markedly lower percent for social support or recreation. They found that the results were significantly dependent on the different community types. Yet, in all types information exchange was the most important reason. Social support was the second most popular reason for members in communities with health/wellness and

professional/occupational topics, but friendship was the second most popular reason among members in communities dealing with personal interests/hobbies, pets or recreation. Therefore, according to Ridings and Gefen [13], online community managers should emphasise not only the content but also encourage the friendship and social support aspects as well if they wish to increase the success of their online community.

D. Attraction of online communities

Mäntymäki and Mittilä [3] and Antikainen [53] have studied attraction in company online communities. Antikainen (forthcoming) introduced an attraction model presented in Table 3. The attraction model includes three elements: different community relations, i.e. attraction relationships; the type of attraction, i.e. whether attraction is related to a member as an individual or as a social entity; and the attraction factors.

Since entertainment and benefit are a sum of many factors, they are not considered as separate attraction factors in Antikainen's model [53].

Table 3. Attraction model (Antikainen forthcoming)

RELATIONSHIP	TYPE OF ATTRACTION	ATTRACTION FACTOR
Member-to-member	<i>Self-related / social related</i>	Knowledge exchange with members
	<i>Social related</i>	Discussions
	<i>Social related</i>	Commercial activities
	<i>Social related</i>	Dating
	<i>Social related</i>	Diversity of people
	<i>Social related</i>	Friendships
	<i>Social related</i>	Playing
	<i>Social related</i>	Roles
	<i>Social related</i>	Similarity
Member-to-maintainer	<i>Self-related / social related</i>	Knowledge exchange with maintainer
Member-to-service	<i>Self-related</i>	Maintainers' content
	<i>Self-related</i>	Members' content
	<i>Self-related</i>	Awareness
	<i>Self-related</i>	Service variety
Member-to-brand	<i>Self-related</i>	Usability
	<i>Self-related</i>	Reputation

Mäntymäki and Mittilä [3] found out that in an online community that resembled a web service, factors were related to the content and service variety while in other online communities, factors related to interaction and relationship played a bigger role.

Mittilä and Mäntymäki [4] also studied the opposite to attraction, non-attraction. They found four factors labelled as non-attraction factors, namely content, membership, usability and culture.

III PERCEIVED ATTRACTION OF ONLINE COMMUNITIES AMONG ELDERLY PEOPLE

A. Earlier studies of elderly Internet users

Despite the fact that seniors are often inexperienced with computers and may need classes to be able to use this technology, today's elderly constitute the fastest growing demographic of the internet users and spend more time on the internet than other demographic users. [54], [55]

Earlier studies have shown that older users prefer internet sites that do not demand complicated manipulation of software, simply in order to browse. They prefer functions that make on-line navigation easier and more convenient; for instance, simple, clear, and polite messages. [56] Other studies have shown that older people want the same things as users in general: a site that is easy to use, fast, clear, and secure. Vuori and Holmlund-Rytkönen [1] report an academic study concluding that the internet users aged 55+ were mostly interested in the same services and operations as younger users are, i.e., sending and receiving e-mail, searching for information, and using e-bank services. Other operations, such as e-shopping, reading on the internet or visiting online forums, were not as popular as it seems to be within younger users. Yet, these operations have future potential to grow.

In Vuori and Holmlund-Rytkönen's study [1], 44 per cent of the respondents said that it is not easy to learn to use internet without help from outside, and more than 80 percent supported the notion of free internet education or advice. Their study showed that in general seniors do not accept the need for special websites. Yet, they disagree with the statement that their needs are "well taken into consideration".

However, based on the studies, it seems that the expert majority's opinion is that the older people need separate internet sites, or at least modifications of existing ones [57], incorporating, for example, larger font sizes and simpler graphics.

B. Methodology of the empirical study

Since earlier studies of online communities [3], [4], [58] have shown the method of posing questions in discussion forums successful in gathering qualitative data, the same method was utilised in this explorative study as well. The data was collected by posing open questions to be able to get also the results that were not expected. The questions posed in the discussion forums are included in Appendix 1. The empirical data was gathered in three online communities. One of them was aimed for elderly people, called as ET-lehti (www.goldenage.fi/ET-lehti/), which is a Finnish web journal for elderly people. All in all, twelve answers were received in 20 days. The answers were of high quality, in other words, they contained rich data. Eleven respondents fulfilled our requirement of the age. In addition, we received two answers by email.

Another online community in this study was Suomi24 (www.Suomi24.fi), a popular online community aimed to

Finnish people. Suomi24 includes discussion forums called "60+", "70+" and "80+", where the questions were posed. However, the questions were removed by the moderator and transferred to the "Looking for pen pals" section. We received four answers in 15 days. Since these answers contained only small amount of data, the quality of these answers was quite the opposite from the ones from ET-lehti. The third online community utilised for the study was Martat (www.martat.fi). Ten answers were received, but all the respondents were younger than 55 years.

It seems that there are quite a limited number of online communities for seniors in Finland. Therefore, collecting data was problematic. Moreover, because of the high amount of the "junk" answers it was supposed that a better way to collect data was to link a questionnaire on the web site. To ensure a satisfactory amount of data it was decided to collect data in another way and also from outside Finland. Therefore, the second step in data collecting was taken by creating a web questionnaire and sending a link to our study into the chosen forums. Because the first answers included only few comments concerning technological issues, it was decided to add one question considering the possible technological problems confronted. A survey formula is presented in Appendix 2.

The request for answering was sent to Näkökulma (www.nakokulma.net), Nicehouse (nicehouse.fi), Suomi24 and Martat. Näkökulma is aimed for people interested in discussing philosophy, culture, religion, science and society. Nicehouse is for women and families. Because the first data collection was not successful in Suomi24 and Martat, the second round by using different methods was conducted. The second round of data collection in these online communities ended with 23 answers; however, three of them were discarded. The number of women was 18 and of men five.

International forums were SeniorNet (www.seniornet.org), whose mission is to provide older adults education for and access to computer technologies to enhance their lives. Another forum was GreyPath (www.greypath.com), an Australian online community for seniors. These forums produced nine answers more in ten days. Three of the answers were disqualified, so the final result was six answers, which included four answers from women and two from men. With these answers the saturation point was reached. In other words, at some point new data was not received but rather the same themes started to repeat themselves.

The analysis of the data was started already during the study. The answers were feed to the analysis software called QSR NVivo. The analysis consisted of searching and identifying different themes from the answers that were then combined to form categories.

C Empirical findings

Next, factors derived from the data are presented. The respondents recognised factors enhancing both attraction and non-attraction.

Asking for and giving advices was a common attraction factor. Respondents looked for advice for various purposes, for instance, photographing, craft, and boating. They give advice about how to use the internet, for example. One of the respondents stated that it is nice to know that if he asks for something, he also gets the answer. This also encourages him to answer others' questions.

Discussing with each other was one of the main reasons to visit online communities. One attraction factor was the expressing of own opinions as well as the learning of others' opinions. The respondents stated that they like to have challenging conversations.

Lack of discussion seemed to be the main reason to end visiting online community. Another reason to end visiting online communities was that some respondents stated that they are unable to understand the language and metaphors used by younger members. In the respondents' opinions, younger people are even too strict in their conversations, and therefore, they preferred online communities focused on older people. In general, disturbing behaviors as well as inappropriate discussions were mentioned as reasons to stop visiting.

Binding new relationships with others as well as meeting people online were important factors. One of the respondents knows many people through the discussion forums and she visits the online community to chat with these people. Since older people often feel lonely and they also might have some physical restrictions, the internet and online communities open up new possibilities to be socially active. Such a reason as to visit online communities to replace one's earlier work community came up in the answers. Furthermore, one of the respondents said that she visits the online community to "open the window into the world". It seems that meeting *the diversity of people* coming from different backgrounds is probably even more important for seniors than other age groups.

Although different backgrounds of other people were appreciated, also *similarity* and sense of community were mentioned. One respondent stated that the backup of the others has been very helpful in ending smoking.

Seeking for dating partner is very popular reason for visiting online communities in general and based of the answers it seems that seniors also look for a partner in online communities.

Furthermore, possibility to meet different kinds of people and discuss with them behind a nickname was one of the attraction factors. Therefore, *anonymity* is one of the seniors' attraction factors as well. One of the respondents said that she has ended visiting a forum because she felt that someone has recognized her.

Information seeking for various reasons from the communities' websites was common attraction factor among elderly people. This kind of information seeking differs from looking for advice and information from other

members of the community. Such pieces of information people look for from the websites as legal issues, congratulation poems and different languages were mentioned in the data.

An interesting attraction factor came up in the answers. One of the respondents stated that he visits online community because he is *aware* of the online community.

According to the respondents, it is important that the software in the online community is easy to use. Some problems with *the usage of own computer and using the online communities* were reported. Also complicated registrations and passwords seemed to trouble some of the respondents. However, most of the respondents said that they had not confronted any problems. Therefore, *the impact of technology-related issues* did not seem to be important attraction of non-attraction factor among elderly people.

IV DISCUSSION AND CONCLUSIONS

The present study of perceived attraction factors conducted among elderly people seems to verify the existence of the factors earlier identified by Antikainen [52] and Mäntymäki and Mänttilä [3]. However, interestingly, such issues as commercial activities, playing, and service variety were not mentioned by the respondents. Therefore, we can perhaps conclude that elderly people are not that interested in those activities in online communities.

The low amount of comments concerning technology related, computer usage and online community usability issues called our attention. The results do not seem to support the suggestion that seniors need special web services as argued by e.g. Judd [57]. The reason for that can be that people slowly become more skilled in using the information technology.

One conclusion of the study is that seniors seem to prefer visiting online communities where other members belong in the same age group. This can be seen as a similarity issue of experiences, world view and verbal expression. The elderly may experience the language used by younger people was hard to understand or too strict and insulting. However, on the other hand, some of the seniors stressed that meeting people from other age groups and backgrounds was their reason to visit online communities. This factor seemed to be even more stressed than in the earlier studies considering company online communities. All in all, social intercommunication received more weight in this study than in earlier studies.

As to the data collection methodology of the study, we can conclude that linking a questionnaire into the discussion forums produced better quality answers than posing questions directly in forums. Therefore, the former method will be favored in the forthcoming studies.

As a managerial implication we suggest that especially non-profit and public organizations could enhance the well-being of elderly people by creating and maintaining online communities. Because there are only few online communities for elderly people in Finland, they wish to

have more communities for them. However, profitability of the online communities for elderly people may be questioned when concerning the results of this study.

With this study we have only opened the path for further studies. Next step is to quantitatively study attraction and non-attraction among elderly people to generalize the results. Since elderly people is a fast growing group of online community members, this kind of research is valuable both for academic world as well as organizations who are building or aiming to build online communities.

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The questionnaire can be found here.

<http://www.surveymonkey.com/s.asp?u=743862575788>

Thank you for your help!

The questionnaire

1. What draws you in online communities? What kinds of activities do you do there?
2. Have you ended visiting some online communities, if yes why?
3. Have you confronted problems with using the sites or services in online communities? If yes, what kinds of? Have you ended visiting because of those problems?
4. Age
5. Gender

APPENDIX 1

Hello!

This is a survey conducted at the Tampere University of Technology to explore reasons what attracts visitors to online communities. Responding takes only couple of minutes and you can answer directly in this discussion forum or by email maria.antikainen@tut.fi.

1. Your age and gender.
2. Why do you visit here?
3. What do you do here?
4. Do you visit other discussion forums? If yes, why?
5. Have you ended visiting some discussion forum?

Thank you!

Best regards,
XX

APPENDIX 2

Seniors over 55 year: Participate into academic study

We are conducting a research concerning the attraction of online communities among elderly people at Tampere University of Technology in Finland. If you are over 55 years, please spend three minutes in answering a short questionnaire.

Product Oriented Thinking And Expert Knowledge In Consulting Services

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Abstract — This article focuses on problematic field of creating service products out of expert knowledge, especially within the field of consulting in the field of IT. This article seeks answer to basic question: "under what circumstances producing products out of expert knowledge is most efficient?" using theory creating conceptual-analytical approach. Here a theoretical discussion towards common concepts known as product, consulting and expert knowledge is encouraged and a new theoretical framework based on previous studies within the fields of consulting and product oriented thinking, as well as knowledge management is presented.

Keywords —Product, Expert Knowledge, KIBS, Consulting.

I. INTRODUCTION

This article focuses on problematic field of creating products out of expert knowledge. Main research problem presented in this article is *whether it is always possible to create products out of expertise?* More precisely, the research question presented is: *"under what circumstances producing products out of expert knowledge is most efficient?"*

This article encourages theoretical discussion towards common concepts known as product, consulting and expert knowledge - and when using taxonomy created by Järvinen [1] it can be defined as theory creating, conceptual-analytical research. Here a new theoretical framework is constructed based on previous studies and theories within the fields of consulting and product oriented thinking, as well as in knowledge management.

II. METHOD

Comprehensive literature review forms the very beginning of this study and there the concepts of product oriented thinking and characteristics of expertise are discussed. Later these are used for further analysis of possibilities for providing consulting services under different circumstances. In practice, this translates into packaging of knowledge intensive business services (KIBS), which has been studied widely [2]. Results of this study will provide a working toolbox for evaluating possibilities of merchandising services based on expert knowledge, as well as an up-to-date theoretical framework for studying different forms of services based on expert knowledge.

Methodologically this new theoretical framework is created through induction, e.g. through generalizing and comparing findings from previous studies. Hence, using

this approach a comprehensive theoretical framework about product oriented thinking is created and it is being enhanced with ideas concentrated on characteristics of expert knowledge. In this article authors have outlined the area to be studied to cover only consulting services, especially within the field of IT.

According to Lee and Baskerville [3] when generalizing concepts from theory, a researcher generalizes from theoretical propositions in the form of concepts to the theoretical propositions that make up a theory (specifically, a set of logically consistent propositions that, pending the results of empirical testing, could qualify as a theory). According to them another form of generalizing from concepts to theory is the formulation of a theory based on the synthesis of ideas from a literature review. In this article, theories from previous studies are utilized and enhanced, to be fully functional in different context.

III. CONSULTING AND PRODUCT

Development of new consulting products produces as concrete conceptions and models of products and services provided to customers to the market as possible. This way invisible product becomes visible and benefits gained through these services are emphasized. This makes the decision of purchase easier for the customer. Consulting can be defined as *a situation in which one person has a problem or difficulty and seeks help from someone with special skills*. Usually consultants influence or advice others without any formal authority or choosing not to use what authority they have [4].

Consultancy can also be defined as activity, recommending appropriate action and helping to implement those recommendations. In the field of information technology consultancy can be defined as professional activity, which provides customers with assistance in identifying and investigating problems and/or opportunities concerned with management, information technology, or some other things in the field of IT [5]

Today's IT field has expanded to such an extent, that it is impossible for one person to master the whole field. Because of this IT management do need consultants. Situations where the use of consultant is well justified can be listed as follows [6]:

- assistance in establishing new venture,
- additional resource for example in certain development projects,
- source of information,
- connector: utilizing consultants social network,

- outsider, impartial and competent partner for discussion,
- as a help in problem recognition, evaluation and solving,
- developer of new methods and systems,
- support for organizational change., and
- trainer for managers and personnel.

Järvinen [7] states that the use of consult in problem situation usually increases the amount of alternative solutions to check and therefore support the holistic approach towards management. Järvinen [8] also suggests that IT management includes different personnel groups and potential suppliers along with consultant into considering different options. Using this approach it is possible to get a broad picture of problem field before any decision making.

KIBS are specialized in knowledge-intensive services, which mean that the core of their services is the contribution of the knowledge processes of their clients and which is reflected in the exceptionally high proportion of experts from different scientific branches in their personnel. There are several strong prospective trends in the KIBS sector. At least two of them are important considering this article. First, consultative way of working is becoming common in all KIBS sectors. In some sectors this is a big change, and other sectors have engaged in consultancy for long time, but are now moving into the field of actual management consultancy. Second, the content of the service provided to the client is broadening. This means the packaging of expert services and offering integrated solutions to customers. This requires adequate recourses of the service providers [9]. To conclude, consulting as a knowledge intensive service is so multidimensional activity that it is sensible to try to make it less abstract and easier to understand. This means that we try to create service products out of expert knowledge.

From the point of view of marketing, there is no single product or services, but one product may consist of both services and product [10]. Quite often companies producing products are trying to include services as an integrated part of their everyday routines, and service oriented companies try to package their services as products. [11].

It is also claimed, that products, or deliverables, consist of services and goods and information [12, 13] Most manufacturing or service businesses offer their customers a package, that is sometimes referred as to "augmented product", which consist of core product like computer, and core, and supplementary services [14]. Therefore we can claim that even completely standardized products can still be customized by people in marketing and delivery [15].

Consulting is service. Therefore it is important to consider first, what service is, and what the service characteristics are. The most commonly and traditionally stated characteristics of services are intangibility, inseparability, heterogeneity, perishability, and ownership. In comparison with (physical) products, services are intangible, which means that you cannot see, feel, taste, touch, display or physically demonstrate a service. Service

organizations use tangible clues to make services more understandable. Inseparability means simultaneous production and consumption. This can be seen as the myth, because there is also a tangible element in a service, which enables the separation of production and consumption, and technology development has separated the production place from the consumption place in those cases when the service is delivered through electronic channels. Heterogeneity means that services are performances produced by individuals, and therefore, no two services are precisely alike. Perishability refers to the fact that services cannot be saved, stored, resold, or returned. This causes problems of under- and over-capacity, because an organization must be ready to create the service when and how (quantity etc) customers want and where they want it. Ownership means that services cannot be owned and ownership cannot be moved similarly to goods, but when services are connected to tangible goods the ownership can be transferred [16].

Consulting is a professional service. Services can be classified across two dimensions that significantly affect the character of the service delivery process. The first dimension is the degree of labor intensity, defined as the ratio of labor cost to capital cost. The second dimension measures the degree of customer interaction and customization. Customization describes the ability of the customer to affect personally the nature of the service delivered. Little interaction between customer and service provider is needed when the service provides is standardized rather than customized [17]. Table 1 illustrates examples of these approaches.

There are also other ways to classify services, such as dividing services to those requiring tangible actions or intangible actions, those with continuous delivery or discrete transactions, etc. In addition there are other dimensions, such as customizing vs standardizing, low touch vs high touch, and low tech vs high tech [18].

There is no exact definition of professional services, which could draw a sharp line between them and other services. Anyway we can find many characteristics of the professional services in the literature. First, professional services are provided by qualified persons with a substantial fund of specific knowledge. Second, problem-solving approach is essential characteristics of professional services. Recognizing the fundamental problem, and addressing the solution, as well as implementing it, are integrally associated with this approach. Third, service providers typically operate in terms of assignment requested by the customers. Fourth, a code of ethics is centrally connected to professional services. This can be official and written, or based on traditions. Fifth, professionals in a certain area often form a professional association¹. Sixth, many professional services require confidentiality. Seventh, in the marketing of professional services advertising has an insignificant role, but understanding the customer's fundamental problem, soil contacts, and referrals have a significant role. Eight, there is

¹ An example of the association in Finland is Liikkeenjohdon konsultit (management consultants).

a high degree of customer uncertainty in professional services. Ninth, professional services are affected by the characteristics of information, which is expandable, compressible, substitutable, transportable, and shareable [19].

TABLE 1
CLASSIFICATION OF SERVICES

		Degree of interaction and Customization	
		Low	High
Degree of Labor Intensity	Low	<i>Service factory</i> – airlines – hotels – etc.	<i>Service shop:</i> – hospitals, – auto repairs – other repair services – etc.
	High	<i>Mass service:</i> – retailing – schools – etc.	<i>Professional services:</i> – consulting – lawyers – doctors – etc.

Virtually all firms compete on the basis of customer service and service offerings. The service at can take many forms. First of all, it can be customer service, such as responding to customer inquiries, taking and fulfilling orders, and even more broadly having a company culture stressing service excellence. Second, free value-added services can accompany, support, and enhance the utility (and potentially price) of a good. Third, service can be the product offered for sale. Although clearly evident in traditional service industries such as hotels, airlines, and banks, product-based firms are increasingly offering services as a product for sale. The rapid growth of IBM's Global Services, for example, is seen in its successful marketing of product support, networking, and professional services. [20]. In this article we consider the service mainly as a product.

Services could be regarded as products also because both in firms providing goods and firms providing services have fundamental similarities:

- 1) Both are production systems, which require human, material, capital, and other kind of resources
- 2) Both have internal, intermediate and ultimate customers/clients/users
- 3) Both require that the firm sustain itself in a fiscally sound fashion
- 4) Both have to constantly seek what customers need and want, how they are meeting or exceeding expectations, and how they are adapting to the constantly changing customer base economically, politically and socially, and demographically [21]

New service could be considered as an innovation, which Rogers defines as an idea, practice, or object that is perceived as a new by an individual or other unit of adoption. Newness does not mean that an idea is objectively new as measured by the lapse of time since its

first use or discovery. The perceived attributes of an innovation are one important explanation of the rate of adoption of an innovation. From 49 to 87 percent of the variance in rate could be explained by the five attributes: relative advantage, compatibility, complexity, trialability, and observability. Relative advantage is the degree to which an innovation is perceived as better than the idea it supersedes. Compatibility is the degree to which an innovation is perceived as consistent with the existing values, past experiences, and needs of potential adopters. Complexity is the degree to which an innovation is perceived as relatively difficult to understand and to use. Trialability is the degree to which an innovation may be experimented with on a limited basis. Observability is the degree to which the results of an innovation are visible to others. Complexity is negatively related to its rate of adoption, but the four other attributes are positively related to its rate of adoption. [22].

KIFs (Knowledge Intensive Firms) can be defined as companies where most work can be said to be of an intellectual nature and where well-educated, qualified employees form the major part of the workforce. The category 'knowledge intensive' embraces a broad and heterogeneous range of firms, for example high-tech scientific and engineering firms and consultancies, and general management consultancy firms. The category 'knowledge intensive' overlaps with (and can include) professional service firms. However it is a broader concept and does not emphasize the features ascribed to a typical profession, such as a code of ethics, standardized education and criteria for certification, a strong professional association etc. [23]

The before mentioned service characteristics easily illustrate, why packaging of services is beneficial for a firm: it can for example make marketing easier while service become clearer, and easier for customer to understand the offer. This might be extremely important in abstract knowledge intensive services.

It is claimed, citing the before described Rogers model of adoption of innovations, that 80 percent of new product failures are due to lack of customers acceptance. The model is used when developing high-tech products [24].

Product oriented thinking in this article means that we try to take all the good characteristics of a tangible products to intangible products like consulting services. This means that consulting service becomes more concrete, easier to produce and purchase etc. The big question is, is it always possible to create products out of expertise, and under what circumstances it is most efficient.

IV. CREATING PRODUCTS AND SERVICES

To create products out of services that require expert knowledge simply means definition, description, planning, development, production and continuous improvement so, that benefits for customer are maximized and the goals of company providing expert knowledge are met. The whole process of creating products is a way of thinking, which utilizes product- or product development strategy in

practice. This is all about specifying and analyzing whole service production into a more easily controllable form [25]. In healthcare creating products is defined to mean definition, specification, specifying and profiling services to customer which are being produced by organization or working unit [26].

In the end of development process for new consulting products a packed consultancy product is being born [27]. Kotler [28] also refers to packaging and claims that it can be subsumed under product or promotion within the traditional framework of marketing. From the customers point of view this means customer communication and customer value.

It is said, that development processes of services differ from development processes of physical products. There are often no specialists that concentrate on service development, whereas product development specialists exist in many organizations. Service production process is often vaguely defined compared to production of physical products. The outcome of service development is often an abstract offer that usually cannot be tried in advance [29].

One solution to the before mentioned problem is, that we use some kind of process thinking while creating or developing services. There is a quite a much literature concerning process management [30, 31] and quality management [32] which is full of different methods and frameworks of how to make processes more simple and well-functioning

To create new consulting products offers a beneficial approach to be used when utilizing expert knowledge accumulated in organization [33]. Basic problem is to be able to recognize possibilities as well as possible threats. Thinking patterns usually associated into industrial production processes do not automatically apply into immaterial goods, such as consulting, and thus open discussion over possibilities is necessary. When creating consulting products there exists always a conflict, which is foundational by nature. Customer wants always unique and personal solution, but almost always consult is forced to create products of his/her core business in order to ensure competitive advantage for the future.

V. TECHNOLOGY INFUSION IN SERVICES

The interpersonal focus of service encounter research is not surprising as most encounters have traditionally been facilitated by interpersonal contact. Consumer services in business-to-business services such as consulting have, until recently, been delivered by human providers. Due to the emphasis on "high touch," virtually all of the service research has explored the interpersonal dynamics of the encounter. Yet, across industries, technology is dramatically altering interpersonal encounter relationships and, in some instances, eliminating them altogether. In some cases, technology may dramatically increase the number of encounters a customer has with a firm. For example, an E-Trade client may check his or her accounts daily instead of waiting for a monthly statement or quarterly call from his or her financial adviser. [34]

The ability to adapt in real time is a distinct advantage for service providers who wish to be responsive to customer desires for individualized service. For example, consultants can all adjust or adapt the service they deliver to fit the immediate expressed needs of a particular customer. In the services literature, this type of customization is also referred to as "discretion", "personalization", and "adaptation" [35].

Cisco Systems is effectively training customers to use technology on their own in order to generate spontaneous delight. Cisco has created a database with questions and answers for many commonly asked questions. For more complex problems, Cisco has developed an expert system that walks users through problem-identification and resolution processes without the need to directly contact Cisco. The company uses a series of questions created by service experts to lead customers to a solution for their specific need [36].

In the study concerning self service technologies (SSTs) they found that in the context of SSTs, instead of experiencing spontaneous delight, customers appear to be highly dissatisfied with unexpected technical failures. Anyway, with the advent of new technology and the evolution of SSTs, SSTs are likely to be developed that have the capability to mimic and/or surpass the positive aspects of interpersonal encounters in the future. This means for example, that companies will have systems in place that not only monitor if and how an SST is functioning but also prevents failures before they happen and/or provide real-time service recovery for customers as they interact with an SST. This is similar in many respects to what firms such as Caterpillar and Xerox already do in anticipating equipment breakdowns through remote monitoring systems. The potential of customization for Internet-based SSTs has already been demonstrated clearly by a handful of leading firms. Given that technology enables firms to know more about their customers (i.e., their preferences and past behavior), it is expected that mass customization will become increasingly common. It also creates an endless array of possibilities for delighting customers in highly customized, unique ways [37].

Firms cannot risk sitting on the sidelines as competitors deploy technology to help facilitate service encounters. Yet, in moving forward, management must carefully address the impact of technology on encounter costs and customer satisfaction and loyalty [38].

VI. CONSULTING WITHIN IT

The traditional goal of an information systems services is to build, maintain, and operate information delivery systems. Users expect efficient and effective delivery systems. However, for the user, the goal is not the delivery system, but rather the information it can provide. Information systems services have many functions: responding to questions about software products, providing training, and giving equipment advice. In each of these cases, the user's goal is to acquire information, and to get high quality service. [39] According to studies concerning

service quality, responsiveness is a more important factor in the people-based industries like consulting, whereas tangibles are a more important factor in the facility/equipment-based industries. [40] Responsiveness means willingness to offer prompt service and to help people. Tangibles refer to facilities, equipment, and appearance of personnel [41].

We could conclude from the before mentioned studies that if we try to create products out of services, for example within the field of IT, we should answer following questions. First, we should know how we can make expert knowledge in consulting services concrete enough. That may not always be an easy task because expert knowledge is complicated and multidimensional by nature. Second, we should know what kind of consulting services can be made to products, because we can't make products out of all services. When considering this, we should think about the customers' needs and goals of a company at the same time. Every consulting service provider must be able to answer these questions.

The central concepts in service development are service idea, service concept and service design. These concepts have been used freely and undefined. This has caused confusion and difficulties in comparing different studies with each other [42].

In a Swedish study concerning new service development from idea to launching, in a four different consulting services in a computer consultant company, they found four phases in a service development: the idea phase, the project formation phase, the design phase, and the implementation phase. The borders between the phases are diffuse and the phases overlap. The study implicated, that the service development influences the whole company in a way or another, it was not carried out in a systematic manner and explicit methods were used only sporadically, it was carried out together with customers since the services were developed through customer specific projects, and it is an activity which can develop the competence of the personal. In order to ensure the quality of the new services it was considered important to involve many employees and customers in the service development work [43].

In the field of ITC industry firms can use more technology in their service than firms on average. Therefore it is good to consider the impact of technology on services.

VII. FRAMEWORK FOR CONSULTING

Because focus of this article is in product oriented thinking, all the good characteristics of a tangible products as well as intangible products like consulting services are taken into account in order to be able to outline the scope of product oriented thinking in consulting. In general, it appears that there simply does not exist one single product or service. Instead, one product may consist of services, product or information, thus making it often very hard to separate these three levels.

Because virtually all firms are competing on the basis of customer service and service offerings, service is indeed

very difficult — if not possible to exclude when focusing on product as concept. On the other hand, as discussed earlier in this article, services can be quite naturally regarded as products, mainly because of the shared similarities between companies specialized in goods or companies specialized in providing services.

Process for creating products out of expert service is quite forward process. Table 2 summarizes our views on this, while providing simple illustration over the process of creating products and services.

TABLE 2
CREATING PRODUCTS AND SERVICES

Creating product out of expert service	Possible tools to improve expert service packages	Good new (service) product
<i>Definition</i>	– Process management practices: definition and describing, of processes	– Clearly defined service production process
<i>Description</i>	– “ –	– Is perceived as relatively easy to understand and to use, not too abstract
<i>Planning</i>	– Use of technology: SST, mass customization, real time service, ... – Process management practices: planning of processes	– Is perceived as consistent with the existing values, past experiences, and needs of potential adopters – Is perceived as better than the idea it supersedes
<i>Development</i>	– Use of technology: an expert system that walks users through problem-identification and resolution processes without the need to directly contact a firm;	
<i>Production</i>	– Use of technology: increase of the number of service encounters	– Has results which are visible to others (observability) – May be experimented with on a limited basis (trialability)
<i>Continuous improvement</i>	– Quality management tools: process improvement, continuous improvement, etc.	– Good service quality

To be able to focus on consulting services and on expertise it requires, a clear summary of characteristics within the field of consulting is necessary. In table 3 an illustrative summary of characteristics of the process of creating a consulting product is provided.

It is difficult to make a clear distinction over what kind of expert service can not be packaged into product. On general level, we can only vaguely assume that services of extremely abstract nature, which include very few tangible clues, are extremely difficult to make into product. This is

to say, that there are plenty of tools to be utilized when developing services.

TABLE 3
CONSULTING WITHIN IT.

Development of a consulting product	Tools and ideas to be taken into consideration while developing expert services
Idea phase ↓	– Process management and quality management practices to make product easier to understand, and to improve service quality (responsiveness, etc.)
Project formation phase ↓	– Develop a service which is perceived as a) consistent with the existing values, past experiences, and needs of potential adopters, b) better than the idea it supersedes, and c) relatively easy to understand and to use, not too abstract
Design phase ↓	– Make results of a service visible to others (observability) and possible to be experimented with on a limited basis (triability)
Implementation phase	– Use of technology: SST, mass customization, real time service, an expert system that walks users through problem-identification and resolution processes without the need to directly contact a firm, increase of the number of service encounters

To summarize our findings, it appears that it is easiest to create product out of service, when following predeterminants are met: 1) *we have product development competence in a firm and we can apply it also in service development*. This refers to the fact that traditionally the development of services has not evolved like for example in product development has; 2) *We can use process management and quality management practices in a firm*. This refers to relevant working methods which are followed; 3) *We can use technology*. This refers to dilemma of “high tech” vs. “high touch”; 4) *We can use tangible clues in a service*. This refers to the way how the service is being presented.

VIII. DISCUSSION

It appears that the ability to use process-, and quality management practices will be very beneficial in situations, where product oriented thinking is required along with required competence within product development. This does emphasize creative thinking and ability to adapt known practices into service development.

In order to succeed in contemporary business environment, access to existing technology is necessity. Lesson learned from IT project management failures is that *IT really matters* [44]. Neglecting the significance of the role of IT in contemporary business environment is not only careless, but hazardous as well. Therefore high competence and extensive professional knowledge of

consultants within the field of IT is crucial. Thus it is extremely important to be able to foresee *when and where expert knowledge is easily transferable into services and even further – utilized into product oriented thinking*.

With help of tangible clues even expert services could be made easier to understand. Tangible clues are physical or tangible representations of services, such as buildings, offices, service personnel, letters, or other kinds of physical surroundings [45]

In general, it appears that product oriented thinking and it's applications in business context appears to be a question of organizational maturity. Although services have been around for a while, but when comparing these with product development techniques and traditions, there is still a lot to do.

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Re-qualifying Delivered Devices and Inventory for a New Product Specifications, a Case Study

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Abstract — The paper examines an e-Commerce system for re-qualifying delivered products and inventory for new product specifications, and proposes a streamline supply chain model with a mass-customization and a customer-direct capability. The paper also introduces benefits and foundation for a strategy for producing generic renewable designs.

The empirical research was carried out by means of a case study in a Finnish SME that manufactures laser diodes for international markets. To provide a background, the product customization in a semiconductors industry, system analysis and architecture are addressed. The analysis and conclusions are based on the authors' experimental findings from this area. The study shows that a mass-customization is beneficial in the semiconductors industry as long as the laser diode designs are properly parameterized and structured in the database.

Keywords — E-commerce, Mass-customization, Supply Chain Management, Product development

I. INTRODUCTION

A. Background of the study

A research [1] shows that responsive Sales Force Automation (SFA) has yielded few promising results. Usually it is difficult for customers to find proper information or a product, and make a selection between large number of product variants [2]. Today's customers are also aware of their buying options, with the requirements they place on suppliers often changing from order to order. This creates challenges but also huge opportunities for system developers, and to those manufacturing companies that can utilize for example the inherent process variation and production testing at individual entity level to their advantage cost effectively.

In response to such an unpredictable customer order cycle, companies are looking to reduce excess or unnecessary inventory – for example by eliminating the inventory entirely using a zero-inventory model [3]. This creates a demand for a mass customization (MC) system in modern economy where products need to be increasingly tailor-made to meet customer requirements. The system developed in the case company enables a customer-direct

capability and a possibility for re-qualifying already delivered products or adjust the manufacturing process in-situ based on new customer requirements and quality control (QC) data. This can be particularly useful in manufacturing of devices with lots of critical variables in the specification. Very often customers require devices in small numbers and beyond the accuracy of today's production technology. Such customer requirements are mostly fulfilled by trial and error manufacturing or manually looking into QC data of previous production runs. The case company has realized the necessary architecture where the re-qualification of devices can be done semi-automatically and very large number of devices can be checked against desired specification.

Collaborative and build-to-order direct supply chains seem to have remarkable effects because of the advantages of the system integration. It takes the skilled managers to successfully engineer high-performance supply chains, ones that are built quickly, respond well, adapt well, and incorporate business intelligence. [3] Among many other companies, Dell, for example, has had success using this strategy in its build-to-order (BTO) scenario [3]. Traditional method of forecasting future demand and developing a production plan based on forecasts no longer works in the industry when shorter order-to-delivery cycles are required.

It is important to have responsive supply chains, which quickly and accurately respond to customer needs. It helps the company to keep promises and to know what production and distribution resources are available. The case company has developed a system that provides real-time integrated checks throughout the supply chain, from customer order to after-sales. The system can also help to set realistic order-delivery expectations as the required manufacturing steps to be performed are known, and the time to be processed can be estimated from previous production runs. The adaptive supply chain can be rapidly reconfigured to adapt to changing consumer demand. The rate at which the company can identify and respond to changing business conditions and consumer requirements can be accelerated.

Even though our examples are based on laser diodes we believe that the system is usable with little or no modifications to all process-role-entity type sectors with products and or services ranging from electronics to medical services.

II. PRODUCT CUSTOMIZATION IN SEMICONDUCTOR INDUSTRY

Semiconductor laser processes are like other semiconductor process vulnerable to process tolerance variations resulting in yield fluctuations but also largely variations in more application specific parameters such as emitting wavelength of the laser. This variation can effectively be used as competitive advantage when company has solid understanding of the individual devices history and other performance limits and that data is provided in usable format to business people [4].

The understanding is achieved through holistic information architecture that allows sophisticated matching of already manufactured devices against new or custom specifications such as those provided by company's space, medical and military customers. Increasing customization usually requires reorganization of the activity structures in production and distribution in order to enhance process flexibility [5]. We, however, have adapted in an early stage a generic process/sub process model, which supports modular product and process architectures, and logistics and suppliers configurations.

Some benefits of in-situ MC and build-to-order [6], [7] that can be applied in (semiconductor) industry:

- Made-to-order manufacturing largely minimizes the risk of forecasting and eliminates distribution stocks
- Increased flexibility and scalability can be gained by integrating customers early into product definition. Company can react fast to changing market trends
- Involving customers can lead to new products, product specifications and even innovations
- Reduction or elimination of inventory in distribution chain
- Helps in product differentiation and customer segmentation management

In general, the case company does not provide off-the-shelf products, but each product is more or less customized design. Some products are, however, manufactured in large quantities, which may provide a better price, but usually a compromise in the design. Truly customized products on the other hand provides better features but for a higher price. We have been experiencing Activity-Based Costing (ABC) [9] model in our environment, which can be used – in addition to internal cost management - to help customers understand how their behavior affects the costs of the product and service. The customers will then only pay for what creates enough value.

III. SYSTEM ANALYSIS AND DESIGN

We have found that *think big – start small* approach can be utilized after proper preparations as long as the

architecture is holistic, generic and information is stored centrally only once. This sets the basis for building and further developing the system very good. It also ensures that all levels of planning are based on the same data. We have actually found out that by following these principles we have been able to increase productivity and relative gains from further systems development for several years now as our underlying architecture is just utilized more and more. We have also repeatedly observed that ROI-% rather increases overtime rather than stabilizes or declines with additional investment on top of the robust, core architecture.

In addition to the architectural aspects noted above we found that actual take-in-use time and system benefits are clearly influenced by information architecture consistency. Naming of information elements clearly is also essential for teaching users to serve themselves and get real user acceptance. In addition, no matter if the user interface is for customers or employees, the importance of training should not be underestimated.

No database implementation or representation can serve for sure the future needs of the enterprise. For this reason and for enabling users to make ad-hoc queries one needs to have structure that is simple enough. This enables the system to bend to changes in business. Yet it is important to maintain semantic enough structure for an average business user to comprehend and effectively use in her/his work. We also found out that simple structure based system is superior to typical big commercial system which has lots of rigidity and will not be able to quickly support changing business and operating models.

IV. SYSTEM ARCHITECTURE

A study [7] argues that MC is only possible if customer integration and co-process are supported by adequate systems being able to reduce the high transaction costs resulting from deem customer-firm interaction. The interaction systems for mass customization are the key instrument to reduce the costs. In literature [10] these systems are called configurators, choice boards, design systems, toolkits, or co-design platforms. No matter what the name is, the systems are responsible for guiding the user through the configuration process. The system may present different variations, provide more information, visualize the product, and show its pricing. The success of such interaction system is, however, by no means not only defined by its technological capabilities, but also its integration in the whole business infrastructure.

The system developed at the case company allows the organization to easily sell custom-made (semiconductor) devices by an advanced e-Commerce system that supports all important business functions and processes. The overall architecture aims to integrate company systems, various lifecycle issues of product fulfillment into a collaborative web-based system of interactive commerce, which supports

product customization over the Internet. Company's current holistic database-centered MES is efficiently linked with Product Data Management (PDM), Supply Chain Management (SCM) functions and Enterprise Resource Planning (ERP) and Customer Relationship Management (CRM) systems [8]. The outcome is a system that practically serves every business process in company by truly transforming the business into e-Business.

All manufacturing functions are integrated to database-centered MES. The relational database stores all data related to products, production and product development, and helps the company to manage, monitor and control operations in real-time [8]. Information is stored on highly structured yet simple and non-redundant way, unlike in most commercial systems, which is one key to cost effectiveness and agility at system level. Product features, applications, and characteristics are parameterized in the relational database.

The company has been collecting measurement and production data since its birth in year 2000. The production equipment are integrated to databases, and measurement data – which is critical when verifying product specifications against the measurement data – is retrieved automatically from database tables. This makes the automatic generation of up-to-date real-time product datasheets easy, even with the smallest entity details. It also makes the marketing less expensive, much faster and more effective. The benefits for customer are clear from the fact that internal inspections, test and quality (ITQ) take their instructions directly from the same information source that was established by R&D and translated by marketing into a product specification.

The external toolkit (web shop) application is used to search product information from the web. It is linked to actual production database. From MC point of view, customers and other interested parties are able to query if a product configuration they have specified is available from the inventory and how many devices the company could ship immediately. Like in any other web shop, the products can be collected to cart, which later can be sent to the company. One of the limits of MC is that excess variety may result in an external complexity [6]. If the web shop is complex enough, the number of different configuration options might overwhelm the users. Piller [6] argues the customers should not start from scratch. In a good MC system there will be a pre-configuration which represents already a full configuration and which customers can modify according to their wishes.

The base of company's operations is a Universal Activity Management Tool (UAMT) [9] that connects together people, products, customers and other relevant entities. All the functions done in the company are based on activities. An activity can be anything from performing a process step in production, entering an supplier invoice, creating a quote,

answering to customer inquiry, having a meeting, or doing an equipment maintenance. All the activities performed within the company are saved to a database with accurate information of date performed and time processed. The information can be later used in a decision-making for example by calculating the cost of the activity. Later non-value added activities can be eliminated and value-added activities improved.

V. STREAMLINE SUPPLY CHAIN MODEL

Like any other MC practice, selling laser chips requires information and co-ordination about the customer needs and desires in order to define a product specification or a product design. Thus the customer and supplier need to be in communication to complete the product development. The communication can be anything from a phone call or email discussion to e-Business system.

Currently there are hundreds of product specific parameters in our database that are more or less important when speaking of laser diodes and their characteristics. Development of a new laser diode chip may be time-consuming, but the results can be utilized in new product specifications later. Having well-structured laser design with detailed electro-optical and mechanical specifications in the database gives us increased possibilities for different kinds of database queries and data analysis.

The same existing product and process information can be utilized anywhere else too, for example when creating new process and sub process chains to manufacture the actual product. In general a laser diode manufacturing in our environment consists of some 200 different steps what we call sub processes. Depending on the workload, the actual manufacturing can take an equivalent of couple of working days if the product specification is already done.

In addition to manufacturing, the process step information can be used in cost management and profitability analysis as well. They work as a basis for accurate Activity-Based Costing [9]. In the same way the overall data serves marketing department needs too as the very accurate product specific information can be directly used in marketing materials.

Many MC approaches implemented in practice are based on offering a big amount of variety and choice [6]. However, there is only a little understanding about the customers, who often have no clear knowledge of what available solution might correspond to their needs. The newer and more complex the individualization possibilities are, the more information gaps increase [6]. Customers may simply lack the knowledge to transfer their personal needs into a concrete product specification if a simple product may become complex if one has to decide explicitly between all features. Semiconductor business, on contrary, is usually done between two companies and the buyers and sellers are familiar with the products. Requests for

quotations often come with a list of very detailed information, so in that sense customers have already a good knowledge what product might correspond to their needs.

Currently the e-Commerce system allows people to search products based on their main parameters and characteristics. If a product is found from the company's product portfolio, more information will be shown and the user can request for more details such as laser chip lifetime or measurement data. In case the product configuration does not exist, the potential customer is notified. If wanted, the requested parameters can be attached to product inquiry, which can be sent to the manufacturer for a closer review.

When the company receives an inquiry from the web, the system automatically creates a corresponding activity to company's CRM. The activity is created for a responsible engineer (in case of his/her absence, for a substitute person). All the necessary parameters, such as product line and product group, are added automatically.

When the responsible person opens the activity, the most suitable product can be quickly retrieved from a Manufacturing Execution System (MES). If a product specification is already available, its pricing history and stock quantity will be seen immediately. The power of the well-structured and parameterized laser diode product (specification) data comes when a product from the stock is not readily available. In that case the product engineers can check out from the database if such product with supplied specification has been manufactured before, or if there is a product close to its specifications.

When a suitable or close enough product specification is found, some changes to original specification may be needed. In that case the specification is duplicated and the changes are done to new specification accordingly. The duplicated specification will still have the information what process phases and sub processes were needed to create the product. Also information of possible subcontractors is found: who may have shipped the wafer substrate or have done possible packaging. This is important information since the laser diodes are qualified by the customer, and the manufacturing processes and wafer substrates affects to the product performance.

In the future the customers can interact with more advanced tool to define and translate their needs and desires into a concrete and a very specific product specification. Even now, the system turns a selling process into a co-design process and can help the company to capture important market trends information from their individual customers. Equally important is to learn from the customer, what might be their needs in the future. In the future we can allow the customers to do part of the specification work and translate those requirements at least semi-automatically to production.

Supply chain, however, is not finished until the product has been shipped to the customer. Usually this part of the model is the most difficult. Once the order is made from the supplier, the customer may pay well in advance for a product, and has to wait days, even weeks to get it. The supplier has to ensure that while the customer's expenditure is kept as low as possible, the value perceived by the customer has to be clearly exceeded [10].

VI. CASE EXAMPLE

A customer requested from the web 2-3 pieces of a custom 1-watt continuous wave multimode laser diode in the 1300 nm range. The supplier had done such laser before, but did not a product available in stock that could fulfill customer's request. The supplier however was ready to launch a whole new growth of wafer process to get the laser chip. After more detailed discussions with the customer, they provided main specifications as follows:

- Wavelength specification 1290nm – 1340nm
- Output power more than 0.5W (1-2W preferable)
- Any package with Thermo Electric Cooling (TEC)
- Devices needed to be from same wafer lot but test data needed to be available from multiple lots with a specific criteria for the manufacturing process of the lots

Based on specification parameters in the database, the supplier was able to find out whether an electro-optical specification that met the criteria was already found. Later – based on existing information – the supplier suggested doing a bonding on C-mount and to deliver the parts for mounting the C-mount on TEC. Supplier expected the lasers to reach over 0.5 watts having 1000mm cavity and 150 μ m stripe.

In addition, the supplier had an ongoing project with following characteristics:

- Ith: below 1A
- Slope: ~0.3 W/A
- Center lambda: 1340-1360 nm
- Iop@1W CW: 4.5-5.5 A
- Aperture: 150x 1 micron
- Mounting p-side down

Having more discussions with customer, the actual need became for 1362 +/- 5nm fiber coupled laser diode. It was also necessary to have over 1 watt from the fiber. That would basically mean having ~1.5 watt output power from the ~200 μ m laser emitter, with 400 μ m fiber size.

The supplier suggested sending 1-10 pieces of chips as prototypes. If they were not suitable, then the supplier

promised to quote 200 micron aperture devices with a customized wavelength. The original inquiries finally lead to new product at 1362nm wavelength and a significant order from the end customer.

The responsible product engineer was able to:

- Find out whether there already was a suitable design for the laser diode the customer requested
- Use existing electro-optical and mechanical specification
- Use the same instruction processes in manufacturing without a need to redesign the instructions
- Find out who was the best substrate (specific material) supplier for the requested design
- Send detailed lifetime and measurement data for the customer based on the previously manufactured product and its specification
- Give an estimated delivery date for the product
- Make profitability analysis of existing production activity data and use that in pricing as well

VII. CONCLUSIONS

Throughout the development of the e-Commerce system, we have learned that the best way to develop a system that supports each business process in the company is to use the same architecture and perform all functions within the system rather than outside the box.

Manufacturing companies are facing rapid and unanticipated changes in their business environment. The new competitive environment requires firms to produce products with a greater specificity to customer needs [5]. Companies that have just recently been mass producers of standard products are faced with situation in which they must provide highly customized products at sinking standard product pricing. When customers are more demanding and aware of their buying options, the supporting system development within the infrastructure becomes crucial. A poorly integrated technology infrastructure presents the same problem to supply chain performance as it does to company's internal performance. Poor systems integration means reduced flexibility and cost control. A company's ultimate success depends on its ability to collect, organize, and analyze data and to disseminate this information throughout the supply chain in a timely, cost-effective way [3]. Also the best and most advanced fulfillment system is worthless if it cannot express its added value to customer.

The value of a proper information architecture is not however limited or even mostly in ability to re-qualify devices against a new specification. The majority of the

value is created as a result of capability to factually respond to verification and process related questions of customers as well as ability to differentiate products between applications and users. The proper architecture also sets a completely different level of possibilities for marketing management and other decision-making that wants to combine product data with business information without lots of manual, error prone work.

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Risks in ERP Project – Case Study of IS/ICT Management Capability Maturity Level and Risk Assessment

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Abstract — Enterprise resource planning (ERP) projects are considered to be expensive, time-consuming, difficult to manage, and extremely risky. ERP projects are risky from the strategic, operational, technical and organisational perspectives. The risks and critical success factors of ERP projects have been widely studied, and the management of risks is crucial to a successful ERP project. Generic risk analyses have faced inflation, and in the worst case companies do not manage risks in their ERP projects at all.

This paper presents the early stage assessment of ERP project risks in three firms' ERP projects. The focus is on company-specific risk identification. Companies of this study have limited maturity in IS/ICT management capabilities. Understanding of capability maturity level is useful to efficient risk management in an ERP project. In this paper we compare the company-specific risks to common risk list found in the literature. Qualitative case study of three firms provides empirical evidence of uncovered ERP risks if only common risk list is used. As a result we claim that in addition to generic project management risks there is also a need to assess company-specific-risks. In fact, company-specific risks are usually critical to company's ERP project success.

Keywords — ERP, ERP project, risk, capability maturity model

I. INTRODUCTION

Nowadays even smaller companies are willing to implement Enterprise resource planning (ERP) systems in order to improve their business operations. In some cases the pressure towards ERP system investment comes from larger co-operation partners. ERP system implementation is a complex project which includes many critical phases, such as ERP system selection and configuration [3], before it is successfully in use. Currently ERP projects, their failures and success factors, are mainly studied in larger companies [6][1]. This is understandable, as in the past mainly large companies were investing in ERP systems. Currently, as small and medium-sized (SME) firms also implement ERP systems, the special characteristics in their case must be understood. In order to support SMEs in their ERP project, targeted risk management processes are needed in this context.

It is a known fact among practitioners and researchers

that many ERP projects are interpreted to be failures. It is even more challenging for smaller companies or business units to implement ERP systems successfully. IT investments, especially those as large as ERP systems, are difficult, as the smaller firms may not have enough resources, capabilities and ERP project experience. Many projects have faced the situation that at least some of the goals in the projects, e.g. schedule or integration, were not met. This stresses the importance of understanding the risks inherent in ERP projects. There is clearly a need for an ERP risk management solution that is dedicated to improve small companies' ERP risk management.

The main goal of the paper is to present a description, assessment and analysis of the early phase risks in three ERP projects. This goal includes several sub-topics to be discussed at least to some extent. Firstly, the special characteristics of smaller firms as ERP buyers are under exploration. We do this by analyzing the cases by IS/ICT management capability maturity levels. Secondly, the actual risks found in the case companies are presented and discussed. We also analyze in more detail how the maturity level has affected the assessed risks. Finally, we compare the company-specific risks, identified in case studies, and common ERP project risk list, adapted from the literature. The result of case studies and the comparison of risk lists' show that IS/ICT management capability maturity level can affect risk assessment. Therefore, this paper enhance the understanding of ERP projects risks end their management especially in companies where IS/ICT management capabilities are maturing.

II. ERP PROJECT RISK THEORY

Various reports about common ERP project risks exist. Sumner in her article studies the experiences of seven enterprise-wide information management system implementation projects.[6] Table 1 shows the risk factors in Sumner's article. The research objects were thorough structured interviews with project managers of companies, all of which are from the fortune 500 list. As a result she lists 20 risk factors divided into 6 risk categories:

TABLE 1
RISK FACTORS IN ERP PROJECTS ACCORDING TO SUMNER [6]

Risk category	Risk factor
Organizational fit	Failure to redesign business process Failure to follow an enterprise-wide design, which supports data integration
Skill mix	Insufficient training and re-skilling Insufficient internal expertise Lack of business analysts with business and technology knowledge Failure to mix internal and external expertise effectively Lack of ability to recruit and retain qualified ERP systems developers
Management structure and strategy	Lack of senior management support Lack of proper management control structure Lack of a champion Ineffective communications
Software systems design	Failure to adhere to standardized specifications which the software supports Lack of integration
User involvement and training	Insufficient training of end-users Ineffective communications Lack of full-time commitment of customers to project management and project activities Lack of sensitivity to user resistance Failure to emphasize reporting
Technology planning/integration	Inability to avoid technological bottlenecks Attempting to build bridges to legacy applications

Huang et al. [2] used the Delphi method to extract 28 risk factors within 6 categories adapted from Sumner. The risks were first identified by seven experts, each of them with experience of at least two ERP projects. Wright and Wright interviewed 30 experienced IS auditors from the Big 5 firms specialized in ERP evaluation and testing [10]. The interviews were conducted in a semi-structured manner. The study resulted in both qualitative and quantitative analysis of ERP problems, ERP application risks, ERP vendor risk comparison, and ERP effectiveness measurement. The eight most common ERP problems included:

- Inadequate user involvement
- Inadequate user training
- Process reengineering
- Lack of controls in ERP system
- ERP system does not match the required processes
- Poor implementation of systems
- Poor task-technology fit
- Poor data conversion

The problems can be transformed into risks, but they are on a very abstract level and thus applicable in any ERP system implementation. However, they do not encourage any specific risk management action as they are too general, and actually not in a risk list or check list form.

Instead, the ERP project risks most often reported are the critical success factors (CSFs). The experiences are usually collected in the post-implementation phase, and most often from large companies. For example, Somers proposes 22 factors recommended in the earlier literature produced by practitioners and academics [5]. Then the list was ranked by senior level IS executives of companies from fortune 500 list and companies from *Directory of Top Computer*

Executives. Top five of the ranked critical success factors list is:

1. Top management support
2. Project team competence
3. Interdepartmental cooperation
4. Clear goals and objectives
5. Project management

These critical success factors can more easily be turned as a risk list than problems discussed above. Still the factors are so common that they apply as a risk for every company despite the company's size or business. The self-evidence of these factors makes them easy to ignore as non-special risk, which does not need an extra attention and activities in order to be reduced or avoided.

The earlier research on ERP project risks is based on checklists and weighting of large companies. Those in fortune 500 lists especially are expected to have structured ICT organization and enterprise-wide ICT strategy. Renken has developed a capability maturity model (CMM) for assessing the IS/ICT management of a company [4]. The final model includes seven IS/ICT management capability maturity indicators refined from the original 15 by eliminating non-critical and duplicate indicators. Elimination was based on prototype modeling of the relationship between indicators and semi-structured interviews of five South African IT professionals.

The seven indicators are:

- IS/ICT applications i.e. how they are utilized
- Business-IT relationship i.e. inter-organizational relationship
- IS/ICT strategy alignment, meaning if IT strategy exists and whether it is aligned with business strategy
- IS/ICT user profile i.e. the IT skills of the personnel of a company
- IS/ICT managerial paradigm i.e. focus of ICT management
- IS/ICT governance i.e. if a predefined IT management process exists and how well it is established
- IS/ICT organization i.e. IT organization form and IT management level.

Each indicator has three to five maturity stages. The model can be used in comparative analysis on the IS/ICT management capability of different companies [4].

There are several other papers also dealing this topical research area of risks in ERP projects. Taylor [7] studied 22 project managers from different vendor IT firms in Hong Kong and the point of view is, in contrast to traditional ERP project risk papers, the IT resource provider's perspective. Amoako-Gyampah **Error! Reference source not found.** presents the ERP implementation factors, both managerial and end-user perspectives, and states that managers have different perceptions than end-users. Tatsiopoulos et al. [8] presented a paper, which stresses the strategic nature of the ERP implementation and especially the strategic issues in the early phase of the project and increasing the importance of operational issues in latter phases. Zafiropoulos et al. [12] created an application for risk management in ERP

project and Yang et al. [11] applied the ideology of FMEA in risk management of ERP introduction.

III. RESEARCH METHOD & CASE COMPANY INTRODUCTION

The risk analysis is a part of the *C-CEI method* introduced by Vilpolo et al. [9]. The method includes *operational* and *contextual* analyses in which the company-specific risks for *risk analysis* are identified. In this section the risk analysis methods are described and the resulting risks presented and discussed.

A. Research method

In our research we made an in-depth case study in three companies. Table 2 shows the phases in the research as well as the number of people involved in different phases. Due to a limited number of cases in this research, the results may not be generalized, but on the other hand we can evince a profound understanding of the cases studied.

TABLE 2

RESEARCH ACCOMPLISHMENT IN CASE FIRMS. PERSONS INVOLVED IN DIFFERENT PHASES (* IN THE FIRM C THE RISK ISSUES WERE COVERED IN FIRST ROUND INTERVIEWS)

	Company A	Company B	Company C
First round interviews	12	8	15
Observations	6	5	8
Risk interviews	2	2	0*
Risk assessment WS	4	5	7
Ways of managing risks workshop	5	5	7

The basic idea was to identify the ERP risks arising from the company reality and therefore employees of various levels of organization were interviewed and observed. The goal throughout the whole project, in which the risk analysis was part of, was to help the company in creating a realistic requirements specification and analysis of the company's context. By understanding the business requirements and the limiting factors of the context it is possible to gain a realistic list of potential problems i.e. risks in the ERP project. This is a good starting point in project risk management.

In risk assessment we did not use any previous general list of ERP project risks. Instead, the risk list was formed during the firm interaction and divided by the project phases; *selection*, *implementation* and *use & maintenance*. The risk list was filled with issues emerging in close interaction with companies personnel.

Risk assessment for the risk list was done by evaluating each risk's probability and effect in a scale from one to five. The number one meant very small probability and effect. 5 meant high probability and catastrophic effect. In the appendix we have used risk multiplication as an indicator of risk significance. It is calculated as multiplying probability and effect. Range of this value is from 1 to 25.

B. Analysis of IS/ICT management capability maturity levels of the case companies

IS/ICT management capability maturity framework [4] is used for analyzing the maturity levels of the three case

companies. The case companies were not actually measured for the maturity estimation, rather the levels of indicators were revealed during the interviews and observations. The framework used includes seven indicators each with levels from 1-3 to 1-5. Table 3 shows the levels of the indicators for every company. Below the table the case companies are analyzed in more detail.

TABLE 3.

ESTIMATED MATURITY STAGE OF EACH IS/ICT MANAGEMENT CAPABILITY MATURITY INDICATOR IN CASE COMPANIES A, B AND C.

Company/ Indicator	Company A	Company B	Company C
Applications	1 of 3	1 of 3	2 of 3
Business-IT relationship	2 of 5	1 of 5	3 of 5
Strategy alignment	1 of 4	1 of 4	3 of 4
User profile	1 of 3	1 of 3	2 of 3
Managerial paradigm	2 of 4	1 of 4	3 of 4
Governance	3 of 5	1 of 5	4 of 5
Organization	2 of 4	1 of 4	3 of 4

All three companies have in common a need to renew their information system in order to better accomplish their operations now and especially in the future. The need for the new system has grown internally in the companies because of the problems in the current system(s) and, for example, poor usability of systems and complex historically developed system structure. Overall the levels of company B are lower than levels in company A and C (Figure 1), but first each company and its levels of capability maturity factors are described in detail.

Company A is a manufacturer of a complex chemical product (turnover about 14M€ and number of personnel approximately 150). Many of the operations are supported by Microsoft Excel and paper and pencil notes. Strict quality and traceability requirements for the product have forced the company to establish their performance and policies. Company A has a long history and the volume of the business has remained fairly stable. IS/ICT technology investments have not directly related to its business strategy. Rather the aim has been to automate and to improve the efficiency of operations. In fact, not all of the users are computer literate. However the maturity of IS/ICT management is higher than that of the users. The organizational issues have been considered and the focus is on information rather than data. Furthermore the matured governance includes defined, documented and trained procedures. The studied business unit is a part of a larger international group, but this capability maturity analysis concerns only the local site. In this case the IS organization is formalized but flat and the manager reports for the steering committee of company A.

Company B is a project-oriented company specialized in industrial assembly operations (turnover about 7M€ and number of personnel approximately 110). The projects are done mainly on the customers' sites. The company also has prefabrication. In order to run the daily business, company B uses operational IS applications for transactions. The IT organization is not explicitly defined and thus the

relationship with business is unclear. The IS investments are driven by other aspects than business strategy. The user profile is very narrow, and besides, as the company is extremely small, the data management is centralized and personalized. The IS management is focused on maintaining the current financial system and its data. The ICT organization is actually one technology-oriented person who has qualified for the current system by actively participating in its engineering process. The business is run mainly out of the ERP system. The current software is more or less an instrument to find out the financial result of a company. The system is not used in project management or financial control during the projects. It is still used for actual cost calculation after the project. This company is also a part of a larger enterprise. This business unit is still run as a separate firm.

Company C is a business unit in a group of total four business units (turnover about 24M€ and number of personnel approximately 250). These businesses are different, varying from contract manufacturing to selling the knowledge and work of design engineers. The different needs of various business units create clear challenges for the ERP project. This particular business unit, company C, mainly earns its revenues by doing projects in planning and installing equipment in its customers' production facilities. IS applications are used for managing off-site assembly projects and for producing information on operations for the group. The relationship between business and IT organization is constructive and organizations have agreed how to manage IT operations. The group has formal ICT strategy and it is known also in company C. The users are competitive and also help the IT organization in specifying the requirements for IS systems. ICT management is actually common to all the business units and well coordinated and integrated. The processes of company C are continuously measured, and improvements are designed and implemented where needed. The ICT organization of the group is the highest level of maturity, but the ICT organization of this business unit lacks specialists, mainly due to a separate ICT department that is common to the group.

In every factor company C has a higher level than companies A and B. The strategy alignment factor especially is more mature than in the other companies. Company B is at the first stage of maturity in every factor and therefore may encounter fundamental difficulties in its ERP project.

IV. CASE STUDY RESULTS

The three case companies represented seem to be rather typical fairly small companies that are planning on making an ERP investment in the near future. The case companies have rather limited resources to put into this project and do not have opportunities and understanding to research all ERP projects' essential issues themselves. External experts are needed in order to support the company capabilities to become more professional system buyers. Still, it must be understood that this kind of firms, too, have individual characteristics that affect the choice of system. Some companies are really technically oriented and have skilled personnel, but others may be like "man-and-a-machine" without any former competence in IT buying, to better specify requirements, engineering, selection and system implementation.

Information technology is one key area when companies are developing their business and search for ways for more efficient operations. ERP solutions often seem to promise a full scale service to answer all possible information needs of a company. The range of systems and their differences are hard to understand even in larger companies, which do have significant amount of knowledge and resources to develop and analyze the information needs and different solutions for them. The case in low IS/ICT management capability maturity level companies, is rather different. They do not usually have large IT departments and many skilled personnel available for the ERP project. Pressure for the information systems may also rise externally from customers or partners rather than internally from the passion to make things work better.

In two case companies a large number of different information systems is a clear challenge. Today one system is used for wages, one for maintenance, one for bookkeeping etc. This system as a whole is complex and there are multiple links between different systems. Data is not easily available and automatically generated from this jungle of systems. In case of system updates or changes it requires a lot of manual work and testing. Links have to be tested to ensure that they work correctly.

Our risk assessment results are presented in the appendix. In fact, this document presents only the top six risks assessed in all three companies. These risks are analyzed in this section. The risks are presented in the same categorization as they were assessed; selection phase, implementation phase and use & maintenance phase.

In the *selection phase* there are many more generic and overall type of risks involved. Companies are concerned if they are able to choose a proper system, a good supplier and a project manager who is capable of this critical job. They were assessed as high risks in all three companies. Firms A and B were also rather worried about their

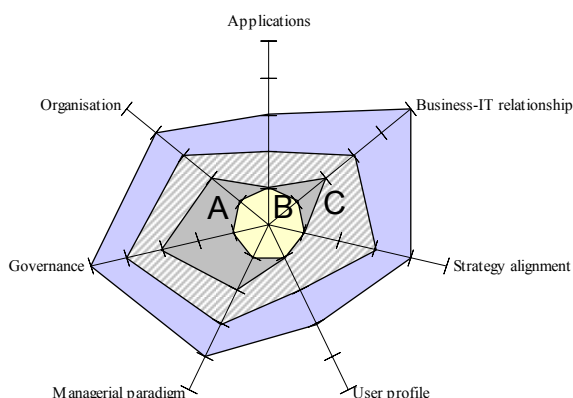


FIGURE 1.

AN IS/ICT CAPABILITY MATURITY RADAR CHART WITH FOOTPRINTS OF COMPANIES A, B AND C. THE SOLID BACKGROUND FOOTPRINT DESCRIBES THE MAXIMUM LEVEL OF EACH FACTOR.

competence in making a contract with the supplier. All these mentioned risks are more or less common to all ERP projects and should be tackled. In every company we can still see some risks in the top six lists that are company specific risks.

In company A the product and production system is rather complex and this has caused some special concerns. There was a lot of discussion about how the system could work in this kind of business and at what possible places standard ERP requires modifications. Company A was also in a situation where some significant changes were anticipated in the near future. The coming system should be able to adapt to an increasing number of customers, differing end products and changing raw material supplies.

For companies B and C the characteristics of the business constituted a special risk. Both companies do projects, with workers in different industrial sites. The projects may be rather short or very long. The system should fit into the project type of business and it should be easy to use from different geographical locations. In the case of company C one other special risk was mentioned. This company has different divisions and business units and many of these have rather different businesses. Some are more work intensive, some more capital intensive etc. The company also had a headquarters with certain requirements of the system. The new system should meet the needs of all the different organization units. Some want a really customized system and the business is clearly run with the help of a system. Some units want to keep the system as light as possible. It was seen as a great risk that the system becomes a poor compromise to all parties.

In the implementation phase the greatest concern was the motivation, commitment and education of the personnel. Companies A and B especially were worried about these issues as well as a lack of change management skills. These two companies had a history of not using IT extensively in their business. Similar concerns were mentioned in one unit of company C, but the overall risk estimations of this company were not as high as in other companies. The general risk of going over the budget was recognized by all companies and they were actually fairly realistic about this issue. Project manager choice in this phase was also worrying every firm but surprisingly in only company C was the lack of top management support in the top six list. The list of company C is slightly different from that of other firms. This company is also aware and concerned that the ERP project will disrupt normal business to some extent. Company C also has a problem of multiple systems, which will partly also remain in the future. These systems have to be linked and this may be challenging in the implementation phase. Companies A and B were worried about the ERP project because they do not have much competence and experiences of similar projects. This can be seen in the implementation risk assessment. Company C has had so many projects that there the problem is to convince people that this project has to be taken seriously. Some people were slightly bored with constantly starting IT projects which seem to make no difference.

In the phase of use and maintenance the disciplined use

of the system was a key risk. In these lists the main concern was if the desired benefits are received in the use phase. Are people forced / motivated to use the system, is only parts of the system used etc. All the companies wanted the system to be flexible to business changes. Here a large number of the risks were more or less general risks. Still, the list includes a few company specific issues; like in company C the concern about getting business relying too heavily on ERP, and this has a negative effect on key persons' motivation. To put this more precisely, in this company project managers had a lot of freedom to deal with their projects. This freedom and the project managers' motivation went hand in hand, and cannot be risked.

As a result of the risk assessment we can also made some quantitative findings from our three cases. Table 4 presents the averages and standard deviations in all three cases and in different phases. The overall results show that the greatest averages are assessed in the implementation phase. In all companies the assessments were similar. The smallest averages were seen in the selection phase. This seems to be understandable, because the case companies were currently in the selection phase and the issues in it were seriously under consideration. Standard deviations were similar in different phases in all cases A and C. In case B the selection and implementation phases' standard deviation was slightly smaller than in the use & maintenance phase and also differed slightly compared to cases A and C.

TABLE 4
AVERAGES AND STANDARD DEVIATIONS IN CASE COMPANIES

	Company A		Company B		Company C		Total	
	A	STD	A	STD	A	STD	A	STD
Selection	9,3	4,6	8,7	3,8	8,5	4,4	8,8	4,2
Implement- ation	11,3	4,6	10,3	3,8	10	4,4	10,7	4,3
Use & maintenance	10,4	4,4	10	5,1	9,9	4,4	10,1	4,5
Total	10,6	4,5	9,8	4,1	9,7	4,4	10,0	4,4

Figure 2 sheds some light on how many serious risks were assessed in the case companies. The total numbers of assessed risks were in three phases in different cases (A,B,C) as follows. In the selection phase (17,17,21), in the implementation phase (33,34,34) and in the use & maintenance phase (15,13,14). As we can see in the statistics below, roughly half of the risks were assessed to be significant, i.e. risk product ≥ 12 , in every phase.

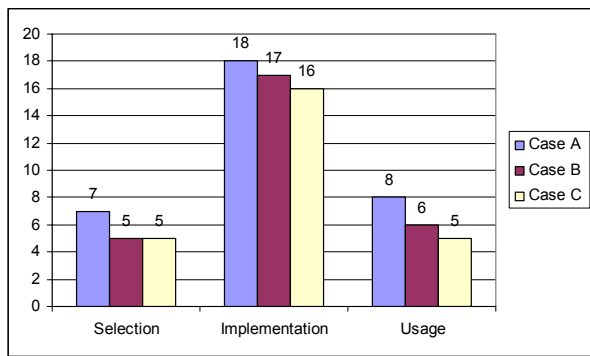


FIGURE 2.

THE NUMBER OF IDENTIFIED SIGNIFICANT RISKS (RISK PRODUCT ≥ 12) IN EACH CASE A, B AND C.

Finally in each case the companies received table of risks that were categorized according to implementation phases. Inside each phase the risks were ranked according the risk product, i.e. value of probability multiplied by value of effect. The purpose for this table was that companies could easily scan through the risks in every ERP project meeting, and address appropriate actions. The relevant actions could be decided based on risk analysis document. The document specifies reason, occurrence and possible preventive or corrective actions for each risk.

V. DISCUSSION

In this section we compare the company specific ERP risks found in the case studies to earlier research of common ERP risks by Sumner [6] and discuss the effects of IS/ICT capability maturity. In a qualitative comparison of case risk lists (risk product ≥ 12) and Sumner's summary of the risk factors we found 8 common risks:

- Failure to redesign business processes
- Failure to follow an enterprise-wide design which supports data integration
- Lack of senior management support
- Lack of proper management control structure
- Lack of integration
- Insufficient training of end-users
- Lack of full-time commitment of customers to project management and project activities
- Attempting to build bridges to legacy applications

The number of common risks in each case was 9/33 in A, only 4/28 in B and 9/26 in C. The share slightly increases as the maturity grows. Sumner's list origin from cases where companies implementing ERP systems are large and the IS management most certainly established. The companies of our case study had fairly low stages of IS management capability maturity indicators. The amount of company-specific risks, which risk production was even or above 12, but not listed in the Sumner's common ERP project risks, was big compared to how thorough the common ERP project risks have been studied in previous related research.

VI. CONCLUSION

It is evident that today smaller companies are also interested in ERP solutions. The sourcing of these is still a rather complex issue and involves a multitude of potential problems. One of the key challenges in the ERP-project is the need to critically assess the whole company's operations. The ERP project is a large-scale change in many business processes and affects almost every employee. The company's context sets some crucial limitations and obvious potential problems, which have to be taken into account in the project.

Our suggestion is that the risks should be evaluated right at the beginning throughout the whole ERP project. Identifying and assessing implementation and usage phase risks are essential when considering system choice. The most important issue in a successful ERP project is an understanding of the company's business and context requirements. General risk list may be really useful tool to find out the greatest risks involved in the ERP project. However, these lists *per se* have a risk of omitting some crucial risks in the assessment. It is a generally known fact that a project's success is often decided in the early phases i.e. in goal description and planning. This is also the case in ERP projects. It is crucially important in this phase to seriously consider why the system is needed and what its effects on the organization will be. Our analysis, which starts from the company context and business needs, is one possible way to support project success. We can state that in the selection phase our analysis identified some significant risks that may have been neglected using a general risk list. In implementation and use & maintenance phases the risk lists were more similar. Our analysis presents the risks in a form and language that is understandable for risk assessment group as in the risk identification phase the risks are found in the company context. This is essentially important in low IT/ICT maturity companies, which may have problems of understanding the issues in a general ERP risk lists. As negative aspect of our risk assessment method is that it requires a significant amount of work and perhaps also help from external experts.

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APPENDIX. RISK ASSESSMENT RESULTS IN CASE COMPANIES (TOP SIX RISKS IN THREE PROJECT PHASES),

Assessed risks in the selection phase (top six list of risks)

COMPANY A (17 risks) AVER: 9,29 STDEV: 4,61	COMPANY B (17 risks) AVER: 8,65 STDEV: 3,84	COMPANY C (21 risks) AVER: 8,50 STDEV: 4,41
Choosing wrong ERP system (16)	Terms of contract not agreed considering the changes in a system (16)	Misunderstandings between buyer and supplier (16)
Choosing poor project manager or project group (16)	Special needs of a company not defined (12)	Concern level goals and business unit goals are not coherent (16)
Inadequate competence in making a contract (16)	System does not adapt to future business needs (12)	System is a poor compromise to all parties (16)
Choosing wrong ERP supplier (12)	Inadequate competence in making a contract (12)	Poor choice of project manager or project group (15)
System not flexible enough under processes' exceptional circumstances (12)	Choosing wrong ERP supplier (12)	System does not support project type of business (12)
System does not adapt to future business needs (12)	Efficient use of the system is not possible from working sites (9)	Efficient use of the system is not possible from working sites (10)

Assessed risks in the implementation phase (top six list of risks)

COMPANY A (33 risks) AVER: 11,33 STDEV: 4,60	COMPANY B (34 risks) AVER: 10,30 STDEV: 3,84	COMPANY C (34 risks) AVER: 10,00 STDEV: 4,39
Personnel don't have commitment to new way of working (20)	Personnel don't have commitment to new way of working (20)	ERP project disturbs 'normal business' (20)
There is not enough change management skills and managership (20)	People don't see the benefits of the system in their everyday work (20)	Lack of time to attend to education in implementation (16)
Costs rise compared to initial estimations (16)	Costs rise compared to initial estimations (16)	Company's project manager is not a full time PM (16)
Personnel is not enough supported in order to use new system properly (16)	Personnel is not enough supported in order to use new system properly (12)	Company is not successful in getting disciplined use of the system in the beginning (16)
Poor choices of project management and/or project team (16)	Supplier is not committed enough to system implementation (12)	Top management is not giving enough support / resources to project (16)
Disciplined use of the system (data entry) is not achieved (16)	ERP project disturbs 'normal business' (12)	Connecting system to other system creates problems (16)

Assessed risks in the use and maintenance phase (top six list of risks)

COMPANY A (15 risks) AVER: 10,40 STDEV: 4,39	COMPANY B (13 risks) AVER: 10,00 STDEV: 5,13	COMPANY C (14 risks) AVER: 9,90 STDEV: 4,40
System not used in a disciplined manner (16)	System not used in a disciplined manner (20)	System makes operations too stiff and this weakens key workers motivation (20)
System does not support the new ways of working and changes in business (16)	System is not felt as helping the business (16)	Company's operations become too dependent on the system (16)
All needed information is not entered into the system (16)	System creates data security risks (15)	System not used in a disciplined manner (12)
System not easily developed (12)	Company's operations become too dependent on system (12)	System not easily developed (12)
Broad use of the system on the worker level is not started in the beginning (12)	Only part of the system used and benefits not realized (12)	Broad use of the system on the worker level not started in the beginning (12)
Only part of the system used and benefits not realized (12)	System does not support new ways of working and changes in business (12)	System not felt as helping the business (9)

Software outsourcing partnership process – a life cycle?

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Abstract — Van de Ven and Poole contend that all the specific theories of organizational change and development used in management research come back to four basic theories: life cycle theory, evolution theory, dialectic theory, and teleology, and that most of the organizational theories are some kind of combination of these four. In outsourcing research most of the researchers implicitly assume that an outsourcing process follows the life cycle theory. In this study we analysed a software outsourcing partnership model and found out that the model indeed followed life cycle theory.

Keywords — software, outsourcing, partnership, life cycle.

I. INTRODUCTION

The focus of this research is on outsourcing partnerships – the process involved in the formation and management of a software research and development (R&D) outsourcing partnership. We are interested in it especially from the organizational change process point of view.

II. ORGANISATIONAL CHANGE PROCESSES

To understand and explain better the reasons and ways behind organizational change the management scholars have borrowed metaphors, concepts, and theories from many other disciplines. This has given many novel views into the processes of organizational change. A combination of theories often gives a more comprehensive understanding of a complex phenomenon [1]. Van de Ven and Poole [1] contend that all the specific theories of organizational change and development used in management research come back to four basic theories: life cycle theory, evolution theory, dialectic theory, and teleology, and that most of the organizational theories are some kind of combination of these four.

‘A life cycle’ is a metaphor often used by management scholars to explain organisational behaviour. The Oxford English Dictionary gives the following definition of a life cycle: “The course of human, cultural, etc., existence from birth or beginning through development and productivity to decay and death or ending.” In management research, next to teleology, it is probably the most often used explanation of the development of an organisational entity

(organisation, product, venture ...) from its birth to its termination [1]. In the **life cycle theory** (Fig. 1) the process of change in a *single entity* is depicted as going through different, necessary, stages. The mode of change during a life cycle is *prescribed*, meaning that the development of the entity is channelled in a predetermined direction where the events are stable and predictable and the changes happen over the long term and are small, thus reducing uncertainty in the process.

The **teleological theory** explains development as proceeding toward a goal, which guides the movement of an entity. The entity itself is purposeful and adaptive; it constructs an end state for itself, takes the actions needed to reach the end state, and monitors its progress. This can be seen as a repetitive process that restarts again and again, as, after reaching the original end state, the entity modifies the goals once again based on what it has learnt. The mode of change is *constructive*, meaning that there is no necessary sequence of events, as in the life cycle theory. However, development results from social construction among individuals within the *single entity* and it is always something that helps the entity in reaching the end state. (ibid.)

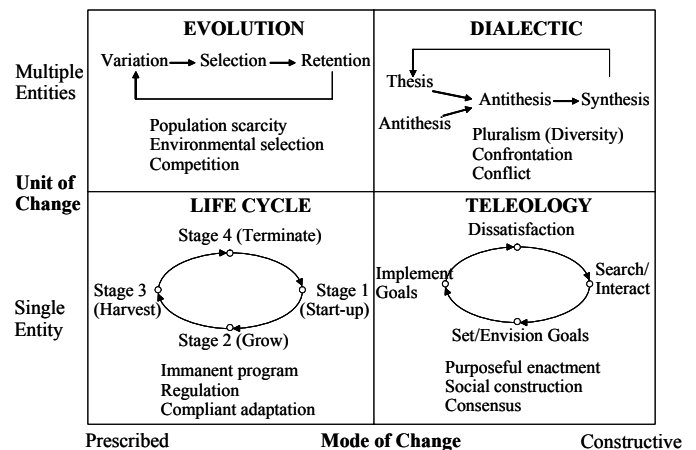


Fig. 1. Process theories of organisational development and change [3, p. 520]

In the **dialectic theory** the assumption is that an organisational entity exists in a world where there are

colliding forces and contradictory values that compete for control and domination. These oppositions may be either internal or external to the organisational entity, caused by conflicting goals inside the organisation or between itself and another organisation. In any case, there are two *or more entities* engaged. Changes in the organisation happen when the opposing forces gain enough power to confront each other. The opposing forces, each with its theses and antitheses, may come to some kind of a compromise, a synthesis. However, it is possible that a synthesis cannot be achieved, and that one or the other of the forces wins over. In any case, a status quo is achieved again and a new entity has been created. In time, the synthesis or an antithesis becomes the thesis for the next cycle of change. The mode of change is *constructive*; the sequence by which the thesis and the antithesis confront each other cannot be predicted.

In the *evolutionary theory* change takes place through competition, caused by scarcity of resources, between *multiple entities*. The entities transmute by creating novel forms of organisations – usually these variations seem simply to happen, randomly or blindly. Competition for scarce resources forces selection between these organisations. Retention is needed for maintaining the previous forms and practices when the evolutionary loop starts again. The mode of change is *prescribed*; even though the mutations seem to be sudden and dramatic, the process has prescribed rules according to which the change either occurs or does not.

III. RESEARCH PROPOSITIONS AND RESEARCH METHODS

In outsourcing research most of the researchers implicitly assume that an outsourcing process follows the life cycle theory. We wanted to find out if this is really the case and thus set two propositions:

P1. The life cycle theory can be found behind the software research and development outsourcing partnership process

The second proposition is to find out if the different phases of the assumed life cycle process also follow the life cycle theory:

P2. All the phases of the software research and development outsourcing partnership process follow the life cycle theory independently of the process as a whole.

To evaluate the propositions we use the software outsourcing partnership model presented by Kinnula [2]. Kinnula's model is based on literature and complemented with empirical data collected from a software outsourcing partnership case.

Kinnula's model (Fig. 2) considers the outsourcing partnership process to consist of four phases: *Planning*, *Developing*, *Implementing*, and *Managing the relationship*.

In the Planning phase outsourcing team members are selected, supportive role of company top management is discussed and business plan for the outsourcing is created. Selection of the most beneficial relationship type needs to

be done when creating the business plan and based on that a definition of the partner selection criteria. [2]

In the *Developing* phase the most important decision of the whole outsourcing process is faced: whether to continue with the outsourcing partnership process or to terminate it. Discontinuing the process would mean either that the customer company needs to be able to take care of the planned-to-be-outsourced work, or that it is necessary to go back and start the whole outsourcing partnership process again with revised objectives based on the new understanding of the issue. If the process is continued the most important result of this phase is an outsourcing partnership agreement. [2]

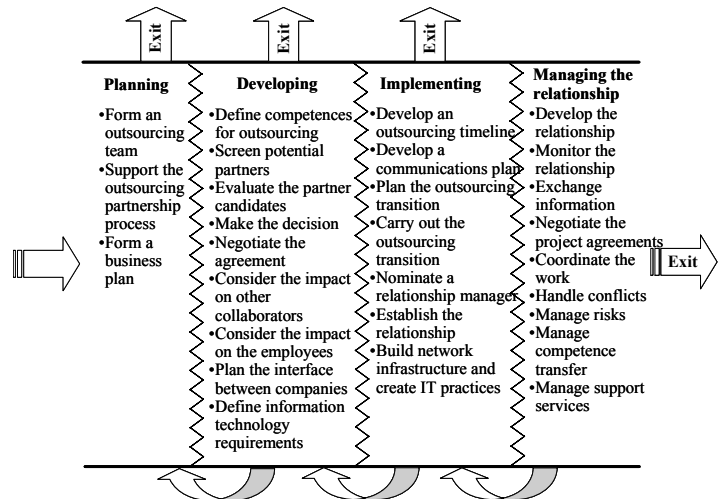


Fig. 2. The outsourcing partnership model [4, p.159]

Before making the decision, however, the potential partners need to be screened, that is, identified and evaluated. If the decision is to continue the outsourcing partnership process, agreement negotiations are started with the selected partner candidate(s). Consideration of how the employees will be affected by the decision is needed as well as the creation of a concrete timetable and communications plan for outsourcing. [2]

The main goal of the *Implementing* phase is to make the relationship work, firstly by getting the transition done (planning it and carrying it out) and secondly by establishing the relationship by creating management processes and setting up the relationship management organization. During the transition, once again, clear support from the top management of both companies is needed, e.g. in the form of briefings for the employees. High level of attention and prompt feedback are also important. This phase is for making the intentions and plans a reality. [2]

In the last phase of the model – *Managing the relationship* – the relationship is up and running and needs continuous maintenance and development. New project agreements need to be negotiated and problems in the current projects handled. [2]

IV. ANALYSIS

Based on the model and case material presented in [2] we sought to investigate the following:

Proposition 1: The life cycle theory can be found behind the outsourcing partnership process

The *teleological theory* is categorised by an entity proceeding towards a goal monitoring its progress and learning from the process itself [1]. There is no necessary sequence of events. The last characteristic in particular makes it clear that the outsourcing partnership process does not follow the teleological theory. While the process does have goals, the main process phases follow each other in a distinct and necessary order. Also the process as a whole does not repeat itself, but instead runs only once and the learning of the process is mainly used afterwards, in building a possible new outsourcing partnership, rather than to guide the process execution while it is running.

In the *dialectic theory*, colliding forces and contradictory values compete to gain control and domination. This is caused by conflicting goals either inside the organisation or between itself and another organisation. [1]

Although it is true that there are usually colliding forces within a company, and also in an outsourcing partnership process (e.g. in choosing the relationship type), it would be an exaggeration to claim that such conflicts are the fundamental nature of this process. It is more likely that the dialectic theory has stronger role before the actual outsourcing partnership process begins, i.e. when making the strategic decision of whether to outsource or not.

The *evolutionary theory* is based on competition caused by scarcity of resources. New forms of organisations are created, usually randomly or blindly. The mode of change is prescribed. Competition for scarce resources forces the selection between the new forms of organisations. [1] This type of competition was not observed in the outsourcing partnership process. Again, similar kinds of situations may exist during that process but they are not in any way in a dominant role.

In the *life cycle theory* an entity goes through different, necessary, stages. The mode of change during a life cycle is prescribed. The events are stable and predictable and the changes are small and take place over a long time period. [1]

In the case of the outsourcing partnership process the stages (called phases in [2]) follow each other in a prescribed order, although on detailed level the line between different phases may be hazy and the phases can occasionally be running concurrently, e.g. if a certain activity from an earlier phase needs to be re-done during a later phase. However, when viewed as a whole, the phases follow each other in a necessary sequence producing input for the next stage and (in case of *Developing* and *Implementing* phases) depending on the input from the previous stage. The events (activities and tasks) during the outsourcing partnership process are predictable, even though they do not always happen sequentially. They are however usually dependent on each other in some way. The

process has a beginning (the strategic need for the relationship) and an end (the outsourcing partnership ends for some reason). The organisational changes, when needed, are actually not small and they happen over a short time period, but still, the main process of the outsourcing partnership in the customer company clearly follows the life cycle theory.

However, things are not as simple as that when a larger scheme is considered. If we take a step *further away* we can see that the relationship is a system of two entities – the customer and the partner company. Hence both forming and managing the relationship involve two entities communicating and affecting the life-cycle process, both with their own goals that are often somewhat contradictory. This set-up is by nature dialectic. For the well-being of a partnering relationship it is important that both companies win in some way, and hence the result is more often a constructive synthesis, rather than the victory of thesis or antithesis (i.e. one entity's goals overrunning the other's).

Based on the analysis above it can be said that indeed, the life cycle theory can be found behind the outsourcing partnership process, and thus the first proposition has been proved true – within the scope set for this study (i.e. the outsourcing partnership process in itself). However, in a larger scope the interplay between the companies (and their respective processes) is more dialectic in nature.

The second proposition for this study was set as follows:

Proposition 2: All the phases of the outsourcing partnership process follow the life cycle theory independently of the whole process.

The outsourcing process can be divided very easily into four phases. The first three phases (*Planning*, *Developing*, and *Implementing*) form a natural continuum, where they follow each other and all of them together form the life cycle of *creating an outsourcing partnership*: it has a beginning (the strategic need for the relationship) and an end (a working relationship exists). The phases clearly follow each other in a tight sequence and the only reason for the existence of each phase is to produce input for the following phase.

Individually, however, these phases do not clearly follow any particular theory. Comparing the activities of the *Planning* phase against the theories of organizational change does not yield a clear match. The phase is not self-steering (the teleological theory), and it is not characterized by conflict (as the dialectic theory), nor about competing activities (the evolutionary theory). The closest it comes to is the life cycle theory as the events during the phase are predictable and to some extent depend on each other. However, a life cycle needs to have a clear end, which is not the case in the *Planning* phase. Against this evidence it is clear that the second proposition is not valid for this phase.

The characteristics of the *Developing* phase do not match any of the theories of organizational change either. The activities are not sequential enough to form a life cycle (the life cycle theory), the phase is not self-monitoring and self-

steering (the teleological theory), it is not driven by conflict and collision (the dialectic theory), nor characterized by parallel, competing activities (the evolutionary theory). As such, the second proposition is not in accordance with the characteristics of this phase.

When analyzing the activities of the *Implementing* phase against the theories of organizational change and against the second proposition, the result is the same as with the previous phases. First, there is no correspondence to any of the theories: the activities do not form a life cycle (the life cycle theory), the phase is not self-steering (the teleological theory), it is not characterized by conflict (the dialectic theory), nor by competing activities (the evolutionary theory). Second – as the phase does not follow a life cycle theory, the second proposition is not valid for this phase.

Characteristics of the dialectic theory and evolutionary theory can be found in the phases, e.g. conflicts at culmination points where big decisions have to be made, but it cannot be said that such characteristics would dominate the phases.

The last phase – *Managing the relationship* – is, however, different. When the whole outsourcing partnership process is contemplated, this phase is clearly the last phase of the life cycle, and continues naturally from the completion of the first three phases. But when the phases are viewed individually this phase is seen to be dissimilar to the first three: it takes a long time (possibly over ten years) and it is also non-deterministic, as the duration of the phase is indefinite and is influenced by the changes the future has in store for the companies engaged in the relationship. Hence, when the relationship begins it is not usually necessary to set an end-date for it. The sequence of events included in the phase is not determined. Thus, the life cycle theory is clearly not suitable for this phase. Due to lack of data from the case it is not possible to state with confidence what the role of dialectic and evolutionary theories in managing the relationship is. However, they tend to be by nature rather disruptive whereas relationship management is more about seeking harmony and balance. Hence it is unlikely that they would dominate this phase either. On the contrary, the phase does seem to have qualities that liken it to the teleological theory: an ongoing outsourcing partnership always has defined goals that guide the relationship and the actions taken. The relationship is also constantly monitored. Yearly strategic plans for the company together with a vision for the relationship and the monitoring of results all mean that it is necessary to define the goals again. Hence new actions need to be taken to reach these revised goals. When the process is seen from within the customer company there is just one entity – the customer company itself – acting in its own best interests. All these facts point to the teleological theory.

Yet things are not as simple as that if we take a step deeper into the management of the relationship – at least into a software R&D relationship. Here, again, a life cycle can indeed be found: the business cases (projects) during the relationship take the form of a life cycle. The need for a

new collaboration project triggers the process, negotiations between companies start, the collaboration project gets underway, and finally, the conclusion of the project also ends this life cycle. However, it is noteworthy to repeat that while this applies to software R&D relationship, it may or may not be true to other business areas, e.g. service outsourcing.

Summarizing the discussion above, based on the analysis of the empirical material and keeping within the scope of this study (i.e. the outsourcing partnership process in itself) the second proposition has been proved wrong. None of the phases individually follow the life cycle theory. Instead, the first three phases do not seem to follow any particular theory and in fact can exist only in the context of creating an outsourcing partnership. The last phase follows mainly the teleological theory. However, if the scope is extended to cover the interplay between the companies, characteristics of the dialectic theory can also be found, at least in software R&D relationships.

V. CONCLUSIONS

The results of this study are based on one model of software outsourcing partnership and thus cannot very easily be generalised. Also, as some of the models underlying Kinnula's model [2] are supposed to be life cycle models the results of this study are not very surprising. However, it would still be interesting to test the same theory in other similar type of models and cases.

To conclude the findings of this study, in the following figure (Fig. 3) the main theories found behind an outsourcing partnership process are presented. Even though in Kinnula's study there is not as much material available about the case study's partner company as there is concerning the customer company, the material strongly suggests that the partner company follows a similar type of life cycle, as well as following the teleological theory during the relationship management phase. To acknowledge the lack of material, however, we have drawn the partner company process phases with dashed lines.

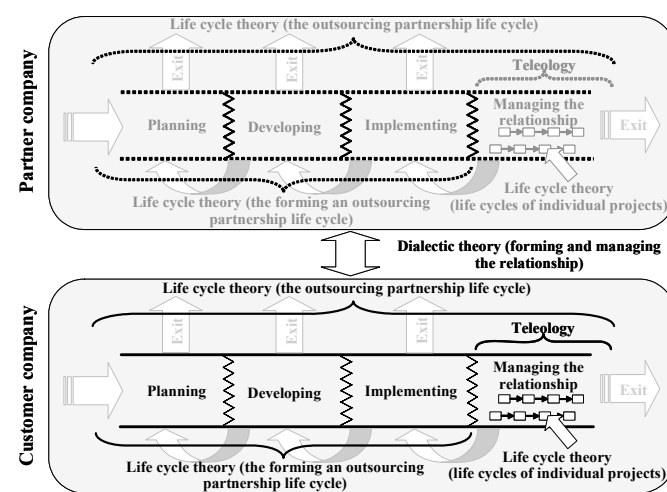


Fig. 3. Theories behind outsourcing partnership process

The outsourcing partnership process is a life-cycle process, of four phases. When limiting the viewpoint to one company only, the first three phases form a sub-process of *forming an outsourcing partnership*, and the last phase is about managing the said relationship. The entire process, as well as the sub-process, follows the life cycle theory, but the last phase is an indefinitely running, self-guided process that follows the teleological theory. Inside the Managing the relationship phase life cycles of projects can be found. When the partnership is seen as a system of two entities, however, the interplay is characterized by conflicting interests as per dialectic theory. In a healthy situation the progress through the processes is driven by constructive synthesis that creates a win-win situation between the companies. As Van de Ven and Poole [1] contend different viewpoint gives us different results and a different understanding of the phenomenon of outsourcing partnership. One theory is not enough to give answers to all the questions and by changing the viewpoint and combining different viewpoints and theories, a more comprehensive understanding of the phenomenon can be reached.

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Subcontracting Product Development – Creating Competitiveness through Networking

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Abstract — Product development has become increasingly complex and resource-consuming. Consequently, internal development capabilities can prove insufficient for maintaining a firm's competitive position. External cooperation and networking have been suggested as means for accessing necessary complementary knowledge or resources. In this paper, cooperation is studied as the key to improving competitiveness, especially in case of small firms. Product development distributed across organisational boundaries can also help companies mitigate the effect of uncertainty and turbulence. The empirical part of the study describes supplier cooperation in four case companies. The focus is on software product development cooperation with foreign suppliers. The paper contributes to better understanding of organising product development across a network of suppliers.

Keywords — software development, network, supplier cooperation

I. INTRODUCTION

The demand on innovation is becoming more and more intricate and resource-consuming in almost all industries, leading to increased importance of external organisations in firms' survival [1]. Product development activities are highly complex and characterised by high amount of uncertainties [2]. Resources and skills should be acquired in a significantly shorter time than earlier in order to outdo shortening product life cycles and technological convergence [3]. As a consequence, there is a growing need for flexibility and interorganisational cooperation even within core functions of a firm, such as product development. In addition, it has been proposed that inter-firm cooperation can successfully solve some problems related to international competitiveness [4], a topical issue pondered by many firms. Increasing number of cooperational agreements implies that the attention of the managers has shifted from internal resources to the capabilities of external factor exploitation [5].

Software development is highly dynamic by nature. Thus, companies need to create both formal partnerships and informal collaborative networks to sustain growth, create market penetration, accelerate the time to market, and control constantly growing research and development (R&D) costs [6]–[8]. Software companies are often small and face the problem of limited internal resources. Nevertheless, small firms are known for their resourcefulness and networking capabilities [9]. The prospects of small companies for cooperation of high

organisational complexity, such as alliances [10] and joint ventures [11], are lesser than those of multinational enterprises as these arrangements suppose that the firm is in a position to turn toward partners whose skills are much more advanced and who can readily be mobilised [12], [13]. Such limitation does not denote lower need for flexibility. In fact, flexibility seems to be an important competitive advantage for the SME networks [14].

In information and communication technology (ICT) industry, the knowledge and intellectual capital actually form the main factor of production [15]. The critical resource of software development is skilled personnel and the work is knowledge intensive. The characteristics of the industry and task in question pose different challenges to supplier cooperation as compared to traditional manufacturing. Besides, the literature regarding strategic management or new product development management is mostly founded upon a large company context and cannot be applied directly in smaller companies [16].

The purpose of this paper is to study the use of supplier networks to complement internal product development in ICT industry, with particular focus on software development. The research is descriptive in nature. Its aim is to understand the principal reasons which have led to supplier cooperation in case companies and describe models of such arrangements. The empirical part consists of a case study of four Finnish firms, which provide their customers software products and related services. Each company has been engaged in software development subcontracting from several countries. They represent different branches of the industry with three of the companies being small- and medium sized enterprises (SMEs). The study describes different motivation for engaging in networking and how cooperation has affected the internal processes and operational models of the firms. Despite the general assumption of cost minimisation as the main incentive for international subcontracting, the case study brings forward several other incentives such as access to complementary resources, increased flexibility and dealing with the industry's turbulence. Networking capability can in itself become a valuable asset for the company and improve its competitiveness.

The study aims at clarifying the rationale behind international networking in software product development. The relationship between a firm's competencies and networking strategy is described along with examples of complementarity of different type of supplier networks to a firm's activities. The focus is on understanding motivation

for cooperative efforts between firms producing digital products or services as opposed to manufacturing firms and traditional view of flow of material from supplier to manufacturer.

II. SUBCONTRACTING PRODUCT DEVELOPMENT

A. Network approach to supplier cooperation

A network perspective focuses on the net of relations between a focal firm and the outside world. Business networks can be described as complex arrays of relationships between a firm and different actors, such as customers, distributors, suppliers, competitors, and government [17]. The traditional microeconomics-based models assume firms to be free and independent units in a market that has atomistic structure and clear boundaries. The network approach challenges this statement by proposing that a company is an integrated part of a network with arbitrary boundaries and each actor is dependent on other actors in the network [18].

The basic elements of the industrial network model are actors, activities and resources [19], [18]. Actors can refer to individuals, parts of firms, firms, and groups of firms. Actors control activities and/or resources. Resources are controlled by a company either directly (ownership of the resource) or indirectly (close relationships with actors possessing the formal control). Different types of resources of an individual firm include input goods, financial capital, technology, personnel, and marketing channels. Activities are carried out within and between individual actors. Resources are tied to each other by activities. The internal characteristics of an actor can be distinguished into possessed resources, performed activities, organisational structure, and objectives and strategies [18]. These attributes affect exchange between different actors as they transfer resources or perform some activity together.

Networks provide access to the resources needed to build up and exploit firms' competitive advantage [17]. An individual firm is dependent on resources controlled by other firms. Internalising all necessary resources would lead to impossible growth situation in a firm [20]. Network arrangement allows a firm to specialise in activities most relevant to its competitive advantage [21]. Utilising external transactions instead of internalising, results in flexibility and focus. They can be powerful competitive weapons, especially in environment that experiences rapid change [22]. A firm's capabilities and competitive forces can be seen as the main reason for inter-firm cooperation [23]. On the other hand, cooperation can create problems due to increased complexity of handling the process with several actors involved [24].

Strategic network as proposed by Jarillo, imply especial relationships between a hub firm and the other members of the network, where contracting parties remain independent organisations despite asset specificity related to the know-how [21]. The resources possessed by different firms are seen as heterogeneous and interdependent, leading firms to devote resources to investments in relationships [17], [20].

Business relationships between firms are affected by resource scarcity and resource development [25]. The purpose of the firms is to mobilise and deploy both internal and external resources available to them [26]. The external resources can be acquired either through co-operation partners with whom a firm has shared objectives or through other partners or sources, in which case the partners need not to have a mutually shared goal [27]. Instead of focusing on limitations of internal capabilities, managers should realise that their capabilities could be complemented through cooperation with other firms [23]. Lorenzoni sees building a network as an entrepreneur's determined way to obtain the most efficient organisational arrangement to compete on the chosen market [21]. Especially small companies with the high level of complementary capabilities co-operate more intensively with their suppliers in order to develop competitive advantages [28]. In industrial market, buyer and sellers often build long-term relationships instead of arm's length transactions, because the body of potential suppliers is limited [29].

When viewing product development as disciplined problem solving, supplier involvement has been seen as one of the factors leading to better process performance in terms of speed and productivity [30]. Partnering with suppliers can also contribute to innovative performance of a firm through reduction of development cost and time, improved quality and value [31]. To be able to use the opportunities that exist in supplier cooperation, a firm needs conscious understanding, strategic awareness, and realising both opportunities and limitations of such cooperation [32]. Strategic awareness should be reflected in how a firm weights internal versus external development and chooses individual suppliers [32].

Researchers have largely addressed internal and external actors involved in product development, with particular interest paid to the interface between R&D and marketing and customers [33]. Nevertheless, the contribution of suppliers to product development and success of a company, has received only limited attention until recently [33]. The review of international networks of a firm, on the other hand, has often been restricted to sales activities. At the same time, possible input of foreign actors into a firm's internal processes, such as product development, is scarcely documented. The motivation of firms to engage in networking in product development activities and effect of such cooperation on a firm's competitiveness deserves more attention. Taking into account a situational point of view as suggested by contingency theory, further contributes to discussion on organising for success [33]. Different operational environments, organisational characteristics and unique histories of firms require differentiated management approaches and organisational structures. Thus, no universally applicable organisation or management approach to guarantee success exists [33]. This notion also applies to supplier cooperation and their involvement in product development.

B. Supplier cooperation in ICT industry

It is not unexpected that interfirm cooperation seems to

increase in high-cost, high-tech market [8]. The number of alliances in ICT industry is growing. The reason for this trend include the need to gain access to new technologies, the need to share risks and costs associated with the development of new products, and the shortening of market opportunity windows [34]. However, also project-based contractual networks can contribute to these issues as illustrated in the empirical part of this paper. Contractual agreements are often referred as tactical; whereas strategic alliances, formal joint ventures and innovation networks are strategic arrangements [35]. In general, the lower the equity involvement, the more limited the alliance control, but the greater the organisational flexibility [36]. High-tech industries are characterised by rapid environmental and technological change, thus there is need for flexibility and lower organisational complexity than these formal forms of cooperation can provide. Consequently, there is need for strategic consciousness of importance of external resources [32].

To preserve its competitive abilities, a firm needs to maintain various types of technological expertise. However, doing everything internally is no longer a feasible solution as rapid technological advances occur on many fronts simultaneously [37]. The natural consequence of such tendency is for a firm to specialise in certain limited areas of development. In addition, it means establishing relationships with other actors, as specialisation does not remove the need for broad knowledge base [24]. The resources of small ICT firms are inevitably limited when compared to larger companies. They are short on the management staff, restricted in terms of available recruitment incentives, and cannot afford to maintain technical specialists in house in narrow areas or ramp up for one-time large projects [38]. These circumstances have provoked significant growth in the use of outside suppliers, with the spectrum of products ranging from routine commodities to specialised development projects, and possible nature of relationships ranging from purely transactional, price-based interactions to highly interdependent partnerships [37].

For ICT industry, the major risks of product development cooperation are leakage of information, loss of control over the process and fear of dependency on a partner [39]. The factors most contributing to success are 1) clear ground rules, 2) personal commitment at all levels, 3) process related factors, especially communication and trust, 4) ensuring mutual benefit, and 5) compatibility of the chosen partner [39].

The tendency to specialise applies to potential supplier firms as well meaning that a certain supplier is compatible with fewer users within a limited geographical area [32]. Therefore, specialisation and scarcity of domestic resources can be seen as natural stimuli for international cooperation and use of foreign suppliers in software development. This trend emphasises the importance of being capable to conduct developmental cooperation in an international environment [32]. The reported reasons for cooperation with foreign actors, in particular, often include seeking for

expertise or lower level of costs. Software development processes are increasingly distributed worldwide and becoming both multi-site and multicultural in search for lower costs and skilled resources [40]. For small or even medium-sized enterprises, global distribution of operations is often possible only in concert with crossing the company's boundaries. Thus, geographically distributed, inter-organisational product development projects are becoming more and more common [41]. Building a competitive advantage requires a firm to be able to replenish its internal resources with the external ones, by engaging in relationships with various domestic and foreign actors. Ability to coordinate and manage this kind of network can in itself become a firm's core competence.

III. CASE STUDY DESCRIPTION

A. Research design

A qualitative approach was chosen because of the scarce amount of information on the subject and its complexity with several theoretical disciplines involved [42]. The survey method was discarded because of the aim of the research, which is to provide insight on the studied subject. In addition, there is reluctance among companies to openly bring forth their experiences in offshore (i.e. foreign) subcontracting, which was noticed when case companies were sought for this study. Selection of the companies for the case study was based on purposeful sampling [43]. The criteria were having software product development activities and experience of cooperation with Russian companies as this was the focus of the initial study. Chosen companies were known to have been utilising Russian subcontractors in their software development activities.

The interviews with the representatives of the Finnish case companies were carried out in 2003. The case companies represent different branches of ICT industry. Company Alpha is a communications operator. Company Beta develops Internet based and mobile applications along with location based mobile information management services. Company Gamma is a project organisation, which at that time had a unit specialised in software development services. Company Delta is a developer of mobile games. Three of the case companies can be described as small companies as they have less than 50 employees which is the criterion used by EU for categorising small-sized firms. The experience in subcontracting varies in length between twenty years and a couple of years. All four companies are familiar with subcontracting to several countries.

In each company, the person responsible for strategic decisions, including software development subcontracting, was interviewed. Company Alpha is larger than the others and has a more complicated organisational structure. The person interviewed was an executive, who has substantial amount of experience in contracting out different activities. In the rest of the companies, them being small in size, the strategic responsibilities were typically accumulated to one person. In company Beta, the person interviewed was both the founder of the company and chairman of the board of

directors alike. He was also responsible for operative management. The interviewees in companies Gamma and Delta were the managing directors. All interviews were recorded and transcribed. In company Alpha, the interview material was supplemented with two presentations given by the interviewee. In other firms, secondary material regarding their offshore development activities was not available. Two follow-up interviews were carried out with the representatives of the companies Beta and Gamma in March 2006 in order to update the data and expand discussion beyond Russia.

The main research question and sub questions have been formed on the basis of preliminary interviews carried out in the case companies. The questions of the in-depth interviews were related to the following issues: motivation for sourcing, strategic significance of sourcing, special characteristics of sourcing in knowledge intensive industry, and possible evolving of sourcing activities into partnership. The emphasis of the second round of interviews was on the use of networks in product development and organisational issues in product development distributed across company boundaries. The main research question of the study is how software firms can enhance their product development by engaging external resources located in other countries.

B. Case companies' experiences of subcontracting

At the beginning of the study, it was assumed that the main incentive for offshore subcontracting was cost minimisation. The motivation for engaging foreign suppliers in product development proved to be more diverse. In company Alpha, it was stated that it is neither reasonable nor cost-effective to do everything internally. Alpha's aim is to concentrate on core functions. Suppliers are used as a source of specialised know-how of good quality. In company Beta, sourcing was launched by a need for certain capabilities that were unavailable internally. For them, there are multiple reasons for cooperation: flexibility, regulation of fixed costs, and dealing with demand peaks. Foreign suppliers also provide proficiency in programming. In a similar manner, company Gamma's network was initiated by a need for specific knowledge and skills unavailable internally. Cooperation with suppliers is a mean for keeping organisation lean. For company Delta, the reasons for cooperation were limited internal resources, need for shorter development time, and cost efficiency. Especially for small firms, engaging external resources, instead of hiring own staff, enabled temporary increase in the work force, but was also a way of minimising risks related to changing economic trends and turbulence of the industry.

The level of necessary compatibility of the actors depends on whether sourcing is practised on a long-term or a short-term basis. In the short run, cost efficiency is essential and the complementarity of resources and capabilities is of less importance. However, if sourcing is planned to last for a longer period, other reasons such as know-how and capabilities of the partner become decisive.

The origin of the supplier appeared to be of lesser importance as compared to the resources and capabilities provided by the arrangement. The factors mostly affecting ease of cooperation with a foreign partner were maturity of the partner and similarity in organisational values; whereas advantages of domestic suppliers were seen in having a common language and short physical distance. Factors generally contributing to success or failure of organising product development through international subcontracting are highlighted in table 1. Communication and coordination of offshore cooperation are supposed to pose difficulties to small firms (Carmel and Nicholson, 2005). However, in the case, it was found that such difficulties diminished with growth of trust and familiarity between parties.

TABLE 1
SUCCESS AND FAILURE FACTORS OF PRODUCT DEVELOPMENT
COOPERATION

Success	<ul style="list-style-type: none"> – Complementary skills – Knowledge of business processes – Understanding development process as a whole – Initiative partner – Mutual values – Good communication and problem solving capabilities – Trust
Failure	<ul style="list-style-type: none"> – Rigid operational models – Ambiguity in goals – Lack of commitment – Differences in organisational culture – Poor language skills – Negative attitude of company's customers

IV. MODELS OF INTERNATIONAL COOPERATION

What the case companies have in common is having a network of suppliers that extends beyond the country of origin. It would be easy to assume that the use of foreign suppliers is motivated by either cost or access to market. Nevertheless, the rationale for cooperation is much more multidimensional. Similarly, there is no universal structure for this kind of network.

A. Company Alpha

Company Alpha is larger than the others and has a more extensive network. The foreign subsidiaries of Alpha typically have their own local networks. The company has utilised subcontracting for at least 20 years and the scope has grown over the years. Currently it has hundreds of subcontractors in different countries. The subcontracted entities have become larger and the providers are assigned more responsibilities than earlier. Alpha has both long-term cooperative relationships and temporary subcontractors, which are found on the market and go through a tender. When choosing offshore location or provider for productional sourcing (e.g. routine programming) the price is decisive factor. This type of sourcing has established practices and stable processes, whereas product development cooperation involves higher amount of uncertainty. Typically, there is need for special know-how for individual projects. The level of specification, which is possible to provide, is dependent on the task domain; some

already have formal descriptions and others are yet undefined. In the latter case, there is need for genuine partnership and cooperative development. New projects tend to be started with already existing proven partners. Some of the long-term relationships have continued for more than ten years. For Alpha, the ideal situation is sourcing from a partner who concentrates particularly on the tasks in question and perfection of their efficiency and quality. Innovativeness of the products is seen as a very important factor for the competitiveness in this branch and it is also sought through partners and their know-how. The aspect of trust is vital because the telecommunication industry and the roles of different players have been transforming rapidly and this trend seems to continue also in the future. Thus, there is a risk of current subcontractors becoming future competitors.

B. Company Beta

Over the years, the company has become more focused in its target business segment and also technologically. Internalising all the necessary competences and maintaining them on a sufficiently high level was not considered an option when the company's goal was to develop products for several technological niches. Sourcing of certain product development tasks was used to avoid pressure on optimising the size of organisation according to the profits or number of customers. Consequently, this meant high level of dependency on partners and trustful relationships were strongly emphasised. At this stage, Beta's subcontractors were, with one exception, small firms as well. Their operational models were seen to be better suited for cooperation with a small creative company. Typically, cooperation was based on an already existing personal relationship – academy acquaintances, company's trainees, and colleagues known through third party projects. Small size of partners was believed to be one of the reasons for the success and fluency of company's sourcing. The biggest problem with decentralising development activities was blurred sense of responsibilities as personnel tended to change on both sides. Partly this was due to the fast changes which characterise the industry, as growth and decline occur suddenly.

Nowadays, the network consists of bigger and more settled partners. Because Beta has been able to secure long-term development projects with several customers, its product development process is less affected by uncertainty. The importance of internal learning and continuity has grown at the same time as the incentives for utilisation of suppliers have lowered and the network of strategic partners has tightened.

As the vision of the company has become clearer, this has also affected the structure of its network. The selection criteria of the partners have become more explicit and the emphasis has shifted from personal compatibility to complementarity of competences. Seeking complementary resources has meant crossing national borders. However, because the company aims for global operations, this is not seen as a challenge. Search for excellence in certain field has often led to establishing a relationship with a foreign

partner. According to the interviewee, engaging offshore suppliers gives company more extensive touch of product's potential on the market. At some point, foreign suppliers were also seen as source of specific knowledge of foreign markets or certain customer industries. However, after Beta became more focused, it was decided that this type of strategic knowledge should be developed and maintained in-house to ensure long-term relationships with the customers. Shift of emphasis to building trustful long-term relationships with customers has led to lower level of use of suppliers, although it has not been a conscious decision.

Company's long experience of operating in a network of international partners has created readiness to operate on a global market. With the growth of the company, the attitude towards partnerships has become more systematic. Overall, the current network is tighter and more strategically oriented according to the company's projected growth direction. Certain level of dependency on other parties is still considered inevitable as there are several strategic suppliers and the network is mainly source of complementary capabilities, not volume. Nevertheless, it is likely that as the size of the projects grows, transfer of software development to countries with lower cost level and sufficient proficiency in technical skills will become a topical issue. As the competitors already have offshore development units, such arrangement may become a necessity in order to maintain company's competitiveness.

C. Company Gamma

During the first round of interviews, software projects were an essential part of activities for Gamma and it had a unit specialised in software development services. Nowadays, it concentrates on product development and consulting for construction engineering and energy sectors in Finland. Gamma has trimmed organisation of non-core activities in order to become more flexible. Concentrating on core competence has meant building an extensive network of partners which complement company's internal capabilities. Such organisational model means high level of dependency on the partners, but it is considered the only viable option due to fluctuating demand. With the help of the network, Gamma is able to provide an integrated range of services while keeping internal organisation lean.

The company started to use subcontracting, because it needed specific knowledge and skills unavailable within own organisation. Gamma itself concentrated on such tasks as planning and supervising projects, and contracted the rest of activities out to keep its organisation small. With time, this arrangement has converted into a network-like structure with about ten strategic partners, both research institutions and firms, which are complemented by short-term tactical suppliers depending on a project. These temporary subcontractors are used only if the task in question cannot be contracted to an existing partner.

Each player in Gamma's network has a specific role and unique responsibilities in a project. The know-how and skills of different partners complement those of Gamma's. Product development activities in a network-like structure could not be possible without sufficient trust and mutual

values. Dependency on partners is a substantial risk. Sometimes, risk has materialised in such a way that Gamma had to take additional work load to compensate for a partner's deliberate underachievement. Despite some negative experiences, operating in a network is seen as the only viable option. Offshore subcontracting does not differ from domestic, if both parties are mature enough. Despite different cultures, it has always been possible to talk things through as long as the partners share mutual values.

The difference between situation in 2003 and 2006 is that also software development activities are now carried out by a distinct partner and not through subcontracting arrangement. New organisation encompasses only the entrepreneur himself and former employees have transformed into distinct partners within the network. The reason for this rearrangement was the need for more dynamic organisational structure and flexibility in carrying out different projects. Nowadays, through its network, company can actually tender for bigger entities. The availability of resources through extensively competent network has proved to correlate with shorter product development time.

In the new arrangement, if a project requires some software to be developed, Gamma recommends its Russian partner for implementation of that part. If this partner is chosen by the client, Gamma gets commission. The specification of software development at the customer site is still done by Gamma. Thus, the practical arrangement has not changed significantly for that part. However, the actual implementation is carried out solely by the partner and the responsibility is exclusively his.

D. Company Delta

For Delta, utilising suppliers enabled quick and cost efficient broadening of product portfolio when company was still young and its financial resources were limited. Those relationships that proved successful have been continued, but the company has not actively sought new partners for product development. Instead, it was decided to downsize the network to only couple of proved partners despite higher costs and slower pace of internal development. The added efficiency brought by faster development pace was reduced by additional communication required in cooperation, especially if any problem occurred. Also the training expenses were higher when crossing organisational boundaries. The external resources obtained through cooperation have been similar to the internal ones. Thus, the company is not seeking complementarity but volume, despite the fact that subcontractors' knowledge and competence have enabled Delta to add some good products to its portfolio. In the interviewee's opinion, subcontractors could not provide any knowledge of market or technology additional to the one the company already possesses. In addition, there is always a risk of a subcontractor turning into a competitor.

V. DISCUSSION

Despite the fact that much is written regarding the

international relationships of firms, the emphasis has been on ownership-based cooperation as opposed to project-based and contractual relationships, which are becoming increasingly common. Especially high level of complexity in technical knowledge makes cooperation more attractive than developing all necessary capabilities in-house. Networking can enable a small specialised firm to concentrate on its core competences and create an extensive offering of integrated products and services at the same time. The paper illustrates the use of supplier networks to complement internal product development in a knowledge intensive dynamic industry. Due to the turbulent nature of the ICT industry in general and software development tasks in particular, possessing and exploiting a set of internal resources can prove insufficient to maintain a firm's competitive position. Utilising external resource pool can speed product development for faster access to market or provide complementary resources to enhance firm's own capabilities and competitiveness. In case of software development, products are more or less intangible and transportation or location of production is of minor importance. Thus, cooperative arrangements between firms producing digital products or services have own peculiarities as opposed to the ones observed in the traditional manufacturing industries.

Preference of contractual relationships over joint ventures or alliances is twofold. Firstly, there is turbulence related to the nature of ICT industry and high-technology industries in general. Organisational and cooperational structures are subjects to frequent changes reflecting rapid changes on technology front. Secondly, there is a disadvantage of being a small company, which typically means weaker position for cooperation negotiations. However, due to their limited size, SMEs are less likely to be able to preserve their competitiveness through sole in-house development [44]. By keeping even their strategic relationships on a contractual basis, small firms try remain flexible in case there are sudden changes in their customer base, operational environment or technology. Alternative scenario is for a small high-tech company with valuable technology to be bought by a bigger player.

The motivation for cooperation varies according to companies' goals. If short-term outcomes are decisive, cost efficiency is essential, whereas complementarity of resources and capabilities is of less importance. However, if cooperation is planned to last for a longer period, other reasons such as know-how and capabilities of a partner can become decisive. In fact, for high-tech companies, knowledge and capabilities of a partner appear to be the most important qualities of a long-term supplier. It was mentioned that the organisational culture of a potential partner is more vital for success of cooperation than the partner's nationality. Both trust and mutual values were highly emphasised as necessary criteria for long-term cooperation. Small firms often find their subcontractors through personal networks, prior acquaintance resulting in lower significance of nationality in the actual sourcing arrangement. This is in line with observation that small

companies, operating in highly dynamic markets, believe more in interpersonal trustworthiness than large firms [28]. Vice versa, without existing personal connection, it is much more difficult for a foreign supplier to convince a customer of its qualifications. The meaning of distance and cultural differences grow when product development process is not so structured or involves a lot of creativity as in game development.

In the case companies, the knowledge related to customers and customer industry was preferably maintained in-house. The attitude towards necessary technical competences was somewhat different. Case firms have used networks of actors to access resources or capabilities rather than internalising them as the internalisation would require significant investments. If a capability is not a focal one, it is considered a better option to leave the capability to supplier, who is able to maintain its technical level and further develop it.

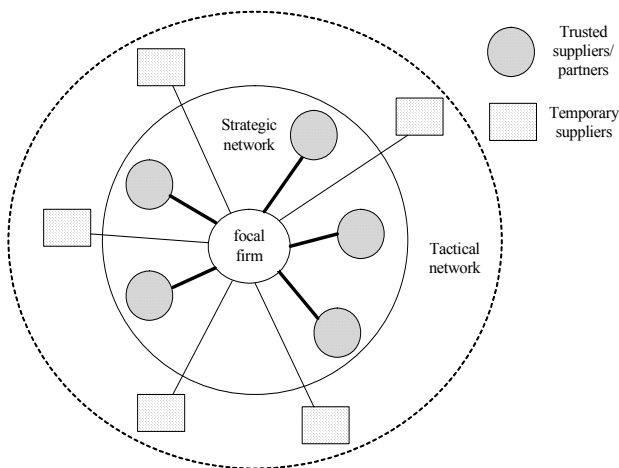


Figure 1: Two levels of subcontracting networks

In this paper, it is proposed that supplier networks can be divided into strategic and tactical level (figure 1). Tactical network consists of temporary subcontractors chosen from a market, whereas strategic network consists of trusted long-term partners. Strategic network provides a focal firm with complementary resources and capabilities. For a high-tech company, such resource can also be knowledge. Scarcity of knowledge or skills on domestic market can be a reason for building a network of foreign suppliers to complement firm's internal product development. On the other hand, tactical network is more likely to contribute to volume, speed or price of development. Location of supplier is affected by the objective of subcontracting. Economising can be pursued through subcontracting from countries of low labour costs, whereas speeding up development is more likely to be sought through closely located suppliers. The focal firm is more dependent on its trusted suppliers than on temporary ones. The relationships with strategic suppliers are of long-term nature and the degree of trust is of significant importance. Complementarity of resources contributes to trust formation between the focal firm and suppliers. If suppliers provide

similar resources, there is greater probability of fear of opportunistic behaviour.

Another assumption questioned is presumed relation between using foreign suppliers and looking for access to a market. Some subtasks of product development (e.g. localisation of products) are likely to involve a natural preference for foreign cooperation. However, not all product development cooperation with suppliers from a particular country is aimed at the market of that country. Companies in the ICT industry often operate on global market. Thus, networking with foreign companies appears to be more natural for them than for firms in traditional manufacturing industries. Similarly, lowering costs is not necessarily the main incentive for cooperative arrangements with foreign supplier, despite the fact that this motivation has received most attention in the press. Instead, the global nature of high-technology products and markets makes the puzzle more complicated. The decisions of what to do and where are rooted in the mixture of elements of knowledge, skills, quality and costs. Thus, it is often more of a question of finding sufficiently high level of know-how at a competitive price, than the cheapest price. In this sense, the traditional views on cooperation based on experiences in manufacturing should be revised for knowledge-intensive high-technology industries. High-technology firms operate in a complex, fast changing environment. Likewise, structures and functions of their networks are far from simple.

VI. CONCLUSIONS

With the increasing amount of uncertainties related to the product development process, there is a growing need for flexibility and interorganisational cooperation even within this core activity. Especially for small firms, cooperation can be the key to improving their competitiveness. Motivation for engaging in a network varies, but it is often seen as a necessary precondition for success or even survival of a firm. Possible reasons for cooperation include access to complementary resources, increased flexibility, economising, and dealing with the industry's turbulence. Ability to coordinate and manage network of external actors can in itself become a firm's core competence.

The findings of the study support the argument that contractual or project-based relationships and distributed product development can contribute to competitiveness of a firm in a dynamic, knowledge-intensive industry. The paper questions the assumption that contractual relationships are used only as short-term or tactical arrangements. Instead, it is suggested that contractual supplier relationships of a firm can be distinguished into two kinds of networks, a strategic one and a tactical one. Retaining relationships on a contractual level provides manoeuvrability while having access to a pool of external resources and capabilities. The limitation to generalise is an inbuilt problem of in-depth case studies [42] and this study is no exception. However, it contributes to the discussion of distributed product development by describing models and practical examples of organising software product development across

company's boundaries.

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The Effect of the Internet on the Magazine Publishing Industry

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Abstract — *The purpose of this paper is to analyze the effect of the Internet on the magazine publishing industry. By combining the views of industrial organization economics and the resource-based view, cross-level analysis is provided at industry and company levels. At the industry level, the Internet has not significantly changed the five forces that shape the nature and state of competition in the magazine publishing industry. At the company level, it is proposed that the Internet does not change the traditional core competencies of magazine publishers. However, dealing with the Internet also means dealing with change. As most media companies have cultures built on consistency, it is proposed that more dynamic capabilities are needed.*

Keywords — Internet, magazine publishing industry, strategy

I. INTRODUCTION

Turbulent change, high competition, new forms of production and distribution, and entirely new types of products have characterized the situation in the media industry over the past few decades [1], [2]. It has been noted that digitalization is strongly influencing the industry: it is changing the existing market dynamics and requires new strategies [3]. According to Picard [4], the development of the Internet has brought significant changes to both audience and advertiser behavior that challenge the long-term survival of the newspaper, magazine and book industries.

Research on the impact of digitalization and the Internet on the media industry has emphasized the newspaper publishing [5]-[7] and broadcasting [8]-[10] sectors. Evidently, the effects of new digital forms of delivering content have had a dramatic impact on the above-mentioned news-focused media. However, magazine publishing seldom is the focus of research.

Nonetheless, as Picard [4] has noted, the Internet has also challenged the magazine publishing industry. No direct analogy to the newspaper industry can be made, as the media products and their business logics differ significantly [11]. Research on the magazine publishing industry and its

online activities is still in its infancy [12], [13]. It is also noted that often a multilevel analysis is called for (see Albarran [14] and Dimmick [15] for argumentation in the media industry), yet cross-level analysis is rare. It is the purpose of this paper to fill that gap by analyzing the strategic effect of the Internet on the magazine publishing industry at the industry and company levels.

The rest of this paper is structured as follows: First, two classic schools of strategy research will be reviewed focusing on the industry and company levels. Then the strategic concepts presented will be applied in the context of the magazine publishing industry and the impact of the Internet. The paper will be concluded by a discussion of the analysis and implications of the paper.

II. STRATEGY RESEARCH ON MULTIPLE LEVELS

The reason why firms succeed or fail is the central question in strategy research [16], [17]. However, the field of strategy research has witnessed “swings of a pendulum” regarding the focus of the research, as Hoskinsson et al. [18] have noted. The dominant view until the early 1990s was the so-called industrial organization paradigm that emphasized industry structure and competitive positions in the industry [19], [20]. A dramatic change in strategy research happened in the beginning of the 1990s when several writers [21]-[23] suggested that instead of the industry, attention should be paid to the heterogenic resources and capabilities of a firm. This view has been called the resource-based view of the firm. Later, researchers [16], [24], [25] have also argued that these views do not need to be opposite, but rather complementary views of strategy, and they both are needed in search of the sustainable competitive advantage.

Strategy research in the media industry has mainly followed the industrial organization view [26]-[28]. Only a clear minority of the research applies the resource-based view [8], [29]. Lately, Chan-Olmsted [2] has argued for a need to incorporate these two views in media strategy

research. In this paper, the industrial organization paradigm will be combined with the resource-based view to analyze the impact of the Internet at industry and company levels.

1) *Industry Level*

So-called industrial organization economics (IO) has its roots in the work of Edward Mason and his colleagues in Harvard in the late 1930s and the influential book of Bain entitled 'Industrial Organization' published in 1959 [18], [30]. They presented the structure-conduct-performance (S-C-P) paradigm that implies that the structural characteristics of an industry, particularly the level of concentration and the height of entry barriers, have a significant influence on firms and thus can be expected to determine the performance of individual firms [31]. With the IO view, strategy research moved towards economics in terms of methodology and became more "scientific" [18]. According to McWilliams & Smart [31], the S-C-P paradigm became a dominant tool in the normative and theoretical aspects of strategy research. The S-C-P paradigm has been widely used in media strategy research [32]; Fu [32] also notes that contemporary IO theory holds that structure, conduct and performance are two-way interrelated.

The central tenets of IO economics were summarized by Porter [19], [20] who is acknowledged to be the most influential writer within the IO school [18], [33]. He presented a framework – the five forces model – that specifies the various aspects of industry structure and provides a tool to assess an industry's attractiveness and facilitates competitive analysis. The five forces are the threat of potential entrants, the threat of substitutes, the bargaining power of the suppliers, the bargaining power of the buyers, and the rivalry among existing firms in the industry. Porter [19] argued that "knowledge of these underlying sources of competitive pressure highlights the critical strengths and weaknesses of a company, animates its positioning in its industry, clarifies the areas where strategic changes may yield payoff and highlights the areas where industry trends promise to hold the greatest significances as either opportunities or threats." Porter also suggested generic strategies that can be used to build competitive advantage.

B. *Company level*

The central tenet of the resource-based view is that a firm is seen as a bundle of idiosyncratic resources and capabilities [21]-[23], [34]-[36]. According to Barney [23], a firm's sustained competitive advantage is based on those resources that are *valuable*, *rare*, *imperfectly imitable* and *non-substitutable*; these strategic resources are called VRIN attributes.

Wernerfelt's [21] definition of a resource was "anything which could be thought as a strength or weakness of a

given firm". Barney [23], on the other hand, placed firm resources into three groups: physical capital, human capital and organizational. Chan-Olmsted [37] suggests dividing resources into property-based resources and knowledge-based resources when researching media companies. Knowledge-based resources refer to a firm's intangible know-how and skills and thus are close to the discussion of capabilities.

According to Spanos & Liokas [38], there was no explicit distinction between resources and capabilities in the early contributions. Amit & Schoemaker [24] define resources as stocks of available factors that are owned or controlled by a firm; capabilities, in contrast, refer to a firm's capacity to deploy resources. According to Grant [39], resources are the source of a firm's capabilities and capabilities are the main source of its competitive advantage.

The evolutionary version of the resource-based view, the dynamic capabilities view (DCV) [40], [41] addresses the processes of future resource creation [42]. In the DCV, the firm's ability to renew its resources in line with changes in the environment is the focus of attention. Dynamic capabilities include strategic processes like alliancing and product development, and are likely to be path dependent routines [41].

III. THE MAGAZINE PUBLISHING INDUSTRY AND THE INTERNET

In the next sections, the impact of the Internet on the magazine publishing industry will be discussed using first the five forces framework, and then the resource-based view of the firm.

A. *Industry level*

Within the IO and five forces framework, the magazine publishing industry exists in monopolistic competition [43] and is characterized by low barriers to entry and a moderate level of direct competition [44]. Also, magazine markets are mature with limited growth potential, and current trends with business process digitalization are leading towards a higher number of titles and a declining average circulation per title [3], [44]. Picard [44] also sees that the threats from new technologies are moderately high in the magazine publishing industry.

The main supplier groups for the magazine publishing industry are freelance journalists, printing houses, paper suppliers, distributors and telemarketing companies. While recent developments in digital technology have sped up the process of manufacturing magazines, the Internet as such has not changed the roles or powers of any supplier group. It remains to be seen if the diffusion of digital copies sold online will transform the role of printing houses and paper suppliers.

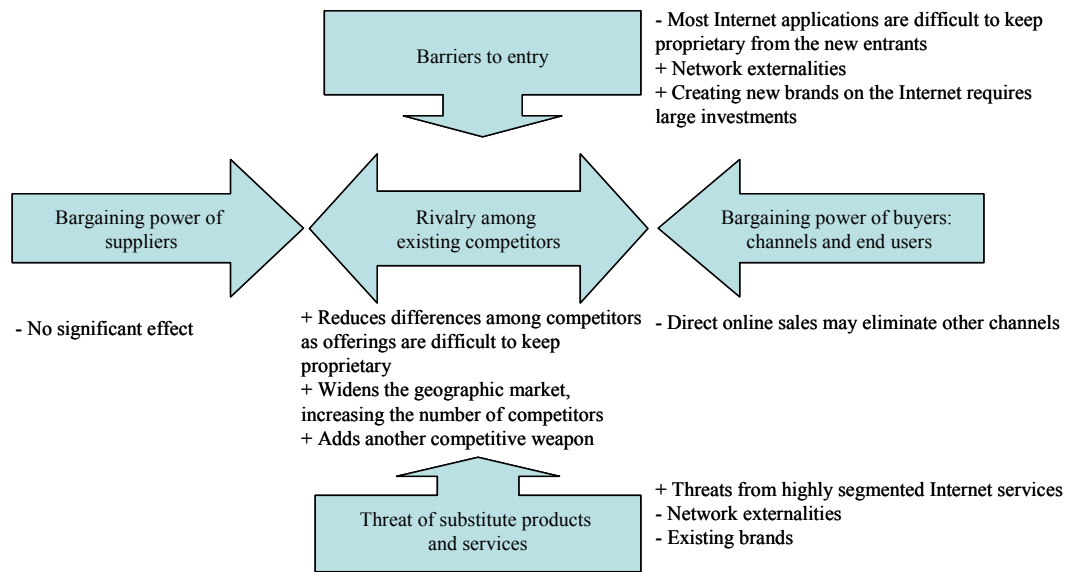


Figure 1. Impact of Internet on the magazine publishing industry

Magazines have two groups of customers: readers and advertisers. According to Picard [4], a particular concern for publishers is the rising use of the Internet and its impact on readership. Advertiser behavior, on the other hand, is not alarming, and increasing brand advertising has driven revenue to consumer magazines particularly. Magazines are sold either by subscriptions or single copy sales. In the future, it is possible that direct online sales would diminish the role of other channels. However, at this point, online sales are still marginal. Porter [45] has suggested that the Internet would make price competition more transparent and thus migrate competition to price. In the magazine publishing industry, this has not been the case. It is proposed here that this has to do with strong magazine brands that differentiate products (in contrast with e.g. the airline business, magazine products are not seen substitutive).

Porter [45] was skeptical about the network externalities online. However, a recent case study in the magazine publishing sector [46] has illustrated that a successful magazine website may well witness positive network externalities and result in higher customer loyalty. It is proposed here that while existing brands and network externalities may provide some barriers to entry and reduce the threat of substitute products, most Internet applications are difficult to keep proprietary of a single company [45]. Highly segmented Internet services pose a threat of substitutes to magazines [3].

It seems that most of the identified effects in turn affect the rivalry among existing competitors. E.g. magazines face new threats of substitute products from highly segmented

Internet services [3] which add pressure to the competition among existing competitors. The Internet also widens the geographic market [45] and thus increases the number of competitors. Therefore, it seems that the Internet's impact on the magazine publishing industry culminates in rivalry among existing competitors; the Internet adds another competitive weapon.

The discussion is summarized in Figure 1 above. Plusses and minuses in the figure refer to the proposed effect the Internet has on each force.

B. Company level

In this section, the resources and capabilities of a magazine publisher will be discussed.

Magazines as media products are concept driven. This means that they involve on-going creation of changing content provided within a package that exhibits continuity [11]. Therefore, according to Picard [11], the core competence of the producers of a magazine is not content creation per se, but rather the selection, processing and packaging of content and thus catching the look and feel of the concept. On the other hand, Hafstrand [29] has argued that the strategic capabilities of a magazine publisher can be located in human resource management, market knowledge and product development. Capabilities, knowledge and routines within these functions are accumulated over a long time and embedded in the organization, and, thus, cannot easily be replicated.

Chan-Olmsted [37] sees that of all media products, magazines are closest to the Internet in terms of customer

involvement and how much time and cost are required to consume the media product. In this regard, adding an Internet dimension to the magazine concept seems very natural, and it seems reasonable to believe that the same abilities mentioned by Hafstrand [29], namely the ability to understand and react to signals from the market, the ability to find, employ and stimulate the right kind of personnel, and the ability to coordinate resources to enhance continuous product development, are critical factors for success when dealing with the Internet, as well.

As discussed earlier, the Internet could be seen as a technological change in the competitive environment that affects both advertiser and consumer behavior. Following this logic, the Internet does not change the strategic capabilities of a magazine publisher, but rather demands more *dynamic* capabilities when dealing with constant development.

Dealing with change may, however, be problematic to magazine publishers. Most media companies have cultures built on consistency and limiting changes [4], [47]. Ellonen & Karhu [48] identified several attributes, such as little respect for digital innovations and fear of new technologies that hinder the development of digital products in media companies. Magazine publishers' organizational cultures and routines, therefore, seem to emphasize the exploitation of old certainties rather than the exploration of new possibilities [49], and their traditional core capabilities seem to inhibit innovation and learning [50]. Thus, it is suggested here, capabilities for organizational learning and other dynamic capabilities [40] are critical for success.

To sum up, at the company level, dealing with the Internet and the changing preferences of consumers and advertisers demands more dynamic capabilities of the magazine publishers.

IV. DISCUSSION AND CONCLUSIONS

The aim of this paper was to provide a multilevel analysis of the impact of the Internet on the magazine publishing industry. By combining the views of industrial organization economics and the resource-based view, cross-level analysis was provided on industry and company levels.

At the industry level, it seems that the Internet mainly affects the rivalry among existing companies. While the Internet and digitalization speed up processes and alter ways of communication, the Internet has not, at least not yet, significantly changed the five forces that shape the nature and state of competition in the magazine publishing industry. The Internet simply adds another competitive weapon to the arsenal.

At the company level, it is proposed that the Internet does not change the traditional core competencies of magazine publishers. Whether publishing in print or on the Internet, sensing the customer needs and packaging segmented content under the magazine brand concept are

still key. However, dealing with the Internet also means dealing with change as consumer preferences are constantly changing and the magazine publisher's organization has to adapt to those changes. Therefore, it is proposed here that more dynamic capabilities are needed.

The Internet has been referred to as a potentially disruptive technology for publishing industries [4], [51]. Emerging or disruptive technologies are defined as "science-based innovations that have the potential to create a new industry or transform an existing one" [52] or as "technologies that enable changes in a firm's product characteristics, added value and product-market positions, destroys existing competencies and drives or enables changes in the value network" [53]. Thus they refer to new technologies that have the Schumpeterian potential to upset emerging markets and competitive positions within them.

Based on this conceptual analysis on the magazine publishing industry, the Internet does not appear as a disruptive technology. Instead, a recent case study [46] has illustrated that the Internet may add a new "closer-to-real-life" dimension to the magazine concept, yet supporting the core print product. Therefore, it is proposed here that, on the continuum from incremental to disruptive technologies, the Internet could be seen more as an incremental, non-disruptive technology [54], [55] that emerges from reinforced core concepts [56]. The Internet has the potential to complement rather than supplement print magazines.

It should be noted, however, that the effects of (potentially disruptive) technology on existing firms are not uniform, but depend on how firms respond to the changes [4], [57]. Following this logic, it seems that firm specific resources and capabilities will define how the Internet truly affects competitive positions in the magazine publishing industry.

It was noted earlier that most media companies have cultures built on consistency and limiting changes [4], [47], [48]; thus it may be that capabilities for organizational change will "sort the wheat from the chaff" and provide a basis for the competitive advantages of a magazine publisher.

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The Effects of CRM Practices And Multiple Channels on Customer Behavioral And Attitudinal Loyalty in Financial Services

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Abstract

Rising world affluence and an aging global population have led to expansive growth in the financial services market in recent years. When coupled with advances in information technologies (IT) and the Internet, the demand for services opens global opportunities for financial service firms and consequently will heightened competition. To gain a competitive edge, many firms have turned to customer relationship management (CRM) to seek a greater understanding of their customers' needs and expectations, and better manage their customer care to gain customer loyalty. However, financial services firms entering global electronic marketplaces face a special challenge in building loyalty and trust. In the absence of face-to-face meetings, firms must devise other means or channels to interact and collaborate with their customers. The results of a survey conducted on financial services consumers in Taiwan suggest that CRM practices in loyalty programs and cross-selling, customer satisfaction and customization, and multiple channels have positive effects on behavioral and attitudinal loyalty. However, multiple channels has a moderating effect on the relationship between customer service and customization, and behavioral loyalty, and a partial effect on loyalty programs and crossing-selling with attitudinal loyalty.

Keywords Customer relationship management, e-commerce, financial services, customer loyalty

I. INTRODUCTION

Rising world affluence and an aging global population have led to expansive growth in the financial services market in recent years. Pricewaterhouse Coopers reports that a worldwide aging population with sizable inflows of retirement-related funds into capital markets, growing discretionary incomes and rising affluence in the US, EU, China and India, and escalating economic development in China and India are the primary drivers of this growth. In the US, the assets of the financial services industry surpassed US\$46.3 trillion in 2004 and are expected to

grow 7 percent by 2008. Worldwide markets are expected to grow as well. When coupled with advances in information technologies (IT) and the Internet, the demand for services opens immense global opportunities for financial service firms and consequently will heightened competition. Information technology (IT) has already proven itself as a key driver of existing markets and a facilitator to penetrating emerging electronic markets (e-markets).

Yet, continuous changes in the financial services environment destabilize the industry. Mergers and acquisitions, squeezed margins resulting from falling returns and rising costs, declines in experienced management, staff and sales force personnel, and new regulatory requirements have led to changes in competition and the way in which financial service firms compete [17]. Mounting global competitive pressures have also contributed to environmental changes. Given the dynamic nature of the industry, financial services firms are beginning to place greater emphasis on business practices that maintain a core of loyal and lucrative customers. Recently, many have turned to customer relationship management (CRM) to seek a deeper understanding of their customers' needs and expectations, and better manage their customer care. The knowledge they gain can provide a competitive advantage through the development of tailored products and services that not only match their customers' immediate needs but also satisfy their future evolving needs.

However, e-commerce and the Internet pose a special challenge to financial service firms. In the absence of personal face-to-face meetings, businesses engaged in global e-commerce must rely upon technology-based means to effectively interact with customers to gain their trust and loyalty. Add to this the convenience of the Internet for increasing consumer awareness and knowledge of alternative products and services, the challenge of maintaining a core base of loyal customers becomes even greater. Thus, identifying factors that lead to loyalty is crucial. *With e-commerce, how does a financial services firm build customer loyalty in geographically dispersed marketplaces and across distant relationships in lieu of*

personal face-to-face contact?

This study examines the relationship between two CRM practices, loyalty programs and cross-selling, and customer service and customization, and behavioral and attitudinal customer loyalty. In the financial services industry, customer loyalty has emerged as a key driver of profitability as loyal customers *purchase* more. Loyalty programs and cross-selling provide incentives for customers to remain with a business. In the case of loyalty programs, the business retains its customers by recognizing them for their patronage through means, such as points (e.g., frequent flier miles) and exclusive promotions. Cross-selling increases the value of a customer's purchase with an array of complementary product and service offerings as well as others that anticipate their future needs. The objective of both is to retain the customer through satisfaction. Customer service and customization reflect the quality of the interactions between the customer and business. While customer service plays a major role in connecting the customer to the firm, customization links the firm to the customers and leads to customized products and services that embody its understanding of their needs and expectations. However, two forms of loyalty exist, behavioral and attitudinal, and the emphases of the two CRM practices may shift with each form. Nevertheless, a financial services firm will benefit from the resources it commits to developing its CRM practices in greater customer loyalty.

II. Background

To gain an advantage over its competitors, many financial services firms are investing in CRM. They seek to better understand their customers' investment habits and behaviors to develop products and services that meet their financial needs in ways that recognize their individuality and cannot be easily duplicated or imitated by competitors. Ultimately, these services along with the care customers receive will lead to customer loyalty.

A. Customer Relationship Management Practices

CRM embodies the modern marketing paradigm of relationship management (RM) and leverages IT to acquire customers, understand and satisfy their needs and expectations, and maintain their long-term relationships through retention programs, particularly those that build loyalty. RM focuses the business on identifying, maintaining and enhancing customer and stakeholder relationships through trust and the fulfillment of exchanges and promises [22]. It emphasizes initiating and nurturing individual long-term relationships over anonymous mass marketing approaches. With RM, the business adopts a one-to-one, customer-centric marketing philosophy and directs its resources towards supporting it (philosophy).

CRM also expands upon RM with its emphasis on information management [35], and draws upon IT to enhance its various capabilities (i.e., database, analysis, communication, etc.). It targets the right customer with the right product or service through the right channel at the

right time [49] and involves attracting (acquiring), developing and maintaining successful customer relationships over time [5], [11], and building customer loyalty [28] through efficient and effective two-way dialogues [37] that seek to understand and influence customer buying behaviors and improve customer acquisition, retention, loyalty and profitability [11], [28], [37], [49].

Although not entirely built on IT, CRM involves IT-enabled business processes that identify, develop, integrate and focus a business' competencies on forging valuable long-term relationships that deliver superior value to its customers [42]. It allows businesses to quickly identify their most valuable customers, and learn about (i.e., develop, maintain, interact) and consequently better respond to their needs and expectations (i.e., emotional content, output) through customized products and services [36]. Thus, CRM improves a business' ability to acquire and retain customers and build their loyalty, a competitive asset [12]. As the relationship flourishes, both the business and customer benefit.

CRM practices involve the actions a business takes to retain its current customers and attract potential customers through personal touches in fulfilling and satisfying their individual needs. These practices include customer segmentation, database marketing, customization and one-to-one marketing, proactive selling, cross selling, loyalty program, and customer referral [30], [36], [49]. In this study, CRM practices pertain to those concerned with customer service and customization, and loyalty programs and cross selling.

CRM Practices in Customer Services and Customization

Customer service represents the vital interface between the customer and a business, and allows customers to communicate with the business and obtain desired information in a timely manner [3]. By drawing customers closer to the business, it helps satisfy their psychological and physical needs and affects the customers' goodwill, willingness to interact and loyalty. As the features and quality that once differentiated products, services and brands become less discernible, customer service will emerge as a key driver to a business' success and contribute to a sustainable competitive advantage. Parasuraman et al. [34] identified ten dimensions of service quality: service delivery, reliability, responsiveness, competence, courtesy, credibility, security, access, communication and understanding the customer. For a business to succeed, it must address each of these dimensions.

The criticality of customer service cannot be underestimated in service industries where service failures and poor service recovery have been attributed for over half the cases of brand switching [16]. Customer service represents the social encounter the customer has with the business [21], and has been associated with quality perceptions and buying decisions [13]. Because the (customer) behaviors that emerge from the service encounter often determine the customer's interpretation of the business' intentions, customer service will affect his/her

satisfaction, perceptions of the product or service, and eventually loyalty [21]. Therefore, service quality can increase the customer's favorable behavioral intentions (to purchase) and decrease his/her unfavorable intentions (to switch, bad-mouth and complain) [51].

Customization provides the business with a distinct competitive advantage through products and services that more precisely fit the individual customer's needs, preferences and expectations, and competitors find difficult to duplicate, imitate or substitute [35]. In contrast to mass-marketed items, customization adds value that cannot be easily obtained elsewhere. Thus, the objective of customization is to provide customers with superior value that meets their individual needs [50]. Pine et al. [40] describe customization as a product of a learning relationship between the business and its customers. It involves eliciting customers for their ideas, converting this information into organizational knowledge and integrating this knowledge into the productions process [41]. Hence, dialogs that foster collaboration and further cultivate the relationship underlie the basic success of customization.

Another benefit of customization is lock-in. If the customization adds a strong sense of value to the customer, customer lock-in ensues [10], [39]. Achieving this hinges on accurately knowing what the customer wants. The knowledge the business gains from its customers can lead to products and services that create greater satisfaction and garner loyalty [38] as well as other operating benefits, such as reduced costs and sustained profitability.

CRM Practices in Loyalty Programs and Cross Selling. A major goal of CRM is to capitalize on future opportunities presented by a core group of long-term customers. Two approaches for retaining these customers have been loyalty programs and cross selling. Loyalty programs play an important role in retaining customers and linking the business to future opportunities. The objective of a loyalty program is to build a positive attitude toward a brand and provide the customer with an incentive to patronize the product, service or brand. A successful program will decrease its members' purchase of non-program brands, and increase their allocation, repeat-purchase rates, usage frequency, propensity toward exclusivity and switching to program brands [46].

Prior studies have found that the development of loyalty programs frequently leads to increases in repeat-purchases and profitability [45], decreases to price sensitivity [44], and raises barriers of entry to markets by making it difficult for new entrants to court customers away from existing businesses [46]. Furthermore, loyal customers tend not to consider alternatives or shop for lower prices [21]. The market research studies of Hughes [24], and Reichheld and Sasser [45] strongly suggest that loyalty programs can increase business revenue and total customer market share. For example, Reichheld and Sasser note that a 5 percent increase in the customer retention may result in a 25 to 95 percent net present value increase in profits as observed over 14 industries. Moreover, the retention costs have been reported at five times less than acquisition costs of new

customers [29].

Cross selling refers to the strategy of pushing new products to current customers based on their prior purchases of a single brand. Butera [7] defines cross selling as the practice of promoting additional products and services to existing customers in addition to ones they already have. It is designed to widen the customer's reliance on the business and decrease the likelihood of the customer switching to a competitor. In contrast to loyalty programs which focus on providing incentives to lock-in customers, cross selling seeks to identify new products to customers based on their previous purchases and buying habits. It is often seen as an indicator of the breadth of a relationship [6].

Successful cross selling requires an information infrastructure for collecting, storing, analyzing and sharing customer information throughout the organization [26], [48], and IT-based analytical tools that identify opportunities [15]. With a wealth of information, the business can mine its data to increase the accuracy of its marketing efforts by identifying the greatest prospects for marketing efforts [20].

B. Multiple Service Channels

IT and the Internet have opened new ways in which businesses communicate and interact with their customers. With traditional businesses, customer interactions were carried over human interface-based channels, including face-to-face meetings, the telephone, faxed messages and direct mail. However, advances in IT and web technologies have expanded the channels to include e-mail, interactive kiosks and television (iTV), mobile commerce (m-commerce) and the Internet. Although more businesses are adopting the Internet as a standard tool for sales and services, its success must be supplemented by other interactions [47]. Howard and Worboys [23] suggest that customers create service portfolios of preferred channels and clearly use them, depending on context and occasion. Thus, the support of multiple channels benefits the business.

Muller-Lankenau et al. [33] cite a Doubleclick Inc. report that indicates multiple channel customers tend to be more loyal, spend significantly more money and are two to three times more profitable than single channel customers. A study conducted by Howard and Worboys' [23] suggests self-service channels that leave the customer feeling valued and empowered will achieve greater satisfaction, thereby generating positive word-of-mouth and increasing the likelihood of future customer interactions. The integration of all channels plays an important role to ensure the customer remains in contact with the business. By managing its channels, a business benefits from reduced time-to-market through effective marketing involvement in product development, and shorter cycle times for creating, tracking, approving and distributing promotional material [19].

C. Customer Loyalty

Oliver [43] defines loyalty as a deeply held commitment

to rebuy or repatronize a preferred product/service consistently in the future, thereby causing repetitive same-brand or same-brand set purchasing, despite situational influences and marketing efforts having the potential to cause switching behaviors. Although frequent usage and satisfaction with a product or service are frequently associated with loyalty, they by themselves insufficiently serve as precursors to loyalty. The study of Alexander et al. [2] indicates that satisfaction's effect on loyalty is more apparent in customers who are inexperienced with a brand than those who are (experienced) due to an evolutionary process that drives loyalty. The customer's attitude toward a service or product (brand) including attitudinal preference and commitment has a greater impact on forming loyalty [25]. Goodwin and Gremler [21] cite quality in a relationship as a necessary element in defining loyalty. Furthermore, Cronin et al. [9] associate service quality, perceived value and customer satisfaction with loyalty.

Day [11] suggests that two dimensions comprise loyalty: behavior and attitude. The behavioral dimension is characterized by consequential actions (i.e., as a result of loyalty), such as repeat purchases, share of wallet (i.e., value a customer places on a brand) and word of mouth. However, the customer does not necessarily hold a favorable attitude towards the brand [14], and repeat purchases may be due to convenience, habit or high switching costs [18].

In contrast, the attitudinal dimension includes formative behaviors as commitment, a desire to maintain a valued relationship [31]; trust, a willingness to rely on an exchange partner in whom one has confidence and embodies integrity and reliability in the relationship [31], [32] and a strong emotional attachment that reflects a customer's bond with a brand. Jacoby and Chestnut [25] describe attitudinal loyalty as a consumer's predisposition towards a brand as function of psychological processes. Attitudinal loyalty results from the development of attitude and leads to positive behaviors, including word of mouth (WOM) advertising and price insensitivity (i.e., not sensitive to price).

III. RESEARCH MODEL

Figure 1 illustrates the study's research model. It proposes that a financial service firm's CRM practices have positive effects on both behavioral and attitudinal loyalty. Multiple channel moderates the relationships between CRM practices and customer loyalty, such that as multiple channels increases the effect CRM practices have on customer loyalty. The following hypotheses have been developed to test the relationships.

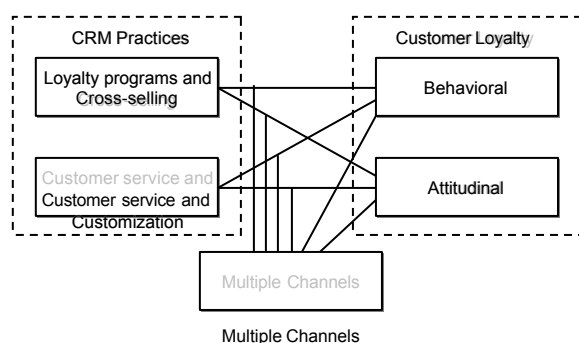


Figure 1. Research model

CRM practices focus on retaining customers through product and service offerings that more precisely match their needs and expectations. Customer service and customization represent the interactions between the customer and financial services firm. Customer service provides a crucial means for customers to interact with the firm and develop their perceptions of it and its intentions, satisfaction with the products and services, and trust. While customer service *listens*, customization *responds* to specific needs. Customization embodies the firm's understanding of the customer's needs and expectations, and provides the opportunity for the firm to lock-in customers. Both allow the firm and customer to exchange (share) information and collaborate. As the relationship develops, the customer engages in repeat purchases and behavioral loyalty ensues.

Loyalty programs and cross-selling have similar effects on behavioral loyalty. Loyalty programs provide incentives to the customers to maintain their relationships and evoke a sense of value (in the relationship) since they are recognized (i.e., extended preferential treatment, exclusive offers, etc.) and rewarded (i.e., redeemable points, perks, etc.) for participating in the relationship. They lock-in the customers by increasing their switching costs. Similarly, cross-selling enhances or increases the breadth of the relationship through added-value product and service offerings that increase the value of the customer's patronage and further fulfills his/her current and future needs. For financial services firms, this may involve selling different types of accounts to suite the customer's changing lifetime needs. As in the case of customer service and customization, the objective of the loyalty programs and cross-selling is to leverage the relationship to lock the customer into repeated purchases.

H1: CRM practices are positively related to behavioral loyalty

H1a: CRM practices in customer service and customization are positively related to behavioral loyalty

H1b: CRM practices in loyalty program and cross selling are positively related to behavioral loyalty

While repeat purchases characterize behavioral loyalty, a customer's emotional attachment to the firm forms with attitudinal loyalty. For global financial service firms, attitudinal loyalty is more critical since such customers are less inclined to switch despite the convenience of the Internet. To achieve attitudinal loyalty, customer service must focus on fulfilling the customer's psychological needs, including the quality the firm projects in its relationship as well as on its service and product offerings. Quality is seen as the perceived value a customer expects to receive (e.g., *Will the benefits of a service place the customer in a more advantageous position?*). The quality of the dialogs will appear in the customized products and

services and set an expected level of performance and value that will eventually extend over the entire brand. Thus, customer service and customization play important roles in forming a customer's attitudinal loyalty.

Loyalty programs and cross-selling are not only meant to retain customers, but add value to the relationship, such that the value appeals to their (customers') emotions. Loyalty programs that bestow an elitist status on high revenue customers appeal to their emotions and consequently shape their attitudes towards the firm. When coupled with loyalty programs, cross-selling that involves exclusivity has an emotional appeal and builds greater trust. If the cross sold products and services are also perceived as having the same quality, trust will extend over the brand. Rather than being satisfied with individual products and services, the customer becomes emotionally attached to the firm.

H2: CRM practices are positively related to attitudinal loyalty

H2a: CRM practices in customer service and customization are positively related to attitudinal loyalty

H2b: CRM practices in loyalty program and cross selling are positively related to attitudinal loyalty

Communication (interaction) with a customer is an essential element to creating customer loyalty. Because the purpose of a communication depends on the task and the need for information, a customer will choose or prefer a channel fitting of the task. For example, promotional announcements may be better suited for email or faxed messages while problems with a service are better handled interactively over the phone or through instant text messaging. For financial services firms, multiple channels play importantly in matching the medium (of communication) to the information or task, particularly when urgency or speed may be required, to support repeated purchases or frequent service (i.e., behavioral loyalty). Interactions over multiple channels also contribute to forming customer satisfaction and creating value that leads to emotional attachment (i.e., attitudinal loyalty). Thus, for financial services firms competing in a global marketplace, multiple channels keep customers connected to the firm and increase retention through lock-in and higher switching costs.

H3: Multiple channels is positively related to customer loyalty

H3a: Multiple channels is positively related to behavioral loyalty

H3b: Multiple channels is positively related to attitudinal loyalty

Communication between a financial services firm and its customers is crucial to customer loyalty in a global e-commerce environment. IT and the Internet have made shopping online and switching convenient, thereby casting greater challenges on gaining a customer's loyalty. The actions and activities involved with CRM practices focus

on creating loyalty. Yet, they alone cannot achieve it without interactions between the firm and customer. Interactions are vital to the success of customer service and customization. Similarly, loyalty programs and cross-selling involve communicating to the customers the benefits of maintaining their relationships with the firm. Depending on the context and occasion, customers will select a means for interacting, such that the number of choices will bear on their satisfaction and retention. The investments and resources a firm dedicates to supporting multiple channels will moderate (enhance) the effects of its CRM practices on a customer's behavioral loyalty.

H4: Multiple channels moderate the relationship between CRM practices and behavioral loyalty

H4a: Multiple channels moderate the relationship between customer service and customization, and behavioral loyalty

H4b: Multiple channels moderate the relationship between loyalty programs and cross-selling, and behavioral loyalty

The perceived quality or dedication customers see in their interactions with the firm will have an impact on their attitudinal loyalty. Multiple channels that effectively and efficiently support a customer's different needs or inquiries will project a favorable image of the firm. For customer service and customization, interactions will determine whether the product or service embodies a rich understanding of a customer in fulfilling an emotional or psychological need (e.g., does the product help project a certain social image). Multiple channels and interactions will also play into the extent to which loyalty programs and cross-selling appeal to customer emotions. In the US, major airline companies have dedicated channels to serve their elite frequent fliers. As a result, these fliers are less swayed by price and routing convenience. Thus, multiple channels will moderate the relationship between CRM practices and attitudinal loyalty.

H5: Multiple channels moderate the relationship between CRM practices and attitudinal loyalty

H5a: Multiple channels moderate the relationship between customer service and customization, and attitudinal loyalty

H5b: Multiple channels moderate the relationship between loyalty programs and cross-selling, and attitudinal loyalty

A financial services firm's CRM practices play an important role in establishing customer relationships, incorporating customer needs and expectations into quality and value-added products and services, keeping customers satisfied and appealing to their psychological needs. CRM keeps the firm in tuned with its customers through efficient and effective IT-enabled tools and methods.

IV. METHODOLOGY

A survey was conducted of financial services consumers in Taiwan. Of the 272 questionnaires distributed, 253 were returned completed (and usable) for a response rate of 93 percent. Participants were asked to think about their most recent experience with a financial services provider (i.e., bank, investment, mortgage, loan or insurance company, brokerage firm, etc.) when responding. The questionnaire contained 26 items related to loyal programs and cross-selling, customer service and customization, multiple channels, and behavior and attitudinal loyalty. Participants recorded their responses on five-point Likert-type scales (1 = strongly disagree, 5 = strongly agree).

Measures (items) were drawn from prior studies. Prior to its release, six experts reviewed the questionnaire for clarity and accuracy in capturing the intended responses. After making adjustments, the questionnaire was pre-tested on a group of 50 persons, which resulted in further refinements.

A review of the demographics shows 55.3 percent of the respondents were female, 37.2 percent were between the age of 26 and 35, and 67.2 percent have a college education (a surrogate for affluence).

V. ANALYSIS AND DISCUSSION

Tables 1 through 3 summarize the results of the regression models (Models I through VI) used to test the relationships. Model I (Table 1) tested the relationship of customer service and customization, and loyalty programs and cross-selling on behavioral customer loyalty. The results suggest that both have positive relationships with behavioral loyalty and support H1. The standardized coefficients indicate the weight each independent variable has on behavioral loyalty. Although the model is significant ($F = 16.77$, $p < .001$), the low R-square (.168) suggests other factors not captured in the model account for a greater portion of the variation.

The results of Model II (Table 1) also suggest that customer service and customization, and loyalty programs and cross-selling have positive relationships with attitudinal customer loyalty, and support H2. As in the case of Model I, the low R-square (.238) indicates other variables not captured in the model account for a greater portion of the variation. However, of the two models, the two CRM practices may be better directed toward building attitudinal loyalty.

Models I and II tested the relationship between multiple channels and customer loyalty. The positive results support H3 and suggest that multiple channels have positive effects on both behavioral and attitudinal loyalty. Support for H1 through H3 allows further testing for the moderating effect of multiple channels.

Models III and IV (Table 2) tested the moderating effects of multiple channels on the relationship between CRM practices and behavioral loyalty. A moderating effect suggests that changes to the CRM practices will have a similar effect on customer loyalty as influenced by changes in multiple channels. The models include an interaction variable to represent the moderator (i.e.,

customer service and customization x multiple channels, loyalty programs and cross-selling x multiple channels) [4]. The positive results of the moderator ($t = 2.46$, $p < .05$), customer service and customization ($t = 2.96$, $p < .01$), and multiple channels ($t = 4.13$, $p < .001$) variables lend support to the moderating effect (H4a supported). However, the non-significance of the moderator ($t = 1.51$, $p = .132$) in Model IV does not provide support for H4b. Thus, multiple channels does not moderate the relationship between loyalty programs and cross-selling, and behavioral loyalty.

Models V and VI (Table 3) do not yield positive results to strongly support the moderating effects of multiple channels on CRM practices and attitudinal loyalty. In Model V, the moderator is not significant ($t = 1.23$, $p = .218$), and therefore multiple channels has no effect on the relationship between customer service and customization, and attitudinal loyalty (H5a not supported). The results of Model VI partially supports the moderating effect (moderator $t = 1.91$, $p = .057$) on loyalty programs and cross-selling, and attitudinal loyalty (H5b partially supported) and further study is recommended. As in the case of Models I and II, the low R-squares for Models III (.161), IV (.162), V (.225) and VI (.216) suggest other factors not captured in the models account for a large portion of the variation.

In summary, the results of the study suggest that multiple channels moderates (enhances) the relationships between customer service and customization, and behavioral loyalty, and to a lesser extent (i.e., marginally) between loyalty programs and cross-selling, and attitudinal loyalty.

A. Discussion

In the financial services market, firms have turned to CRM to improve customer experiences, build new relationships, connect to customers in emerging market segments, and connect customers to their products and services. Although firms have deployed CRM for various purposes, its greatest potential lies in understanding and anticipating customers' needs and expectations, and innovatively converting this knowledge into products and services that eventually capture their loyalty. Thus, it is important that the way in which a firm approaches its CRM practices and customer care, and presents itself will have an impact on the longevity of its customer relationships and loyalty. For firms to achieve behavioral and attitudinal loyalty, they must first make certain their customers are satisfied since a loyal customer is a satisfied customer. This becomes a greater challenge for firms conducting business in global electronic marketplaces and building long distant relationships. As Pricewaterhouse Coopers recommends, firms must use technology to match products to their target customers' needs, and generate information for finding, cross-selling and retaining their customers. Moreover, firms that invest in improving their customer care practices and direct their resources toward enhancing the customer experience increase their chances of retaining their customers.

Interactions play a vital role in supporting customer

service and customization. In a global electronic marketplace, the absence of face-to-face meetings requires a firm to seek other means to engage in effective and efficient two-way dialogs with its customers and understand and influence their behaviors. Hence, it behooves a financial services firm to deploy multiple channels of communication that are best aligned to satisfying its customers' communication needs. The results of this study suggest that customer repeat purchases and share of wallet, consequential actions characterizing behavioral loyalty, may be due (in part) to the convenience of interacting with the firm's customer service and collaborating in customization. For customer service, channels supportive of efficient and effective communication will yield greater levels of customer satisfaction, trust and behavioral loyalty, such that the better the customer care experience, the more likely the customer will patronize the business. Similarly, successful customization requires effective interactions, not only through directed dialogs but over a broad range of communications to detect behaviors, such as buying habits, preferences and involvement. Thus, interactions supported through multiple channels tend to enhance the effects of customization on behavioral loyalty.

Multiple channels partially influence the effects loyalty programs and cross-selling has on attitudinal loyalty. Since their inception, loyalty programs have been successful in courting and retaining customers. However, the ubiquitousness of loyalty programs and the selective sophistication of customers have dampened their effect [8]. To reinvigorate their effectiveness, loyalty programs must instill a sense of value-added and leverage their benefits to draw customers toward further commitment with unique, emotional and compelling rewards. Effective interactions between the firm and customers must convey these benefits to create an affective response. Multiple channels appear to enhance the effects loyalty programs by helping customers form positive attitudes toward the firm.

Cross-selling also benefits from multiple channels. Interactions that promote cross-selling will help form attitudinal loyalty. The motivation for cross-selling is three-fold: most customers prefer having a single point of contact for their financial services (Adamson, 2006), the more products a customer holds, the less likely he/she will leave and the more likely he/she will hold higher balances in his/her accounts [27], and while the odds of selling to a new customer are 15 percent, the odds to an existing customer are 50 percent [1]. Therefore, the key to interactions is not only for understanding and satisfying the customer's current needs, but using them to remain vigilant and communicate a sense of responsiveness that appeal to his/her emotional attachment.

In all models, the selected CRM practices in this study accounted for a small portion of the variations. Future studies might examine the effects of other practices, such as database marketing, customer referral, proactive selling and customer segmentation, and the extent to which culture or societal differences affect responses.

Advances in IT and the maturity of e-commerce have benefited financial services and placed them into a global marketplace. Enlisting technology to reach customers worldwide has become a necessary condition to firms. Yet, the same technology that enables firms to solicit customers also enables customers to be more selective and exert their buying power. Thus, firms must carefully focus their CRM applications on activities that underlie the development of both behavioral and attitudinal loyalty, including customer service and customization, and loyalty programs and cross-selling. Of the two, attitudinal loyalty is lasting and more beneficial, but takes more commitment and time to bring to fruition. However, behavioral loyalty will be more applicable to pursuing new or inexperienced customers.

It is important for financial services firms completing in the Internet-enabled global marketplace to recognize the CRM practices that they will benefit from, particularly gaining the long-term loyalty of their customers. In an e-commerce environment where business is conducted remotely and electronically, the methods practiced in face-to-face settings have given way to less personalized, technology-based ones. Thus, knowing how to connect to customers by recognizing the CRM practices with the greatest returns is vital to a firm's longevity.

VI. CONCLUSION

CRM has opened several opportunities for financial service firms competing in global electronic marketplaces. Most importantly, it allows firms to keep track of their customers, establish learning relationships, open channels of communication and engage in meaningful dialogs with their customers. Because e-commerce removes the face-to-face interactions, the challenge for firms is on *electronically* building customer loyalty. The two CRM practices examined in this study, customer service and customization, and loyal programs and cross-selling, are important, although not sufficient for developing behavioral and attitudinal loyalty. The analysis indicates other factors not captured in the survey may have a more significant impact in determining behavioral and attitudinal loyalty. For financial services firms that are engaged in e-commerce and have adopted CRM, emphasizing these practices will help achieve long-term customer loyalty.

Table 1. Direct effects on behavior and attitudinal loyalty

		Model I			Model II		
		<i>Dependent Variable</i>					
		Behavior Loyalty			Attitudinal Loyalty		
		Std. coefficient	t-value	VIF	Std. coefficient	t-value	VIF
<i>Predictors</i>	Customer service and customization	.130	2.00*	1.267	.208	3.34***	1.267
	Loyalty programs and cross-selling	.191	2.88**	1.316	.156	2.45*	1.316
	Multiple channels	.207	3.19**	1.266	.266	4.28***	1.266
	R-square	.168			.238		
	F	16.77***			25.97***		
	n	253			253		
*Significant at p < .05, **Significant at p < .01, ***Significant at p < .001							

Table 2. Moderating effects on behavioral loyalty

		Model III			Model IV		
		<i>Dependent Variable</i>					
		Behavioral Loyalty					
		Std. coefficient	t-value	VIF	Std. coefficient	t-value	VIF
<i>Predictors</i>	Customer service and customization	.184	2.96**	1.151			
	Loyalty programs and cross-selling				.241	3.78***	1.208
	Multiple channels	.257	4.13***	1.153	.234	3.69***	1.197
	Customer service and customization x multiple channels (<i>interaction</i>)	.143	2.46*	1.003	.088	1.51 (<i>n/s</i>)	1.010
	Loyalty programs and cross-selling x multiple channels (<i>interaction</i>)						
	R-square	.161			.162		
	F	15.91***			16.09***		
	n	253			253		
*Significant at p < .05, **Significant at p < .01, ***Significant at p < .001							

Table 3. Moderating effects on attitudinal loyalty

		Model V			Model VI		
		Dependent Variable					
		Attitudinal Loyalty					
		Std. coefficient	t-value	VIF	Std. coefficient	t-value	VIF
Predictors	Customer service and customization	.253	4.23***	1.151			
	Loyalty programs and cross-selling				.232	3.76***	1.208
	Multiple channels	.309	5.16***	1.153	.311	5.06***	1.197
	Customer service and customization x multiple channels (interaction)	.069	1.23 (n/s)	1.003			
	Loyalty programs and cross-selling x multiple channels (interaction)				.108	1.91 (n/s)	1.011
	R-square	.225			.216		
	F	24.05***			22.82***		
	n	253			253		
*Significant at $\alpha < .05$ **Significant at $\alpha < .01$ ***Significant at $\alpha < .001$							

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The Impact of Individual Employee Differences on Information Seeking in Today's Information Rich Work Environment

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Abstract — Recent advancements in information and communication technologies (ICT) such as video conferencing, email, instant messaging, and Intranets have dramatically changed the landscape of communication in most organizations. The objective of this study is to gain an understanding of how different types of organizational members seek information. This is necessary ifor the management to provide the right infrastructure and processes to support such information needs. This study adds to the body of literature on information seeking behavior by incorporating gender, and cultural variables as well as the organizational variables of organizational status (salary or wage) and newcomer status. The findings will help management in assessing what ICT should be installed in order to provide the appropriate support to facilitate information and knowledge dissemination and sharing in organizations.

Keywords — Information seeking behaviors, newcomer behaviors, information and communication technologies, communication quality

I. INTRODUCTION

Recent advancement in information and communication technologies (ICT) such as video conferencing, email, instant messaging, and Intranets has dramatically changed the landscape of communication in most organizations. Organizational members require and seek information about their specific job-related duties, expectations about their roles, values and norms concerning their behavior, and feedback about both job performance and social behavior. As responsibilities and roles within organizations change, and as organizations themselves undergo transformations, information seeking behavior is expected to be of more importance to both the individual, as he or she makes sense of the environment, and the organization, as it attempts to disseminate information to its employees. The quality of a decision depends on the information used to make the decision [1]. Therefore, a thorough understanding of how the organizational members communicate with each other and their information seeking behaviors is necessary in order for the management to provide the right infrastructure

and processes to support such information needs.

A large amount of literature concerning information seeking behavior has developed. While an organizational member's need for information is a widely accepted phenomenon, it has been largely studied in two contexts: during organizational entry and for managerial decision-making. This focus on new employees and managers has virtually excluded a wide range of employees who must actively search for information to help them function in the rapidly changing, information-rich organizations of today.

II. INFORMATION SEEKING BEHAVIOR

Individuals can seek information from a variety of sources, and these sources convey information in a variety of ways [2]. Personal sources of information include peers, direct supervisors, experienced coworkers, other newcomers, superiors other than their direct supervisor, subordinates, support personnel, and individuals external to the organization [3]. Prior research indicates that experienced peers and direct supervisors are the most frequently accessed sources of information [4]. One source of information is the downward-flowing communication from management, generally in the form of official messages. Other non-personal sources include electronic, written, or task-generated information [5, 6]. Employees also often have a large variety of written sources available, including manuals, policies, job descriptions, performance evaluations, bulletin boards (electronic and traditional), etc. While traditionally these sources have been in hard copy, technology has made this material accessible through electronic media.

Information richness [7] posits that in some cases the medium itself provides additional information. If the medium is rich (as is the case in face-to-face or verbal communication) meaning beyond literal meaning can be conveyed through visual cues, body language, and tone of voice. Thus a whispered conversation between coworkers may include more information than the same textual information provided in a company memorandum. The interaction between the parties may engender a warmth or sociability which extends beyond the meaning of the words. This "social presence" [8] can be one of the benefits of personal interaction. On the other hand, non-personal

sources allow the individual to focus on the message and not the context in which the message is offered. Additionally, the message is not filtered through the biases of another [9].

As organizations increasingly adopt new technologies, the information provision options also increase. E-mail, voice mail, document imaging, teleconferencing, electronic bulletin boards, list serves, etc. can all serve as sources of information. As employees adapt to these new technologies, the importance of information richness and social presence may shift. Various studies have been done on variables that influence the effectiveness of information seeking on the Internet. Many of these studies have looked at contextual variables, such as the use of the retrieved information [10]. Still others have looked at demographic variables such as education [11], gender [12, 13], status [14], culture [15], and age [16], and found significant differences in information seeking techniques and their effectiveness while used in searching the Internet. However, the question remains as to how these findings can reveal which factors may impact the effective acquisition of information in the information rich workplace. Ross [15] examined several characteristics of Internet search behavior: the variety of information-seeking goals, the cultural and situational context of search, and the iterative nature of the search task, to suggest ways that interfaces can be redesigned to make searching more effective for users.

III. INFORMATION SEEKING BEHAVIOR MODEL

To develop an understanding of the association between the various individual and contextual factors and the information seeking behaviors, the authors interviewed 13 managers in the Information Systems Department of a large governmental agency. These managers identified three sources of employee information: getting information from passive published sources, such as memos from management and postings on-line message boards; active interactive sources, such as sending a memo to ask a source for the information; and observations, such as watching other employees. Based on the data collected, the authors identified four types of information seeking behaviors instead of the three originally hypothesized. The hypothesized factors of published materials and observation were included in the model. However, the social networking factor actually contains two factors: asking a supervisor, senior coworker, or friend; and asking senior management.

A. Information Seeking Tactics

Although there are a number of ways to examine the specific tactics used to uncover information, a common classification uses seven types of tactics [2, 3]. These tactics include: overt questions [17, 18], indirect questions, third party sources, testing limits in a confrontational manner gaining information directly from reaction to a behavior [19-21], disguising conversations that take the form of jokes or self-disclosure in order to elicit information without asking a question, observation, and surveillance which analyzes the observations

retrospectively [19, 22]. Because our research explores information-seeking behavior of employees at all stages within the organization and at all levels of the organization, we have simplified these tactics into three categories.

B. Demographic Variables

Gender. The workplace of the late 1990's is a very different place for women and minorities than it was in the 1970's and even the 1980's. In the 1970's, female and ethnic minority managers were frequently seen as "tokens" and initial experiences were very different from those of white males [23]. Today's workplace is much more diverse, with more women and minorities represented in the managerial ranks. As women and minorities assume new roles in organizations, their experiences must be reevaluated to determine what is really happening in the today [24].

Traditionally, research in organizational studies has focused on males. The communication literature, however, finds some differences between males and females. One study posits that two communication styles exist: the status (male) style which focuses on tasks and the connect (female) style which focuses on relationships [25]. Other communication differences based on gender have been uncovered. Men have been found to interrupt more and dominate the conversations [26, 27], while women seek confirmation or consensus. Other research, however, by Kacmar and Hochwarter [28], finds no support for gender differences in communication.

Studies on information seeking which have examined the effects of gender have had conflicting results. While Burke and Bolf [6] did find that women rated their immediate supervisor as a less important source of learning than men did, other studies [29, 30] found no significant effects for gender. Recent research has focused on how women specifically seek information on the web [13]. This study examines gender difference in the use of information seeking tactics within the organization.

Language, Ethnicity, and Race. Research investigating the information seeking behavior of individuals based on ethnic groups or race has not been done, although it is generally accepted in the information seeking literature that individuals do differ in their information seeking behavior. The basis for these differences remain uncovered. Studies investigating communication behaviors of minority groups generally have found some differences, although Kacmar and Hochwarter [28] did not find any race effects on communication patterns.

In organizational research, it remains unclear whether all minorities have the same organizational experiences. White women and black men have been the most studied, while the organizational experiences of Hispanics, both male and female, and female blacks have been largely ignored. Teboul [31] points out that very little is known about the different experiences of the various racio-ethnic groups in the United States during organizational encounter, which is itself one of the most widely studied contexts of information seeking behavior. Even less is known about their information seeking behavior as organizational employees, no longer newcomers. Research [32] indicates that women and minorities feel that their

access to information in organizations is less than that of white males.

Consumer behavior research suggests that individuals most often seek sources of information that are similar to them, not only in terms of demographics, but also in values and lifestyles. People tend to communicate with those most like themselves. Thus minority groups in the organization may have reduced access to information if they are unable to interact with those like themselves. They may seek other sources of information.

The role of ethnicity in information seeking is further complicated by the language barrier. Given the rapid increase in the number of Hispanics in the workforce in the United States, the organizational experiences of these individuals are of special interest. Although there does not yet exist an extensive body of research comparing Hispanic and non-Hispanic employees, some research in this area is beginning to appear [33]. It appears logical to propose that individuals tend to seek information from personal sources who share their language. Organizations that include more than one primary spoken language may also include individuals who are using different information seeking behaviors. Information that is filtered through an unfamiliar language may not be interpreted accurately [34].

This research attempts to uncover differences, if they exist, between minorities and others in the organization in terms of their information-seeking behavior. Specifically, the study examined race (black/white), ethnicity (Hispanic/non-Hispanic), and preferred language (English/Spanish).

C. Organizational Factors

Compensation Status. While most research has focused on managers, recent organizational trends have made it even more critical for employees at all levels to have access to information [35]. Total quality management prescribes access to information by employees at all levels of the organization so that they are empowered to make decisions and solve problems. Downsizing has, in many cases, reduced the number of levels of management within the organization; those remaining have a wider sphere of influence and authority. Additionally, the sheer quantity of information available to organizational members, through the implementation of internal and external databases, the increased interconnectedness of organizations, and widespread access to the Internet has resulted in an unprecedented amount of information available to employees at all levels of the organization.

Most of the information seeking behavior research has been conducted with managers, and results indicate that they often prefer information rich sources of information [36]. These sources may be preferred because the managers typically use the information to support decision making and the information needs may be complex and subject to interpretation. A personal source of information, by providing clues beyond the literal meaning of the message, may assist in its interpretation. On the other hand, very few studies focused on non-managerial employees and little is known about their information seeking behavior and how it compares to that of managerial employees. We

included the compensation status variable which was defined as whether an individual was paid on the basis of salary (managerial and professional) or wages (non-managerial) in our model to gain more understanding.

Tenure. Much of the research in information seeking behavior has examined the role of this behavior in the socialization process of new employees [2]. One of the foundations of this study is the belief that information seeking behavior is important throughout an individual's tenure in an organization. A newcomer to the organization could be typified as a novice who becomes more expert as he or she becomes socialized into the organization and the position.

Salterio [37] offered an extensive review of literature on the behavior of experts in information search. He concluded that there are mixed results as to whether experts search for more or less information than novices; his research in a natural decision support environment, however, indicated that the processes employed by the two groups are different. His results indicated that experts take less time than novices to complete an information search, employ fewer steps in research, and examine a different amount of information. If the strategies that new hires use to cope with uncertainty are of interest, then so too should be the strategies that existing employees use, especially given the increasingly uncertain environment most organizations are facing.

Research in the area of information-seeking behavior has been narrowly focused on newcomers and managers. Thus it has largely ignored a wide range of employees who actively search for information to help them function as organizational members. Individuals require information about specific job duties, role expectations, acceptable and valued behavior, and appraisal of both job performance and social behavior. Our research examines employees at all levels of the organization and as both newcomers and non-newcomers at all points of organizational tenure.

D. Outcome Variables

If minorities and women do exhibit different forms of information search behavior, then the organization is interested in how these different behaviors impact some outcome variables. It is possible that the outcomes of their job experiences, such as commitment and satisfaction, may also be affected. Research documents some of the positive effects of gaining information on individuals within organizations [35]. These benefits include commitment, identification, lower rates of absenteeism, and reduced turnover; satisfaction, performance; and levels of effort ([38]. Additionally, Morrison [39] found that information adequacy was negatively correlated with intention to leave the organization. Clearly these are desirable outcomes for organizations.

The socialization literature links uncertainty and the socialization process to certain outcomes, including job satisfaction [40], performance, and turnover [41]. Given that information seeking behavior also reduces uncertainty, it is possible that the information seeking behavior itself may result in some of the same positive outcomes. For the purposes of our research, two outcome variables were

studied: commitment and satisfaction. It is expected that actively seeking information, as opposed to taking a more passive role, will alter the individual's connection to the organization, as measured by commitment and satisfaction with the organization. Based on the above discussion, the research model developed to structure the research focuses on four areas: individual differences, contextual factors, information seeking tactics, and outcomes. Figure 1 presents this research model and the research hypotheses are summarized in Table 1.

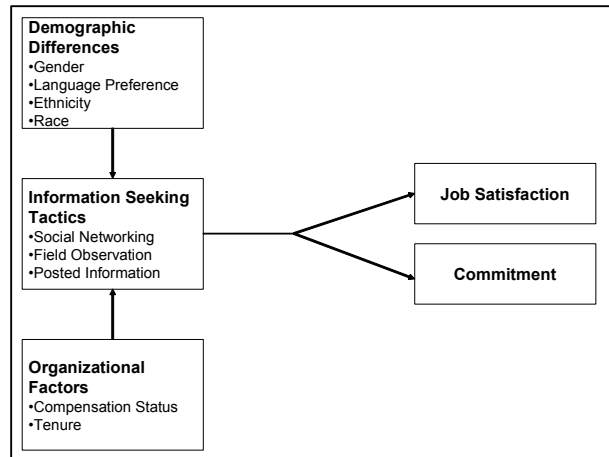


Figure 1 The model of information seeking behaviors.

IV. METHOD

A. Participants

The population of this study consisted of 216 employees in a corporation that is one of the major importers of cut flowers into the United States. The company has been in existence for 24 years, and the current president has been president of the corporation and its subsidiary for nine years. Participation in the study was strongly encouraged for all employees. Of the 216 employees in the organization, 183 participated in the study. Three surveys had to be discarded due to respondent literacy problems. The resulting response rate was 83%.

Respondents included 85 females and 95 men. Approximately 68% ($n = 123$) of the participants were Hispanics, but only 45% ($n = 81$) chose to answer the survey in Spanish. 167 respondents described themselves as Caucasians, while eight said that they were black. Employees were classified as salaried (53) and hourly wage (127). Employees were also classified as newcomers (20) who had been with the company for six months or less and tenured (157) who had been with company for longer than six months.

B. Measures

Employees were given survey consisting of three scales: A modification of Morrison's Information Seeking Scale [39] which were based on Ashford's [42] measure of information seeking behavior, a 20-item version of the Minnesota Satisfaction Questionnaire [43], and Meyer and Allen's [44] measure of commitment. The instrument was

number-coded, and the organization was given access only to anonymous data. Employees were assured that complete confidentiality would be maintained. All of the instruments were originally written in English, but they were back-translated into Spanish [45]. Subjects were given their choice of an English or Spanish version, although they were strongly encouraged to choose the version written in the language in which they believed themselves to be the most proficient.

Table 1
A Summary of the Research Hypotheses

H1: Individuals in organizations will exhibit three types of information seeking behavior: social networking, field observation, published or broadcast materials.
H2: There will be significant differences between males and females in information seeking behaviors.
H3: There will be significant differences between blacks and non-blacks in information seeking behaviors.
H4: There will be significant differences between Hispanics and non-Hispanics in information seeking behaviors.
H5: There will be significant differences between English speakers and Spanish speakers in information seeking behaviors.
H6: There will be no significant differences in the information seeking behavior of salary and wage employees.
H7: Individuals will exhibit different types of information seeking behavior depending on their newcomer status.
H8: Information seeking strategies will be related to satisfaction.
H9: Information seeking strategies will be related to commitment.

V. RESULTS

The factor analysis identified three types of information seeking behavior: Observation, social networking, and posted information. The method of social networking contains two tactics: Asking a supervisor/senior coworker/friend, and asking senior management.

In terms of gender, no significant differences in information seeking behavior were uncovered. In studying information seeking differences between blacks and non-blacks, there was a statistically significant difference on the use of observation and written material. In both cases, blacks used these behaviors more often than non-blacks. This finding is consistent with research that states that individuals tend to communicate with those most like themselves [46]. Because of the small number of blacks in the sample, their use of non-personal sources of information is not surprising. The finding regarding blacks also supports, at least in part, Ibarra's [32] research that

indicates that women and minorities feel that they have less access to information than white males.

Both non-Hispanics and those who preferred English for the questionnaire administration used observation more frequently as an information seeking behavior. Additionally, non-Hispanics rated interaction with top management as a more frequently used behavior. It was expected that in an organization such as this, with a large number of Hispanics who speak Spanish, there would be many opportunities for personal interaction for those individuals that might not be available in organizations with a less diverse population. Additionally, it was not surprising that Hispanics and those who prefer Spanish would utilize a medium with a strong social presence [8], if given a choice. The use of watching others to obtain information by non-Hispanics and English speakers was somewhat surprising. Perhaps this difference is attributable, not so much to their preferences but to the strong preference for interpersonal contact among the Hispanics and Spanish speakers, which may inhibit their use of observation.

Waged employees rated interpersonal contact with supervisors, coworkers, and friends more highly than did salaried employees. While research has confirmed the strong preference of managers for information rich sources [36], this research indicates that the preference may be even stronger for waged employees. More research in this area remains to be done, as our data analysis failed to reveal a model to predict compensation status based on information seeking behavior.

Table 2 Individual Group Preference in Selecting an Information Seeking Method	
Information Seeking Tactics	Preferred by Groups
Social Networking: Seek advice from senior management	Non-Hispanic group
Consult with peers	Waged group Hispanic group,
Observation	Non-Hispanic group Black group English preferred group New comers
Posted information	Black group English preferred group

Newcomers are more likely to watch others than non-newcomers. This is consistent with Morrison's [39] finding that newcomers engage in monitoring more frequently than inquiry and Salterio's [37] conclusions that experts and novices differ in information seeking behavior. These results are not surprising, since newcomers have not yet developed the relationships with coworkers that would allow them to use these behaviors more. They may be hesitant to ask questions of a coworker. Also, perhaps much of the information that is instrumental for a newcomer can be obtained by monitoring. As the individual becomes socialized into the organization, however, he or she may require more information, such as

performance feedback and social feedback that cannot be so easily obtained by observing. The individual group preference of the information seeking tactics is summarized in Table 2.

Both satisfaction and commitment were significantly correlated with seeking posted and written communication; additionally, satisfaction was correlated significantly with observing others. This was a somewhat unexpected result, since it was expected that personal contact would be more closely associated with these outcomes. Several explanations are possible. One is that the individuals who use written communication and satisfaction are more effectively socialized, and thus experience more positive

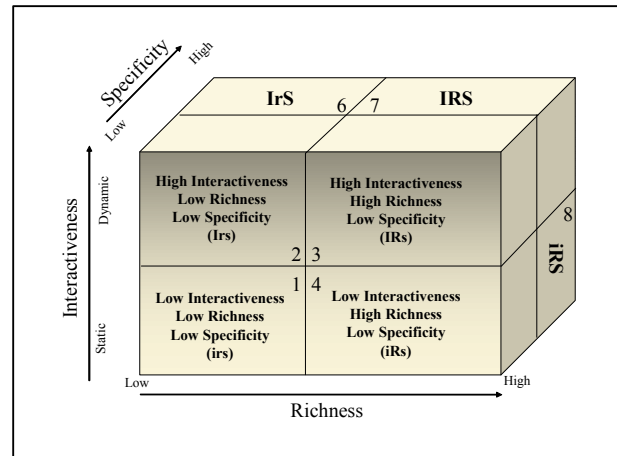


Figure 2 The three underlying dimensions – richness, interactiveness, and specificity - of communication quality.

outcomes [40]. Additionally, it may be that these sources tend to reduce uncertainty more than the personal sources, and thus lead to higher levels of satisfaction and commitment.

Relating the findings for the individual differences in information seeking behavior to the results for the outcome variables, some interesting points can be made. Blacks had significantly higher scores on posted information and observation than non-Blacks. This should lead to higher scores on commitment and satisfaction. However, due to the very small sample size for Blacks, the experiment should be repeated.

VI. COMMUNICATION QUALITY

Wong and Dalmadge [47] suggest that communication medium needs to be studied as a multi-dimensional construct. Three dimensions underlying the construct of communication media quality are identified: (a) The richness of the communication medium (R), (b) degree of interactiveness supported by the communication medium (I), and (c) the ability to support high level of specificity in data representation (S). Wong and Dalmadge [47] define richness to be a function of the multiplicity of information stimuli, temporal criterion of processing such stimuli, and the depth/intensity of the stimuli. Face to face, video conferencing, streaming video, computer conferencing and online/streaming presentations are all examples of very rich communication channels. All of them support visual

information – allowing users to process gestures and body language along with voice and alpha numeric data.

Interactiveness is a measure of the timeliness and degree of association (i.e. one-way, two-way, multiple-way) that a given collaboration method allows for synchronizing data transmission in multi-way communication. The specificity dimension in a collaboration method refers to the capability of allowing the appropriate data representation forms to go through in the communication process. The use of a suitable data representational form is important for capturing the correct aspect and level of abstraction, so that the most critical attributes of the original object, including constraints associated with possible courses of action and time sequence of events [48], can be reserved or replicated. The three dimensions of communication quality are graphically represented in Figure 2.

Table 3 Characterization of Information Seeking Tactics in terms of the Communication Quality Dimensions	
Information Seeking Tactics	Characterized by
Social Networking: Seek advice from senior management	High richness, high interactiveness, and high specificity (IRS)
Consult with peers	High richness, high interactiveness, and low specificity (IRs)
Observation	High richness, low interactiveness, and low specificity (iRs)
Posted information	Low richness, low interactiveness, high specificity (irS)

Based on Wong and Dalmadge's definition [47] for communication quality, the four information seeking tactics can be characterized in terms of the three dimensions that underlie the concept of communication quality. Both of the social networking methods allow a relatively high level of interaction between the inquirers and the parties being consulted. The face-to-face presence during the consultation also allows a high level of richness. However, social networking methods do not necessarily provide information in the right format that support the information needs of the information seekers. In the observation tactic, richness is usually good, while the information seeking is usually one-way, i.e. only the observer is acquiring information. Therefore, the level of interaction is low. Since the observer can acquire only information that is available to be observed, the information so acquired is not necessarily in the right format to fit in the information processing model of the observer. As such, the level of specificity is usually low. While the 'posted material' as an information tactic is relatively low in interactiveness (being one-way information exchange) and richness (lack of face-to-face presence), the tactic has a higher level of specificity because of the available of artifacts (e.g. posted web pages, memos, and posted circulars) to provide a physical

evidence for the existence of the information. The characterization is summarized in Table 3.

Based on the three dimensions of communication quality, Wong and Dalmadge [47] provided a typology that classifies the major enterprise collaboration technologies according to their technical properties. The implication is that organizations should look into the communication needs in their companies, and then develop a communication infrastructure that is capable of providing appropriate communication supports to such needs [49]. The ranking of the collaboration technologies is summarized in Table 4.

Table 4 The Relative Communication Quality of Major Enterprise Collaboration Technologies			
Collaboration methods	Communication Qty Dimensions		
	R	I	S
Fax	L	L	H
Written Document (wrtDoc)	L	L	H
File Transfer (FileTran)	H	H	H
Web Pages (html)	H	H	H
Shared Database (SharedDB)	L	H	H
email	L	H	L
Instant Message (instMsg)	L	H	L
White Board (whiteboard)	L	H	L
Electronic Meeting Systems (EMS)	H	H	H
Document Conferencing (docConf)	H	H	H
Shared Document (shareDoc)	H	L	H
Video Conferencing (videoConf)	H	H	L
Tele-Conferencing (teleConf)	H	H	L
Telephone (teleCall)	H	H	L
Face-to-Face (face2face)	H	H	L
Computer Conference (CompuConf)	H	H	H
Information Sharing (infoSharing)	H	L	H
Video Streaming (streamVideo)	H	L	L
Audio Streaming (streamAudio)	H	L	L
Presentation Streaming (streamPresentation)	H	L	H
Smart-room (smartRoom)	H	H	H
Legend: H = 'High', L = 'Low'			

The current study has allowed us to determine which information seeking tactics would be preferred by the different classifications of employees. By determining the communication quality dimensions for each of these tactics, an employer could match the corresponding dimensions to the collaboration methods in Table 4. Thereby, determining which would be the best technologies to use to get the information disseminated to a given classification of employees. For example, *newcomers* tend to prefer to gather information through *observation* which is high in richness, but low in interactiveness and specificity. Based on the Wong and Dalmadge (47) typology, the organization could use video streaming or audio streaming to effectively reach these employees.

VII. MANAGERIAL IMPLICATIONS

The result of our analysis has important implications to the management. First, the positive correlation between the use of the non-social networking information seeking tactics and outcome variables suggests that the organization should not necessarily provide more published forms of information in communication, but instead ensure that employees are using the posted material already provided. An over proliferation of published material may in fact increase uncertainty rather than reducing it. In some cases, the published material may need to be revised and restructured to ensure suitability. Management should focus on providing a good structure for laying out the various information and documents on the intranets to facilitate their search and sharing among employees. Management also needs to study if the posted information and documents are published in a suitable form and language. The objective is to encourage more users from the different groups to increase the use of post material as an information seeking tactics.

Second, the study reveals that satisfaction may also be increased if individuals have the opportunity to observe others. However, observation may not always be an available training option for employees due to various constraints. Management should consider making training video available on the intranet for the important tasks. Employees who need to make observations as a knowledge acquisition method may have an alternative.

Third, as we have discussed in the previous paragraphs, management should provide to the different groups of employees the appropriate collaboration and communication technologies and tools to support their preferred mode of information seeking.

In addition, Ross [15] examined several characteristics of Internet search behavior: the variety of information-seeking goals, the cultural and situational context of search, and the iterative nature of the search task, to suggest ways that interfaces can be redesigned to make searching more effective for users. It is possible that by better understanding how different groups within the work environment are more comfortable with retrieving information, we can better design interfaces that will make the necessary information more accessible to these stakeholders, thus establishing a more efficient work process.

VIII. CONCLUSION

The limitations of this research include the confinement of the study to one organization. The results may not be generalizable to others and the study should be replicated. Additionally, the number of blacks included in the study was very small. While the organization provided an excellent opportunity to examine the information seeking behavior of Hispanics, a higher proportion of blacks would allow a more thorough examination of differences based on race. Another limitation to the study is that the information seeking behaviors were self-reported. Additionally, while results were obtained with satisfaction and commitment, other outcome variables which have been linked to

information, such as performance and turnover rates should be examined.

To conclude, this study indicates that differences in information seeking behavior can be found among different races and ethnic groups. Employees other than managers and newcomers engage in information seeking behavior, although their behavior differs from that of managers and newcomers. How individuals within organizations seek information can result in increased satisfaction and commitment. If additional research extends and refines these findings, organizations should examine more closely the information preferences of their own employees and provide opportunities for them to obtain information in ways that will increase their organizational commitment to and job satisfaction.

Moreover, managers are responsible to plan and acquire information and communication technologies to support proper functioning of work groups and coordination of business processes. Since the technical properties of an information and communication technology determine the quality of communication it can support; therefore, it is managers' responsibility to make sure the collaboration technologies are properly matched with the needs of the various work groups and processes.

This study adds to the body of literature on information seeking behavior by incorporating gender, ethnic variables, and race as well as the organizational variables of compensation status (i.e. salaried vs. waged) and newcomer status (i.e. the tenure variable). Additionally, it measures the effect of information seeking behaviors on the outcome variables of satisfaction and commitment. The results provide evidence that there are differences in information seeking behavior among the various groups studied and that some information seeking behaviors are correlated with satisfaction and commitment.

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The Impact of Technovation and Collaboration on Strategic Service Classification in the Digital Economy

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Abstract — Service organizations increasingly organize themselves and operate on a value chain level. This creates important challenges and opportunities, which call for a realignment of strategic focuses, in particular with respect to the impact of technovation on service creation and services *modus operandi*, their resulting service classification, and the restructuring amongst different service value chain industries. This research builds on a recently developed classification scheme, referred to as the Services Cubicle, that transcends current industry boundaries and includes upcoming service business trends in technovation. The paper subsequently illustrates a variety of service industry examples in order to clarify the resulting service classifications, taking into account deployment of varying degrees of technovation in that industry.

Keywords — service classification / taxonomy, services value chain, technovation, collaboration, digital economy

I. INTRODUCTION

In today's service economy, innovations in technology and integration with computers and telecommunications are viewed not only as a powerful facilitating mechanism for service organizational growth, but in fact are a driver creating new service markets, transforming industries and seen as enablers for transforming the nature, content, context and scope of the service offerings.

Technovation in this context refers to innovation and creativity with or without the application of IT, e-commerce, telecommunications and information management, in conjunction with process, knowledge and relationship management; all of which are required in designing and managing a more effective and efficient service delivery channel in a fuzzy organizational setup. Recently [63] has emphasised the need for collaborative relationships with stakeholders as an important factor affecting innovation performance and productivity. In support of the above, [40] in particular, has examined knowledge creation activities of service firms and has found that collective knowledge mobilization and the sourcing of external knowledge from stakeholders is found

to be more conducive to new service introductions and innovation success.

Due to increased proliferation of technological and IT advancements and the key role organizational behaviours and innovation have in gaining competitive advantage, researchers are starting to focus on the combined effects of these environmental, technological and service-specific attributes on the service industry. In response to these dynamics and to realise benefits from these multitude of factors, a number of industries such as the telecommunications, IT industry, law firms, restaurants and airlines are already moving away from traditional organizational structures. They are seen to be adopting clusters, value nets, value chains and holonic structures with fuzzy boundaries in a virtual or physical sense as evident in [65] [66] [58] [59] [50] [60] [84] [85] [86] and [41].

Moreover, many of today's services are increasingly market driven and are designed and delivered on a supply chain/value chain level (ie mobile services), hence include complexities of strategic alignment, value creation and positioning, asset definition and management, and the like.

The dynamic changes in organizational structures and the advent of technological advances in the services industry have broadened Schmenner's [69] conceptual service classification as shown in [1]. In there, the authors have examined the combined effect of technovation in a collaborating setting with service-specific attributes on service classification, resulting in a three-dimensional "Services Cubicle" taxonomy. A third dimension, titled "degree of technovation" (innovation, technological management, delivery channels and organizational structures), is added which, along with the "degree of relative throughput" (measured for a service transaction as compared to others in the industry) and "degree of variation" (customization for and interaction with customers), provides flexible and dynamic ways of classifying services in ways that transcend current industry boundaries, and one which addresses upcoming service business trends that deploy technology and e-commerce.

This research builds on the various dimensions underlying the development of this ever-changing service taxonomy, and focuses in particular on specific industry examples targeting the four quadrants of Schmenner's [69]

framework. It illustrates the applicability of the new classification scheme for service organizations, providing service organizations with a management tool which will assist managers to position, align, assess and validate the impact of their changing service offerings.

II. LITERATURE REVIEW

To-date services are categorised as pure services, or within the context of products viewed as bundles of physical goods and services, with service classifications made from various standpoints to enhance strategic thinking in services as shown by several researchers [34] [67] [68] [80] [14] [74] [75] [35] [10] [32] [31] [13] [22] [14] [79] [54] [16] [17] [18] [11] [19] [52] [76] [43] [44] [45] [53] [24] [39] [37] [48] [83] [6] [81] and [49].

At the same time of the development of service classification schemes, we witnessed the need to define service delivery processes from an operations and management perspective. In this context while the number of contributions are too numerous to elaborate on individually we list the contributions of several researchers [36] [20] [64] and [81]. Of particular interest is the work by Schmenner [69], who improved upon his own SPM framework [72], whilst applying the principles of the Theory of Swift, Even Flow [70] and [71] by retitling the axes of the SPM to degree of relative throughput (measured for a service transaction as compared to others in the industry) and degree of variation (customization for and interaction with customers) respectively. As this research provides the building block for development of the service cubicle classification, it will be further discussed below.

Schmenner's [72] SPM framework was subjected to a number of criticisms, i.e. interaction and customisation may not necessarily act in one direction [30]; straight-forward direction of causation from service encounter to service process choice [20]; capital-labour ratio not seen as the driver of a service classification with control of internal operations, and lack of theoretical evidence for the importance of the productivity diagonal [81] [76] and [36]. In response to these criticisms, Schmenner modified his 1986 framework using The Theory of Swift, Even Flow [70] and [71] resulting in a revised SPM [69]. He applies the Theory of Swift, Even Flow and states that the swifter and more even flow of information in service operations, the higher the productivity. The challenge therefore becomes to hunt for bottlenecks within the service production system, and making sure that throughput, in the form of customers or employees lacking knowledge, information, or instructions, does not accumulate. Schmenner's revised 2004 SPM framework redefines the axes of the service process matrix as degree of variation (customisation for and interaction with customers) and relative throughput (measured for a service transaction as compared to others in the industry) with the lure of the diagonal resulting in greater productivity.

To reaffirm the authors thinking in developing a service taxonomy using technovation and collaboration, [78] recently demonstrated in his empirical study how innovation by service firms differs from innovation in manufacturing, and argues that the currently dominant conceptual framework and empirical approaches need to be broadened to adequately capture innovation in services. Further, [78] points out that innovation in services brings to the floor "softer" aspects of innovation, based on the skill-set and inter-organizational norms, thus allowing for an innovation orientation towards "organizational changes", besides new innovation products and new production processes. Furthermore, a recent empirical study by [40] using survey data of 167 Finnish knowledge-intensive firms, examines collaborative knowledge creation activities in service firms. In here, it is empirically evident that collective application of knowledge more likely leads to significant improvement in services than individual application of knowledge and secondly, that external sourcing of knowledge from customers and competitors is more conducive to new service introductions than incremental learning on the job. As evident, the driving force behind these changes is the innovativeness of individuals, the business organizations and the innovation system [82], the distribution of knowledge across organizations [7], the "learning economy" [47] and "national systems of innovation" [46] [56] and [26]. As such innovation in services is largely dependent on adopting externally developed technologies that facilitate new service provision and/or enhance service productivity [62] and [77], resulting in scientific and technological breakthroughs in networks [12].

Further, a firm's recognition and requirement to collaborate formally or informally [25] and [63] in boosting significantly the innovation output and competitiveness of firms is seen in a diverse range of service industry settings [5] [23] and [9]. Also, [63] provides evidence for maintaining collaborative relationships with stakeholders as important factors affecting innovation performance and productivity.

Whilst limited evidence of innovation and knowledge management in services, or across service value chain or networks exists, empirical evidence in the context of collaborative organisational structures in the Supply Chain Management area related to manufacturing industries has started to surface [8] [42] [21] [57] and [61]. As for the service industry, lack of empirical evidence and the urge for greater productivity, and the multi-dimensional functional, structural, operational and organizational aspects of the service industry require further investigation. In this context, the authors will elaborate the impact of technovation on the service creation, strategy, operations and value creation of traditional and collaborative service organisational structures through development of an enhanced services classification, with illustrations across a number of service industries previously classified under Schmenner's latest framework [69].

III. SERVICES CLASSIFICATION AND THE SERVICES CUBICLE

As can be seen from the works of several researchers, in particular the ones highlighting the importance of service classifications [28] [29] [17] [36] [69] [70] [72] and [81], service classifications have been, and are important, for several reasons:

- allows service firms to gain strategic insights based on their position in the matrix and to investigate the strategic changes of service marketing and operations over time
- sheds light on the managerial challenges and presents new ways to manage them,
- leads to enhanced understanding of productivity and value creation for service operations and marketing,
- develops understanding of customer encounters and association with service delivery mechanisms,
- provides insight and rationale into service companies accepting change when and why, and finally helps to explain trends on how some leading service companies have been able to sustain their competitive positions for decades and are evolving at a pace faster than the overall economy in order to survive in the future,
- provide Managers with a structural management tool set which educates and guides them in addressing the challenges of the dynamic service industry.

Recently, [1] posited a number of key questions that are critical to service firms in evaluating the potential for success and repositioning their organisational strategies:

- Should the service classification be directed at just internal operations, on a customer-supplier one-to-one relationship basis, or should it be derived based on internal and external operations which affect the service offering, hence striking an optimal balance for information sharing amongst key players at inter- and intra-organisational level?
- Should the service continue to be purely based on technical characteristics of the delivery medium, service-specific attributes, customer focus or throughput time, or a combination of these attributes as they have been done to-date? In fact, in addition to the earlier listed characteristics, should the service classification analysis include more complex factors of technovation, service channels and organisational structures?
- Is the impact of information, technology, knowledge, relationship and overall processes known, understood, and considered feasible in the context of a global service offering with a global service delivery process?
- As alliances and collaborations are formed among stakeholders, how does the core firm strategically package its services and reposition itself amidst other stakeholders and the industry overall, such that the resulting service offering fulfils market segment specific customer expectations?

- Do firms have the ability to assess their strategic position in the global market with respect to relative cost efficiency, productivity, value adding, profitability, and above all customer satisfaction, in relation to other existing services or equivalent service offerings, as to facilitate the analysis of make-or-buy decisions?

The diversity of the service sector, its globalisation, changing business processes, rapid influx and use of web enabled services, along with the inception of service value-chain management concepts demand a new service management paradigm. In light of the deployment of e-commerce, service industries are transforming radically the manner in which firms operate within a context of globalisation and service delivery mechanisms, thereby creating new service industry and market opportunities, with ongoing progression and dynamic ways of converting tangibles to intangibles (and vice versa) along a specific industry service value chain. For example, with the advent of broadband and internet, there is major competition amongst various industry players – TV, telephone service providers and internet, popularly known as the Triple Play. As a consequence, companies like Telstra Corporation in Australia and SBC in USA, both prime providers of telecommunication services, are lately positioning themselves with new generation service packages including services such as video-on-demand, and example that will be elaborated on later in greater detail.

Recently [1] developed a new theoretical services classification scheme, based on [69] framework, by introducing a third dimension to classify services in ways that transcend current industry boundaries, and which addresses upcoming service business trends that deploy technology and e-commerce.

In [72] the movement of services from Professional Services to Service Factory along the productivity diagonal is due to the use of technology, innovation and standardisation in processes, caused by the relative split of front-end and back-end functions, but all in the context of internal firm service operations. Innovation and technological change are without doubt the main drivers of economic growth at organisational, sector and economy-wide levels, which means technovation is the basis for future economic growth. A strong and well-developed innovation system and culture will underpin economic growth and social well being.

It is to be noted that the use of technology and e-commerce in the earlier 2X2 matrix of [72] refers to internal operations, and is distinct from the usage in the context of inter- and intra-organization structures. Our social infrastructures

and inherent knowledge experiences play a vital role in relationship and information management in facilitating service encounter design and service delivery across value networks. Hence, this new dimension “degree of technovation” is a key element of a service business process and is pivotal in the new service classification scheme. In

response to these dynamics, traditional organizational structures are adopting clusters, value nets, value chains and holonic structures with fuzzy boundaries in a virtual or physical sense, which leads to the definition of collaboration. Collaboration as defined by [2] means establishment of inter-weaved and loosely-coupled multi-directional service relationships, belonging to the same or different industry value chains, whilst leaving room for firms to manoeuvre, enter and exit alliances or networks, in the quest for identifying value propositions.

In the three dimensional Service Cubicle framework, [1] have introduced the degree of technovation (technovation and collaboration) as a third dimension, comprising the use of technology and e-commerce, along with new organisation structures as a result of collaboration (from loosely coupled alliances across multiple industries, to partnering, virtual network consortia etc.) in conjunction with degree of relative throughput (measured for a service transaction as compared to others in the industry) and degree of variation (customisation for and interaction with customers). For the purpose of this theoretical construct the joint measure of degree of technovation has a high value when a service displays both a high technovation and a high degree of collaboration. Similarly, when both individual measures are low, the joint measure of degree of technovation has a low value. In a situation when a mix of high technovation and low collaboration (or vice versa) exists, the joint measure of degree of technovation falls somewhere in between the two extremes. Naturally, not all services will cluster neatly around the productivity diagonal; nevertheless the grading will be helpful in classifying a whole host of diverse services across this 3-3 matrix.

The Service Cubicle framework [1] is illustrated in Figure 1 with Service Factory (SF), Service Shop (SS), Mass Service (MS) and Professional Service (PS), with the Degree of Technovation being assigned the scale from Low to High.

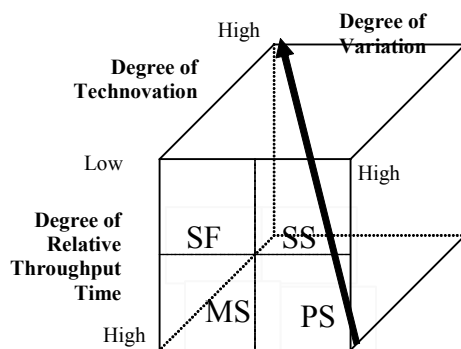


Figure 1 : The Service Cubicle Framework

IV. INDUSTRY EXAMPLES OF THE SERVICES CUBICLE CLASSIFICATION

Using some of the industry examples which Schmenner [72] and [69] referred to in his previous models, our focus identifies proposed shifts and impact of the degree of technovation in today's service developments. Similarly to Schmenner's [69] 2-dimensional service process matrix, the cubical diagonal of the 3-dimensional matrix brings attention to distinctions that have revolutionized delivery of services and may hence show the path to increased productivity, but not necessarily to profitability. If there is any relationship to profitability, it may be purely due to an increase in productivity. This is still to be established in future empirical validation of both classification schemes.

We now turn to a detailed discussion of this service classification with relevant service industry examples belonging to each of the four quadrants of the framework, as originally presented by Schmenner.

A. Industry Example 1: Telecommunications Industry and Film/Television/Video-CD Industry

The traditional telecommunications industry faces a threat to its traditional voice services, with cable companies like Cox in the U.S. offering phone call and high-speed internet access over its cable in competition with local phone companies. Further, with the advent of broadband and internet, there is major competition amongst various industry players – Television, telephone service providers, and internet, popularly known as the Triple Play. Regulatory requirements for phone and cable services are different in different countries, eg. in Australia, Telstra Corporation who owns half the cable, and SBC, a phone company in the USA which owns no cable, while both are prime providers of telecommunication services. In response to competition generated by different value chain services, cable providers and power companies providing broadband services at TV channel speeds are lately positioning themselves with new generation service packages, including services such as video-on-demand.

Video-on-demand services affect the service value chains of several industries, grouped as telecommunications (telephony, internet broadband access and Television), and multimedia (Television/film industry, sports and entertainment, and retail purchase/rental of DVD), respectively. This example is unique in the sense that two major industry chains, offering a multitude of service offerings via different channels while meeting different market segments, are affected as a result of technovation. This is further elaborated on below in how the two separate and diverse industries are affected, and how technology innovation creates opportunity for new markets and new channels with new service delivery methods, which eventually results in an elevated win-win value proposition for all partners involved.

Several telecommunication service providers are taking a lead and provide video-on-demand services packaged as part of their traditional telephony and internet services, which cover a range of sports, entertainment and film related services. On the other hand, companies, like Cox in the USA, represent pure cable services providers that are packaging their core broadband internet services with telephony, and video-on-demand services. Benefits are greatly realised by the film industry from a pirating perspective, traditional telecommunication and cable service providers from the perspective of ancillary services which are slowly becoming core of the operations, and end customer with a unique service experience (the value add) whilst at home. Further, through the use of CISCO consumer electronic devices that sit beneath televisions and receive wireless signals from broadband connected computers, the downloading of pay movies and reproduction of internet content on other TV screens around the home, will be readily available. This provides the home theatre viewers with an innovative means of fulfilling the home experience within flexible and accessible reach. These new service offerings are indeed feasible only because of technovation, due to the partnering and collaboration among stakeholders of different value chains, resulting in alteration of service value chains, transformation of complete organization structures, or resulting in some form of networked collaboration.

However, this downloading of movies may pose a threat to the operations of several other service industries - CD/Video shops, movie theatres, and multimedia/film entertainment; unless innovation provides a difference in experience that appeal to customers. In a similar vein, if films were to be released directly to the internet on a pay per view system at some point in time after the release of the film, it may prevent the illicit pirating which then in turn benefits the film industry. Another school of thought suggests that internet awareness for a particular movie may more than offset the negative side effect of pirating resulting in growth for the industry. Irrespective, the film industry needs to find ways to capture this lost market or take advantage of the growth in the market – encoding films such that they could not be saved, or watched once only so that there is a market for DVD when purchased later, and the likes.

As we all know, traditionally two decades ago, the notion of movie theatres becoming obsolete was raised when video renting became popular. For an increasing number of people, going to the cinema was an outdated notion, especially when it is more comfortable to stay home and watch a film in your own private home theatre. But the creation of movieplex-facilities proved to be a huge success, creating a social “night out” experience, rather than a pure movie experience. In a similar vein, as people are becoming more and more comfortable watching movies in their own home theatres at a cheap price with access round the clock, the movie theatre business needs to provide a difference in experience in order to survive and

remain competitive. An experience that concatenates the sensory and physical real-time Disneyland experience with the 3-d IMAX theatre visual impacts, may be an example of the next wave of new customer experiences in this regard.

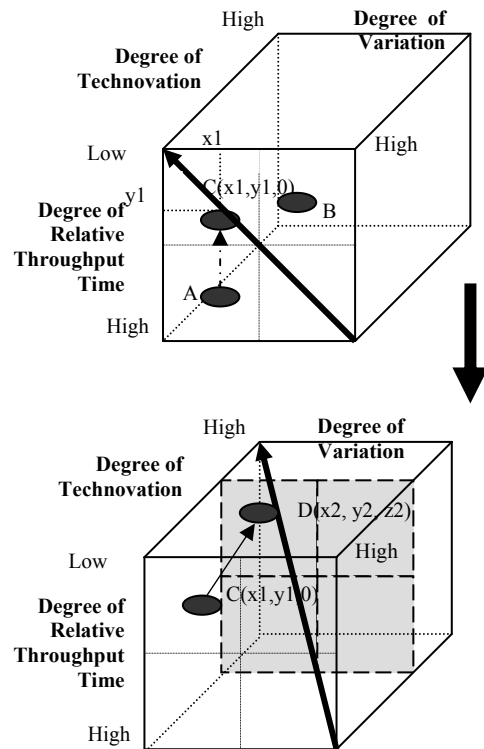


Figure 2 : The Service Cubicle Framework as applied to Telecommunications services

Whilst these developments are purely based on technological developments, the different players in the industry must strategically position themselves whilst working collaboratively, and must redesign service offerings to meet different market segments accordingly. According to [69] and referring to Figure 2, back-of the house operations of telephone services (network connection design and operations etc.) would be classified under Mass Services at A, while front-end activities (ordering etc.) would be classified as a Service Shop seen at B. However, due to technology advancements in the telephone infrastructure and operational management systems, telephone services and features (calling line display, call waiting etc.) under [39] have re-classified telephony services as a Service Factory shown at C($x_1, y_1, 0$). Technovation, in broadband internet in particular, has impacted several industry value chains, some favourably and some adversely. Based on the new proposed framework, this new service-offering proposition as discussed above is placed at D(x_2, y_2, z_2) in a 3X3 ‘service cubicle’ framework, with the new service offering placed at the high end of the degree of technovation, relatively reduced degree of relative throughput and degree of variation such that $x_2 \leq x_1$, $y_2 \leq y_1$ and $z_2 > 0$ as shown in Figure 2.

B. Industry Example 2: Retail Banking Industry

Banking is a service industry that continues to be changed by trends such as deregulation and advances in technology. With the introduction of ATM's in the late 1960's, bank customers were able to draw cash twenty four hours a day and could do functions such as dispense cash, accept deposits, transfer funds, and provide information on account balances. In the process, banks have already formed co-operations, as well as nationwide and global networks, that enable a customer of one bank to use an ATM of another for cash access worldwide. Although ATM's are a mature technology and its wider application is a proven example of technovation and partnering, as well as a proven delivery channel for banks, internet e-commerce applications have further changed the way people do their banking thus impacting the operations of this industry. Customers can now manage and access account information and transfers, online bill payment, and financial investment services via e-banking and bpay. Since the turn of the century, the adoption of e-banking has greatly increased, with twenty percent of people with internet access now using online banking facilities [27]. The result is less human contact and more self-service with increased standardization, thus improving productivity. Further, [51] point out that it has been very difficult to get mature customers accept ATM and internet banking that cover the entire suite of regular banking services. Yet the fear of security breaches has been a major issue, and banks have tried to respond by emphasizing the benefits of ATM at the teller line, while increasing security measures for internet-based transactions as technology advances [73].

Schmenner [69] classifies retail banking with ATM banking included at F as a "Service Factory" in Figure 3, as opposed to "Mass Services" as shown at E in Schmenner [72] framework for reasons explained in there.

Although ATM is a result of technology development, yet is a completely different delivery channel for delivering retail banking and to-date has been successfully deployed, the authors believe that this service should have been deployed in a frame other than $z=0$, ie. $Z_3>0$ say as positioned at $G(x_3, y_3, z_3)$. It appears that under the frame $z=0$, lower throughput times and/or less variation was achieved as a result of the banking operations that had changed overtime resulting in greater productivity. Hence, the transition should have been from Mass Service to Service Factory ie. E to G, with improvements in productivity and further complemented with technology initiated value-add benefits by the use of ATM, Credit Cards, and internet banking. This in turn results in global access (for frames $z>0$) where technology has not only transformed the design of the service itself, but has changed the operations that delivers this retail banking service to its customers via different delivery channels. This development clearly highlights the role of technology, collaborative inter and intra working of banks and other organisations, existence of several delivery channels right

from plain old days of pass-books, cheque books to bpay options, credit card facility, ATM, and internet banking with withdrawal, deposit and transfer options from anywhere in the world at a flash. Not only has the transition resulted in improved productivity and efficiency of organisations, in fact has given bank customers full management control of their finances which has resulted in greater customer satisfaction. Several flexible delivery options exist, from the most primitive to the most advanced, with each delivery option having its own pros and cons, however it is the management of these options that poses challenges to the owners' of this industry. Under this new schema, it would be appropriate to position retail banking within the Service Factory cubicle, with $z>0$, such that it has a low to medium technovation and low to medium collaboration, resulting in placing this service offerings at G ($z_4>0, x_4\leq x_3, y_4\leq y_3$).

With technology expected to further advance, further benefits could potentially be realised with the use of voice recognition technology (VRT) in the area of retail banking, which recognises individual signature traits in the voice (rather than the words themselves), and has now advanced to such a stage as to be a reliable way of identifying a person. This technology would be especially useful as a way of uniquely identifying customers using ATM's, negating the need to carry cards or memorise pin numbers. This VRT associated banking technique could be used to improve the banking service value chain by making it unnecessary to carry bankcards, banks not required issuing them, and the like. Further, the same VRT banking technique could also be used to legally identify ones self while engaged in internet banking from anywhere in the world, thereby abolishing time and spatial differences. Banks are now partnering with telecommunications service providers to trial out these banking service delivery channels, which will lead to further partnering across industries as shown at H, and will affect the banking value chain industry with the VRT ATM/internet banking etc being repositioned at H (x_5, y_5, z_5) such that $x_5\leq x_4, y_5\leq y_4$ with $z_5\leq z_4$ and $z_5>0$ which positions this service offering with high technovation and high collaboration, resulting in higher degree of technovation.

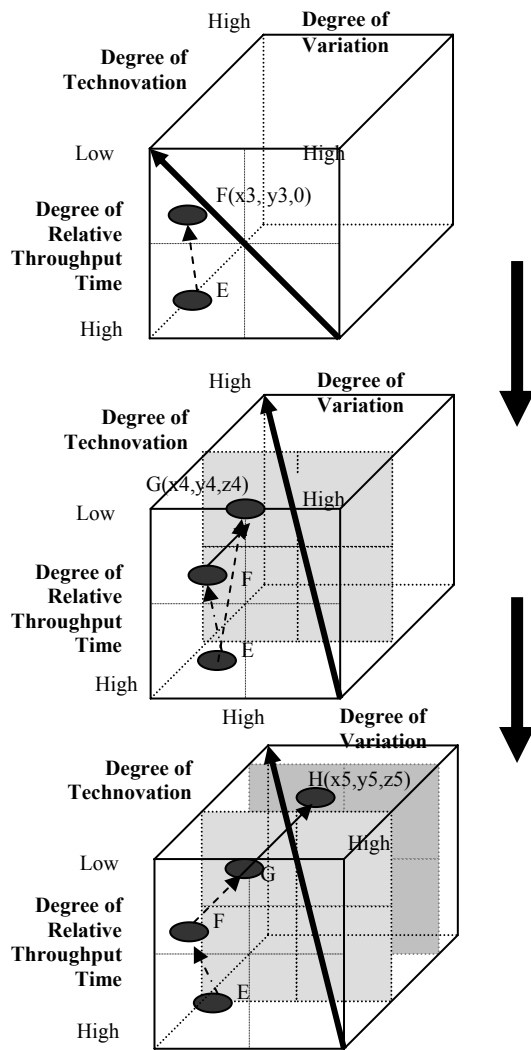


Figure 3 : The Service Cubicle Framework as applied to the Banking Retail Industry

C. Industry Example 3: Medical/Health Industry

Schmenner [69] argued that hospitals originally were a Service Shop placed at I which over time, due to innovations, had a trend to convert to for-profit hospitals as shown at K, with reduced customer interaction, customization, and relatively reduced labour intensity. However, [91] draw attention to both growing user/customer dissatisfaction with mass production to individual problems, and the growing power of users to find their information on the web, leading to user/patient having greater control and ability to query their treatment. This indeed poses challenges to the medical industry and hence, in an effort to improve healthcare delivery, globalisation and advancements in technology enable a delivery shift from highly concentrated performance locations (eg. Hospitals) to virtual delivery environments such as telecare/telemedicine [15] which allow for delivery of healthcare to remote patients and facilitating information exchange between generalists and specialists. The primary

contribution is the importance of the [4] presents evidence for telemedicine technologies which can be traced to the pre-electronic era, addresses the need to address unfulfilled necessities in terms of medical services using telemedicine technologies with user involvement as a growing feature, more in the context of healthcare systems for organisations, nations and worldwide organisations [87] [55] [15] [4] and [33]. Further, [4] presents an internet-based telemedicine environment specifically tailored for Nigeria, which fulfils its government's aim of bringing useful healthcare to rural and outlying areas.

As an example, with the aid of mobile and wireless technology, Telemedicine kiosks trial processes that support emergency health care. A consortium drawn from 10 countries – the USA, Britain, Australia, Japan, Korea, India, Indonesia, Bhutan, Greece and France, has been developing these kiosks. [71] highlighted that nations where groups of companies routinely pursued “swift, even flow”, should industrialise more quickly, and to a greater extent, than those nations whose companies did not pursue swift, even flow in their processes. If this is true, then medical facilities in developing countries need to move within an alliance structure where researchers, doctors, and institutions are all collaborating. The resulting value add is the provision of such services as mentioned above, made possible by new technology applications and the creation of new service delivery channels through collaborating consortia of industry partners.

One can easily envision the progression of such services beyond emergency services, to include more advanced applications such as heart scans and medical diagnostics made available to places where these services are currently non-existent. E-health systems exhibit a range of applications, including emergency telemedicine, epidemic control, and combating bioterrorism, all which can be worked towards. While these solutions certainly have promises, there are a number of challenges and implementation issues which require attention, the key one being organisation and cultural inertia across nations and organisations, security and privacy, as well as the exploitation of technology and information systems in an informed manner. The value-add of these type of service offerings is self-evident, and will result in a shift in productivity for under- developed market segments as shown in Fig 4, in an attempt to establish a medical system which can enhance citizen's equality in the availability of medical facilities. Hence, at this stage, it would be appropriate to position traditional medical/hospital industry still within the Service Shop quadrant at K(x_7, y_7, z_7), with telemedicine moving towards a Service Factory at L (x_8, y_8, z_8), such that it has a medium technovation and low collaboration, resulting in placing this service offerings at L such that $z_8 \Rightarrow z_7 \Rightarrow 0$, $x_8 \leq x_7 \leq x_6$, $y_8 \leq y_7 \leq y_6$.

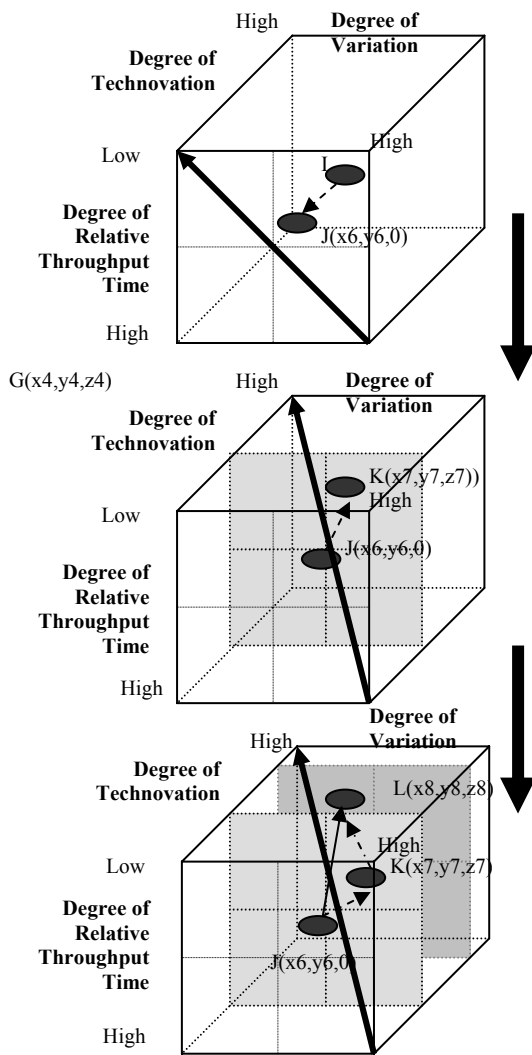


Figure 4 : The Service Cubicle Framework as applied to the Medical/Health Value Chain

D. Industry Example 4: Professional Services Industry

Under the old SPM framework Schmenner [72] classified professional services provided by architects, consultants, doctors, tax accountants, lawyers and other professional's lies within the Professional Services quadrant. However, Schmenner [69] in his revised framework placed the traditional tax accountants still at the same place, where the customization and interaction (variation) was great and the relative throughput time (order-to-delivery) was high at $M(x_9, y_9, 0)$. In contrast, Schmenner positioned firms such as H&R Block (new business organisational structures), which are more focussed on individual tax returns etc and require less customization, interaction and relative throughput times, in the Service Factory quadrant at $N(x_{10}, y_{10}, 0)$. This is illustrated in Figure 5.

Since the beginning of the office-technology boom of the 1980's, in a similar vein lawyers have been accused of being fearful and reluctant to adopt modern technology, and

have often been compared unfavorably in this regard to accountants and even doctors. In particular, focusing on the legal professional services, a more objective view of lawyers demonstrates that they adopt effective technology with enthusiasm when the tools are appropriate for the professional tasks they face. However, over time the mere introduction of paralegal staff for supporting the back-end office activities demonstrates the ability of lawyers to change and focus on their distinct and core activities, even though reluctantly, thereby placed in the Service Factory-quadrant by Schmenner [69] at N.

In an era of technological advancements and internet, most law firms are experiencing dramatic changes and are forced to evaluate the way in which they will conduct business with their clients with particular emphasis on productivity of legal staff, cost control and operational efficiency. As clients demand new services and immediate access to attorneys and information, at all times of the day from anywhere, law firms have started to realise the potential of deploying integrated knowledge management systems in an urge to put a new focus on high-value service delivery rather than on billable, hour-based matters. Legal market regulation in the UK is on the way to significant liberalization, which possibly may affect the development of online legal services. [90] reports that the British government will move to adopt the Clementi Commission recommendation that "will allow outside investors to own law firms and other professionals to form partnerships with solicitors". Through the use of information technology, [38] presents links between knowledge sharing attitudes, reward attitudes and use of IT and demonstrate how stimulating knowledge sharing, storage and dissemination of information and providing tools and rewards are important

Against this backdrop, law firms are now seeking innovative solutions and technology applications, in conjunction with new ways to lift barriers to collaboration, including outsourcing and off shoring some of their non-core legal activities. Whilst the effective implementation and roll-out of these knowledge based systems may take time, it is evident that functions such as automated document management, legal research, self-service research tools, query databases, portals, data mining, practice management and transactional systems will form the strategic asset of the adaptable and multiservice legal firms. CISCO's untethered Intelligent Information System [88] and LexisNexis Total Search solutions [89] are solid evidence of such legal management systems. As these changes will happen over a period of time, the authors place these novel legal service offerings as high value-add professional services, made up of medium technovation and medium collaboration components, still requiring customisation and interaction with clients but with relatively lower throughputs, placed still the Professional Services-quadrant at $P(x_{12}, y_{12}, z_{12})$ in Figure 5. In contrast, the more traditional paralegal functions followed by outsourced, off shored, and online legal functions are placed in the Service Factory quadrant at $O(x_{11}, y_{11}, z_{11})$,

made up of high collaboration, high technovation, low customer interaction and customisation, with very low throughput such that $x_{12} \geq x_{11}, y_{12} \geq y_{11}, z_{12} \geq z_{11}$ (see Figure 5).

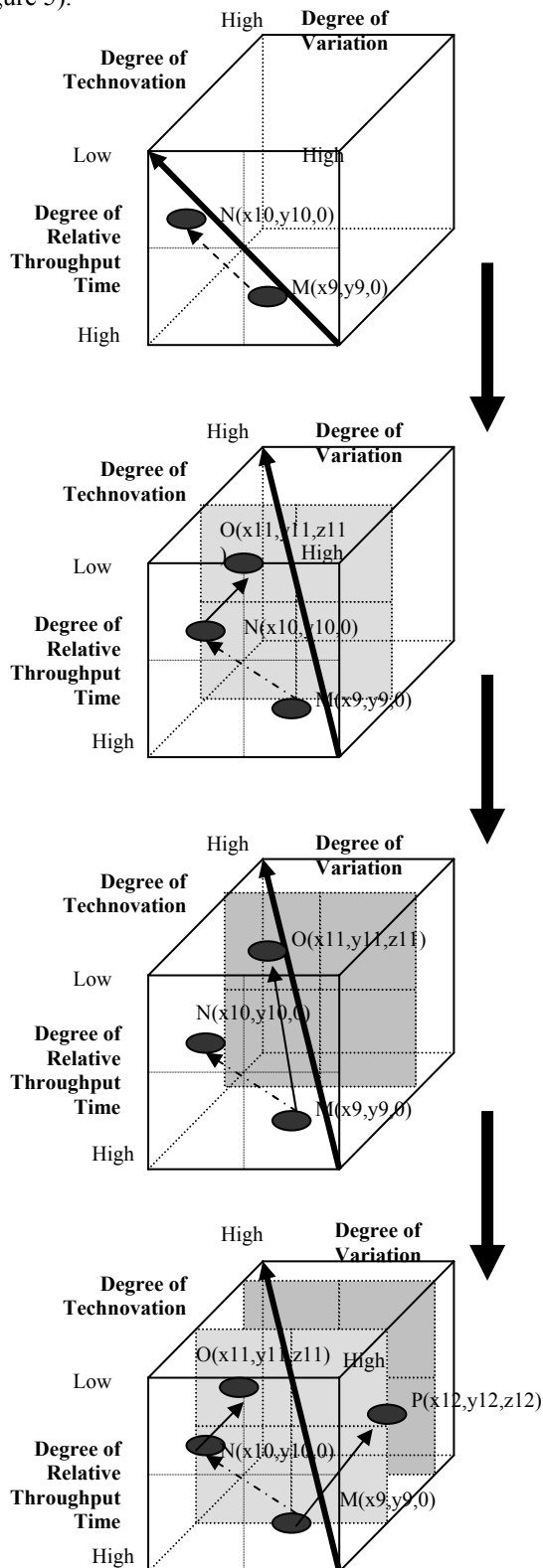


Figure 5 : The Service Cubicle Framework as applied to the Professional Services Value Chain

Specific managerial challenges confronting law firms include maximising productivity and efficiency, network resilience, increased mobility, collaboration support, flexibility, security and network administration. Based on innovative solutions, collaboration and technology, law firms can design and devise service offerings to suit clients demands, differentiate themselves from competitors, and contain costs. As technovation advances and as law firms forge closer relationships with clients, the Service Cubicle will provide legal firms with a tool to visualise the impact of operationalizing different service offerings relative to varying value-add outcomes. They in turn will enable legal firms to strategically reposition themselves as they strive to become more services-centric, with respect to the industry or the consortium.

V. BENEFITS FROM A SERVICE CUBICLE CLASSIFICATION

As evident from the above industry examples, the new service classification offers a template for discussing the requirements of service offerings based on factors that are mission-critical to service industries.

Once a service offering is positioned in the cubicle, this taxonomy provides service firms a framework and a means for management of these services under dynamic conditions. It offers a template for strategic discussion, which may address issues such as:

- how new technology and IT may bring organisational, relationship and process changes in a firms strategic outlook leading to new ways of marketing the elevated service offerings, access to innovative customers and/or markets,
- how introduction of a newly deployed technology for sale of goods may trigger innovative ideas in a completely diverse and different service industry and bring process change, organisational structural change leading to collaboration with other industry chains leading to change in the role of the intermediary,
- how application of knowledge experienced in one situation may lead to innovation in creation and design of a new service portfolio in a totally diverse industry or situation,
- how unification with other industry partners may lead to delivering collaborative service offerings, with the service still under the control of the prime service provider, leading to establishment of Services Value Network Consortia's,
- how organisations may see the need to reposition and realign themselves strategically, tactically and operationally whilst managing risks, sustainability and fit in an attempt to introduce new service offerings,
- how new service offerings require changes in operational service delivery processes, customer and stakeholder touch points and the role of intermediaries resulting in greater customer/client satisfaction and reduced impact of uncertainty,

- how technovation and collaboration may lead to collaborative value-add in the form of reduced throughput times, reduced customisation and interaction, increased number of new service offerings, delivery channel options, increase in trust and openness amongst stakeholders, plug-and-play organisational structures and many more, and
- how introduction of new services impact productivity and collaborative value-add vis. the impact on service specific attributes, throughput times, delivery channel options, organizational changes, technological and process implications, hence may assist in optimally managing risks and uncertainties linked to business.

VI. CONCLUSIONS

Service organizations increasingly organize themselves and operate on a value chain level, in response to new ways in which services can be marketed, branded, operated and delivered in today's digital economy. This creates important challenges and opportunities, which call for a realignment of strategic focuses, in particular with respect to the impact of technovation on service creation and services *modus operandi*, their resulting service classification, and the restructuring amongst different service value chain industries.

This research builds on a recently developed classification scheme, referred to as the Services Cubicle that transcends current industry boundaries and includes upcoming service business trends in technovation. The paper subsequently illustrates a variety of service industry examples in order to clarify the resulting service classifications, taking into account deployment of varying degrees of technovation in that industry. These examples were carefully selected in relation to recent service process classifications by Schmenner, and were compared to his earlier classification scheme.

Once a service offering is positioned in the cubicle, this taxonomy provides service firms a framework and a means for management of these services under dynamic conditions. It offers a template for strategic discussion, in order to better position, align, assess and validate the impact of their changing service offerings, whilst addressing the complexities of strategic alignment, value positioning, asset definition; as well as technology, process, knowledge and relationship management.

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The key success factors in distributed product development – case Russia

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Abstract — Distribution of new product development encompasses both great opportunities and threats. In this paper we aim to identify both key success factors and common pitfalls for Western firms in the organisation of distributed product development in Russia. Russia's national innovation system holds a lot of potential for foreign firms, but there are also many challenges to be addressed. By following general guidelines for co-development, the chances for success are likely to increase also in the case of joint development with Russian firms.

Keywords — Distributed product development, Russia, Innovation process efficiency

I. INTRODUCTION

Increased competition has forced organisations to develop their overall efficiency. This development has occurred naturally in the primary processes, such as manufacturing, due to e.g. development of machinery and quality standards. The increased importance of knowledge in building strategic capabilities has led to questions of efficiency of the innovation process. Improving innovation process performance is critical, but the research on development of innovation process efficiency has proven to be challenging due to immaterial nature of process, long causal loops between development steps and results, and lack of valid performance indicators.

In traditional processes, one common method of improving overall efficiency has been co-operation over organisational boundaries or outsourcing. Many researchers have raised the question of also extending the innovation process over organisational borders [1], [2]. Term innovation process covers a wide variety of working phases where the main stages are identification and development of business concept (e.g. Front end of innovation, FEI), product development (e.g. new product development), and product launch. Researchers have identified that product development phase opens up an opportunity for externalisation. Distributed product development offers lucrative benefits such as cost efficiency, sharing of financial risk of development, and access to know-how that cannot be utilised otherwise. However, there is strong debate over strategic implications of distributed product development (e.g. the risk of losing valuable knowledge to a partner and absence of learning occurred in product developing work).

The reliance on external sources in research and

development (R&D) process has increased dramatically since 1990 [3]. The trend is likely to continue in the future as products become more complex and require a wide range of different competencies, which increases the need for usage of external sources in R&D work [3], [4]. Common implementation methods in external technology acquiring include joint ventures, strategic alliances, and licensing [3].

Co-operation over innovation has been found to increase the probability for innovation, even without initial R&D investment. According to De Propis, the likelihood for innovation was increased by co-operation by 10 %, whereas investing 1-2 % of yearly turnout increased the chance on average by 5 % [5]. Such finding suggests that especially smaller firm should seek to co-operation in innovation to preserve their limited resources.

There is a substantial variation across different national innovation systems. For firms, such variation creates a strong motivation for tapping into foreign innovation systems in search for new technological solutions [6]. Likewise, distinctive features can be identified in different economical zones [7]. These regional specifics have to be acknowledged when organising distributed product development. They dictate the rules of co-operation and their thorough understanding is critical for successful implementation. Therefore, it is valid to examine region specific factors in conjunction with general factors regarding distributed product development.

In this paper we aim to identify both key success factors and common pitfalls for Western firms in the organisation of distributed product development in Russia. This is done by comparing the successful routines identified in literature review to Russian business environment and business culture. We discuss Russia as an example of shifting product development activities in order to access a pool of resources and knowledge. So far, the main interest has been on access to market, productional co-operation and subcontracting. We argue that the potential of product development co-operation in innovative fields could be better exploited with acknowledging critical success factors.

Distribution of new product development encompasses both great opportunities and threats. On strategic level, the key question is manageability. The role of the managers is to maximise the gains achieved from product development externalisation while reducing the involved risks. The research question and defining sub questions for this study are:

1. How distributed product development of Western firms should be executed in co-operation with Russia based high technology firms?
 - a. What are the critical success factors and pitfalls of distributed product development?
 - b. What are the special characteristics of Russia based organisations and how innovation work can be carried out in Russian macro environment?

II. JOINT PRODUCT DEVELOPMENT

A. Innovation process

Product development is a part of innovation process, the implementation of which has been studied extensively by the research community [8], [9]. It starts with a product idea and ends at product launch. According to for example Herstatt et al. [10] and Koen et al. [11], product development is preceded by the FEI-stage, where an idea is created, project outlines and objectives are specified, and required resources are charted. In product development stage the abstract idea is concretised to a product [e.g. 8].

The implementation of innovation process is challenging due to the requirements set by organisation's business environment. This is emphasised in high technology markets where complex product development projects require a large knowledge base and product life-cycles are traditionally shorter. Shortening life-cycles cause also increase in the importance of timing (or the cost of delay) in product launches. Variations in new product development process performance have lead to many studies where successful routines for product development implementation are searched [12], [13]. These studies have shown that risk and uncertainty will always be significant factors in innovation process, with proper management techniques the variance in new product success can be significantly reduced [12].

Tidd et al. [14] argue that being innovative has become one of the most important factors when building strategic capabilities. Traditionally organisation's internal structure has set the surroundings for innovation [15]. Organisation's capability to innovate is determined by the way in which knowledge is developed, documented, shared, managed, and applied in the organisation. By forming external linkages organisations can extend their innovation environment to produce better products with increased product development process agility. Such approach is in line with dynamic capabilities proposed by Teece et al. [16] where they argued that organisations need to be able to evolve their capabilities to match market developments. Due to the path dependency of innovation [e.g. 14], rapid changes in competitiveness are virtually impossible, forcing organisations to seek competence from outside. This, in addition to shortening product cycles and ever tightening competition, is likely to increase the use of joint product development.

The overall challenges in innovation process, and more specifically product development, have caused

organisations to search for alternative methods for product development implementation. Extending the process over organisational borders offers interesting opportunities. We have divided the motives for co-operation to three main approaches: financial, functional, and strategic (Figure 1).

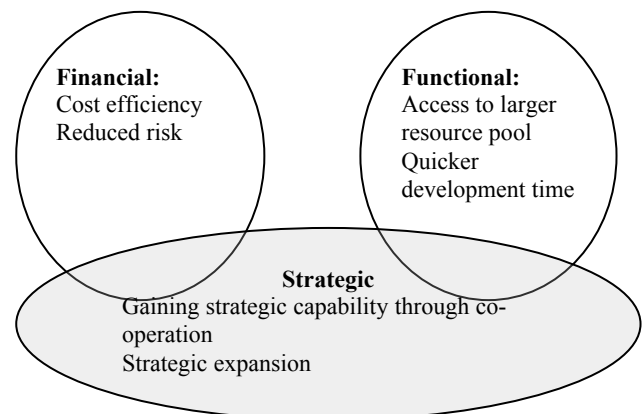


Figure 1. Motives for co-operation in product development

Financial approach emphasises the economic efficiency in the innovation process, which is influenced by e.g. lower development costs, fasten project execution, and shared risk. The basis for this approach is in the research done on the relationship between the costs of acquiring technology against the transaction costs of beginning an alliance [e.g. 17]. Ettlie and Pavlou [4] conducted an empirical testing to statistically test the effects of joint development on success rate of product development. They found that in the case of high technology products, both the product success rate and product commercialisation were higher than in internal product development. This suggests that in the case of high technology product development, the success rate of projects can be increased, thus increasing the manageability of the process leading to decrease in risk.

The functional approach is based strongly on the increased importance of knowledge in the innovation process and increasing complexity of new products. Through co-operation, organisation seeks to utilise larger resource pools that enable it to develop products that could not be done otherwise.

The strategic approach considers the long time implications of co-operation and it can be seen to somewhat overlap with the two approaches presented earlier. With a strategic approach, a technology under consideration is not seen merely as an opportunity to gain access to external resources, but a way to increase organisation's future capabilities either through learning or by acquisitions depending on the importance of the technology. In the case of international alliances, the motive can be the access to region specific market knowledge [e.g. 18]. Co-operation can be used as a stepping stone to extend operations to new geographical regions or new business areas. Co-operation with a selected external partner can be used to provide crucial knowledge of a market or business specific characteristic that is needed for a successful market entry.

The emphasis between these motives is highly case

dependent. Narula divided joint development to horizontal- and vertical- co-operation [19]. He argued that in the case of vertical product development the primary drivers are financial, whereas in horizontal co-operation the driving factors are functional. When the joint development is done with a competitor, strategic factors are dominant motives behind co-operation.

B. Selection of product development implementation method

Product development can be executed by traditional approach internally, completely externally, or by mixing these approaches and conducting only some parts of the process externally either by outsourcing or by alliances. The appropriate implementation method and possible need for externalisation of product development are decided in the FEI stage. Although co-development offers lucrative opportunities for managers, the decision to involve external organisations in product development is not so obvious. Narula [19] argued that the type and importance of technology have to be considered when making decisions of external product development due to related risks. The main risks are: 1) problems in negotiating and setting the terms for co-operation (transaction costs are significantly higher than in traditional outsourcing); 2) the knowledge in innovation process is usually tacit, which reduces learning for new competences; 3) co-operation partners may misuse the opportunity and utilise jointly created knowledge to enter markets by themselves or with competitors; 4) legislation on innovation differs strongly depending on nation and industry. Narula introduced a framework for selecting the appropriate implementation method presented in Figure 2. Of the external implementation methods, organisations use currently considerably more resources to outsourcing than co-operation [19].

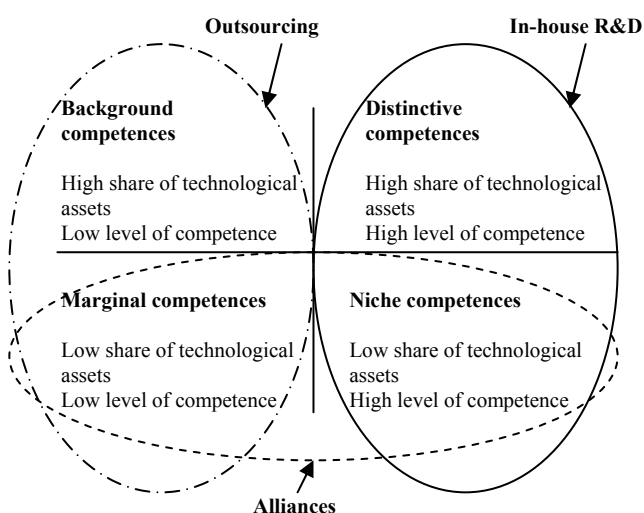


Figure 2. Selecting the implementation method for external product development [Adopted from 19]

Kimzey and Kurokawa [3] added the time dimension to

the situation and divided the technologies to three categories: *strategic technology* that is emerging and can be an important piece in building organisation's future capabilities, *critical technology* that is an existing unique technology that can offer imminent short-time competitive advantage, and *enabling technology* that is broadly available technology with little value by itself. The importance of the technology can be seen to have effect on organisation of co-operation. In the case of strategic technology, the needed knowledge should be acquired to organisation's capabilities. Critical technology offers opportunities for co-operation, which leaves the possibility for future acquisition if necessary. In enabling technology, the driving force can be seen to be most likely cost reduction and the appropriate method for implementation is either alliance or outsourcing.

The type and nature of innovation has strong effect on the suggested implementation methods [20]. For a modular innovation (e.g. sub-system), the implementation of joint development can be organised with relative ease as the level of needed knowledge exchange is relatively low and the effects on organisation's competitiveness are limited [20]. However, in a systemic innovation (e.g. product platform), joint development becomes problematic as it strongly effects organisation's competitive base [19].

The fundamental question behind externalisation of product development is whether it can be externalised? Many researches claim that not only can it be externalised, but this is essential for building organisation's competitive base in modern markets [14], [15]. Strong resistance to the subject suggests that despite great potential, the decision of externalisation of product development requires intensive analysis and preparation to minimise the potential risks.

C. Implementing joint development

Implementation of joint development can be divided into two main stages: forming an alliance and managing the alliance. Both of these stages are important for a successful implementation. Research on the critical success factors in each stage has been limited, but some general guidelines can be found.

The stages of alliance formation can be divided into selecting a partner, negotiating the alliance, and setting the partnership in motion [e.g. 18]. No generally accepted guidelines have emerged for partner selection and the research on the subject is relatively scattered. Below are presented some of the main factors for partner selection:

1. Short-term returns for both companies [21]
2. Clearly defined long-term potential for both companies [21], [22]
3. Shared vision of technology and market developments [21]
4. Shared destiny of co-operation [21]
5. Definition of organisation's place and strengths in value chain [21]
6. Establish measurable goals and objectives [22]

The importance of short term benefits was highlighted by Deck and Storm [21] in their Cisco case. It was seen to be

essential for a successful joint development relationship. The absence of fast wins is likely to cause loose of motivation, leading to straying from original plans and eventually to an unsuccessful project [21].

Organising the actual joint development is a challenging task. Deck and Storm [21] approach the problem with managerial view. They argue that organisations that succeed in joint development use managerial system that consists of three levels: 1) strategy level where partners and co-operation methods are evaluated, 2) execution level where operational managerial routines and measurement systems are created, and 3) infrastructure level where the needed systems are created to support inter-firm working. Malek [22] also suggested that successful organisations utilise similar framework for management. This framework is used to present success factors for joint product development found in the literature (Table 1).

TABLE 1
SUCCESS FACTORS FOR JOINT PRODUCT DEVELOPMENT [21], [22]

Level	Success factor
Strategic	Assign an active executive sponsor for each relationship Support from senior management Define conflict resolution process Maintain mutual respect and willingness to learn
Execution	Define deliverables clearly Continuous measurement for performance Establish periodic fact-based relationship progress review process
Infrastructure	Establish direct communication linkages between teams for both externally and internally Provide real-time information flow system between organisations

Malek [22] suggests that organisations participating in joint development must change their routines to suite inter-firm co-operation and try to adjust organisational culture accordingly. Deck and Storm [21] found contradict evidence from their case study as they discovered that normal routines (e.g. weekly status meetings) are adequate for successful product development. Their case study suggested also that problems in operational work during joint development are inevitable, as they are in internally done development, but with well managed process and with the support of senior management the encountered problems can be overcome more easily [22].

The geographical distance can cause problems for international joint product development. De Propis has found linkage between geographical distance and co-operative innovation [5]. Organisations located near to each other are more likely to start co-operation in product development. This poses a challenge for a geographically more scattered joint development. Such challenges must be acknowledged when planning and implementing an international joint product development project.

III. POTENTIAL FOR PRODUCT DEVELOPMENT CO-OPERATION WITH RUSSIA

A. Overview of Russian innovation environment

As a country, Russia has a lot of potential for product development co-operation. The legacy of the Cold War leaves Russia in the paradoxical situation of a generally poor country with a disproportionately well-endowed technology potential [23]. Large investments in innovative activities were a distinctive feature of the socialist period and Soviet Union had excellent achievements in several fields of science [24]. Likewise, the Soviet educational system was largely devoted to natural and technical sciences [25]. Advanced fields include optical and mathematical processing, aviation, space, atomic energy, biology, pharmacy, and nanotechnology; to mention some of promising technologies that could benefit Western firms in their search for new product ideas [26]. However, the funding of science and technology suffered a substantial downturn as the innovation system collapsed along with the socialism. After significant decline in the overall investments in R&D in the 1990s [27], the expenses have started to increase again and the share of enterprises reporting innovative activity is growing [28]. Despite Russian innovation system showing signs of recovery in the recent years, there is still imbalance in the innovation environment, especially in the relations between the main actors: R&D institutions, universities and enterprises.

It is necessary to understand the structure of Soviet R&D system to better grasp the current state of research activities in Russia. The allocation of tasks between universities, research centres and industry used to be well defined during the Soviet times. Universities were responsible for education. Research and product development were mostly conducted in large research institutes in a highly centralised manner. The state provided the main share of financing. The focus was often on applied research for military purposes or basic research. In both cases, little interest was paid to market. Fundamental research and applied development were commonly conducted in isolation from each other [28]. Branch R&D centres had tight connections with the corresponding industries. Usually, it was one or two large factories that supported research in an institute. Change of the regime scattered the pieces of the puzzle and forced the players to regroup in order to find new sources of financing.

Nowadays, the division between education and research is much less clear. For example, in Saint-Petersburg, several technical universities have recently established different supportive institutes and innovation centres in order to improve self-financing and support their ambitions for quick productisation of research efforts [29]. Universities and research institutes have started to comprehend the importance of commercialisation of their activities. The focus is shifting to applied research as it is more attractive in financial terms. The share of state financing is small, and it is supplemented, in varying proportions, by funding from municipal organisations,

companies and in case of universities, overhead from educating commercial students. However, a threat exists that large-scale neglect of fundamental research may result in deterioration of its state in the long run and extinguish competitiveness of research institutions. Commercialisation initiatives are hampered by the fact that Russian government reserves property rights to all intellectual products commissioned by the state. However, it has been proposed to allow science workers to use findings from research commissioned by the state for commercial activities inside Russia, given that these findings are outside the domain of state security [28].

The emerging private sector is poorly connected to the academic institutions performing public R&D [30]. This relation is significantly less formalised than earlier as the number of companies within an industry has grown and there are many new players. In the Soviet economy, there were fewer and larger enterprises as compared to a market economy [31]. Economic changes in Russia have resulted in development of a large number of entrepreneurial firms, including those established by former personnel of state research laboratories. According to a survey of more than 200 small and medium sized companies in Saint-Petersburg, the main barriers to innovation are lack of retained earnings, lack of state support in form of tax and social payment discounts, lack of subsidised credits, and high interest rates of bank credits [29]. As a consequence, research and development activities are either financed from retained earnings or owners' funds.

Innovative firms face the absence of wide domestic demand because there is little interest from the traditional manufacturing industries and the ones based on natural resources. As this sector accounts for two-thirds of industrial investment in R&D, the innovative firms must rely on export market to generate sufficient demand for their products [30]. Majority of Russian large companies are still focusing on organisational or market innovations, with only few that have proceeded to modernisation of equipment and further to technology development. Despite reporting some innovative activities, large companies tend to dislike long-term, science-intensive and innovative projects. Possible explanations for this antipathy are continuous decline of real output during transition period, political crisis, and general pessimism. However, demand on innovative solutions is likely to increase before long due to economic growth and toughening competition. [32]

Governmental support for innovative organisations has earlier been criticised [33] and it has been signified by representatives of high-tech industries that Russian legislation is designed to support the oil and gas industry. Lately, some measures have been taken to better address the needs of innovative activities, including decisions regarding establishment of supportive infrastructure consisting of technology parks, incubators and innovation centres. Russian Federation has issued strategy for development of science and innovations till 2010 [27]. The main problems addressed are: 1) establishment of new financing institutes for support of new scientific

development, 2) development of innovation infrastructure, and 3) development of information infrastructure in science and innovation business. The strategy sees creation of conditions for internationalisation of the innovation environment, development of infrastructure for R&D commercialisation, and implementation of effective intellectual property rights as key tasks. The concepts presented in the strategy are generally perceived as valuable and necessary, but there is skepticism regarding degree of actual implementation among representatives of higher education [29].

The value of Russian science and technology is heightened by the expectation value of Russian human resources [26] reflecting the number of technology and science students – 40% out of total 4.7 million students [34]. However, high intellectual potential is often combined with minor experience in business and serious lack in marketing skills. Thus, turnover of high-technology firms tend to be low despite high level of education of staff.

B. Business environment

The transition to market economy has not been smooth despite significant progress. The authorities have significant influence on business operations in Russia. Decentralisation has resulted in institutional chaos in terms of numerous, frequently changing local policies [35]. The business environment is known for volatility, especially one related to legislation. Remes lists several problems such as an oversized bureaucracy in controlling economic activities of enterprises, deficiencies in taxation, weaknesses in the rules on corporate governance, not applying international accounting standards, poor protection of the intellectual property rights, the banking system heavily dominated by state banks, and a weak SME sector [36]. The activities in the market are complicated by the governmental interference resulting in poor legislation, unfair conditions of competition, high transactional costs and entry barriers [33].

Nevertheless, business life in Russia is rapidly developing towards Western standards. In the recent years, management practices have improved and many organisational innovations have been adopted [37]. However, Russian economy is still insider-dominated because of untypical distribution of property rights. Most Russian enterprises are manager-dominated, with managers being also an important owner group due to the privatisation programme. The managers' attitude toward outside investors and bank credit is very cautious, as those would limit their power. Such situation results in poor investments as well as lack of structural change and growth. [38]

Similarly, the majority of high-tech firms are owned by entrepreneurs and their close circle. The availability of resources to high-technology start-ups is limited and funding mechanisms are rudimentary at their best [39]. The transparency of operations is restricted, which makes outsider evaluation of a firm extremely difficult. For example, representatives of Russian high-technology firms are reluctant to provide financial data on spending on

research and development [39]. Turbulent environment has resulted in short term focus of Russian firms in selection of their partners, with decisive criteria being access to financial capital and complementary capabilities that enable dealing with turbulence [40]. Overall, Russian firms tend to be focused on survival, which results in dominance of short-term criteria in decision-making and business development [40].

C. International co-operation

Academic discussion on Western-Russian co-operation is largely devoted to investments and exploiting opportunities of the vast Russian market. Indeed, the market-driven investments of foreign companies (e.g. in food and tobacco industries, consumer goods production and services provision) typically prevail over cost-driven investments [28]. Co-operation in the field of technology and product development has received less attention from researchers despite some statements that there is a strong basis for developing business-sector R&D collaboration [41].

Besides genuine problems, caution is caused by attitudes on both sides. Russian scientific and industrial leaders still tend to view foreign business with some suspicion, whereas foreign businessmen continue to view Russia as a difficult environment and a poor risk in investment terms [41]. Nevertheless, several high-tech companies are already pursuing opportunities provided by access to large amount of highly educated personnel with good quality-cost ratio. Especially information and communication technology companies have been active in this development. Intel came to Russia as early as in 1991, when it started co-operation with a group of programmers in Sarov. These activities were later acquired and transformed into Intel's research laboratory [42]. Since then, Intel has opened research laboratories, and later on also marketing and client support centres in several locations: Moscow, Saint-Petersburg, Novosibirsk and Nizni Novgorod [42]. Among other companies that have opened R&D centres or dedicated development centres in Saint-Petersburg are Sun Microsystems, Motorola, Metacomunications, LG Electronics and Siemens [28].

Co-operation of foreign companies with Soviet industry and academe was controlled by political regime. With collapse of the Soviet Union, Russia's information base opened, but the country is still far from being comparable to the West in many terms. Overall, Russia has become increasingly open to international and scientific co-operation, which is evident in the growing number of international R&D projects, joint ventures and Russian subsidiaries of multinational companies [43]. For Western part tempting targets include not only resource acquisition and capturing market share but also access to competitively priced skills and technology potential [43]. An issue that has to be taken into consideration when planning technological co-operation is that few of Russian technological alternatives have been developed directly for commercial application [41]. Thus, there is need for conceptual development in order to recognise commercial

potential of these technical solutions.

For Russian part international co-operation provides access to Western state-of-the-art technology and enables restructuring of production plants [43]. To some extent, Russian firms are also interested in gaining business know-how, related for example to quality control and management issues [18] as there is scarce experience in working at international levels of technical and quality standards [23]. Alliances are likely to improve the competitive position for both domestic and foreign market even enabling competition with rival multinational enterprises that have entered local market. Especially as Russian customers tend to prefer Western technology and products.

Entrepreneurial and commercial culture is a relatively new phenomenon in Russia [25]. Having only technical knowledge has not been sufficient in creating competitive exportable products and the exploitation of innovations still lacks in effectiveness. As a consequence, another reason for Russian companies' interest for co-operation with Western partners is that they hope to be able to obtain contacts with potential Western clients.

Likewise, many universities express interest in co-operation with foreign firms, especially as Russian side does not necessarily have enough financing for implementation of innovative ideas on its own [29]. However, these entities tend to lack resources or references for search of foreign partners and establishing initial contact. Teaming up with a foreign partner is considered an attractive option, if only one knew how to find such a partner. Russians typically prefer working with European partners, because of short geographical and perceived cultural distance.

The share of small and medium sized companies co-operating with international partners is still small. The main reasons are high entry barriers into foreign markets, sufficiently high domestic demand, and lack of financing [29]. Controversially, small firms may see international co-operation as one option for dealing with financial problems. New post-Soviet firms are generally less burdened by extensive financial or institutional commitments, along with lesser degree of bureaucracy and formalism [23]. This gives Western partners direct access to needed skills, whereas Russian partners have greater freedom for creativity and initiative [44].

Hagedoorn and Sedaitis observed that research intensive alliances are likely to take the contractual form, whereas a manufacturing orientation would lead to an equity joint venture. They propose two options for co-operation: joint ventures with older, more established firms and contractual agreements with newer firms. The former offers investors greatest asset security, control and host country incentives, making them the most attractive form of transaction for cost-sensitive, asset importing or specific investment. Conversely, the strengths of the alliance with new firms lay in the opposite direction of greater flexibility and the freedom to risk and innovate. [23]

Non-equity Western-Russian alliances are existent, but

their amount is difficult to estimate, because they are not registered in the statistics. Such arrangements are also used for manufacturing purpose. For example, there are Finnish-Russian production subcontracting relationships in the metal industry, but their success has been only modest due to different perceptions of the alliance and expected contribution by the partners [45]. The most common problems were related to the quality of the product, and delivery times. The motivation for production alliances is typically rooted in lower production costs or gaining access to market. Nevertheless, shifting low-level jobs to Russia offers only moderate savings as the Russian labour costs are not as low as in for example China and India. The potential of Russia is far greater in terms of knowledge-intensive activities, because of the elements of scientific creativity, innovation and quality [26]. Nevertheless, R&D co-operation is hampered by the weaknesses of the Russian business environment, the general sense of political instability, and cautiousness of the Russian side due to fear of losing their technology [41].

IV. DISCUSSION

A. Co-operation with Russian firms

Success of an international alliance with a firm from a transitional economy largely depends on careful screening and assessment of the host-market partner [18]. It is necessary to evaluate potential partner's motivation for co-operation. Acknowledging partner's motivation for co-operation helps to avoid possible conflict of interest. Other characteristics to consider are position on the local market, network of contacts, and experience of international co-operation. The latter can not only serve as reference but also depict skills for dealing with problems of a foreign partner. Depending on a task, it may be necessary to evaluate production capabilities.

There are many aspects of Russian business life that have to be taken into consideration: different business and communication practices, perception of quality, role of trust, bureaucratic system, grey economy, importance of personal networks, access to procedural and regulatory information, and protection of property rights at different stages of development. There is room for improvement in some of the practical issues, such as time of visa handling and difficulties with foreign financial transactions. These circumstances are likely to lead to higher transaction costs in negotiations for possible co-operation.

Operating in Russia requires a Western firm to be able to adapt to a highly dynamic environment. There are certain risks and uncertainties related to operating in Russia, because of low degree of institutional predictability. Shifting regulatory environment poses specific challenges to a Western firm and it is extremely difficult for a foreign actor to keep up with changes. Therefore, it is wise to ascertain that the Russian partner has a good knowledge of operational environment and can proficiently respond to changes. The problems of corporate governance and

intellectual property rights are well acknowledged and hopefully addressed in the near future. However, for the time being, it is better to pay specific attention to these issues to protect one's interests.

Despite their generally positive attitude to international co-operation, Russian firms are not active in seeking foreign partners, either because of sufficient demand on domestic market or their lack of finances and/or skills. Despite high level of technical know-how and skills, Russian high-tech firms typically lack in ability to commercialise their products, which makes competitive foreign markets especially hard to access.

B. Product development co-operation

Product development is one of the most complex activities of the firm because of the high degree of related uncertainties: difficulty to estimate demand, changing markets, new technology fields, and difficulty to estimate cost and time required [46]. It is a complex function, which requires flexibility and availability of complementary resources.

Without a sufficient capability to take risks, it is better not to distribute development. Crossing organisational boundaries means that a firm has lesser degree of control over activities. Co-operation in a strategic function such as product development requires trust. As a precondition for trust building, the partners must be conscious of each others goals for the partnership. Distributing product development must be based on long-term commitment from both sides.

The inherent uncertainties of product development activities make using formal contracts difficult, because all possible issues cannot be addressed by a contract [47]. Thus, it is more likely that uncertainty is addressed by use of informal agreements or by equity arrangements. However, Russia is still largely associated with opportunism, which results in extensive sticking to contracts by foreign actors. Unfortunately, such reliance can also lead to lesser motivation for innovativeness. Russian intellectual property rights still have some loopholes, which do not make co-operation or trust formation any easier. The challenge is to obtain sufficient level of trust between partners. At the same time, it is necessary to unambiguously define the ownership and intended use of the outcome of co-operative development efforts.

Russian firms' capability for long-term co-operation in product development is hard to evaluate. Because of limited internal finances and difficulties in getting external financing, the focus of management is mostly on day-to-day operations. Thus, it can be questioned if they are able to sufficiently commit to longer co-operative efforts. The tasks of joint development should be designed in such manner that there are also short-term returns, which enhance commitment and motivation.

Despite high technical skills, Russian firms' technology management skills are less developed. Commercialisation requires contributions from both sides of a partnership. Co-operation should be based on shared vision of technology and its potential use. Defining goals and objectives should

take into consideration national characteristics and cultural differences. The partners must also share practical understanding of the timeframe and contribution that are agreed upon. Speaking different languages poses additional challenges for communication and it is important to make sure that the message is understood in the same way by both parties.

Differences related to national culture need not to be dominant, if partners have similar organisational culture. In fact, many Russian high-tech companies strive to adopt Western ways of management to increase their desirability as partners. On the other hand, it would be ignorant of a Western firm to come to another country and act omnisciently. Such behaviour is unlikely to be a good precondition for trust building.

One option for consideration is co-operation with established research facilities (e.g. research centres and technical universities) or firms with connections to such facilities (e.g. university-based start-ups), to ensure access to latest technological development. Connections with Russian universities can also prove valuable because of their ties to authorities and industry. For example, most universities maintain contacts with their graduates. Such connections could act as a source of industry knowledge or recruitment channel.

V. CONCLUSIONS

In this paper, we have shown that co-development is challenging. The research on the subject is limited, but some general steps for successful co-development can be found. By following these steps, the chances for successful co-development are likely to increase also in the case of joint development with Russian firms. Decision of externalisation of product development is still a tough question for innovation managers. Possible benefits from joint product development are clear and lucrative, but the practical implementation tools are relatively undeveloped. Changing markets are likely to force organisations to increasingly utilise co-development, but the risks involved in both strategic approach and in implementation cause that such endeavours require carefully planned and careful implementation. Russia's national innovation system holds a lot of potential for foreign firms. Economic growth has contributed to general stability, but there are still many issues that have to be addressed for day-to-day business operations to become fluent. These peculiarities need not to be obstacles for international co-operation, but they must be acknowledged and taken into consideration when planning distribution of product development.

The purpose of the paper was to review and discuss theoretically specifics of distributed product development process. We discussed the applicability of the concepts presented in the literature to a phenomenon of product development distributed not only across organisational, but also country boundaries. As a synthesis, we proposed a number of critical success factors contributing to successful implementation of distributed development activities. In addition, the paper attempts to contribute by combining the

discussion regarding country specific risks to the one on the risks of distributed development. This work has been a conceptual paper that needs empirical validation. Empirical research is necessary to test if suggested success factors are applicable in practice.

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The Network Characteristics of Open Source Software Business – a Multi-disciplinary Case Study

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Abstract—Open Source has become an important phenomenon in the field of software business, as Open Source can be seen as a viable alternative for traditional, proprietary way to develop competitive software solutions. Open Source bases on a networked way to develop software – networks are formed within one specific Open Source project (i.e. internal network) and between several Open Source projects (i.e. external network). This paper presents a case study of an Open Source project called Laika and its external network formed with other related Open Source projects. The network analysis of Laika is carried out both from technological and business-oriented viewpoints and by following qualitative research methods.

Keywords—Open Source software, business networks, communities, dependencies, case study.

I. OBJECTIVES OF THE PAPER

This paper presents a multi-disciplinary approach to the phenomenon of Open Source software development, covering the issue of Open Source network characteristics both from technological and more business-oriented industrial network point of view. This paper has a strong empirical focus, as the aim of the paper is to analyze Open Source software network characteristics through an in-depth, qualitative case study of a one specific Open Source community, called Laika.

We have gathered data related to Laika both by discussing with the people involved in Laika project and by participative observation in Laika project. The network analysis carried out and presented in this paper is, however, only a snapshot of the Laika project and its external network structure.

Although this paper presents only a snapshot of Laika's external network, we believe that Laika offers an

interesting field to address the issue of Open Source networks. In this paper, we will introduce and analyze the Laika network, through the elements of mutuality, interdependence, distance, priorities, different power relations, and investments made in the relationships. These elements are based on a literature analysis of both technology and industrial network approach fields.

We will also present in the paper the concept of "super-communities", which are collections of Open Source communities working for a common good.

Towards the end of the paper, we will discuss what kind of theoretical contribution the Open Source phenomenon can bring in our opinion and what kind of future research we will carry out in this research area.

II. TECHNOLOGICAL VIEWPOINTS TO OSS NETWORKS

Collaboration between Open Source communities is commonplace. A main idea of the Open Source is to utilize existing third party Open Source components and projects instead of doing all by oneself. This easily forms complex networks where actors are dependent on each others. Dependency can be one way or two way dependency depending on how communities see partner's achievements.

The basic principle for the cooperation is voluntary participation (Frees 2002). In contrast to the traditional industrial projects, communities dependent on each other have proceeded without any formal agreements. This type of collaboration is suitable only if actors see that the partner's action yield some benefit for them too. If partner's achievements are deemed useless, it is not worth participating in the partnership.

A close cooperation may also cause changes in priorities. As a result of collaboration, projects are utilizing more and more other's features, and connections between actors are becoming more and more complex. The traditional approach is that one's own project has always the highest priority. However, in the Open Source project it is sometimes more important to give support to another

related project than to continue develop one's own project.

Another phenomenon typical for the Open Source project is that the communication between other Open Source communities is mostly handled by a public way. For the most part the communication is handled via mailing lists, irc-channels and other public manners such as using a bugzilla to report errors of the applications. The benefit of this kind of communication is that anyone who is interested of the project can join to the mailing list to get the latest news, and share own ideas and insights with other developers. As a result, new patches and releases for the open source projects have usually been published more often than in the case of proprietary software solutions (Porter 2001). This may cause some unexpected problems if an Open Source project is dependent on several other Open Source projects. If the other projects that the specific project is dependent on will be updated frequently, a lot of extra work has to be done to ensure the compatibility to new versions of the projects.

On the other hand the stability of Open Source projects is better than in the case of proprietary software. In the other words the project cannot be interrupted suddenly through a single actor because of large amount of independent developers.

III. INDUSTRIAL NETWORK APPROACH TO OSS NETWORKS

According to Easton (1992), the industrial network approach aims at achieving understanding of industrial markets as complex networks that are formed from a bunch of inter-organisational relationships. Möller & Wilson (1995) summarize that network theory aims at providing conceptual tools for analysing both structural and process characteristics of industries. The goal is to understand complex systems of relationships by studying an industry from a holistic perspective. They also point out that both the structural and process characteristics can be viewed at different levels, which are the industry level, the level of firm in industry, the level of the firm as a nexus of business exchange relationships, and the relationship level.

Håkansson & Snehota (1989) point out that the network approach takes into consideration the relations between different actors. All the actors, their activities, and resources are bonded, linked, and tied up together, and in this way they build up a wide network. Easton (1992) illustrates the basic elements of the network approach from four different viewpoints, or metaphors: networks as relationships, positions, structures, and processes.

A basic assumption with the network approach involves the essential unit of **relationships**, from which proceeds understanding of the network as a sort of cluster of relationships. Furthermore, relationships are characterised by four basic elements: mutuality, interdependence, different power relations, and investments made in the relationship. It is also important to keep in mind that the effects of the relationship can be both positive and

negative, and both primary and secondary functions in the relationships can be found. Primary functions refer to the relationship's effects on the parties involved in the dyad, whereas secondary functions refer to the effects that the relationship has on the other actors in the network (Anderson, Håkansson, & Johanson 1994).

Analysis of networks as **positions** mainly involves examination of the network from the viewpoint of a single actor, which can be either an individual or an organization (Easton 1992). However, micro and macro network positions can be differentiated. Micro positions are characterised by the role of the actor in relation to another actor, the actor's significance to another actor, and the nature (strength) of the relationship between two actors. Thus, micro positions focus on dyadic relationships. A broader perspective, on the other hand, is characteristic of macro positions – e.g., also the nature of so-called indirect relationships and the company's own role in the overall network.

Networks as **structures** are concretised through the interdependencies between the actors. If there are no interdependencies between the actors, neither will there be any network structure. The greater the interdependence of the actors, the clearer the structure of the network. Thus, there can be so-called 'tight' and 'loose' networks. Tight networks are characterised by a great number of bonds between the actors and well-defined roles and functions for actors. Loose networks, on the other hand, are illustrated by the opposite characteristics. The question of the boundaries of the network is also related to the 'networks as structures' perspective. Although in principle the whole world economy could be seen as one huge network, it is essential for the purposes and implementation of research to divide networks into smaller pieces and examine these smaller parts of networks.

The nature of networks as **processes** mirrors the nature of the networks themselves: networks are stable but not static. Due to the interrelationships among actors in the network, evolutionary changes are more characteristic of networks than radical changes are (Easton 1992).

In next, we will apply these network analysis tools coupled with a more technical analysis in the case of Laika.

IV. THE CASE OF LAIKA IN TERMS OF NETWORK CHARACTERISTICS

Laika is an Open Source development project aimed at the creation of an integrated development environment for developing applications for embedded Linux devices that run on the Maemo platform (Laika 2006). The main idea of the project is to integrate the work of several Open Source projects in a single software tool (Järvensivu et al. 2006).

Although Laika itself forms an interesting network to study, in this paper we will address the external network of Laika, i.e. the network that Laika forms together with other Open Source projects. In fact, Laika is dependent on many

other Open Source projects such as Maemo, Scratchbox, Eclipse and CDT, which form a network of dependencies outside the project.

In next, we will analyze the external network of Laika through the network and technological terms opened up in the theoretical discussion in sections II and III.

As already stated when discussing the industrial network approach, relationships are characterized by four basic elements: mutuality, interdependence, power relations, and investments made in the relationship (Easton 1992). Mutuality, interdependence, and power relations may vary a great deal from one Open Source project to the next. Dependencies between two projects can be two-way, leading toward mutuality and usually more balanced power relations between the projects.

However, one-way dependencies are also commonplace (i.e., an Open Source project is dependent on another Open Source project but not vice versa). This usually leads to unbalanced power relations between the two projects since only one of the parties of the dyad is dependent on the other.

The structures of projects within the Open Source environment can vary rather a lot in their level of tightness or looseness, as is discussed by Eric Raymond (1999). Within one Open Source project, the position analysis is performed mainly at the level of individuals. But when we leverage the analysis from one project to several, the level of analysis changes to that of entire communities; i.e., we analyze the positions of different Open Source projects against the background of each other.

The level used in network analysis is an interesting issue that has been discussed a great deal by network researchers in general, also outside the Open Source context (see Tikkanen 1998, Möller et al. 2002). In our study, we differentiate between two levels of network analysis, examination within the context of a single Open Source project and consideration involving several Open Source projects and focus on the latter one.

In Table 1, a summary of the analysis of the Laika project in the form of network characteristics is presented.

TABLE 1
NETWORK CHARACTERISTICS OF LAIKA

Network Element	External network of Laika
<i>Relationship mutuality and interdependence</i>	Mutual relationship and high interdependency between Maemo and Laika; one-way dependency between Laika and the other projects (e.g., Eclipse)
<i>Relationship investments</i>	Shared goals as drivers of fruitful cooperation – e.g., sometimes priority has been given to the work of another project instead of one's own
<i>Network position and power relations</i>	Laika: critical position as “glue” between other projects but has no power in the other projects
<i>Network structure</i>	Mostly loose networks
<i>Network processes</i>	Evolution – radical when the supercommunity experiences major changes, static otherwise

As already discussed, the Laika project is dependent on many other Open Source communities. Together, Laika, Scratchbox, Maemo, Eclipse, and CDT form a network in which changes in one project create changes in others. The central role of Laika project is to work as glue between the others and integrate them together into a single software tool. Therefore Laika project is even more sensitive for changes in the network structure. Figure 1 illustrates the network formed by communities related to Laika.

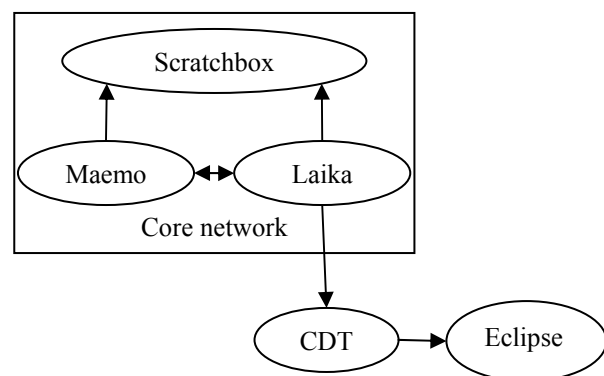


Figure 1 Network formed by communities related to Laika

Laika, Scratchbox, and Maemo form the core of the network whereas CDT and Eclipse are loosely connected to

Laika. The core communities are working towards common goal: make embedded Linux application development easier. Therefore they are closely related and see partner's achievements useful. Between Eclipse and Laika there is only one-way dependency, in which Laika is dependent on Eclipse but not vice versa. In other words Laika get benefit from Eclipse project to a greater extend, but Eclipse does not directly get profit from Laika project.

V. CONCLUSIONS

In this paper, we have discussed industrial network approach as an analytical framework coupled with more technical viewpoints for explaining how Open Source communities work and are linked with each others. As a practical example we used the community developing Laika, an integrated development environment for Maemo, a Linux platform for mobile devices used in, e.g., the Nokia 770 Internet Tablet.

The lessons learned from the experimentation of the community are many. To begin with, it seems obvious that network elements are a key to understanding how communities work and are linked together. In fact, sometimes communities can share responsibilities and create tightly coupled entities that aim at development toward a common goal. In our example, the development of an Open Source mobile device platform benefits from the work of all software developers involved. We can consider this kind of establishment a "supercommunity," or a community of communities that share schedules, goals, and interests. From this perspective, Laika can be seen as a member of the Maemo supercommunity. In industrial network approach terms, it seems in the case of Laika that networks of single communities will broaden into macro networks that have some rather loose network structures but also some very tight ones.

Another interesting discovery is that it is the communities that set their priorities themselves to best benefit the network to which they belong. In the case of the Maemo supercommunity, various communities have sometimes adopted supporting roles to benefit some key community. In exchange, these communities have then received mutual assistance in some other phase of development. This mutuality element has been part of the foci of the industrial network approach literature, and, through the research on OSS communities and networks, we can add new insights to the theoretical debate on networks. In Table 1, a way of summary of the application of network approach to the Laika context in the form of network elements can be seen.

We believe there is much work that we can carry out in the field described in this paper. Below, we provide an outline for future activities concerning Laika, the community maintaining it, and research into the progress of Laika's development.

Concerning Laika, our best prediction is that it will

become more and more entangled in the network of Maemo development. Furthermore, while one could assume that actions should be taken to extend the scope of the community to other mobile and embedded Linux environments, we believe that Laika is directly associated with Maemo and that no support is being considered for alternative environments, even if they could benefit from Scratchbox development support. Therefore, assuming that more and more Maemo-based devices are placed on the market, we expect other developers to join Laika, either directly or via plugin technologies that can be integrated into Laika. In a financially oriented environment, such a commitment to a single seminal platform could be considered strategically unwise, which clearly separates community-oriented development from traditional frameworks. At the same time, however, it is conceivable for some development platform other than Eclipse to be supported as well, since this would not alter the mission of the community.

In terms of industrial network approach, we plan to continue monitoring the evolution of the Laika project, as well as the actors participating in the development work. Thus, in our future work, we will concentrate more on the internal network analysis of Laika project. We believe that through in-depth and longitudinal case studies new and fresh insights can be added to the literature addressing internal and external network analysis.

We also wish to study, in the long term, how companies can participate in the development, as well as to observe how funding issues affect the community, potentially leading to the establishment of a company that can take responsibility for some aspects of the community's work, such as helping developers who use the tool. Then, it would be interesting to observe whether the introduction of financial responsibilities changes the manner in which development is organized and how priorities are chosen.

Another direction for further research arises from the industrial network approach perspective. To begin with, we wish to study networks of other communities as well. This will give us a better understanding of how communities are born and evolve, which in turn enables the creation of long-lived Open Source communities fostering growth at other levels. Furthermore, the relationship of communities and companies building on the community contributions is considered an important subject for future study.

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The Provision of Inter-organisational Infrastructure as An Appropriate Role for Cosourcing

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Abstract — A case study of credit unions in the financial services sector in Australia designed to examine the motivations and constraints to cosourcing – or the sourcing of a common activity jointly by a group of organizations – and assess whether the provision of inter-organisational infrastructure is an appropriate focus for cosourcing

Keywords—infrastructure, financial services, outsourcing, core capabilities.

I. INTRODUCTION

A number of organisations have recently begun to actively seek opportunities where existing services can be provided jointly. In the UK, for example, three banks and Unisys formed a joint cheque processing venture [1]. It would be useful therefore to understand the factors that determine whether such initiatives are appropriate. Given that the activity concerned is typically no longer conducted in house the outsourcing literature – and in particular that relating to why outsource and what to outsource – would seem to be a logical starting point. However while Gallivan and Oh [2] recognise a class of outsourcing – cosourcing – where a group of organisations come together to obtain a common service from a supplier, a review of the literature suggests that little research has been conducted in the area.

The current paper seeks to start to address this deficiency by proposing that a focus on the provision of inter-organisational infrastructure is an appropriate role for cosourcing

II. THE COSOURCING DECISION AND A FOCUS ON INFRASTRUCTURE

While research examining the motivation for outsourcing draws from many theoretical perspectives, one is particularly relevant with regard to determining what to outsource from a *strategic* perspective: resource based theory [3]. When one moves from outsourcing to cosourcing it is also necessary to consider the benefits of acting jointly. Here it is suggested that there are two

potential sources – based upon economies of scale and network externalities.

A. Economies of scale

Economies of scale refer to production and distribution efficiencies which come with larger size [4]. From a supply side perspective the benefits have long been recognised as a motivation for outsourcing [5]. Cosourcing introduces a demand side dimension. As a group of organisations aggregate their demand a potential supplier should become better placed to realise economies of scale in meeting it.

B. Network externality theory

Network externality theory suggests that the “value of a unit of a [network] good increases with the number of units sold” [6]. The classic example is telecommunications where the value increases as the number of customers grows. The actual value of a network good is determined by key characteristics such as complementarity and compatibility [7]. The work of Katz and Shapiro [8] suggests that cosourcing may be beneficial for activities where there are either direct – connectivity related – or indirect – where the value of a unit of the good increases with the number of units sold – network effects that are either direct – where the JSP facilitates connectivity – or indirect for example as a consequence of the wider availability of complementary goods.

C. Resource based theory

Resource based theory suggests that firms secure success by utilising their unique resources comprised of intangible and tangible assets that are tied semi-permanently to the firm [9]. From the resource based perspective, success is maximised where organisations focus their attention on those areas where their distinctive capabilities lie [10] and rely on others for the provision of ancillary activities. Not all of these activities are likely to be appropriate for cosourcing – what organizations consider core and ancillary will of necessity vary. Cosourcing will thus be limited to those activities considered ancillary across a number of organizations – with organizations acting individually to outsource their remaining ancillary activities.

It is suggested here that one appropriate focus for cosourcing therefore will be on the provision of inter-organisational infrastructure – see Figure 1.

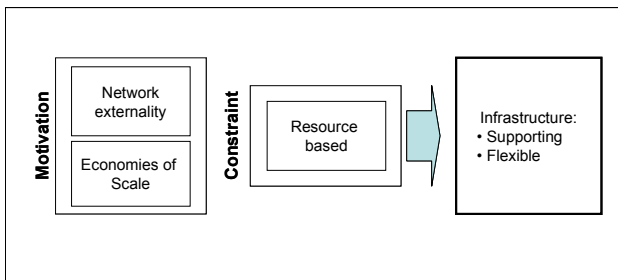


Figure 1: Inter-organisational infrastructure as an appropriate focus for cosourcing

Based upon a synthesis of the research at the time, Duncan [11] defined infrastructure as “a set of shared, tangible, IT resources that provide a foundation to enable present and future business applications” (p38). From such a perspective infrastructure provides support for the delivery of varied and adaptable applications [12]. There exists a reasonably extensive body of literature considering infrastructure within a single organisation (see for example [13], [14], [15], [16]) and several attempts have been made to identify what characterises such infrastructure – for example Star and Ruhleder [17] and Weill and Vitale [12]. However little work appears to have been conducted considering infrastructure that serves a group of organisations. Weill et al [14] and Weill and Vitale [12], for example, acknowledged infrastructure as existing outside the firm but did not consider it further. One exception is the work of Borman [18] who suggested that there are two defining characteristics of such infrastructure – that it *supports* the activities of the organisations using it and is sufficiently *flexible* to allow those organisations to exploit it in different ways.

Referring back to Duncan [11] these characteristics can be seen to directly contribute to the fundamental proposition of infrastructure serving as an enabling foundation. The first requires that the infrastructure does not function as an end service itself but rather facilitates, or is incorporated, into the end service delivered by each organisational user i.e. it underpins rather than overlays the activities of individual organisations. The second can be seen to build upon this supporting role by ensuring that organisations can incorporate the infrastructure into their operations in the manner most suited the individual needs i.e. it does not force excessive standardisation. Such a perspective may satisfy the requirements of the resource based theory. Wernerfelt [9] suggested that organisations secure success by utilising their unique resources to differentiate themselves. Ensuring cosourcing function in a supporting role and does not inhibit flexibility will enable organisations to tailor their use of it to best exploit their individual capabilities.

The remainder of the paper consists of the presentation and analysis of a case study of an instance of cosourcing, that is perceived by users to be successful, to ascertain both whether economies of scale and / or network externalities

are motivating influences and whether the cosourcing displays the necessary characteristics to be considered inter-organisational infrastructure.

III. METHODOLOGY

The financial services sector was selected as the broad domain for the empirical work as it has been identified as well suited to outsourcing due to the repetitive nature of many processes and their information intensive nature [19]. The focus was on credit unions which are member owned financial institutions that provide a comprehensive range of retail banking products and services. Around 180 credit unions currently operate in Australia with 3.6 million members and more than \$29 billion in assets. The specific instance of cosourcing examined was the core banking system and associated computer services. A core banking system is the IT application that provides the core transaction processing capabilities – encompassing back office, origination, front office and teller processing activities – that enables a credit union to develop and manage its various savings and loans products. The computer services to support the operation of a credit union’s core banking system are provided either internally or by a computer bureau. Bureaus vary with regard to whether they are independent commercial providers, or collectively owned by credit unions, and whether one or multiple core banking systems are supported. The range of options available is illustrated in Figure 2.

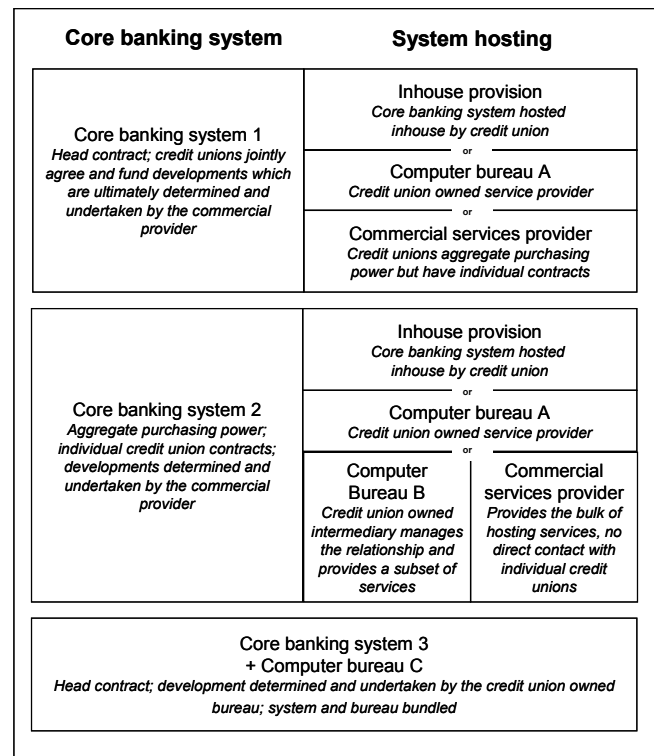


Figure 2: Core banking system and hosting options

The case study method was employed as it is seen as particularly appropriate where research and theory are at a

formative stage and a phenomenon is not well understood [20]. The case work presented here is primarily explanatory and draws upon the work of Dubé and Paré [21] with regard to the approach followed. It was therefore decided that the primary locus of triangulation would be between different organisations [22]. Of course, where possible and appropriate multiple interviews were conducted within a credit union to provide internal triangulation. While not ideal such a situation is not unique and there are numerous instances of other research (for example [23], [24]) where it has not been possible or has been nonsensical to conduct interviews with multiple actors within an organisation. Furthermore in all cases it was possible to achieve a degree of internal triangulation through the review of credit union documentation – primarily annual reports and board papers.

The sampling strategy followed can be seen as a combination of *intense* (in that the particular instance of cosourcing selected was one that was perceived to be very successful) and *maximum variation* (in that a diverse range of individual credit unions were selected in order to identify common factors that cut across variations) [25]. Because cosourcing was not universal amongst credit unions it was possible to examine whether the factors identified influenced the decision both from the perspective of credit unions that cosourced and those that did not. This represents an extension to much of the existing case study research on outsourcing where the focus has solely been on organisations that outsource (for example, [26], [27]).

A total of 14 credit unions were interviewed representing over 25% of the total asset base of the sector. Interviews were between one and two hours in duration and a semi-structured interview protocol was followed.

Credit Union	Total assets
CU1	< \$100m
CU 2	< \$100m
CU 3	\$100-\$500m
CU 4	> \$500m
CU 5	> \$500m
CU 6	\$100-\$500m
CU 7	>\$500m
CU 8	\$100-\$500m
CU 9	>\$500m
CU 10	< \$100m
CU 11	>\$500m
CU 12	\$100-\$500m
CU 13	>\$500m
CU14	\$100-\$500m

Table 1: Credit unions details

IV. RESULTS

The interviews suggested that both economies of scale and indirect network externalities serve as motivating forces for the cosourcing decision. In addition the cosourcing examined appears to function flexibly in a supporting role

allowing organisations to focus on and exploit their specific core capabilities. As such it can be seen to serve as inter-organisational infrastructure. However it also became apparent that cosourcing is unlikely to be monolithic and that a variety of options is desirable both to ensure competition between suppliers and to meet the different preferences of specific organisations. Furthermore cosourcing was seen as introducing a need to compromise with other credit unions. As such, and as Figure 3, illustrates cosourcing is likely to lead to multiple infrastructures rather than a single one.

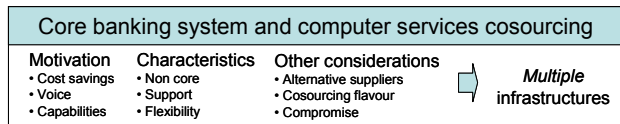


Figure 3: Cosourcing and the emergence of multiple infrastructures

A. Motivation

Core banking platforms and the computer bureaus that host them were seen by the majority of credit unions as areas where they had similar needs and could benefit from coming together to secure access to economies of scale.

“We are a medium sized credit union and we want access to those services, we rely on some of those large credit unions to get that aggregated purchasing power so that we get a reasonable price” CU14

“We’re small, we just can’t fund huge IT programmes” CU3

The desire for voice or the ability to get on the radar screen of suppliers can be seen as an indirect network externality – in that the voice increases as the number of credit unions utilising a particular option increases.

“If I was to negotiate, number one, they’d say well who are you? How big are you? How many members do you have etc., and they’d basically put me on the bottom of the pile” CU6

“The aggregated voice that you can do if you all speak as one voice, you can .. make some sort of demand and it might be a fair sizeable chunk of their business” CU14

Additional advantages however were also suggested for small and medium sized credit unions – including access to technical and managerial capabilities.

“small get access to new technology, large get volume based transaction discounts” CU5

B. Non core, supporting and flexible

From a capability perspective the majority of credit unions see their core banking system and computer bureau as critical not core. Furthermore they were firmly seen as serving in back office support roles.

"Because it's your core banking system, everything hangs off it and everything goes through it.. you can't run the business without it. Yes it is a tool, but it is just so critical it has got to be part of every consideration" CU9

"core is anything that touches the members.. happy to outsource the back office – things that the customer will not notice" CU5

"You can focus on your core business, focus more on your core business and doing what you do well, rather than focusing on those things that you then do very efficiently" CU14

"it's opaque, it's chugging away, and it has no bearing on the business." CU3

In only a few cases was the basic core banking system or computer bureau seen as core and in those circumstances they were retained inhouse.

The credit unions were also generally of the view that even with a common core banking platform there were considerable opportunities to configure it differently and build upon it with front end applications to develop points of differentiation ie there was an opportunity for flexibility.

"with enough parameters that you can make it look and feel different and be different" CU9

However it was also recognised that if you diverged too far from the core you could create problems for yourself.

"the minute you are a very highly modded site it costs you much, much more to get everything bolting on the way it should" CU11

Furthermore it was not recognised universally that the cosourcing option engendered sufficient flexibility.

"Why did we remain in-house? .. It gives us flexibility.. If we want to run reports today, two days time, right this minute or whatever, we have that flexibility to run reports. Whereas if you're with an IDPC², you have to put in a request for work, explain why, give some priority to it. So we don't quite have the flexibility" CU6

"better off being masters of our own destiny and staying in-house... enabled us to do was move very quickly with product development" CU9

It should also be noted that not all non-core activities are considered equal, that some are more sensitive than others and this may impact the likelihood of cosourcing.

"The general ledger footprint is identical.. [it is non-core but] aggregation is probably a phase that everyone's got a bit nervous about, I don't want someone else doing my numbers or sharing, doing my numbers as well as the credit union next door to me's numbers" CU12

C. Supplier competition

Credit unions were generally keen to have access to multiple alternative suppliers.

"they're a commercial entity, they're out to make a buck and we've had first hand experience when they've sold us modifications to the system that we know one of the credit unions before us paid for the same modification" CU12

"they're negotiating agreements and if we don't like it we can find another bureau" CU14

"Think it is good that there are alternatives- around three is right.. not more because [the industry] can not support but three gives choice" CU5

However it was also recognised that decisions were long term and there were differing perceptions as to how easy actual change was.

"do not revisit the decision often because it is such a major task to change" CU6

D. Cosourcing choices

The interviews suggested that there is more than one flavour of cosourcing. The cosourcing of computer bureaus for example differs with regard to whether the focus is primarily on buying power or operation.

"The host agreements are all separate .. So this is just purchasing power.. What we're trying to do is to get as much of the cost benefit without selling your soul. We think we've got a half way house. So why go that extra step if you don't have to. That's our position. We negotiate together, but at the end of the day we are separate entities. We are separate businesses, with the same supplier. That works for us." CU3

Even where the cosourcing is oriented towards operation there is variation with regard to the functionality provided, how standardised the operating environment is and the pricing of contracts.

"part of the reason why we like the [core banking] solution was it actually did away with a lot of those third party relationships you had to maintain to keep all those things going" CU9

"if you start running two platforms on your bureau, then it adds an extra layer of cost. It's much more efficient to run only one platform." CU5

² IDPC – Independent Data Processing Centre. The common term for the cosourced computer bureaus used by credit unions

"[Credit Union X] is getting it at a better price than me because what's happened is as the company makes more sales the unit cost of doing all the business comes down and for new customers it applies that. It's not going to say to us as a steady customer, look, good news because we signed X, Y, Z, we're going to cut your price by 3 cents in the dollar." CU7

Such variation in part reflects the differing organisational perspectives as to what is appropriate. For example there are conflicting views with regard to the amount of functionality a core banking system should provide.

"The beauty of that is, not coming as a package.. it's all modular" CU14

"[Application 1 is] very expensive to deal with. They have a core and then you have half a dozen different subsets that are provided by different providers. So you have installation costs and project management costs associated with all of those subsystems" CU12

"The number of suppliers that you are dealing with brings complexity for your depth of interface and then managing, you know, if you are making changes in your core one does it happen in the other application" CU13

There was also seen to be the potential for a particular cosourcing arrangement to be come too large, cumbersome or unmanageable..

"There's only ten of us, when it was 250 users you got rooted" CU4

E. Compromise

A dependency on other credit unions was also seen to be introduced with cosourcing. In structuring cosourcing arrangements interviewees suggested that one of the most difficult tasks was managing the balance between the individual credit union and the group as a whole. In addition being part of a group introduces the risk that the group will not always seek to move in the same direction.

"There is inherent compromise in all of these systems..." CU4

"I think there is always strength in numbers, but it is also making sure that the people who are then agreeing to the development, there is a common understanding and agreement of what needs to be done. I think the numbers give you benefit but it is making sure that everybody is on the right page and agreeing to the right direction and looking at it from, not only their self interest point of view, but the benefit of all parties involved." CU13

"For years and years, we pushed and pushed to get this done, and no one seemed to be interested because they'd never had it before in the other system. To this day we still

haven't got it. That's frustrating. .. when you're in a group you've got to wear the down side as well" CU3

"The system had to be selected to suit all sizes. This system can run on all sizes, but it runs better on the bigger organisations" CU14

V. DISCUSSION AND FUTURE RESEARCH

The cases suggest that when considering cosourcing two of the driving forces are indeed externalities and economies of scale. They also suggest though that benefits will likely vary across organizations in accordance with internal characteristics such as existing cost structures. In terms of whether providing inter-organisational infrastructure may be an appropriate focus for cosourcing the evidence is broadly positive. It would appear that the cosourcing examined both functions in a support role and provides flexibility and thus satisfies the necessary characteristics to be considered infrastructure. However the comments regarding not straying too far from the norm suggest that there are limits to flexibility and it is not absolute.

Furthermore it is interesting that interviewees emphasised both their preference for there to be a number of alternative suppliers and the compromise that cosourcing requires. It is likely that taken in combination these factors – different perceptions of what is required, the desire for competition and the need for compromise – explain why multiple cosourcing arrangements have developed rather than a single one.

In terms of future research, given the comment that some non-core activities are too sensitive to cosource, it would be useful to examine in more detail what characteristics of an activity make it amenable or not to cosourcing ie looking beyond the basic core, non-core divide.

It would also be useful to look in more detail at appropriate combinations of participants for cosourcing. Is there for example an optimum number of participants beyond which the incremental transaction costs of managing the cosourcing arrangement outweigh the incremental scale benefits (see for example the work of Hancock et al [28] regarding diseconomies of scale) or compromise becomes too problematic. Are there preferred compositions – for example that avoid or embrace the inclusion of a partner that is of a significantly larger scale than the other participants. What are the important organisational considerations – relating to factors such as strategy, structure, processes and culture ([29], [30], [31]) – to ensure that there is an appropriate "fit" between participants.

Furthermore how easy is it to identify a set of common interests that is stable over the long term for a group of organisations. In other words is cosourcing likely to be a common phenomenon or are there sectoral difference that

will influence the likelihood of organisations working together (as Hagedoorn [32] might suggest)? At a minimum variations in the extent of environmental uncertainty [33] and the degree of competition [34] may have an impact.

Finally it is also important to seek to examine in more detail the concepts of support and flexibility. What exactly do they entail and what are the implications in areas such as systems integration (does flexibility best provided through extensive or limited integration?).

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The Role of Complexity in Preparing for Municipal Decision-Making

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Abstract - The purpose of this paper is to analyze how the theories of complexity may give insight and a new perspective into the preparation of decision-making at the municipal level. Based on concepts like emergence, self-organization, far-from-chaos, connectivity and feedback processes, the paper suggests that more attention should be paid to the invisible dynamics of the preparation process. Municipalities are regarded as open and complex social systems that must ensure democracy and make effective decisions at the same time. Furthermore, municipalities should be able to analyze information and to construe the meaning of their operational environment. Among other things, officeholders and politicians should also be creative and innovative. This paper is based on a conceptual analysis done by the author. The literature of that analysis included several dissertations concerning decision-making at the local government level in Scandinavian countries, particularly in Finland¹. This paper is based also on other sources. This paper is descriptive and interdisciplinary in nature, and the goal is to outline a framework for future research.

Keywords - Preparation of the decision-making; municipal management; complexity.

¹ Municipality is the smallest administrative unit in Finland. Finnish local authorities have a high level of autonomy which is guaranteed by the Constitution. Every four years residents elect a local council in free and democratic elections. The council is the decision-making authority in municipal finances and operations. The municipal executive board, which is appointed by the council, does the preparatory work on matters coming before the council (=mandatory preparation). The board is responsible for the municipality's day-to-day administration and financial management. In Finland, the municipal manager is an official appointed by the local council, who serves under the municipal executive board.

(The Association of Finnish Local and Regional Authorities)

I. INTRODUCTION

Traditional political research has been concentrated on power and the notion of power is described typically as a social relation connecting capacities, actions and consequences [47]. The *dualism* between politics and administration has been seen to prevent effective and organized action [3]. From the effectiveness point of view, the decision-making should be a *rationalistic* process.

Rationality means herein that a decision-maker has the ability to predict the future environment as well as identify the basic aim of the organization and its related measures of success. In addition, s/he should be able to map the capabilities of the organization, evaluate the performance of each option and select the best alternative. Despite a lot of effort by researchers, there has been a strict criticism of the rationalistic decision-making model (see e.g. Simon [39], Lindblom [24], Huczynski and Buchanan [17], McKenzie & van Winkelen [30]).

The rationalistic view has been condemned as problematic for at least two reasons. One is that it implies that the main concerns of organizations and managers are making choices or solving problems [3]. Brunsson [3] has argued that successful management has more to do with the ability to motivate people and create a communicative organizational culture than making rational decisions. According to Brunsson, "organization's main problem is not choosing, but it is taking *organized action*." Furthermore Thierauf has pointed out, that in reality the most creative and capable organizations should engage in more *problem-finding* than problem-solving [45]. The focus should be away from "what is" to "what can be" [45]. In the same way, McKenzie and van Winkelen has emphasized that successful organizations must pay equal attention to creating new knowledge and exploiting existing knowledge [30].

The other problem is that rationalistic decision-making is based on the concept of complete information [39]. In reality the idea of complete information is by necessary a fad. In the decision-making context, information is important, but just one element of the muddling process. In practice, and within the context of municipalities, decision-making is confused by the opposition of interests among stakeholders, bargaining and negotiation between powerful groups and individuals, the limitations of personal capabilities and the actual lack of information (see e.g. Choo [5]). In addition, Brunsson argues that in political organizations these same counteracting forces are part of the organization's basis for legitimating itself [3].

This paper does not reflect an interest in the notions of power or dualism itself. Instead, it is claimed that the operational and decision-making environment of local authorities is increasingly complex, turbulent and dynamically changing. In order to make good decisions succeed in the real world, politicians should draw attention to how the preparation phase of decision-making is organized. For example, resolutions related to the aging of the population, securing welfare services, increasing productivity and sustaining competitiveness in the global economy are challenging ones for the local government authorities in Western Europe. Making decisions in these fields requires considerable amount of preparatory work.

Based on the earlier research (see e.g. Sotarauta [40]) and the experience of the author, it appears that the traditional models of municipal decision-making require revision. The core question will be: how to reconcile the values of democracy, effectiveness and creativeness in the preparation of the decision-making? Instead of increasing information in the preparation of decision-making, it is suggested that the focus should be on improving interaction between politicians and officeholders.

II. MUNICIPALITY AS A SYSTEM

A system is traditionally described as a collection of *parts* that are interconnected or *related* to one another and which also relate to the *environment* surrounding the system (see e.g. Checkland [4]). Systems can be open or closed. Social systems (e.g. organization or tribe) are in principle open, which means that they exchange information with their environment [43].

A system-theoretical view on municipality is depicted in Figure 1. Simplistically expressed, the changing demands and support from the environment are seen as inputs that 'drive' the municipality. To the same extent, various decisions and actions represent outputs of the municipality. Feedback processes are information flows that ensure the dynamics of the system. [43]



Figure 1. The municipality as a system (based on Easton [8]).

According to the presumptions of system theories, the local communities can be divided into political and administrative sections [34]. The aim of the policy is to strengthen local democracy. In this view, politicians are representatives of their constituents, who trust those they elect to use their best judgment to defend the public's interests. The officeholders' main duty is to ensure the effectiveness of the implementation of the decisions.

However, it could be said that there has been a management paradigm shift in the public sector. So-called New Public Management (NMP) emphasizes the managerial approach, efficiency and responsibility (see e.g. Clarke et. al. [6]). The New Public Management has remoulded the internal settings and workings of local administration [36]. This paradigm shift has also strengthened the position of officeholders, and the role of municipal managers as strategic leaders has increased [35]. (See more in detail about strategy process in Finnish municipalities e.g. in Sotarauta [40] and Rannisto [35]).

A. Changing environment

It has been argued that, due to the rapidly changing environment, an overly strict division into politics and administration should have disappeared. Among others, Sotarauta [40] has stressed that the basic assumptions of classical planning have simplified multidimensional social decision-making. For example, municipal institutions are faced at the turn of the millenium with many *wicked problems* which are problematic because they cannot be solved either by traditional planning or without planning [40]. Such wicked problems have several characteristics. According to Rittel and Webber [38], they are problems that have no definitive formulation, clear stopping rule or immediate test of a solution. Every wicked problem is essentially unique and is often symptomatic of the other problems. Also, the causes of a wicked problem can be explained in multiple ways. [38] Wicked problems are also noted by the fact that they refuse to be bound by administrative limits [41].

Many observers argue that previously quite clear boundaries in organizations and decision-making have begun to fade. This has multiple consequences. For example, Sotarauta [40] has pointed out that decentralized decision-making and a self-organising network of actors appears to be applicable for a complex, rapidly changing and unpredictable environment. At the same time, however, there may paradoxically be counter-effects in terms of increasing complexity, unpredictability and the rate of changes [40].

Furthermore, it could also be argued that in the preparation phase of decision-making the focus should be more on *sense-making* [48] than increasing the information flow. The aim should be that the participants of the preparation get an overview what is important and relevant concerning the

decision under discussion. The “frame of reference” directs interpretations and reduces uncertainty and ambiguity [48]. It enables people to comprehend, understand, explain and predict.

For the above-mentioned reasons, it could be said that more attention should be paid to communication and interaction between the political decision-makers and the officeholders at the local government level.

III. MUNICIPALITY AND COMPLEXITY

In a simplified manner *complexity* is always a property of a system. Mittleton-Kelly [33] emphasizes that complexity enriches traditional systems theory by amplifying additional characteristics of complex systems and by stressing their *inter-relationship* and *interdependence*. It has also been pointed out that complexity may be a main feature of the humanity [29]. In organizational research, complexity has increased its popularity during the past decade. However, there has not been an agreement on how this concept should be applied in organizational context (see e.g. Luhmann [25] & [26], Kauffman [19], Mingers [31], Holland [15] & [16], Mittleton-Kelly [32] & [33], Stähle [42], Anderson [1], Maula [28] & [29]).

Mittleton-Kelly [33] has aggregated ten *generic characteristics* or principles concerning complexity. They are self-organisation, emergence, connectivity, interdependence, feedback, far from equilibrium, space of possibilities, co-evolution and historicity as well as time and path-dependence. It should be noted that the complexity does not comprise a single, unified theory but rather a family of theories, arising from the fields of biology, physics, chemistry, computer simulation, evolution and mathematics [33]. The recognition that organizations are complex adaptive systems allows us to learn more about organizational dynamics [23].

In this paper, complexity is used as a framework to help understand the behaviour of a complex social system, particularly municipality and the preparation phase of decision-making. From the point of view of the municipal decision-making relevant complexity concepts are discussed more detail in chapter 3.2.

A. The preparation of the decision-making

Based on the conceptual analysis, it can be said that there is no single way to define the preparation of decision-making in the local government level [18]. On the one hand, it has been described as formation of the intent of the municipality [14]. On the other hand, it can be understood as the manifestation of the decision-making efficiency [13]. Publicly expressed, the objective is to ensure that decision-makers have adequate

basic information about the matters under consideration. Some forms of interactions are more *organized* than others. For example, the municipal executive board is responsible for preparatory work on matters coming before the municipal council. In addition, local authorities provide members of the municipality with information on current issues in process, or plans affecting them, their progress, decisions reached and their effects. Inhabitants of municipality are also encouraged to express their views to those in charge of planning and decisions. Moreover, inhabitants of the municipality have right to propose initiatives in municipal issues. On the other hand, there are number of interactions which are *unorganized* in nature. In town planning, for example, there may be strong interests outside the official decision-making process which may exert significant influence on decisions, without any responsibilities [34]. Furthermore, there is evidence that many de facto decisions are already made by informal institutions, in which case the formal decision-making procedures are needed for legitimacy [35]. This is consistent with Brunsson's observation, that the decision process can be legitimized by the illusion that it is concerned with a choice [3].

The conceptual analysis [18] strongly validates the presuppositions that the preparation of the decision-making consists of multiple interrelationships both within the local government and between administration and inhabitants of a municipality (see Figure 2).

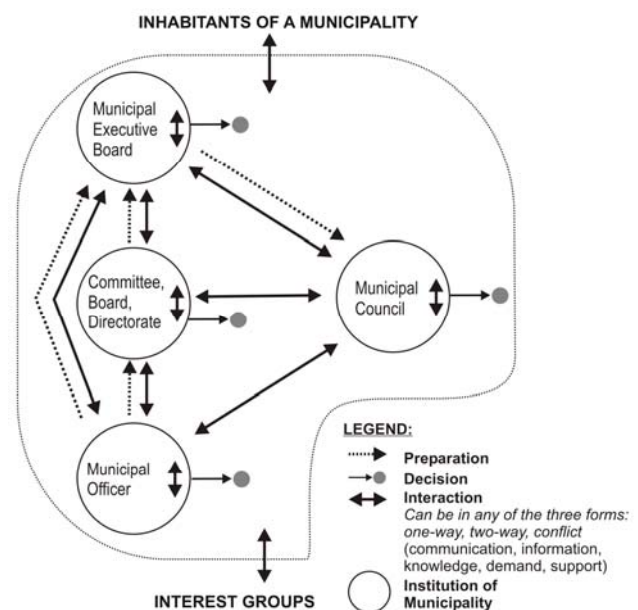


Figure 2. Finnish municipal preparation and decision-making process (Jalonen [18]).

These interrelationships can be based either on trust and cooperation or on competition and conflict. As noted before, there are increasingly number of societal problems that requires co-operation within local government and between local government and other stakeholders. A local industrial policy in the pressure of globalization, and health and social questions including the problems of ageing, among other things, are such areas where the need for cooperation is perhaps greater than ever before. However, policy-making has been a frequent source of conflict for local governments. For example, common issues such as town planning and public services to citizens, engenders conflicts between politicians who represents different interests.

Furthermore, the findings of the analysis are in line with public opinion, whereby de facto decisions are made already in the preparation phase and the formal decision-making procedures are needed for legitimacy. It could be said that the preparation and decision-making are blended each other.

Due to the numerous feedback processes and connections, the municipal preparation of decision-making has no *definable boundaries*. Indeed, it is almost impossible to evaluate the participants' influence. For example, in town planning there might be strong interests outside official preparation process, which may have a significant influence on decisions, without any responsibilities [34].

B. The preparation of decision-making as a manifestation of complexity

Based on the conceptual analysis, it seems that the preparation of decisions contains at least some elements of a complex system. For example, it could be said that the preparation is more or less boundless. It consists of feedback processes, the actors are connected each other, and there are emergent phenomena which make the preparation process to a certain extent unpredictable. Stacey [44] points out that complex systems consists of unforeseen contingencies, non-linear causalities and inconsistency behaviour. Complex systems can be described as something that cannot be foreseen from what is known of the component parts. Instead, the interaction of the individual components emerges some kind of aggregate property [23]. A relation between the parts and the whole is depicted in Figure 3.

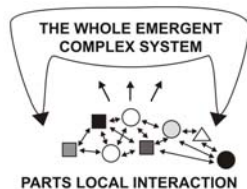


Figure 3. Emergence in complex systems (adapted Sotarauta 1997; originally Lewin 1993).

Emergence is the process that creates new order together with *self-organisation* [33]. In the context of municipal decision-making, self-organisation and emergence requires that the preparation system is capable to produce and to reduce entropy. Ståhle [43] has described the self-organisation as a chain: the production of entropy; disequilibrium or chaos; the reduction of entropy and finally new organisation.

In social systems, the entropy generally refers to information. Information has been appreciated as a significant factor in systems change processes (see Figure 4.)

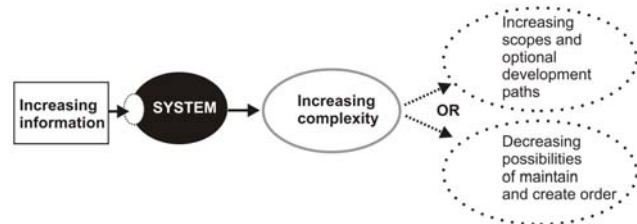


Figure 4. Information and change of system (adapted Keskinen [20]).

The researchers in the field point out the problem is that individuals often evaluate new information on the basis of their existing knowledge and mental models [43]. In the political context, the new information might be considered as a threat by politicians and officeholders. For example, Harju [12] has find out that in the context of municipal decision-making the new information is not appreciated as a valuable part of the process, but rather as an obstacle to effective decision-making. The risk is that decision-making is based only on information which reasserts the old power structures, and that the preparation process fails to guarantee the necessary diversity. Lacking diversity of the preparation might inhibit identifying changes in the environment. For example, it can be claimed that looking for *weak signals* requires rich interaction and communication between the actors in the decision-making process (see more on weak signals e.g. Mannermaa [27]).

In a human system, *connectivity* and *interdependence* mean that a decision or action by any individual may affect related individuals and systems [33]. Moreover, in order to be effective, there should be effective *feedback* processes [43]. Mitleton-Kelly [33] puts that positive feedback drives change, while negative feedback maintains stability in a system. When applied to human interactions, feedback means impact that changes potential action and behaviour [33].

The connectivity, the interdependencies and the feedback processes of the preparation process are documented in Figure 2. Based on conceptual analysis, it seems clear that, there are two kinds of feedback processes. On the one hand, the aim of preparation is to facilitate a *convergence* of (conflicting) interests (negative feedback). On the other hand,

the purpose might be to *diversify* the preparation process (positive feedback). The divergence and the convergence are depicted in Figure 5.

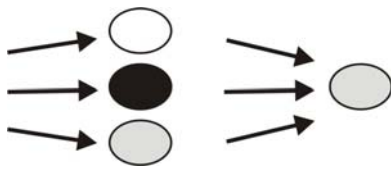


Figure 5. Divergence and convergence (adapted Maula [28] originally Arthur Andersen 1999).

In the preparation of decision-making, divergence can be seen as an imperative condition in order to be innovative and to create new knowledge. Respectively, convergence is closely related to the effectiveness of the process.

The feedback processes can be also considered from the view point of the chaos theory. A system, which exchanges information with the environment, is constantly at the *edge of chaos* or *far from equilibrium* [33]. In social systems “far-from-equilibrium” means that there are conflicting interests which create tensions in the system [43].

There is also the so-called *bifurcation point*, some kind of ‘moment of truth’ where the system has various options. Ståhle [43] describes these bifurcation points as zones between determinism and free choice. When a social entity is faced with a bifurcation point, it endows the entity with *space of possibilities* [33].

At the bifurcation point, the system discards a measure of information in order to build new order [43]. Therefore, the bifurcation can be seen as a source of innovation. According to Mitleton-Kelly [33], the alternatives at the bifurcation point “are sources of innovation and diversification, since the opening up of possibilities endows the individual and the system with new solutions.” This is what is depicted in Figure 4 and in Figure 6.

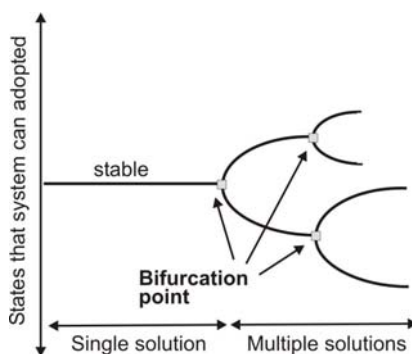


Figure 6. Bifurcation (adapted Mitleton-Kelly 2003).

In the municipal decision-making process, there are also bifurcation points, which determine a particular life path for that process. On the basis of the conceptual analysis, there is strong evidence that in order to exploit opening possibilities, there must be an atmosphere of confidence based on communication intensity (see e.g. Harisalo & Stenvall [11]). This is also consistent with the basic concepts of Luhmann [26], who argues that the self-organisation of social system is based on communication and trust between constituents.

C. Complexity and the information technology

According to Geiselhart [10] the studies of information technology in government have focused on the instrumental outcomes, i.e., the efficiency of information provision and service delivery. There is also strong evidence that, e.g. practical efforts for increasing computer-based communication have been concentrated on strengthening existing structures and one-way communication [37]. So far, it has been a myth that technology stimulates democracy. These research findings are compatible with the presumptions of representative democracy.

However, the focus should be on how computer-based information and communication technologies might be integrated into administrative processes to ensure effectiveness, participation, resilience and legitimacy [9]. Geiselhart [10] suggest that information technology has the potential to repluralise democratic policy. Klijn & Koppenjan [21] argues that in the post-modern era the most challenging demand for the local authorities is to develop more communicative and interactive decision procedures. Moreover, Kooiman [22] points out that traditional approaches in modern societies “neglect diversity, do not cope with dynamics and unsatisfactorily reduce complexity.”

Seen from the complexity view, information technology is an emergent phenomenon which opens up new channels of communications and increase the connectivity and the interdependencies of the preparation process.

Interactive systems such as computer-based communication are also feedback systems, and hence they can generate surprises even while showing identifiable patterns. Complexity theory emphasizes that “rather than suppressing the resulting disorder and instability as undesirable risks, these processes can be accepted as inherent in all forms of evolution, adaptation and renewal” [10].

Even though it has been argued that administrative decision-making is based on formal knowledge (i.e., fact), Simon (1957) has already stressed that overly strict division into policy and administration represents an oversimplification, because it would be difficult to distinguish reason from values in the decision process [39]. In other words, political and administrative decisions are based on the best information and sound reasoning as well as

values, opinions and emotions. Therefore the big question concerns how information technology facilitates not just rational deliberation but also creates and communicates moral principles in addition to expressing personal and group values [7]

Information technology amplifies complexity and the connectivity of the preparation process. The resulting 'messiness' should be regarded not only as natural, but crucial for the survival of the preparation system. The objective should be to conjoin environmental complexity with organizational complexity [2].

IV. CONCLUSIONS

In the context of local government, complexity arises at least from problems concerning the integration of complex information from a variety of sources, imperfect or incomplete information, the presence of uncertainty and complex interaction between the politicians and officeholders.

This paper has concentrated on the challenges facing the preparation phase of municipal decision-making. Its description is based on a complex social system, which implies that more attention should be paid to the *invisible dynamics of preparation*. In particular, the research should focus on the interactions and interrelationships between politicians and officeholders. According to the complexity theories, even rather small matters may generate large and irreversible impact on the preparation process. Respectively, the preparation process could be immune to specific planning. This means that the preparation process may benefit from diversity, connectivity, the exchange of information, flexibility and the utilization of emerging information as an input. On the other hand, a preparation process that, detail-wise, is carefully planned beforehand may be a vulnerable one.

One proposed solution to the dilemma of *effectiveness* and *creativity* is outlined in this paper. It is that conflicting interests in the preparation process should not be damned as the barriers of the effective activity. Instead, they should be seen as triggers or tensions which activate interactions between the actors of the process. Actually, it may be claimed that the more dynamic the environment, the more a *need for communication* exists within the preparation process and between the process and its environment. In other words, the focus should be on both *the parts* and *the whole* (see Figure 4). In finding a balance between the convergence (negative feedback) and the divergence (positive feedback), the municipality might be one step closer to reconciliation of the values of effectiveness and creativity.

ACKNOWLEDGMENTS

I thank my supervisor, Professor Marjatta Maula at the Tampere University of Technology, who has provided invaluable support, ideas and constructive feedback. I also thank my second supervisor, Professor Pasi Tyrväinen at the University of Jyväskylä for offering comments and suggestions, especially with reference to communications. Possible errors and indistinct sentence content are invariably due to my personal limitations.

This paper has been financially supported by the Turku University of Applied Sciences, the Regional Fund of Southwest Finland (Lyyli and Kalle Vihanto Foundation) of the Finnish Cultural Foundation and the Finnish Foundation for Economic Education.

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The role of Customer Participation in Creating e-Service Value

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Abstract — Customer participation in service delivery has been argued to be growing especially in the field of e-services. The aim of this paper is to explore the role of participation on customer perceptions of e-service value. The theoretical framework represents a four-dimensional model of e-service value based on technical, functional, temporal, and spatial value dimensions and it is suggested that e-service value is influenced by the service, customer, and situation. An empirical study based on 3328 usable responses investigates consumers' perceptions of an online travel service. The findings show that active participation on the site increases service value and hence it indicates that customer participation has a role in creating value to e-services. The paper contributes to service marketing research through its empirical findings on e-service value and customer participation.

Keywords—customer participation, e-service value, service management

I. INTRODUCTION

An increasing number of products and services contain some form of technology. The recent technology developments have had a significant impact on the value creation (Parasuraman and Grewal 2000). The role of the customer in creating service value is changing. Value is not something that is delivered to the consumer; rather it is produced in cooperation with the consumer (Normann and Ramírez 1994; Woodruff and Gardial 1996). Customer participation in the production of both goods and services has been argued to be growing (Bendapudi and Leone 2003). Traditional self-services such as self-service restaurants are complemented with self-service technologies such as self-service check-in.

Technology-based processes, such as online services or self-service kiosks that consumers interact with enable customers to independently perform the service without interacting with the service personnel. When customers co-create value (Normann and Ramírez 1994; Woodruff and Gardial 1996) or even independently create value themselves (e.g. Dabholkar 1996; Meuter et al 2000;

Anselmsson 2001), the perceived value is increasingly less fixed to a specific time or location controlled by the service provider. Service value resides in the convenience of self-service and the resulting temporal and spatial flexibility (Heinonen 2006). Also, the ability to “produce and consume the service when needed or where needed is one factor in customer satisfaction” (Bitner et al. 2000:144).

However, although the digitalization of consumer has been acknowledged in service marketing research, the focus of e-service research has been on perceptions of e-service quality (e.g. Dabholkar 1996; Zeithaml, Parasuraman and Malhotra 2000; Kaynama and Black 2000; Santos 2003; Yang and Jun 2002; Anselmsson 2001; Gounaris and Dimitriadis 2003; Li, Tan and Xie 2002, 2003, Zeithaml, Parasuraman, and Malhotra 2005) and to a lesser extent e-service value (e.g. Mathwick, Malhotra and Rigdon 2001, 2002, Chen and Dubinsky 2003, Heinonen 2004, 2006). Other areas of research involve describing and categorizing self-service technologies (e.g. Dabholkar 1994, Meuter et al 2000) or adoption and attitudes of e-service (e.g. Curran & Meuter 2005, Curran & Bagozzi 2002, Curran, Meuter & Surprenant 2003). Research on customer participation in turn has focused on its economic implications (Bendapudi and Leone 2003). However, although it is well-known that e-services improve customer-firm interactivity and dialogue, research on the role of customer participation on e-service value is only in its beginning.

The aim of this paper is to explore the role of participation on customer perceptions of e-service value. Particularly, how do consumers use e-services and how does this influence value? The theoretical framework represents an extended view on customer perceived value of digital services. This is interesting when considering that the customer's possibility and willingness to participate in service delivery influences the total service offering. It is suggested that e-service value is based on four dimensions of value (technical, functional, temporal, and spatial) involving benefit and sacrifice components, and that it is influenced by three factors (service, customer, and situation). An empirical study based on 3328 usable responses investigates consumers' perceptions of an online travel service. The four value dimensions were evaluated based on assessments on willingness to buy and on

perceptions of the difference between competing services. Also, respondents reported their level of use of the service, which represented the participation in the service process. The findings indicated differences in the perceptions of each value dimension and in the corresponding subdimensions depending on the level of customer participation. In general, active participation on the site increases the perceived value and hence it indicates that customer participation has a role in creating value to e-services. The paper contributes to service marketing research through its empirical findings on e-service value and customer participation. The practical contributions include an improved understanding of the challenges of customer participation for managing e-service.

II. SERVICE VALUE

In the service literature, customer perceived value has been defined as “the consumer’s overall assessment of the utility of a product based on perceptions of what is received and what is given” (Zeithaml 1988:14). It thus represents the perceived trade-off between benefit and sacrifice. Often quality is seen as the benefit and price as the sacrifice (Monroe 1990). Recently, it was argued that value is created in the consumption or use of the service (Edvardsson et al 2005; Vargo & Lusch 2004).

Research on e-services has focused on e-service quality but there is also an increasing number of studies exploring e-service value (Dabholkar 1996; Zeithaml, Parasuraman and Malhotra 2000; Kaynama and Black 2000; Santos 2003; Yang and Jun 2002; Surjadaja, Ghosh, and Antony 2003; Gounaris and Dimitriadis 2003; Parasuraman, Zeithaml and Malhotra 2005, Chen and Dubinsky 2003, Mathwick, Malhotra and Rigdon 2001). Recently, customer perceived value was conceptualised with four value dimensions: technical, functional, temporal, and spatial e-service value (Heinonen 2004). The technical dimension denotes what the outcome of the service interaction is and the functional dimension involves customer perceptions of the process how the service interaction occurs. The temporal dimension refers to customer perceptions of the time when the service interaction occurs whereas the spatial dimension denotes perceptions of the location where the service interaction occurs. It was even argued that the temporal and spatial dimensions are more important than the technical and functional dimensions (Heinonen 2004). Recently, Heinonen (2006) described the sub-dimensions of temporal and spatial value. Other research focuses on experiential value (Mathwick, Malhotra and Rigdon 2001). However, there is a need to understand how customers’ through their active participation in service delivery influences service value.

III. CUSTOMER PARTICIPATION

Different types of service involve different levels of customer participation, and in order to describe the level of customer participation it is necessary to investigate different types of services. In the research on service encounters it is possible to describe the level of customer participation depending on the nature of the service interaction. For example, Lovelock (1983) illustrated customer-employee interaction based on whether customer goes to the service organisation, the service organisation comes to the customer, and whether the interaction occurs at arm’s length. It can be argued that the difference in the level of participation is based on how easily the customer can access the service by choosing where the service delivery occurs. Lovelock’s study includes different number of service outlets and it can be seen to decrease the level of participation.

Shostack (1985) explored the nature of service encounters and identified three types of services. The direct personal encounter referred to direct human interaction. The indirect personal encounter in turn denoted verbal but no face-to-face interaction. The remote encounter was argued to occur without human interaction with the service provider, such as through mail or machine. This is similar to Meuter et al’s (2000) definition of self-service technologies that involve little or no human interaction and where the customer produces the service independently. Bitner et al (2006) also suggest that the servicescape has three dimensions depending on the service usage, i.e. self-service where the customer performs most of the service activities and remote service at the other extreme where the service employee performs the service without customer involvement in the servicescape. In interpersonal services both customers and employees are active. It can thus be argued that the lack of human interaction results in large customer participation.

Customer participation in service delivery has been conceptualised with different levels (Bitner et al 1997, Chernatony and McDonald 1998). Customer participation can be low meaning that the customer is only required to be physically present during the service delivery, moderate, i.e. the customer’s input in the service delivery customises the standard service, or high where the customer co-creates the service product together with the service provider. Hence, the customer can be viewed as either a productive resource, as a contributor to quality, value and satisfaction and as a competitor to the service organisation (Bitner 1997). The input can be information, physical effort or inconvenience. When considering technology-based self-service options then the low level of customer participation is not directly applicable. In fact, the customer is expected to contribute to the service delivery and perform some of the tasks traditionally performed by the service employee. Conversely, the moderate and high levels of customer participation are especially relevant for technology-based

self-services.

In their review of the research on customer participation Bendapudi and Leone (2003) found that early research on customer participation was focused on the company perspective with case examples of why customers participate in the service production. Another research theme was argued to involve a focus on managing customers as partial employees. Their study focused on the psychological implications of customer participation on customer satisfaction and they found that customer satisfaction differs depending on whether the customer participates in the service process. Because satisfaction and value are linked (Storbacka, Strandvik and Grönroos 1994) it can be argued that customer participation also influences service value. There is consequently a need to both focus on the customer perspective on customer participation, and also see its influence on service value, as it has not been included in previous research.

Customer participation in the service delivery process is changing value creation in many ways. Because consumers are servicing themselves through technology-based self-services, it is easier for them to contact the company through a number of different channels. In this way, it is frequently the consumers that initiate the interaction, for example inquiries, information searches, and complaints are easily performed on the Internet. Also, the number of conversations and interactions between consumers, consumer communities and companies is growing (Prahalad and Ramaswamy 2004). Hence, the traditional product- and company-centric perspective on value creation is shifting towards personalized consumer experiences where consumers are co-creating value with the company (Prahalad and Ramaswamy 2004). This means that consumers are doing activities traditionally performed by the service contact personnel. As a result, instead of doing routine transactions such as informing consumers it is possible to direct resources towards more value-increasing activities, such as creating experiences for consumers.

IV. CONCEPTUAL FRAMEWORK

In this paper, as depicted in figure 1, a four-dimensional value model and based on technical, functional, temporal, and spatial dimensions (Heinonen 2004) is used to study how customer participation influences service value. It is argued that the level of customer participation influences the service value and the importance of these four dimensions. The value dimensions are defined in the following way. Technical value relates to the outcome of the service interaction. Functional value involves interactions between the customer and all kinds of interfaces of the company, both personal and technical. Temporal value denotes perceptions of the time of the service process. Spatial value involves customer perceptions of the physical place and its characteristics. Using a value-in-use perspective and a comparison of

different alternatives as reference point it is argued that both benefit and sacrifice are embedded in the value dimensions.

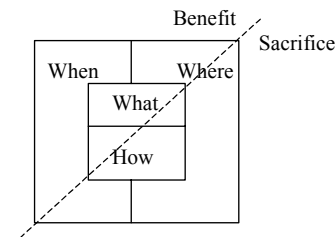


Figure 1: Four dimensions of service value

Customer participation in this paper denotes the user's activity on the web site and how many different aspects of the site are used. For example, at a web site it is usually possible to search for information, book or buy, navigate through different links etc. Web sites also include more than information, such as doing queries to get information or recommendations, or carry out discussions with other consumers online. The degree of customer participation is seen to vary from high to low depending on how many of these alternatives are used.

Two customer-related factors are seen to mediate the influence of customer participation on customer perceived value: they are customer energy and customer orientation. First, customers may show different amount of energy concerning a particular relationship, which consists of customer involvement of a product/service category and customer commitment of the relationship. Second, the task/experience orientation of the consumer also has a role in the relationship between customer participation and customer perceived value. The value of a service is influenced by the motivation to use the service, i.e. whether the customer has a particular task to perform, such as to execute a transaction, or if the customer does not have a rational need but uses the service to find new experiences and explore different issues.

V. METHODOLOGY

An empirical study conducted in September 2004 explored the perceived value of an online travel service. The usable sample size was 3328 of a total of 3408 responses. 31% of the respondents were between 20 and 29 years of age, 26% were between 30 and 39 years, and 24% were between 40 and 49 years. 7% were younger than 20 years, and 13% older than 50 years. Of the sample, 76% were female and 24 % were male.

The data was collected with an online questionnaire hosted at the site of a travel agency for one and a half weeks. The questionnaire was developed with several iterations involving two researchers, consumers and representatives of the chosen travel bureau. A student group tested the first version and then after iterations and modifications between two researchers a developed

questionnaire was tested by a new set of respondents that were also asked to verbally comment the questionnaire. Before the questionnaire was set up online, representatives of the travel bureau reviewed and commented it. As a result of this, it was possible to create a questionnaire that represented the real web service as much as possible. This was important especially for the questions representing the participation in the specific service.

All four dimensions included sub-dimensions that were based on Heinonen (2004) and they were combined and adapted to the studied service. It has been argued that although the value dimensions exist independently of service type, the subdimensions and their operationalisations need to be modified to the specific service (Heinonen 2006). This also means that there is a need to exclude or include subdimensions depending on the chosen service. In this study, it meant for example that entertainment was included as a new subdimension because the service involves an experience as such, whereas the subdimensions were originally developed for a transactional type of service, i.e. a bill payment. A set of 18 questions was developed to measure service value. Technical value included three sub-dimensions: content, tangibles and price. Functional value was represented by process easiness/functionality, security, entertainment, decision support and dependability. Temporal value involved three sub-dimensions: temporal efficiency/usefulness, speediness and temporal latitude, all with one question. Spatial value included four sub-dimensions; spatial latitude, visual layout, channel functionality and navigation.

The perceived value was measured in two different sets with the same questions; one set reflecting the level of activation of the attribute measured by the willingness to use the service, and another set representing the evaluation of the same attributes compared to competing services. The activation question was formulated as, for example: "How interested are you in using a website that contains more information about the travel destination than a brochure?". These questions were measured on a three-point scale: (1) does not add to my interest in using the web site, (2) somewhat increases my interest in using the web site, and (3) considerably increases my interest in using the web site. The evaluation question was posed as "Now compare Travel Agency X's web site to other similar web sites concerning the content of the website". The scale points were: (1) other similar web sites are significantly better, (2) other similar web sites are somewhat better, (3) Travel Agency X's web site and other web sites are equally good /I do not know, (4) Travel Agency X's web site is somewhat better, and (5) Travel Agency X's web site is significantly better.

Customer participation was measured with a set of questions that were specifically developed for the chosen web service. It included different service characteristics that the consumer was able to use, and the level of

participation was higher the more service elements that the respondent used. The level of involvement and commitment were each represented with one question, whereas task/experience orientation involved two questions, and they were all measured on a five-point Likert scale.

The data was analysed in the following way. Questions concerning the subdimensions were recoded into a sum variable based on the sum of the importance weight and the benefit/sacrifice evaluation. Overall value represented a sum variable of all the subdimensions and it was further recoded into three value groups (low value, moderate value, and high value).

Questions concerning customer participation were given weights depending on the relative level of participation. Each activity on the web site gave one point, for example, search for contact information gave one point but if the respondent additionally gave feedback through the web site, then two points were given. In this manner, the higher participation, the higher weight. The participation weight was then recoded and the respondents were grouped depending on level of participation (low participation, moderate participation, and high participation). In general, customers were highly active on the web site: low participation represented 12% of the respondents, moderately participating respondents represented 83%, and high participation was represented by 5% of the respondents. The site was mainly used to search for information about travel destinations and traveling (84%), and planning a trip (77%). The majority of the respondents also searched for offers (80%), searched for information in different parts of the site (72%), browsed for travel destinations by country/many countries (83%), used destination search (60%), or used quick search options (51%). 65% of the respondents indicated an interest in reading other consumers' travel diaries. Other options on the site used by many respondents included search for contact information (45%), advanced search (49%), booked their holiday on the site (21%), read information about the children's club (22%), and paid their holiday on the site (16%).

The level of involvement was recoded into two groups, low involvement and high involvement. The two task/experience orientation questions were summed and recoded into two groups: experience orientation and task orientation. The majority of the respondents, or 95%, were highly involved in the service category. 88% of the respondents were also experience oriented, i.e. they used the site to surf, rather than to search for a particular thing.

VI. FINDINGS

Although the majority of the respondents perceived all the four dimensions as offering moderate value there were differences between the value dimensions (table 1). The temporal value dimension involved high value for 23% of

the respondents, whereas the corresponding percentage for the functional dimension was only 8%. Compared to the other dimensions, the temporal dimension also was perceived as offering moderate value by the lowest number of respondents. The technical and spatial dimension involved high value for almost 17% respectively. The technical value dimension represented low value for only 7,5% whereas the corresponding percentage was almost 15% for the functional dimension. If the moderate and high value groups are summed, the findings indicate that the temporal dimension was perceived as the most value-adding, followed by the technical dimension. The functional dimension was perceived as the least value-adding.

Table 1: Differences in the level of value

	Technical dimension	Functional dimension	Temporal dimension	Spatial dimension
Low value	7,5%	14,8%	9,8%	9,2%
Moderate value	75,7%	77,1%	67%	73,9%
High value	16,8	8,1%	23,3%	16,9%

A factor analysis with principal component analysis method was conducted to get an overview on the perceived value of the service. A sum variable of the sub-dimensions representing the four dimensions was used. It indicated that three components explained 51% of the variance. The KMO measure of sampling adequacy was 0.938, which indicates a good fit.

Table 2: Factor analysis of the sub-dimensions
Rotated Component Matrix^a

	Component		
	1	2	3
content	,199	,582	,166
monsavin	,187	,659	,044
clarity	,213	,589	,334
instruct	,040	,467	,515
trust	,192	,240	,561
easyuse	,177	,351	,537
entertai	,039	,046	,782
reliabi	,361	,281	,495
efficiency	,471	,069	,563
speed	,640	,255	,247
tempchoi	,808	,215	,131
recommen	,440	,376	,329
spatchoi	,783	,246	,159
correct	,606	,322	,177
visual	,283	,174	,641
tools	,267	,485	,331
navigati	,323	,553	,298
pricecom	,237	,686	,113

Extraction Method: Principal Component Analysis.
Rotation Method: Varimax with Kaiser Normalization.
a. Rotation converged in 6 iterations.

Table 2 indicates that factor 1 is based on temporal and spatial value, as the variables that loaded include speed, temporal choice, spatial choice, correctness of the details, and efficiency of time used. This factor can thus be described as value related to flexibility. The second factor loaded mostly on technical aspects, where content,

monetary savings, clarity of the service, instructions, price comparisons, tools, and clarity of navigation were important. The value related to this factor thus involves the outcome of the service and is based on rational elements. The third factor involved the functional aspects of the service, i.e. ease of use, entertainment, reliability, efficiency, and visual appeal. The value is thus related to the service process and it involves also feelings and emotional aspects of the service experience. Hence, it can be seen as the opposite to factor 2.

Cross-tabulating customer participation and customer perceived value indicates that the level of participation does influence the perceived value (table 2). Low participating respondents are over-represented in the low value group whereas high participating respondents are over-represented in the high value group. There is also a significant correlation (0.000) between participation and overall value.

Table 2: Customer participation and perceived value

		Overall value class			Total
		1,00	2,00	3,00	
Low participation	Count	19	291	11	321
	Expected Count	10,2	275,1	35,7	321,0
	% of Total	,8%	11,8%	,4%	13,0%
Moderate participation	Count	55	1760	228	2043
	Expected Count	65,2	1750,9	226,9	2043,0
	% of Total	2,2%	71,1%	9,2%	82,5%
High participation	Count	5	71	36	112
	Expected Count	3,6	96,0	12,4	112,0
	% of Total	,2%	2,9%	1,5%	4,5%
	Count	79	2122	275	2476
	Expected Count	79,0	2122,0	275,0	2476,0
	% of Total	3,2%	85,7%	11,1%	100,0%

Of the respondents, 86% perceived the web service as providing moderate value, 3% perceived it as providing low value whereas 11% perceived it as providing high value. One surprising finding is that although the respondents were not task oriented, emotional elements in the service were less important than technical and economical elements. In other words, the travel service value is based on rational aspects at the expense of more experience-based aspects.

VII. DISCUSSION AND CONTRIBUTION

The empirical study based on 3328 usable responses investigated consumers' perceptions of an online travel service. The four value dimensions were evaluated based on assessments on willingness to buy and on perceptions of the difference between competing services. Also, respondents reported their level of use of the service, which represented their participation in the service process. The findings indicated differences in the perceptions of each value dimension and in the corresponding subdimensions depending on the level of customer participation. Although the respondents were not task oriented, emotional elements in the service were less important than technical and economical elements. In general, the findings showed that

active participation on the site increases the perceived value and hence it indicates that customer participation has a role in creating value to e-services. On the other hand, one surprising findings was that high customer participation was also related to low value. This can be explained by the fact that high participation such as to actively try to find something particular in the service or to use the service without succeeding, can result in low perceived value.

The paper contributes to service marketing research through its empirical findings on the perceived value of e-services as well as to the knowledge of how customer participation influences service value. Future research needs to qualitatively investigate customer perceptions of how participation influences service value. It is relevant to understand what sub-dimensions are related to high customer participation and vice versa. Also, there is a need to explore further other factors influencing the relationship between service value and customer participation. Although the findings indicated a high correlation between service value and customer participation, it is interesting increase the knowledge of the actual relationship. Another interesting topic for future research is to investigate the role of the chosen service, i.e. to compare other types of services, both e-services and traditional interpersonal services, and see how the level of customer participation influences service value.

VIII. MANAGERIAL IMPLICATIONS

The practical contributions include an improved understanding of the challenges of customer participation for managing e-service. The higher the customer participation the higher the perceived value is. This suggests that the perceived service value can be maintained or even increased without further managerial input, as the customers seem able to create value by using the service. However, sometimes high participation results in low value. This is evident when the customer tries to use the service without succeeding to find the correct function. This situation represents a challenge for managers because when the customer is active and highly involved in the service, even small decrease in the service performance represents a high sacrifice.

Because of the high customer participation in e-services, and the findings that customer participation influences service value, a managerial challenge is how to positively influence the value that is created in the service process. Drawing on the findings, it is suggested that the role of the firm is to create an arena that enables and facilitates service consumption. This can be done either by decreasing the amount of activity and input needed from the customer in the service process or by increasing the level of value that is created in using the service. Based on previous research, this can include both utilitarian and hedonic value (Francis and White 2003) where the focus is to create either rational

or emotional value.

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The role of open knowledge in regional development – case study

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Abstract - The paper describes the experience of CSP, a regional agency in the field of the Information Society. As catalyst for innovation in Piedmont region (north-west of Italy), CSP has been working in line with the regional strategy for the development of a knowledge-based economy.

The paper outlines the key elements of the current strategy for regional development and describes the model and results implemented by CSP.

Keywords – Regional Catalyst, open knowledge, service-oriented production, micro-firms.

I. INTRODUCTION

CSP - Innovazione nelle ICT is a local development agency in the field of Information Society. CSP, as catalyst for innovation in Piedmont region (north-west of Italy), has been working in line with the regional strategy for the development of a knowledge-based economy.

CSP is actually running a Structural Fund Project (called DIADI 2000) focusing on technology transfer towards SMEs. Through DIADI 2000 CSP, looking at state-of-art initiatives such as the R&D EU DBE project, aims at introducing the business ecosystem pattern in Piedmont. DIADI 2000 is a medium-term project aimed to locally complement the long-term research-based orientation towards open knowledge.

The paper firstly outlines the key elements of the current strategy for regional development, secondly it describes the model and results implemented by CSP.

CSP has been addressing 3 interconnected domains to reach its aim: culture, business models and technology. According to CSP regional experience, the open knowledge paradigm is a possible approach to increase local competitiveness, favouring the widespread of competences and tools, as well as the rise of new business opportunities.

The project so far has managed to disseminate some key concepts to SMEs — such as a focus on highly customised services (rather than on software), reassurance that the software elements needed are widely available (importance of OS components), and that there are merits in reinforcing the dynamics of networked businesses and ecosystems.

Furthermore, the project saw the implementation of a software component which has been released following the Open Source paradigm in order to promote its use in SMEs business networks. The project is now co-financing some

Pilot Projects addressed to stimulate local SMEs to implement new knowledge-intensive services.

According to CSP vision, the open knowledge paradigm - as to say a model of production based on knowledge openness and sharing - represents one of the main challenges for the local entrepreneurial system in the near future.

II. THE REGIONAL STRATEGY

A knowledge-based economy, defined as an economy based on knowledge production, distribution and use[1], is one objective to favour Piedmont growth and increase local competitiveness.

The diagram in Figure 1, inspired by the Digital Ecosystem research vision [2] shows the interconnections among growth, innovation policies and ICTs, and appears to represent the background of regional strategies. Policies are fed by the economic growth and can be addressed to support the development and accessibility of open knowledge.

Nowadays knowledge is more crucial than ever before and applications of ICTs are the drivers of the new economy[3]. ICTs play a key role in knowledge formalization and distribution, reducing the effort of gathering and disseminating knowledge and giving it an easy-to-find and easy-to-use structure. This peculiarity fits a growing number of industrial activities, in which the amount of knowledge to be managed is simply too large for any single actor.

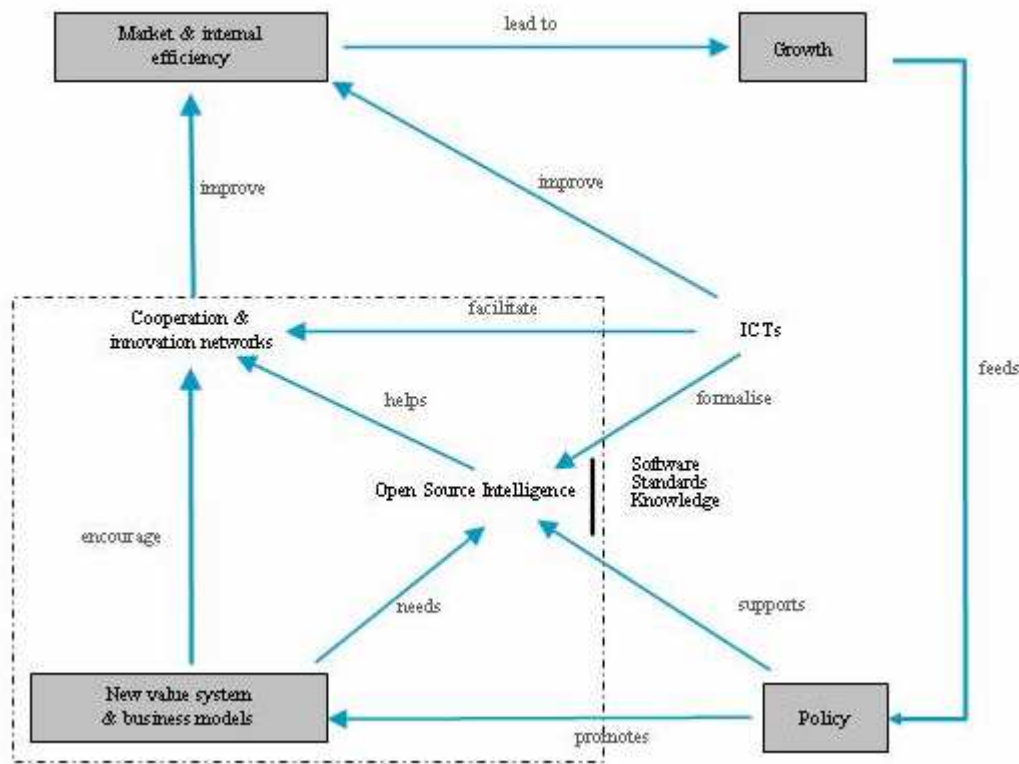
A new approach is emerging world-wide in the ICT sector, based on collaboration, knowledge mutualism and open innovation: open knowledge - made of open software, standards and information – can be the paradigm to build new value system & business models, where cooperation and innovation networks can contribute to the improvement of market and internal efficiency.

Policies can contribute to change the background of value added production, leading to new dynamics of cooperation and competition in the productive community and thus reinforcing the market efficiency from which growth is generated. Cooperation and innovation networks, also through ICTs, unify producers, suppliers, partners, competitors and other stakeholders in a shared base of knowledge. “This economic community produces goods

and services of value to customers, who are themselves members of the ecosystem”[4].

> over 95% of small/medium enterprises are micro-firms with less than 10 employees, traditionally reluctant to the

Figure 1: The Open knowledge paradigm – Diagram of ICTs and Policies for growth



Inspired by the “Flow diagram for growth catalysed by ICTs” in *The Digital Ecosystems Research Vision: 2010 and Beyond* [2]

Thus, innovation policies can promote the establishment of collaborative environments to share knowledge and services and to exchange information among complementary actors.

III. THE CSP MODEL

CSP is a regional development organisation in the field of Information Society. It aims at facilitating the innovation processes, at regional level, in order to compete in global markets.

CSP, within a Structural Funds Regional Project called DIADI 2000, has faced the question of favouring the spread of the model of open knowledge paradigm. DIADI 2000 is focused on technology transfer among SMEs as to increase their competitiveness.

With the aim to gain a deeper knowledge of SMEs and their local environment, CSP action in DIADI 2000 started from the analysis of the Piedmont entrepreneurial system, which showed today Piedmont local situation is characterized by two main trends:

introduction of technological innovation.

> the ICT sector is still strongly focused on software production and body rental, although business opportunities in such domains are heavily decreasing due to local and global changes in markets.

In DIADI 2000 CSP had to face those challenges in order to draw up a sound programme to implement the regional strategy.

A. Business ecosystem approach

CSP drew its attention on networking and collaboration dynamics as key lever for micro-enterprises business growth and survival in the market.

More than ever before, in the knowledge economy companies should collaborate and learn from shared experiences and best practice, in order to optimize the development, improvement and marketing of products and services.

Value networks are made of several actors providing specific tasks in a complex and wide networked system. In such “networked organizations” each actor makes its effort

with the aim to produce and offer goods and services to respond to the contingent requirements. The interdependency, connecting manufacturers with suppliers and customers and sometimes competitors, is based on stable collaboration, cooperation, negotiation, trust and reputation.

Technologies play a complex role in helping develop organizational structures, and the networked form in particular, allowing the delivery of the right knowledge to the right person, for the right purpose (knowledge logistic). At the inter-firm level of “networked organisations”, ICT can reduce inefficiencies resulting from lack of coordination between firms, reducing information asymmetries between buyers and suppliers and building closer relationships among trading partners. Nevertheless, CSP analysis showed that in Piedmont business relationship and interactions within entrepreneurial “networked organizations” are still based on face-to-face communication.

With the purpose of contributing to overcome this weakness, CSP focused its action on collaborative software platforms enabling the optimisation of resources and relationships management within “networked organisations”. In this context, CSP has been working with the aim to make the local entrepreneurial system progressively evolve into a business ecosystem, where members “work co-operatively and competitively to support new products, satisfy customer needs [...]”[5] and cooperate in order to be more competitive. A business ecosystem is “an economic community supported by a foundation of interacting organizations and individuals”[4]. It implies a high degree of interconnection among all actors involved and knowledge is widely exploited in different economic activities [6].

B. From the software to the service

According to CSP vision, a model of production based on knowledge openness and sharing represents one of the main challenges for the local entrepreneurial system in the near future. Open Source Software is the base for an alternative business model of growing importance: “while improvements in the open source software are not appropriable, commercial companies can benefit if they also offer expertise in some proprietary segment of the market which is complementary to the open source program”[7]. Companies which have understood that, are already participating to cooperative development of Open Source Software and have introduced a new approach to intellectual property within their business strategies.

In a paradigm based on open knowledge, the outcome of a knowledge collective production is not the product to be commercialized but it rather represents the base on which a marketable activity can be built (support services, training, customization ...). Contributing to the development of a public knowledge or good generates rewards for

contributors in terms of skills improvement, learning, enhanced development of specific software components (as in the case of OSS), and competitive advantage [8].

Two main business strategies can be identified for companies approaching Open Source Software:

- The distribution of open software products can facilitate firms in reaching a wide base of customers for the provisioning of support services (training, customization, maintenance, updating, ...).

- The participation in open development, sharing parts of one’s own software product within the free software community, can draw some benefits for the company in terms of potential product improvements made by external developers. Furthermore, it can help a key-product to gain a wide diffusion, thus ensuring opportunities for the commercialisation of proprietary complementary products.

In Piedmont regional policies, the Open Source model is a key lever for the spread of innovation, standards and knowledge and for the increase of local competitiveness.

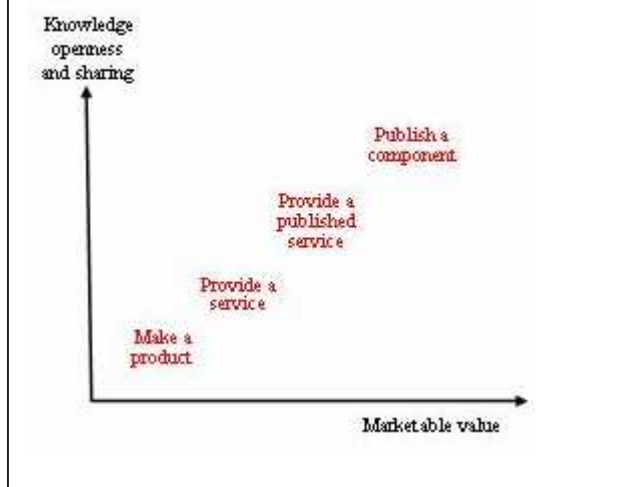
Due to local and global changes in markets, ICT companies are suffering for a decrease in business opportunities linked to software production and body rental, which still represent their core activities. The ICT sector is now requiring advices from research organizations and support from the government in order to re-gain competitiveness and to preserve the marketable value of their production.

According to CSP vision, the *marketable value* of ICT production can be interrelated with an approach based on *Knowledge openness and sharing* (intended as open knowledge made of standards, software and knowledge) as shown in figure 2. As Regional Catalyst, CSP promotes a progressive evolution of local companies core business from a product-oriented approach into a service-oriented model based on shared components. Doing that, CSP means to favour the development of a local ecosystem based on “cooperation for competition” which could contribute to increase the market efficiency and the local socio-economic growth and competitiveness.

The change from a software-oriented production into a service-oriented one (based on shared components) can not be expected to happen immediately and directly but rather to be a progressive evolution, since it firstly requires a change in culture: companies need to go over cognitive barriers and well-established behaviour. Changes in behaviours can be also influenced by business aspects: companies (mainly small ones) have a need for mid-term results and the marketable value is one of the key levers to influence their attitudes.

In these terms, companies should not necessarily consider production based on an open knowledge approach as limited to a non-profitable sphere. In addition, “open-source software is by some measure less expensive than proprietary software”[9]: using it lowers the cost for applications and services.

Figure 2. From product to service: evolution of ICT supply towards open knowledge



Moving from the existing conditions of production and competition in a regional industrial background, local innovation policies, government initiatives and regional catalysts can promote the spread of the open knowledge paradigm by offering financial support to open source products and projects, setting up stable legislations in the field of intellectual property protection able to promote correct exchanges of knowledge, facilitating access to research output produced by universities and promoting the availability of open resources and components to be used in the productive field.

More specifically, Regional Catalysts, as mediators between research/academy and the industrial world, could concretely act to favour the availability of Open Source Software components to be shared within the productive community, in order to stimulate the implementation and commercialisation of knowledge-based services.

IV. CSP EXPERIENCE AS REGIONAL CATALYST

As for large enterprises, where production and distribution are effectively managed through specific software platforms, also “networked organizations” require software tools enabling the smart management of their business.

Many types of software can make the management of a firm’s resources more efficient. Nevertheless, most of applications and solutions today available on the market have been created for the needs of large corporations and value net partners and are very often sectorial.

Based on its skills and vision, with the ambition of favouring the spread of ICT in “Networked organisations”, CSP developed and published Talea, an experimental software component to be shared within the local community of SMEs. Aimed at supporting the customer-supplier interaction in an Enterprise Application Integration perspective, Talea is a multi-device software platform for

the customization of knowledge-based services supporting B2B.

Talea was released following the Open Source principles and is now available at <http://talea.csp.it>. Releasing Talea, CSP has meant to make a first concrete step to increase the availability of open components to be used in the productive field, favouring the diffusion of a service-oriented approach (see “2.1.From the software to the service”). Talea can be viewed as a generic matchmaker for e-business, supporting a flexible matching between services provision and request: its architecture has been designed in order to facilitate easy customization to specific domains, thus enabling even smaller companies to customize services targeting customer-supplier interaction. The result of the customization is an application that can be exploited by the final user to provide and consume *resources* (products or services). Talea users can be both “providers” and “consumers” of *resources*; “providers” are small/medium enterprises, while “consumers” can be individuals, agencies or enterprises.

The transition from a software-oriented production into a service-oriented one - based on shared components - must start from a cultural change. Therefore, CSP action did not only concentrate on technological aspects related to the model implementation, but has also focused on dissemination activities for a shift towards a new cultural attitude. Moreover, considering that companies have a need for mid-term results, CSP has analyzed the sustainability of the model, concentrating on legal and business issues from the market perspective.

Moving from the existing conditions of local “networked organizations” CSP offered financial support to open source projects using Talea open software for the implementation of innovative services. To favour the customization and experimentation of Talea-based services in the real market, DIADI 2000 is 50% financing some Pilot Projects. Developed by Piedmont small/medium enterprises, Pilot Projects are aimed at customizing some new knowledge-intensive services dedicated to support collaborative business in the most several domains, such as social and medical, pharmaceuticals, tourism, agronomy, small local trade, goods delivery and sustainable transfer.

For instance, one of the Pilot Project is aimed at increasing the competitiveness of the small local trade in comparison with the large-scale retail trade, through the creation of a strong network of small local trade within a specific neighbourhood. It applies Talea brokerage system for the integration of the 3 key components of the small local trade: the local shops’ supply, the delivery of goods, the need for sustainable transfer. The implemented system will in fact also be able to optimize the transport routes, in line with sustainable and environmental development plans.

All Pilot Projects will close on July 2006; they include an experimentation phase with real users, as to test and consolidate the new services to be transferred to the real market.

V. CONCLUSIONS AND FUTURE WORK

In this paper we have introduced the vision of CSP about interconnections among local development, innovation policies and ICT, as well as its experience as a Regional Catalyst promoting the spread of a development model based on Open Source and open knowledge.

The key issue lies in moving the scene from a software-oriented production into a service-oriented one, using Open Source as a key lever to move further steps towards a knowledge-based economy. This would lead to renewed dynamics of cooperation and competition among the actors of the local business ecosystem, in order to gain a higher market efficiency than in a monopolistic approach based on a strong intellectual property protection.

With the aim to develop a regional knowledge economy based on “an efficient system of distribution and access to knowledge as a *sine qua non* condition for increasing the amount of innovative opportunities”[10], CSP future actions will be aimed at further trialling initiatives able to exploit Knowledge as a way to create innovation and economic growth.

Moving from Talea experience and from the Pilot Projects that will be implemented, CSP intend to further involve Piedmont SMEs in the development and customization of Open Source Software components, the access to which will be widely promoted as opportunity for the increase of local competitiveness.

Moreover, for the further dissemination of the open knowledge paradigm, CSP is establishing a network addressed to SMEs and involving all regional centres of excellence leading Open Source research and development activities. The network will be aimed at facilitating access to research output and promoting the availability of open resources and components, in order to help SMEs improve their expertise, to ease their participation to collaborative knowledge production and to foster their competitiveness.

As resulting from CSP experience, the role of Regional Catalysts [11] is crucial in local development processes to achieve local consensus among stakeholders and opinion leaders from the productive community and to spread innovation and facilitate the share of knowledge in networks of local players, thus helping the development of a local business ecosystem.

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The Selected Implications on Effects to Traditional Business Sectors of Increasing Marketing in WWW – tentative findings

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Abstract - The use of internet marketing of the durable goods has provided many implications on trading and service processes such as real estate and car trading business in Finland. The objectives of transaction and trading, i.e. the houses and cars, are not yet actually sold via internet. Hence, the digitalized services and modern market places should be constructed in order to satisfy future coming needs of e-business.

In this paper of time serial research and data concerning internet utilization and its implications on business process of car trading and real estate business. The phenomena are pointed out by multivariate analyses, especially factor analyses in time serial data 2002-2006.

The use of internet in information retrieval has increased from 66% (2002) into 81% (both 2004 and 2006) of questionnaire fulfilled customers in real estate business. In second hand car trading business the comparable amount of internet users has increased from 56 % (2003) to 75 % (2005) of all answered customers.

The main focus is to analyze the development of phenomena concerning the increasing role of internet as information source in purchasing process, especially comparing value chain theories and information retrieval in real estate and used car markets.

The time serial analyses points out at least the main competitiveness factors of the website marketing. Also some expected development of competitive capabilities are presented in the conclusion part of study.

Keywords — e-business, purchasing process, Internet usage level, competitiveness factors, real estates, cars

I. INTRODUCTION

A. Presentation

Real estate and second hand car business are good examples of business sectors selling expensive durable goods or investments for households. The idea of continuous time serial study concerning the development of internet marketing utilization in durable goods was

developed in co-operation by the producer of www-site portal, Alma Media Interactive, and the research group. The primary target was to measure the level of internet utilization in purchasing process of the durable goods. Therefore, the most used information sources were measured. The questionnaire was given for the customers at the end of bargaining process when they had already signed the trade agreement.

In order to describe different kind of customer groups and their behaviour, the questionnaire included Likert-scale from 1 to 5 opinion and attitude statements concerning the purchasing process, decision making and satisfaction to the certified estate dealer or car dealer. The data was analysed by multivariate analysis, especially factor and cluster analyses.

These studies were produced annually, started on 2002, 2004 and 2006 in real estate business, then 2003 and 2005 car trading business. The questionnaires in both of the business lines follow the equal basis, so the comparability of factors can be consider reliable and adequate. The data basis is fulfilled by study of car traders 2006 in order to validate opinions considering role of internet in purchasing process and future coming competition factors.

A value adding element of internet in information retrieval in traditional trading and service business for consumers is also clearly verifiable according data. The earlier literature of value chain and customer management theories in e-business and purchasing process is briefly presented in next section II. Section III introduces the research methods and data basis, section IV the empirical results. In section V we conclude the study and take part in to discussion considering future coming competitiveness factors of website marketing and studied business lines.

II. THEORETICAL BASIS

A. Value adding through internet utilization

The unitization of the internet has rapidly changed the former consumer marketplaces and trade practices already. When the idea of e-commerce was developed, the role of information systems was central. [1,2] From marketing

platform the role of internet has changed into online information source and exposition stage of any available goods. Especially in real estate business, which is an information-intensive and information-driven industry and in which firms act as intermediaries [3,4].

According to the modern value chain theories there are close connections between delivery chain and consumer's satisfaction [5]. Value Chain Management is promised to provide a firm flexibility, and through flexibility a competitive advantage. A company needs ability to adapt constantly developing business environment and awareness of the emerging opportunities [6]. Corporations' responses to individualized and changing needs are expected to be carried out with evolving technology.[7].

Another remarkable competitive advantage can be gained through CRM (an acronym for Customer Relationship Management) and its latest version eCRM. The core of eCRM is providing all information concerning the customer throughout the company allowing every employee to see "the whole picture" of the customer relationship [8]. In some technologically advanced companies (usually doing e-business) and organizations this idea has expanded to the level of letting the customers themselves access the same information.

The earlier studies on knowledge sharing in business networks have concentrated primarily on identifying the conditions of co creating to take place and information flows mainly in dyadic inter-organizational business relationships [9, 10]. Importance and variety of different types of business nets are studied by Möller and Svahn (2006). They introduced the framework for roles of knowledge and learning in three types of business nets [11]. They contribute to the theory of network management focusing in corporate collaboration and therefore fail to integrate the customer to the process of value creation in information sharing. Basically value networks are born in the process of out-sourcing corporations functions.

Much more attention needs to be given to the customer perspective. Customers could and should be brought in to the network. On the other hand, dependability makes a corporation vulnerable. To make the network profitable, corporation needs to define its own special business area clearly and focus on that [12].

Some attempts have been made to enlighten the possible inter-action between SCM Relationship Management). The key to the integration of the two traditional operating process could be KM (Knowledge Management)[13]. The framework of KM offers means to sharing knowledge between individuals in terms of creating and sustaining competitive strategies to build more efficient organizations. E-business is greeted with warmth as the producer of new solutions to interact with customers, rivals and colleagues.

Presuming that corporations' primary function is creating customers, we must accept the fundamentals of the firm to be gaining, satisfying and retaining customers. Three core operating processes and central organizational requirements

must be fulfilled for the organization to be capable continually deliver superior customer value in the customer preferable forms. Taking advantage of the interaction of product development management process, the supply chain management process and the customer relationship management process can competitiveness advantage be developed. It is inevitable to analyse both the firms internal content [6] and external content to prosperous e-business to come true [13][14].

B. Earlier studies and literature on customer behaving in e-commerce

Thou e-business has its barriers [15,16,8], especially trust involving issues[17], its rapid development leads us to believe its usage continues to grow [4]. The major concerns, technological infrastructure, regulatory environment and economic dimensions, produces difficulties mainly when doing business abroad, which seldom is the case when dealing used cars or real estates. Nevertheless, several researches have proved the multidimensional and context-dependent nature of perceived customer value [18]. Also has been shown how the different aspects of e-commerce affects perceived customer value [12]. For greater efficiency and productivity corporations should be more open to empowering the customers and letting them to control the purchasing process in their own terms.

Naturally, customer joining in these information processes sets increasing number of possibilities in the disintermediation of market intermediaries. To mention an example, in the USA publications lists for-sale-by-owner (FSBO) properties are increasing [19] by-passing traditional real estate brokers (Fletcher 1997).[20].

In this tightened competition situation, real estate industry is going through enormous change. Some realtors have adopted new technologies and used it successfully, while others are adapting to the situation creating new forms of brokerage and other value-adding mechanisms. [21]

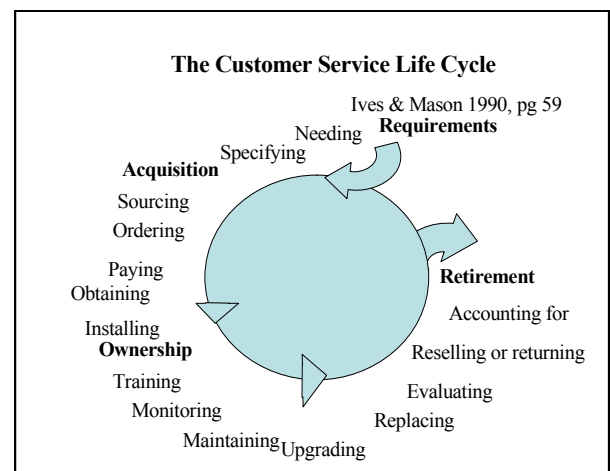


FIGURE 1
THE SERVICE LIFE CYCLE ACCORDING IVES AND MASON 1990

TABLE 1

Study	Kaiser-Meyer-Olkin.	Bartlett's Test of Sphericity			N
		Approx. Chi-Square	Df	Sig.	
2002 real estate	0,737	4690,97	1540	0,000	267
2003 car trade	0,732	4221,21	1653	0,000	221
2004 real estate	0,764	5878,52	1326	0,000	339
2005 car trade	0,700	3057,29	1081	0,000	273
2006 real estate	0,741	2873,41	1035	0,000	200

The framework of Customer -service Life Cycle points out the four stages and the twelve steps in the customers purchasing process. CSLC clarifies the aspect of each step and suggests that each and every one of those phases could be intensified with assistance of the information technology. In spite of the on-going technical revolution, the winning strategy still lies on the corporation's ability to provide service over customers' expectations [12, 22].

CSLC provides examples and initiatives for every step of the way to assist the customer with IT-solutions. The difference between CSLC and traditional customer service theories is that the CSLC widens the perspective of the purchasing process to the time before the actual functioning (e.g. requirements stage =customer observes the need for a product or a service) and to the time after the purchase (e.g. usage monitoring, upgrading, disposal and evaluation).

III. RESEARCH DESIGN

A. Systematic in data collection

The focus was to point out the purchasing process and its information retrieval, instead of the selling problematic of flats, houses and used cars. Therefore, the questionnaires were given by the estate dealer or car trader to the consumers at the selling deal signature gathering.

The answer percent varied between from 12% to 23 % of printed coupons. Beside the questionnaire there was also given a postage free envelope to University of Tampere. All of the answers got a free number of new magazines or some other small present.

The paper format of questionnaire was selected to avoid distortion in sample, like selectivity of daily internet user consumers. During the last real estate study 2006, the questionnaire was also available on e-questionnaire format, but only 17 consumers used that possibility.

B. Data basis of the summary study

The data of this time serial analyze is collected in five different consumer studies on 2002-2006 by authors. In three different real estate business studies, the number of consumers answering to paper format four pages questionnaire varied between 200-339 consumers on 2002, 2004 and 2006. Equally based literary questionnaires concerning car trade business were answered by 221-273 consumers in two studies 2003 and 2005. Hence, altogether 1300 consumers have taken part in to this study.

The data was analyzed by SPSS 12.0.1 for Windows statistic software. The factor analyses variables tested by KMO and Bartlett's Test of Sphericity. The Kaiser-Meyer-Olkin measure of sampling adequacy tests whether the partial correlations among variables are small. Bartlett's test of sphericity tests whether the correlation matrix is an identity matrix, which would indicate that the factor model is inappropriate.

Besides above mentioned consumer time serial studies there is also one research already done in winter 2006 to chart the corresponding opinion development among car traders. The focus of trader study was to compare, whether the traders and consumers find equally effects of internet usage in trading business. That internet questionnaire was answered by over 230 car sellers and car trade managers all over Finland. These results are just lightly commented in discussion part of paper, not equally analyzed as the data of five consumer studies.

C. Research questions analyzed in this paper

Altogether there were 70-90 questions concerning information retrieval and purchase decision making process for the consumers, who had just signed their car or apartment selling documents. The internet utilization percentile in information retrieval of purchasing apartments and used cars and its development in time serial are the primary results reported here.

For the multivariate analyses presented main factor results in this paper, were taken about 50 opinion and attitude questions in Likert scale from 1 to 5. In these questions were asked the opinions about purchasing process and information retrieval in different media, satisfaction to their dealer behavior and activity in seeking the best result for the buyer's needs. Also the main criteria of purchased apartment or car were included in these analyses.

There are also plenty of research questions, which results are not presented in later publications of authors. For example, these are the results of questions concerning principal reasons to start the purchasing process, the final purchasing price and amount of loan. The consumer clustering formations as well as the socio-economical background information of answers are left for later publications. The background information indirectly reported in this paper is the age group of answers and geographical distances from car dealers' to consumers comparing internet users and other answers. There are so many different variables in real estate business, so the same effect can not be pointed out in that context.

IV. PRIMARY RESULTS

A. Internet utilization level in information retrieval

None of altogether 1300 consumers had bought either their real estate or second hand car without visiting at dealers and having target perception by themselves or by their family members; exclusion the new built flats in building site. Therefore, the decision making process concerning apartments and second hand cars purchasing is not still basing just by using internet sites. All of the deals were done after subjective excursion and/or trial drive at traders'.

The trends of consumers' internet usage and its increase have become obvious already in earlier studies. At the beginning of the time serial studies produced by authors, only the younger generations used internet as a primary information source looking for advertisements concerning houses and second-hand cars. The elder generation strongly preferred newspapers and print media advertisements for the same purpose. In the later follow-up studies the internet has become prevailing media among almost all consumers' age groups.

During the last two years the overall majority of all other age groups, except the oldest consumers i.e. those over 60 years, have pronounced using themselves at least some websites in information retrieval process of real estate and second hand car markets. Figure 1 presents the development in real estate business and figure 2 in car trading business sectors.

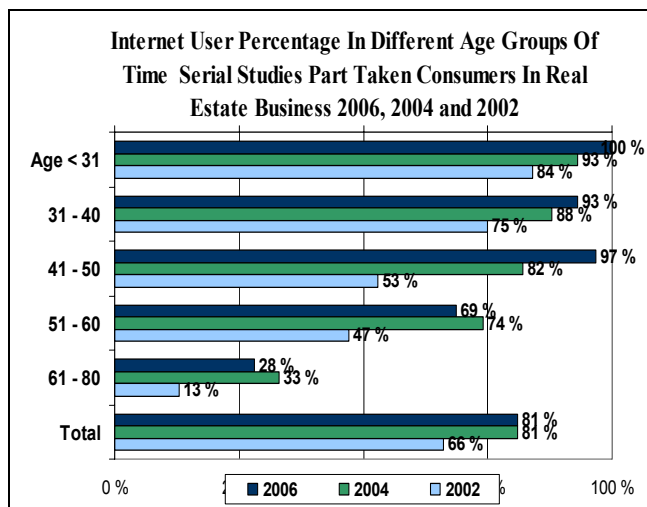


FIGURE 2

INTERNET USER PERCENTAGE IN DIFFERENT AGE GROUPS OF TIME SERIAL STUDIES PART TAKEN CONSUMERS IN REAL ESTATE BUSINESS 2002, 2004 AND 2006

The similar phenomenon is also happening in used car trading business, even more early compared to real estate sector.

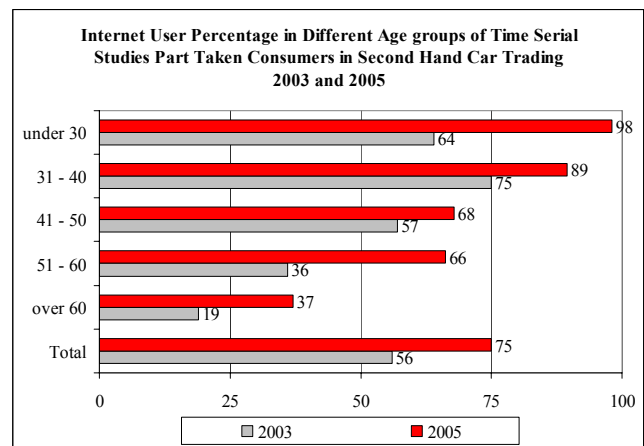


FIGURE 3

INTERNET USER PERCENTAGE IN DIFFERENT AGE GROUPS OF TIME SERIAL STUDIES PART TAKEN CONSUMERS IN SECOND HAND CAR TRADING 2003 AND 2005

B. Main factor development

The changes both in internet utilization and in dealer's role in decision making process have occurred very recently and rapidly. Therefore the major phenomena and its factors are analyzed carefully by using multivariate analysis in this large scale data basis.

Factor analysis attempts to identify underlying variables, or factors, that explain the pattern of correlations within a set of observed variables. Factor analysis is often used in data reduction to identify a small number of factors that explain most of the variance observed in a much larger number of manifest variables.

TABLE 2
MAIN FACTORS AND THEIR EXPLANATION PERCENTAGE IN DATA OF REAL ESTATE BUSINESS 2002, 2004 AND 2006

Factors 2002:	Eigenvalue	% of variance in data explained
Good service level of realtor	4,85	8,66
Internet's primary position in information retrieval	2,54	4,53
Safe surroundings of the apartment	2,50	4,46
Active communication by realtor	2,48	4,43
Good reputation of certified estate realtor	2,10	3,75
Entertainment in home seeking	2,08	3,71
Also: Cost level of housing; Wide selections of targets at certified realtor; Service level of surroundings; Just a perfect apartment itself		
Factors 2004:	Eigenvalue	% of variance in data explained
Good service level of realtor	4,85	9,34
Internet's primary position in information retrieval	3,10	5,96
Keeness to pay for extra services like real prices or mobile services	2,77	5,32
Safe surroundings of the apartment	2,05	3,93
Entertainment in home seeking	1,85	3,55
Just a perfect apartment itself	1,70	3,26
Also: Service level of surroundings; Good reputation of certified estate realtor; Cost level of housing; Assistance of capable realtor was needed; Wide selections of targets at certified realtor; Irritation caused by too active realtor		
Factors 2006:	Eigenvalue	% of variance in data explained
Good service level of realtor	4,93	10,71
Internet's primary position in information retrieval	3,53	7,67
Safe surroundings of the apartment	1,92	4,16
Just a perfect apartment itself	1,81	3,93
Service level of area surroundings	1,77	3,85
Entertainment in home seeking	1,72	3,74
Also: Assistance of capable realtor was needed; Good reputation of certified estate realtor; More pleasant experience than expected; Systematical seeking process gave results; Open mind for different alternatives		

In real estate business the Eigenvalue of internet i.e. meaning internet as a favorite information source in retrieval process has grown systematically. The good service level of realtor has kept its place as the most powerful position in the list of data explanatory factors. The factor of internet as primary retrieval source in realtor business has also remained its second position in factor explanatory position list.

TABLE 3
FACTORS AND THEIR EXPLANATION PERCENTAGE IN DATA OF CAR TRADING BUSINESS 2003 AND 2005

Factors 2003	Eigenvalue	% of variance in data explained
Usefulness of car shows	4,01	6,91
Guaranty and safety properties	3,84	6,61
Internet's primary position in information retrieval	2,58	4,45
Budget funding offers	2,28	3,93
Newspaper is the primary information source	1,84	3,17
Experiences in certain car mark	1,77	3,05
Also: Skillful purchaser by oneself; Good reputation of car trader; Irritation caused by too active trader; Rapid purchasing process; Wide selections of cars at traders		
Factors 2005	Eigenvalue	% of variance in data explained
Entertainment in good car seeking	3,12	6,64
Performance abilities of car	2,91	6,19
Good service level of car trader	1,95	4,16
Internet's primary position in information retrieval	1,83	3,89
Newspaper is the best information source	1,48	3,14
Experiences in certain car mark	1,46	3,10
Also: Budget funding offers; Rapid purchasing process; Irritation caused by too active trader; Assistance of capable trader was needed		

In car trading business the factor variation has not been as equal as in real estate business; the selection variation of factors is wider and has more variation than in real estate business sector. One of the explanations might be the internet utilization has become primary advertisement media much earlier as business as usual comparing to real estate business.

C. Some other obvious phenomena of internet

In data can be pointed out some other interesting phenomena comparing internet users and other consumers.

The distances between traders and consumers have increased a lot during the time research period, because internet advertising offers nationwide marketing field. The interesting cars can be trial run by a keen custom coming as well from 10 to 1000 kilometers distance.

TABLE 4
DISTANCE IN KILOMETERS FROM CAR TRADERS' TO CONSUMER'S HOME IN AVERAGE 2003 AND 2005

Distance from home km	2003	2005	Change in %
Non-internet users	29	42	45
Internet users	51	60	18
All answers total	42	55	31

Another trend to contribute for success of new shopping malls is concentration of retailing to ever-bigger complexes. In daily consumer goods this development has continued a while already and is currently maturing.

Generally consumers prefer to do their daily purchases in few kilometer radius from their home, but in Finland this issue is not so important according to AC Nielsen's international Shopper Trends study. Finnish consumers prefer shopping places from where they can easily get everything they want and that offer comfort of visit. In special goods area this development is currently pronounce as huge amount of plans demonstrate. And this development has potential to proceed much further, as distance is even less important factor when purchasing special goods [24].

D. Connection between internet usage and factor of internet's primary position in information retrieval

The connection between internet using and explainer level in data variation follow same directions. The correlation level between those variants is strongly positive, $R^2 = 0,626$.

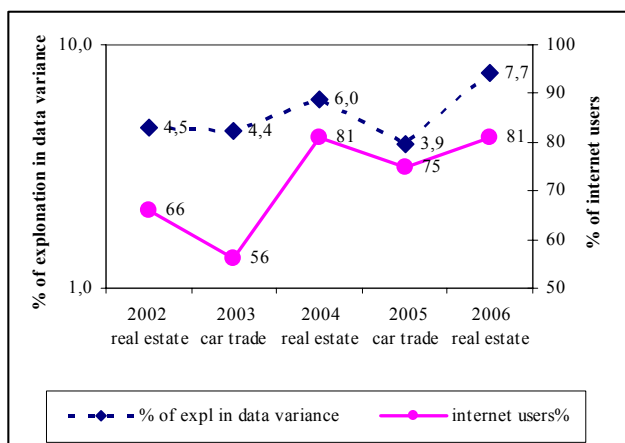


FIGURE 4

TIME SERIAL CONNECTION BETWEEN INTERNET PRIMARY FACTOR AND INTERNET USAGE LEVEL

The more customers use internet in information retrieval, the more they expect to get value adding knowledge through the websites.

This phenomenon is according our time serial studies became equal in different lines of business.

V. CONCLUSIONS

A. Role of dealer in change

The basic of the phenomena of growing internet advertisement is partly lying on different time valuation concept of consumers. Time is money and customers are less willing to use their leisure in trade shops or common housing showings. The trend seems to expect almost 24/7 service level in trading services or at least in the information retrieval process of purchasing.

The information seeking process before purchase decision making by consumers has become more target oriented comparing to the 1990's. In earlier times an impulse and even the purchasing making process for an apartment or a car, could get started easily in local well-

known car shop or neighborhood housing show. The role of dealer was to give the basic information and also some pleasure from entering into the shop in order to encourage the purchase decision making.

B. Widening market area through internet portals

The purchasing process of second hand car was in earlier times more like a nice experience or performance for the whole family, not so much a compulsory achievement as it seems to be usually common nowadays according both consumers and car traders.

The development has multifunctional reflections in trading process. The service process at car dealers' is already developed quite effective and comfortable. The benefits on the traders' side are that the consumers visiting at their shop have quite serious intentions to buy a car or a house they are visiting for.

The cost-benefit relationship comparing internet and printed media is frothing out in the longer distances of consumers and car trades. The markets in especially seek special cars have become national instead of local. On the other hand, the price comparisons by consumers have become business – as – usual; therefore also the sales profits are limited. The less coverage the dealers get, the less they have possibilities to invest in multimedia advertising. So far the costs of internet advertisement in sale portals are cheaper than costs in printed media; therefore most of car dealers prefer electronic media.

The major challenge, especially concerning the car trade business, is nowadays how to attain consumers into car shops. Therefore, the role of internet has altered into the source or free arena in comparing the attractive alternatives and seeking the most interesting targets, before any shop visits are needed. The information monopolies of realtors' days seem to be over forever.

C. Effects of internet usage in real estate companies point of view

In real estate business the consumers are more critical than earlier to the behavior of realtors. Because of the large selection of real estates and houses available on the internet sites customers have become more independent from the realtor or dealer. Also their expectations towards their realtor have grown. It seems that as customers are getting more eager to gather the information needed by them; therefore the realtors need to redefine their work tasks. Expanding their professional skills to new areas (e.g. consumer advising and protection, taxes, other services associated with real estates, like decoration services) should be taken under serious consideration as realtors want to develop new competitiveness advantages.

In a situation with consumer having all the information needed, ineffective work diminishes. Resource allocation will become more effective as consumers select the real estates markets worth seeing based on adequate information before contacting the realtor. As consumers' awareness of

the possibilities offered by internet grows, open forums allowing customer to customer sales, are likely to increase lowering the transaction costs to next to nothing.

D. Demands of new media by consumers

There is a huge difference between real estates sites and other online services: the impossibility to carry through the whole transaction online. Clearly, the value adding element for the customer in online services should be charted open-minded.

The demands of internet advertisement have grown rapidly. For the first, the information concerning trade selection should be trustable and as real-time as possible, updated at least daily. More and more efforts should also be put on visualization, like 360 degree video shows and many different high quality photographs.

Optimal situation would be for the consumers the possibility to replace the common shows of an apartment with ability to familiarize themselves with the interesting apartment at their own time, when ever they want, where ever they want. One possibility is to provide consumers a portal, which includes the ground plan equipped with links to 360 degree panorama scenes of every room.

There are also some interesting points of view and gaps concerning service response rapidity. Some consumers, who are very interested to purchase a certain car or house, are so eager to get more information about their just-found dream; they were not even willing to wait until next business hours in order to call the trader or getting email from him/her.

Therefore, the careful analysis of potentials in personal response services and information sources 24/7 basing on internet leads could produce value-added benefits both for the traders and consumers. These modern services and IT-solutions should build to be operating and functioning perfectly entity in totally digitalized environment.

WWW has caused also many reflection effects also into traditional trading and service processes. The markets mentioned in this paper concern real estate business and car trading business. The objectives of transaction and trading, i.e. the houses and cars, are not yet actually sold via internet. Hence, the digitalized services and modern market places should be constructed in order to satisfy future coming needs of e-business.

E. Discussion

The contribution of this paper is in bringing the connection between internet users, data concerning main factors development of consumers in the time serial studies, and the reflecting effects on increasing internet utilization. Yet we do not know the strategic decisions making process and criteria, how the car traders and realtors really select which media they use for advertisement. The next phase is to ask realtors their opinion about competitiveness abilities of different media in order to identify, if the consumers results shown in this paper have sustainability and

continuity. Also it is interesting, if the internet portals keep - or even if they wide - their primary position in information retrieval in traditional sectors of business.

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The Sustainable Management of the Service Center for High Tech Industry in Asia — A Case Study of Mio-TECH

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Abstract — In the past, enterprise needs to invest a great deal of tangible assets such as: lands, labors, facilities and factories in order to reach certain scale of economics and acquire the competitive advantages. However, in this information rich era, enterprise's direction of strategic thinking has shifted from the production orientated model to the customer orientated approach, and it needs to provide differential services to avoid the cutthroat price competition. Owing to the demand of customers for immediate and reliable consulting service, the establishment of call center becomes the communicative bridge between enterprise and customer; to date, call center even became an important link in the market competition. Building an excellent call center is the essential move to implement the customer relationship management, and providing meticulous concern for customers is the key to improve customer loyalty.

In this study, Mio Technology Limited (Mio-TECH), a manufacture of portable electronic navigation devices, is taken as an example of case firm to explore the organizational system and management of its call center since the enterprise has evolved its service models based on the product features to enhance the business planning. To view from the management aspect, the current call center has emphasized the integration of resources and professional division of work. Therefore, the call center utilizes the applications of communication and computer technologies to automatically handle the great quantity of works; and implement the competitive human resource in China region to cooperate with Mio-Tech's headquartered in Taiwan to build good customer relationship for worldwide users.

This paper analyzes how Mio-Tech's call center improve the customer service in terms of strategy, technology, manpower and procedures and has found that the technical enhancement, the customer's expectation and the corporate strategy have been significantly communicated and leveraged into a sound customer relationship management system.

Keywords — call center, customer relationship management (CRM), outsourcing

I. INTRODUCTION

High-quality products may attract customers, but good service is the prerequisite to establish the long-term relationship between enterprise and customer. Recently, with the enterprise focus towards the customer service, call centers has become an important information source of customer relationship management (CRM)[1-3]. As the

literal meaning of CRM which is keeping good relationship with customers; broadly speaking, it indicates that making good quality of customer service, enhancing customer satisfaction, keeping customer loyalty to enterprise and further advancing future reliability of customer. It provides a wide spectrum of arranging measures for relevant departments to offer customers excellent service quality, and its main purpose is to maintain customers who have contributed to enterprise [4-7]. Therefore, build the customer information database is the first step to develop CRM [8-10]. In terms of the application of information management technology which mentioned in the book, "Business @ the Speed of Thought: Using a Digital Nervous System", the analytic capability of data mining is an important issue in CRM [11] and CRM is used by information technology to interact between the clients and the enterprise with integrated tools. Based on this principle, the business marketing strategy is to evolve into a better one-to-one marketing[12].

The case firm of this study is Mio Technology Limited (Mio-TECH) which is a supplier of portable electronic navigation devices including smart phone, pocket PC, and portable navigation device (PND) with its own brand: Mio Digi-Walker™. The operation sites of Mio-TECH are distributed over regions in Taiwan, China, US, and Europe. As for its service sector, it provides quick product information and application inquiry, as well as multilingual service web pages that allow consumers all over the world to share with the ubiquitous service through its fast and convenient maintenance service online, 0800 (toll free) service hotline or call center service.

The call center establishment was designed according to the requirement from its OEM client, Dell Computer Corp during the initial stage. While Mio-TECH has its own brand, the call center gradually transformed from B2B into B2C model with comparative amendment for its operations. The call center possessed its own professional competence as a result of many years of serving in OEM market; however, with making responses to the new market, it needs to redefine the service indicators and educational training for customer service personnel, etc... Since the product is more complicated than general consumer electronics through the technical aspect, it is not suitable for outsourcing service. Therefore, this study will address those issues and explore in three directions respectively, such as establishment of

human resource (HR), procedure planning and system management of the call center.

This paper will be organized as follows. The literature review will be explained in Section 2. Section 3 will demonstrates the methodology implemented in this study and the empirical findings will be shown in Section 4. Discussion, implications, and contribution are in Section 5 and conclusion will be in Section 6.

II. LITERATURE REVIEW

CRM is an important mechanism for enterprise, which business model has evolved from production-centric to customer-oriented approach [2]. According to the researches of Gartner Group, CRM can be divided into the following 4 cycles:

TABLE 1. CRM CYCLES

<p>1. Knowledge Discovery Analyze customer information to ensure whether enterprise's marketing strategy is correct or not, and start to make market segmentation and customer prediction. Benefit of this phase will enable marketing personnel to understand the customer behavior patterns and make them to propose better decisions.</p>	<p>2. Market Planning Define products, plan entire channels, schedule, marketing set planning, assist marketing personnel in analyzing relevant channel preference, event-related inducement, and competitive advantage/disadvantage analysis</p>
<p>4. Analysis & Refinement Analyze the difference between the empirical and predicted results and amend the sampling rules from knowledge database to attempt the modification for better realization of the customer expectation in the market</p>	<p>3. Customer Interaction Implement communication channels with business customers, which includes potential buyers, and call center is the interaction window during the contact</p>

Data mining is the foundation of business intelligence in CRM. In terms of CRM's questionnaire analysis, data mining is the core technique which is able to analyze and transform corporate internal data into the analyzable format. With capability of storing a great deal of customer information that provided by data warehousing, data mining is not only able to accomplish the accurate marketing policy in the target market, but also able to make analytic report to be customized and enhance the hit rate of marketing in the target market. After sound analysis and familiarity with the customers, CRM is able to efficiently build relationship with customers and further propose the effective marketing plans for corporate. Furthermore, the enterprise need not loosely focus its customers to waste its marketing cost, and it will enable different service strategies for different customer groups in order to strive for the maximum profit.

How to improve customer satisfaction is an important issue for every enterprise, especially during the growth phase of operating scale. Enterprises need to provide fast and accurate customer service to maintain its goodwill and customer loyalty. Under this purpose, a call center is built as a communication bridge between customer and enterprise.

Its service items include product inquiry, commodity marketing, and maintenance service...etc. In the past, enterprises were production-oriented in Taiwan while their service models were OEM/ODM generally. That is, the external marketing as showed in Figure 1 is focused [13] and only emphasized on how to provide excellent quality control (QC) for mass production with high-quality OEM products to clients. However, "service" becomes the main priority of customer demand nowadays. Under the pressure of profit-seeking, enterprises' OEM model of earning profits from international manufactures has shifted into the operation of ordnance bench mark (OBM) for the case firm Mio-TECH. Furthermore, the interaction between employee and customer has come with the tide of fashion, thus interactive marketing became an important management issue. Since enterprises need their personnel to interact with customer end, how enterprise would possess high quality customer service personnel with high customer satisfaction has also become a key topic in internal marketing. After carefully examining the golden triangle in Figure 1, the company/employee/customer relationship is truly symbolized and will be discussed in this study for the case firm.

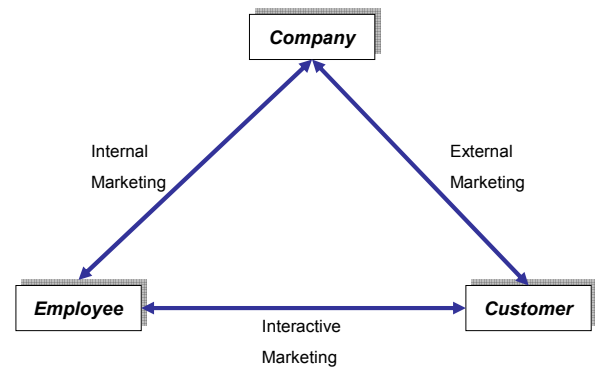


Figure 1. Service golden triangle

III. METHODOLOGY

Exploring from the business model of call center, CRM needs to adopt strategy at the starting point of planning, and then define necessary technology, staffs and operating procedures to cooperate with strategy. Therefore, these 4 items: strategy, technology, staff and operating procedures are the keys to make planning [14].

A. Strategic Facet of Call Center

With the concept of orientation towards customer service emphasized by enterprise, call centers become an important information source of CRM. The "PEPSI" Model [4] of CRM strategic development cycle for enterprises can be categorized into the following 5 steps:

1. Corporate Position and Value Proposition: every enterprise needs to determine its own position and core value of its products, as well as integrates its marketing and business units into a package of service to fulfill the customers' expectation of enterprise image.

2. Experience of Customer: Enterprise should be able to use the information technology to accumulate the experiences and suggestions from customers, such as the online FAQ (Frequently Asked Questions) help website. As a result, it will reveal very precious information for users for inquiring which will also simplify the inquiry requests for the call center
 3. Product, Process & Channel: As for building good relationship with customers, it needs to interact with customers and lead them to enterprise's call center, or via the official website for service which effectively save a great amount of expenses.
 4. Segmentation: The purpose of building CRM for enterprise is providing customers a customized service, and further to develop the additional services for customers. According to customers' characteristic, demand and their experiences, enterprise shall segment and categorize them in order to provide more appropriate service, to establish service that more suitable for different customers, and to enhance customer satisfaction, or, even further to discover the potential customers and to prevent existing customers from flowing away.
 5. Capability of Information: As for categorizing the customers, it needs to design appropriate procedures for conducting the analysis of "consumption behavior" to achieve better decision and make an effective use of the information.
3. Capability of Troubleshooting: The capability of the vendor's support is an important factor to reduce the loss and timely restore the normal operation during system malfunctioning.
 4. Integral Planning Capability: System platform shall be built in module format and provide the scalability when enterprise needs to expand the system functionality for the competitive environment.
- Information technology is the critical factor that related to the success of CRM for the customer information management and analysis. On the other hand, well-developed information technology enables the enterprise's marketing capability to make a rapid response.

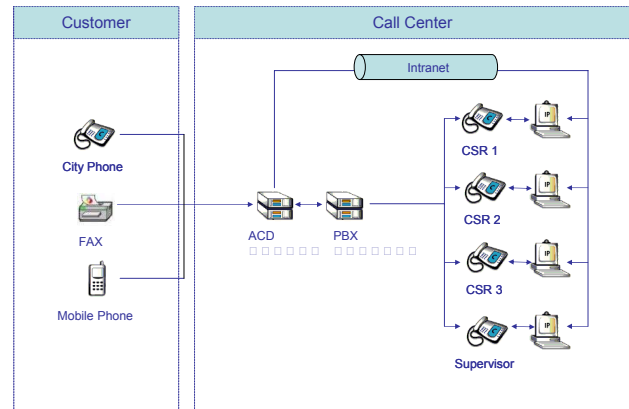


Figure 2. Information technology for call centers

B. Technologic Facet of Call Center

While customers dialing the toll free number to contact the service personnel, the voice interaction will undergo the following systems: ACD (Automatic Call Distribution), IVR (Interactive Voice Response), and CTI (Computer Telephony Integration) as shown in Figure 2. Such a system will allow customer service personnel to perform his/her own professional competence including business product advertising, customer information exchange, maintenance service, complaint handling ...etc. In addition, the complicated professional knowledge can be organized and updated in the FAQ database for future use[15-19].

During the planning stage of the call center, the enterprise needs to make a long-term schedule of operation direction, to retain the capability of future expansion and to avoid the repeated investment that may further affect customer's rights and interests. Therefore, following items should be considered:

1. Experience of Hardware Vendors: The experience and reputation of the system vendors is the important indicator to ensure the quality and performance for the call center construction under limited budget.
2. Integration Capability of the Software and Hardware: Integral customer system has covered computer, database, communication and network, which will not be completed with just simply implementing a single solution. Each key technology has its own professional competence, thus the integration capability of system planning and establishment is very crucial to the entire system's success or failure.

C. Human Resource Facet of Call Center

Human resource (HR) management is able to help call center to effectively plan the work load for service personnel and reduce the waiting time for users. In addition, enterprise's product characteristics, users' behavior and budget control all affect the HR and following 5 items are considered for HR management:

1. Who? Who will call? It needs to identify the inbound calls from customers who already owned enterprise's products, or the potential buyers. Call center shall provide different service content with aiming at different group of customers.
2. What? What's purpose of this call? If the question relates to the product issues, any suggestion or report is needed for the support team to evaluate for improvement.
3. Where? Dialing routes of users to the call center are mainly the city phone, mobile phone, Internet phone (VoIP, Skype) ...etc. Each route reflects different cost for the call center.
4. When? When will call? From the historical data, it can be known about the peak and off-peak periods of customer calls. And the close relationship may be found from the requests stimulated by the marketing activities.
5. How? How to solve customers' problems? The skill level and SOP of service personnel will affect the average length of response time. The solution regarding to each call will be based on the perfect FAQ database and the regular training for the service personnel.

Effective dispatch of the on-duty customer service personnel becomes the key to enhance the efficiency of call center. It is very common to increase the number of customer service personnel on duty during the peak season, and arrange the on-site training during the off season between the shifts. Call center's superintendent shall consider the overall amount of calls to distribute the number of agents, meanwhile, he/she needs to estimate whether any related activity that results in increasing/decreasing the amount of traffic at current period. Therefore, according to company's policies, the shifts for personnel may be differed from 24-hour and day shifts. Moreover, the respondent group commonly has 2-shift, 3-shift and overlapping shift, but it needs to make proper amendment due to the actual traffic daily.

Call center is a department where the communication becomes its major product, and customer service personnel play the key role in it. Selection and incubation of talented personnel is very important to maintain the good communication quality and the following 2 issues should be considered:

1. Recruit suitable customer service personnel

Customer service personnel who generally perform the first contact with customers shall have certain understanding level on his/her company's products. Thus the first step for incubating professional skills is to pick up the right staffs with associated education or similar working experiences.

As for the working capability, it mainly focused on the voice, tone, warm-heartedness and good temper under pressure. While analyzing the personal characteristics of these above mentioned key items, the administrative unit can have a clear picture for job dispatch among personnel. Some are suitable to directly interact with customers, and some may be ideal for the support work behind the scenes.

2. Incubation of customer service personnel

The intention of customer service is to solve the problems that requested from users, thus the incubation of problem-solving capability for customer service personnel is his/her professional competence which includes the familiarity with product specifications and working procedures, the conversation manners for clear explanation. Unqualified service personnel should be quickly identified for further training or transferred to other department in order to maintain high quality service standard.

We may frequently hear about the customer dissatisfaction with products, and they may dial to the call center for complaining the after-sales service. Professional competence of customer service personnel shall not only possess good communicative skills to moderate customer's mood, but shall possess capability to handle the emergency and business negotiations to achieve the goal of support and enhance satisfactory benefit for customers [20,21].

D. Measurement Indicator of Call Center

The performance of organization behavior needs to be evaluated through indicators, that is, by means of an evaluating system with quantified methods to measure the performance of regular operation, and tools that commonly

used to determine the organization performance of individual (such as: single customer service personnel) and team (entire call center). The indicators can be quantified into following three categories for discussion.

1. Performance Evaluation

Since call center is a work place full of pressure with faster pace, it is very important to have effective communication schemes for conversation. There are 8 performance indicators for call center as follows:

1. Average response speed
2. Average handle time
3. Average abandon rate
4. Average waiting time
5. Resolving rate per call
6. Utility rate per on duty agent
7. Average cost of amortization per call
8. Average quantity of calls handled by each on-duty Agent

2. Integral Quantified Indicators

We may set the service indicator (service level) as the percentage of receiving customer's call within 5 seconds or 5 times of rings for the customer service personnel. Actually, this is the most common used indicator for every call center. If this indicator falls below this level, additional personnel are needed.

George Baldino[4] has pointed out the following 7 points which are able to enhance the indicator of customer satisfaction:

1. Support from High Level Management: High level management plays a key role in customer satisfaction since each improvement solution usually needs the interdepartmentally collaborative operation, and the managing authority's support and promotion is able to carry out the project more smoothly.
2. Design Exclusive Solution: According to its product characteristics and consumer behavior, every enterprise shall develop a set of exclusive customer satisfaction measurement solution. While some enterprises are divided similar customer groups in the same market, the measurement solution that is suitable for firm A may not suit firm B due to different business procedures within the corporate.
3. Understand Customers: Without understanding the customers, it will be hard to achieve the customer satisfaction since there is no indication of meeting customer needs. The most effective way to understand customer is through customer's feedback, and the most common approaches are the in-depth interview and the focus group.
4. Benchmarking: In general, it can be divided into internal benchmarking, industrial benchmarking and competitive benchmarking. Even the evaluation results of the customer service shows improvement by internal benchmarking, the improvement from external benchmarking will be more objective.
5. Draft of Action Plan: the enterprise should propose the draft of action plan through cross department study for

customer satisfaction. The detailed procedures are needed for implementation.

6. Continuous Improvement: Customer satisfaction measurement should be conducted continuously. The continuous improvement of customer satisfaction ensures the company's future competitive advantage, and make sure of its products that conform to customers' expectation.
7. Understand the difference between Customer Satisfaction and Customer Retention: Even there's a significant correlation between customer satisfaction and customer retention, it still need to emphasize that the measuring indicators shall be determined differently by other study.

3) Individual Quantified Indicators

The routine works of the customer service personnel include the number of calls received by a person per day, average communication time per call, frequency of updating knowledge database, hours of education training. Other related quality indicators include the conversation manners, tamper, call receiving skills, and professional knowledge. The quantified indicators of the performance evaluation can be judged by two categories: internal self-grading and external grading. Such indicators abovementioned can be supported through ACD (Automatic Call Distribution) system and the monitoring system with customer satisfaction survey for internal grading. In terms of the external grading, through system's voice recording, it may conduct the random inspection for on-duty agents. The inspection items include: whether they follow the criteria to answer customers, whether the respondent answers need further follow-up, and to know any relevant aspect that needs to be improved. According to enterprise's short-term or long-term goals, such as enterprise's strategy and operation performance, all evaluation mechanisms should be examined from top to bottom levels. Furthermore, compactly integrating with related units, resources and procedures within enterprise will make the performance evaluation to be objective, fair and conform to the long-term benefit for enterprise.

IV. EMPIRICAL FINDINGS

The case firm established in 1987 and locates in the Science-based Industrial Park in Hsing-Chu, Taiwan, which was mainly engaged in PC production and manufacturing during the early stage. In recent years, the corporate product line has expanded to the digital home appliances, high-end server and portable digital assistant related products.

Its headquarter is located in Neihu, Taipei City and has many foreign business branches in US, UK, German, Belgium, Japan, and China. As for its production sites, Hsing-Chu factory in Taiwan is responsible to implement new products and manufacturing of high-end products; Guang-Dong factory in China produces motherboard, desktop computer, workstation, server,...etc. Jian-Su factory

in China manufactures wireless communication products mainly, such as navigation products (GPS), pocket PC, and smart phone. Furthermore, its core competence has been transformed from the early production and QC, R&D focus into OBM operation.

In such a severely competitive environment of micro-profit era, enterprise has encountered the threat from many external factors in the aspect of making profit, such as: too many substitute products, threat from homogeneous competitors, unpredicted change in consumer behavior, threat from new technology industries and the capability of price negotiation. According to SWOT Analysis in TABLE 2, Mio-TECH has many advantages like the largest market share in Taiwan with high quality products. However, it also need strengthen product maintenance in the scope of after-sales service for GPS products. The quality, service speed and cost of maintenance have been emphasized as the most important issues in services. This study will focus on the establishment of related systems and specifications for Mio-TECH call center in China region, and the service indicators generalized for the specialty of navigation products.

TABLE 2. SWOT ANALYSIS OF THE CASE FIRM

	S Strength S1 Taiwan Car GPS Market Share No. 1 S2 Many Agents S3 Developed with hardware vendors with excellent QC	W Weakness W1 No exclusive service branch to conduct the rapid promotion and localized activities W2 Long waiting time due to the outsourcing of Maintenance service
	O Opportunity O1 High growth of car navigation system	SO: Strike 1. Diverse Mio products with completed low to high-end products 2. Integrate mobile phone with electronic navigation system WO: Strategic Alliance 1. Vertical link of the collaborative firms engaged in telecommunication, car service and car stereo 2. Participating major GPS discussion groups
	T Threat T1 Low difference between homogeneous products T2 Potential competitors into the market.	ST: Turning point 1. Collection of updated touring information 2. Upgrade the hardware with new specification 3. Update the latest map information WT: Defense 1. Knowledge data base updated quarterly

The TABLE 3 statistics are analyses of case firm's competitors in Taiwan region. As for the on-line inquiry service about the maintenance condition, there's no such competitor who possesses the relevant customized service up-to-date. This unique service strengthens Mio-TECH customer satisfaction and the detailed will be explained in the following.

TABLE 3. SERVICES OFFERED AMONG COMPETITORS (DATA COLLECTED BY THIS RESEARCH)

Firm	HP	ASUS	GARMIN	Mio-TECH
Years of Warranty	1 year	2 years	1 year	24 month
Warranty Contents	a. Free parts replacement b. Free maintenance c. Free home pick-up and delivery	Any failure occurred under the normal operation (non man-made factors) within the warranty period, ACER will responsible for all expenses incurred by maintenance and parts replacement.	Any failure occurred under the normal operation and it determined as the device problem, then the manufacturer will bear all responsibility within the warranty.	Any failure occurred under the normal operation and it determined as the device problem, then the manufacturer will bear all responsibility within the warranty.
Home Pick-up	Yes	N/A	N/A	Yes
Global Warranty	N/A	N/A	Yes	N/A
Name of Upgrade	HP care pack	N/A	N/A	Home Delivery Repair
Upgrade Service	On-site response on next working day. The scope of coverage includes all necessary parts and materials.	N/A	N/A	Immediate pick-up after phone registration, 3-hour special engineer will conduct the preliminary on-line troubleshooting via phone. The scope of service covers the services of hardware recovery, troubleshooting and software upgrade
On-line Inquiry	N/A	N/A	N/A	Official Web Page
No of Maintenance Center	4	9	N/A	29 (Lemel)

- Customer service promotion

In Feb. 1st, 2006, Mio-TECH provided users in Taiwan region with a member-only customized service, named "Mio Home Delivery Repair" (code name ERMA) which is able to simplify the maintenance procedures. This promotion integrated the logistic planning with the home pick-up service and customers don't need to go to the maintenance site for service. They can easily get the service of maintenance, the process inquiry and troubleshooting through Mio-TECH call center to assign the pickup and return schedule, for example. A flowchart of the promotion is in Figure 4.

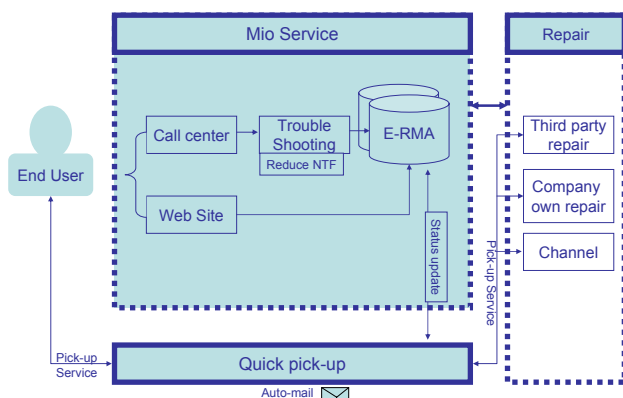


Figure 4. Case firm customized maintenance procedures

The case firm has cooperated with logistic industry, when customer's request for returning product back to the manufacturer. Customer may apply the "Home Delivery Repair" service via call center or network, then the call center will register the customer contact information and maintenance details for customers. At the same time, the manufacturer technician will make a phone call to help the user and decide whether the problem can be solved during the on-line troubleshooting. If the engineer confirms that product should be returned for repair, the manufacturer will immediately inform the logistic agent for the product pickup. The procedures can be showed in Figure 5.

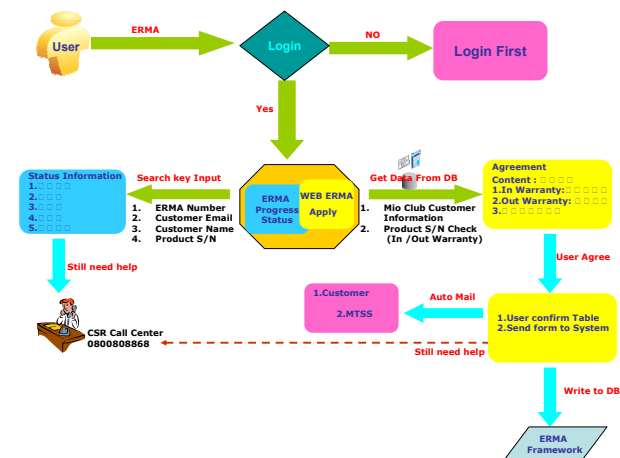


Figure 5. The procedures of the customized request

In order to understand the satisfactory condition for the registered customers who have used such a service, a customer survey cross Taiwan is conducted and hopes to realize the customer behavior and customers' expectation of the after-sales service. Scope of the survey is designed for the existing customers and the key points to inquiry are:

1. How do you know the service of "Home Delivery Repair"?
2. Impression to "Home Delivery Repair" service and suggestion
3. Customer data update
4. Overall satisfaction with Mio-TECH

Under the sampling error is $\pm 3\%$ within 95% reliability, the sample size of completion should have at least 160 copies. The survey duration is from March 1st to March 20th, 2006. Within 3 weeks, there are totally 250 person responds and the affective reply is 175 persons where Male/Female ratio is 138/37. From the survey, 97.2% customers who used the service are satisfied with such a service. Since other vendors haven't provided similar services, this customized service has become a unique tool and useful show case during the market promotion.

Even the call center implemented the customized service for only 2 months, and the related operation procedures will be gradually amended in the follow-up review meetings, over 90% of them are satisfied with this service. However, the data shows the usage of the new service is only used by less than 30 % of total users. The reason might be caused by insufficient advertisement within such short period. Therefore, the case firm will try to enhance the utilization ratio of "Mio Home Delivery Repair" and improve the professional competence in hardware maintenance for customer service personnel.

• Employee Evaluation

Customer service personnel are on the first line of service and the work pressure came from customer directly. Therefore, the HR cost will also higher than other sectors in the enterprise. In the call center, a department with high pressure of work, the average HR turnover is 300% annually. That is, there will be 3 rotations of new blood in one working year, thus the demanding aspect of education training and incentive system is relatively important. As for the incentive methods, it needs to setup the practical rewards such as bonus and vacation, and as to the mentally aspect, job promotion and public praise can be adopted.

Since customer service personnel are representing their enterprise, in order to have consistent enterprise image, they shall demonstrate the standardized conversation skills and manners during the communicating with customers. Due to the fact that the characteristics of every product are varied, the standardized respondent wordings shall be defined. To ensure service contents provided by customer service personnel that are acceptable by customers, management personnel will make sampling picks from the recorded conversations or monitor the lines of in-progress conversations to conduct the monitoring and quality analysis. A sample of the monitoring is shown in Figure 6. As for the service standards of Mio call center, each customer service

personnel shall be inspected with sampling check more than 3 times per week, each time shall have the writing record. If the score is lower than the acceptable standard, an interview will be conducted by higher level manager. In addition, if bad service record occurred within 2 consecutive weeks, the post of the frontline customer service personnel will be relieved and reevaluation will be examined. Further training might be needed before the personnel return to the work position.

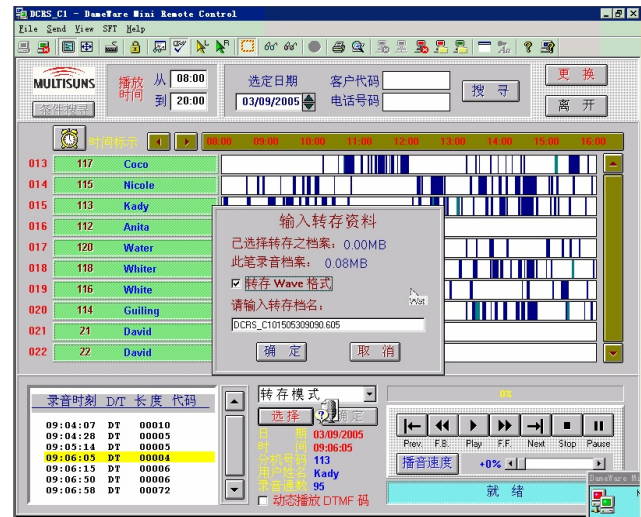


Figure 6. A sample of the monitoring mechanism

• Employee Education

From Mio-TECH's experience, effective dispatch of customer service personnel becomes the key to enhance the efficiency of call center. It is necessary to increase the number of customer service personnel on duty in the peak season which can handle more requests from customers. During the off-season, it is also required to assist the service personnel for training during the shifts. The education can help the personnel to learn the characteristics of new products in the next market phase and prepare for the FAQ in advance. In addition, it depends on the historical information and analysis of marketing plan to carry out the education schedule. Figure 7 illustrates the historical data of call answered in Mio-TECH and related job training is performed.

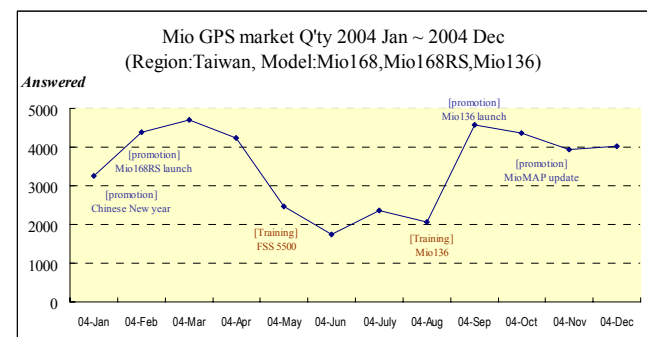


Figure 7. Historical data of call answered in year 2004. Training schedule is also planned.

V. DISCUSSION, IMPLICATION AND CONTRIBUTION

Service scope of call center can be divided into two directions: receiving service (inbound) and dialing service (outbound). The main performance indicators of the receiving service are successful respondent rate, abandon rate, and average conversation time. On the other hand, the main performance indicators of the dialing service are the sales amount within a certain period and development of potential customer roster. Those indicators should be examined carefully. For example, if it only views the average handling time, such measuring criteria may cause single data's growth which will result the customer service personnel in trying hard to end the conversation shortly in order to receive more inbound calls. That is, it will lose the actual satisfaction under CRM. Therefore, some enterprises will ask for the outsiders to conduct the satisfaction survey (out-bound) for its internal telemarketing (in-bound) of the call center. An internal inquiry system is shown in Figure 8 for illustration purpose.

Daily Report :			
项目	8390-China(350)	Mio-TW(360)	Total(Average)
1. Total Calls In	64	109	173
2. Abandon>20	0	1	1
3. Calls Answered	62	107	164
4. Calls In(excluding abandon<20sec)	64	107	173
5. % Abandon	.0 %	.9 %	.5 %
6. Average Waiting (sec)	73	31	52
7. Service Level	95.2%	98.0%	97.0%
8. Agents On Queue	2	4	6
9. Average Calls Per Agent	31.0	25.5	27.3
10. Total Calls Logged	33	33	66
11. % of Total Calls Logged	53.2%	32.4%	40.2%
12. Average Communication (sec)	199	149	168

值班人员接听状况 :		
值班人员	接听数	接听时间
781	22	45 分 12 秒
1980	7	1 小时 3 分 32 秒
3133	22	1 小时 9 分 32 秒
3233	35	1 小时 9 分 34 秒
4892	24	58 分 8 秒
5934	15	36 分 47 秒
6692	8	37 分 50 秒

Figure 8. Inquiry system of performance indicators

The amount of inbound calls is unpredictable, and it is totally depended on customer's action, thus planning and deployment of service personnel and facilities are very critical to the operation cost of call center. Service indicators (service level agreement) are the referential basis that used to measure passive telemarketing center, and it is able to determine whether the deployment of customer service personnel is sufficient to handle the call traffic; on the contrary, if it deployed too many customer service personnel that will increase the total idle time and cost as well. The basic criteria of measurement include:

1. Average Handle Time (AHT)
2. Abandon Rate
3. Average Waiting Time (AWT)

In order to avoid customers from abandoning their calls after a long period of waiting that may generate the negative impression for this company, for example, anti-sales promotion may occur, enterprise should offer better customer service as soon as possible. Besides, the threats of many replacement products, price competition for homogeneous products, consumer behavior change, short life cycle of products, and new technology products are all

competing in the same market nowadays. If the enterprise is not able to maintain its brand image with follow-up service, the enterprise may possibly encounter the predicament of losing its customers. Thus, to improve the after-sales service can be the first move for increasing the competitive advantage for the company which will also strengthen customer's loyalty. To achieve such an ideal, Mio-TECH's call center has following self-established service indicators:

1. Cooperate with enterprise's integral strategy to continuously develop the customized service for products.
2. Enhance the satisfaction level of customer service and reach the leading position in the industry.
3. Improve the customer service effectively and efficiently control the cost.
4. Realize the update of knowledge and skill for all customer service personnel
5. Enhance the customer satisfaction and contribute more value to the enterprise.

The Trend in the Service Center

Along with the globalization, the transformation of internationalization for enterprises is also needed in order to broaden the business territory. In order to get close to serve customers and save communication cost, many enterprises choose to seek the outsourced call centers and maintenance sites locally. Due to the culture and social customs in every region are different, so dose the sales strategy. Such an approach causes the enterprise to monitor many call centers and the headquarter needs to provide the technological support and establish the marketing strategy. This kind of operation model may derivate different customized services to different product characteristics.

For the case firm, the production of car navigation system is in China and the marketing and R&D units still retain in Taiwan's headquarter. Unlike the previously mentioned model, the case firm authorize its branch companies to build the service channel according to the market scale, for example, self-built call center, maintenance site or outsourcing professional call center. Therefore, as for the appointment of local management, customized service will be a key point to enhance the service indicators.

Regarding the product characteristics, the utility and precision of e-map are the service keys to such an electronic device. Under such condition, there are trends in the service center as centralization, customization and horizontal alliance and will be explained in details.

1. Centralization

To respond to the rapid development of Internet, service personnel in different regions can use the same system via the communication service through the Internet. The enterprise is able to establish more quantity and higher quality call centers in the regions with lower HR cost to provide customer service in other regions. The ACD can automatically distribute the request to the proper service personnel. For example, the integrated call center can enable the call center in China to serve the customers in Taiwan and

China as shown in Figure 9. Figure 10 demonstrate more detailed request flow between IT modules.

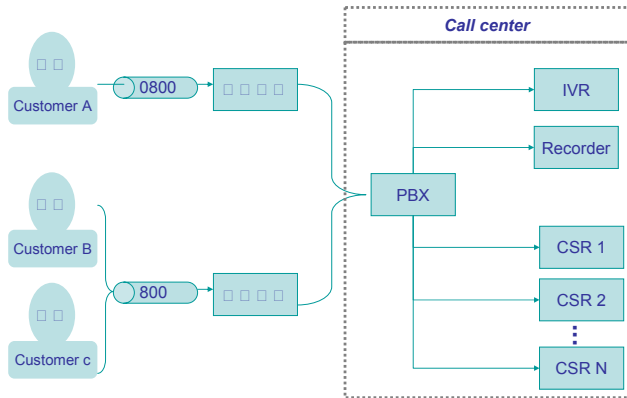


Figure 9. Case firm integrated call center diagram

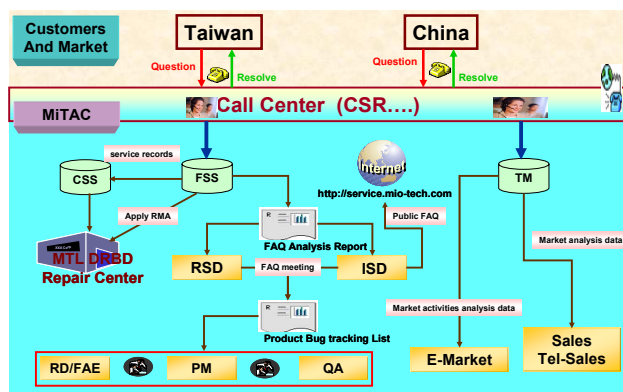


Figure 10. Detailed request flow between IT modules.

Similar implementations are also applied for many international companies which setup their call centers in India for English-speaking service. Many European language speaking international companies setup their companies in Czech where they can integrate the local low HR cost with centralized hardware facilities to provide the integrated service.

2. Customization

Under the intensive competition of marketing, customized customer service will become the critical factor to gain advantage for customer satisfaction. The role of call center is no longer passively receiving the customer's inquiry and it begins to transform into actively perform the playmaker position for product sales. Since the customers are intolerable from fraudulent calls and reluctant to receive the outbound service from the traditional call center, the outbound service of the case firm focuses on the contacting with agencies who are participating the product development in its business unit and the customer information update for market unit. The diversification of the services from the service center retains its flexibility for different variety of customers.

As for the reengineering of call center's procedures, the direction of implementation is usually focused on enhancing

the service quality and reducing operating cost. Due to the customers' demands are varied according to the characteristics of products, the enterprise should cooperate with professional and reliable resource distribution as the basis of proposing the customized service to customers. Certain business operations shall be adjusted and modified for the integrated service which is very crucial for the success of the business reengineering.

As the example of the "Mio Home Delivery Repair" (code name ERMA) from the case firm, the planning, testing and launching take about 2 years before it finally online for operation. The survey study shows the differential and diversified customized service offers better custom satisfaction.

3. Horizontal Alliances

The so-called strategic alliance (horizontal alliances) is virtually integrated with common marketing activities from two different industries. From the value chain point of view, the collaboration creates a win-win situation for both of them.

The partners of the strategic alliance can be in different industry or the same industry. One situation is the cooperation between the competitors that have common target in the same market to ally with minor competitors to strike on their main competitor. The other situation is Co-Branding which are two different industries in the same supply chain to jointly promote the new product. An example is the joint promotion from the notebook industry and the Centrino platform from Intel.

The cases of Mio strategic alliance can be summarized as following:

1. Mio products entered the home shopping channel through ETV Shopping channel from 2004.
2. Mio168 built-in Greece-Athens City Map for Chinese Taipei Olympic Team during the Olympic Games, alliance partner: Chinese Taipei Olympic Committee.
3. Mail order alliance with major credit card companies like ChinaTrust, CitiBank where the users can select Mio products from the mail order catalogue from 2004.
4. Mio136RS Black Bat Limited edition which was launched when the movie "Batman III Batman Begins" was on the stage.
5. Big size MPV's shuttle equipped with Mio GPS, alliance partner: Volkswagen Taiwan in 2006.
6. Mio Home Delivery Repair promotion, 2006
7. Mio A700 GPS PDA Phone e-Map Upgrade, alliance partner: Chunghwa Telecom in 2006.
8. Mio-TECH cooperates with Mercedes Benzes. The buyer of every model of Mercedes Benzes will get a unit of C710 as bonus in Taiwan. Alliance partner: Mercedes-Benzes Taiwan, 2006

After successive activities through strategic alliance, Mio is the leading vendor in GPS products in Taiwan with high market share. This study indicates that the high quality product can attract customers but good service is the key to establish the long term relationship with customers. The centralized communication channels, the customized service

and the horizontal alliances for the service center prove the sustainable management of the service center is essential for the business.

IV. CONCLUSION

To successfully implement CRM into the customized service, the enterprise should set the clear strategy, department support and organization operations. Continuous reviews of the quantified service indicators will help to monitor the customer satisfaction and understand the service personnel quality.

This study is taking Mio Technology Limited (Mio-TECH) as an example of case firm to explore the organizational operations of its call center such as applications of communication and computer technologies to automatically handle the large quantity of works, utilize the competitive human resource (HR) in China region to cooperated with Mio-TECH's headquarter in Taiwan to build a good customer relationship service center for worldwide users.

The centralized communication channels, the customized service and the horizontal alliances for the service center prove the sustainable management of the service center is essential for the business. Therefore, the technical enhancement, the customer's satisfaction and the corporate strategy have been significantly communicated and strengthen the customer relationship for the case firm.

ACKNOWLEDGEMENT

The author would like to thank anonymous reviewers for valuable suggestions and thank Chris Wu and Neng Liu of Mio-TECH for data collection and simulation works.

This work was partially supported by the National Science Council in Taiwan, Republic of China, under Grant NSC94-2416-H009-018 and NSC95-2416-H009-027.

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Three Phases RFID Adoption: A Road Map to Success

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Abstract —Radio frequency identification (RFID) uses radio frequency technology for automated identification. The use of RFID brings the second source of information to enterprise management. It is said the second source is because, in the conventional approach, the information is shared among the various units through an integrated enterprise system. In this study, we define three layers of networks, i.e. Intranet, Extranet, and Internet, can be used to share RFID data and the adoption of RFID technology can be recognized into three phases: standalone adoption, supply chain adoption, and global adoption. Issues in each adoption will be address as well as road map to the success will be included.

Keywords —RFID, Supply Chain, Technology Adoption

I. INTRODUCTION

Radio frequency identification (RFID) using radio frequency technology for automated identification has been acknowledgement in many uses such as inventory control and asset tracking to replace the use of traditional barcode technology [9] [11]. The technology allows multiple objects to be identified without line of sights by embedding with a product for a unique identity to be imprinted. Further, transient information can be updated or changed during the transition throughout production systems, warehouses, airliners, trucks, distribution centers, retailers, and finally to the end customers [9] [12] [5] [2].

In fact, the impact of this technology goes far beyond the benefits gained by individual parties when it integrates with supply chain partners. With adoption of global identification standards such as the Electronic Product Code (EPC), an identification scheme for the universal identification of physical objects, the applicability of this technology can be fell from the supply chain, to the logistics chain, the distribution network and finally to the end-user [3] [6] [1]. Services such as warranty or maintenance can be verified and carried out in a timely manner. After-sales services can also be monitored, providing effective customer

relationship management; other possibilities are location-based commerce, product tie-in promotion, or cross-sales with minimum efforts. The EPC Network, hosted by EPCglobal, was originally developed by the Auto-ID Center (now called Auto-ID Labs) to manage the EPC. Note that EPC is a encoding scheme in which an identification scheme for universally identifying physical objects is defined. On the other hand, EPC Network includes the physical layer capturing the location and other information, and information layer to provide name service, such as object name service (ONS) and EPC Discovery Service (EPCDS) [10].

The use of RFID brings the second source of information to enterprise management. It is said the second source is because, in the conventional approach, the information is shared among the various departments through an integrated enterprise system or is shared among the partners to enhance the performance of the whole supply chain. However, very often, the information is not synchronized with the physical flow until track and trace function is activated. A familiar scenario is that a production line is eager but cannot use some parts on dock since the arrival of the parts has not been input into the enterprise system yet. With RFID, the logistic information of the arrival parts can actively pull the information from the system. In this case, two sources of information are synchronized at all time.

In this study, RFID related data can be shared via three different layers of network: Intranet, Extranet, and Internet. The data kept in Intranet is mainly shared among departments of a company while in Extranet is for collaboration over supply chain partners. In contrast, the data kept in Internet are designed to be shared with publics. The adoption of RFID technology can be recognized into three phases: standalone adoption, community adoption, and global adoption. However, the greatest concern remains on both privacy and security issue and global standard issues [4] [7] [8]. The later sections will introduce the advantages of three phase's adoption.

II. STANDALONE ADOPTION

The standalone adoption is implemented in a company without involving external parties. The adoption of RFID can improve internal operations such as synchronized manufacturing, real-time inventory management, and valued-added logistics. The advantages are obtained mainly because the information flow is synchronized with and is activated by logistic flow. That is, the logistic flow will (1) precede track and trace when the goods reach to particular workflow nodes, (2) synchronize with the information in database, and (3) extract additional information from previous workflow nodes or networks. Note that in conventional approach, without using RFID, both information and materials flow across departmental units following predefined workflow separately and independently. These two flows are synchronized only when track and trace function is activated.

We can use inventory check as an example to illustrate the advantages because the use of RFID in house. In conventional way, a manager classifies ABC types of inventory items and monitors A type items closely and frequently. The full scale of inventory check cannot be executed too often since it demands time and resources and interrupt operations. The execution normally takes hours or even days depending on the scale of the check. In fact, the inventory report is obsolete when the check is completed if it takes too longer time. However, this is not the case when RFID is adopted. With the use of RFID, both sources of information can be synchronized, i.e. "what you see is what you get". This provides real-time traceability, responsiveness, flexibility, reliability, and accuracy. In summary, the use of RFID in a standalone adoption can:

(1) Automate identification and data capture. RFID can provide the states of materials in real-time. The RFID-enabled operations can update the states of materials to database actively to expedite internal operations. For example, in the manufacturing process, what stage of process and current owner of the materials, expecting completing time as well as other useful information such as size, weight, and shipping and handling requirement can be obtained in real-time. The automatic data capture and identification can help both a company to acquire the most updated information and the states of orders effectively. Moreover, the adoption can prevent undisciplined human interference, such as the delay of data updates or incorrect barcode reading.

(2) Reduce latency gaps between material flow and information flow. To measure the performance of operation management, the responsiveness indicates how soon the system can respond to a user's request, such as inventory check. The punctual and efficient reading of RFID-enabled operation can respond can provide better operational flexibility that is possible to adjust inventory levels, regulate capacity, use alternative sources of supply, vary the lead time to the customer, and introduce new products.

(3) Enhance reliability and accuracy. The real-time and punctual data can help to improve reliability and accuracy in many aspects. For example, in manufacturing execution system (MES), production of product or change of order policies can be revised according to just-in-time information. Or, the forecasting, customer order promising, purchasing, costing, shipping, and the shop floor functions of advanced planning and scheduling (APS) can be tightly integrated. This integration realizes accurate supply chain execution in which several plants and warehouses are incorporated. Moreover, the real-time and responsive data can also help to determine which plant should make which products to maximize customer service and profitability accurately.

III. SUPPLY CHAIN ADOPTION

In the collaborative resource planning that supports on-demand business involves functions of financial and support integration, customer integration, executive decision integration, engineering integration, and manufacturing integration. The collaboration is achieved through the integrated logistic flow and information flow. When a product is shifted from one company to another using integrated logistic flow, the embedded RFID data can synchronize the corresponding information flow between companies. The information thus can be used to enhance different degree of resource planning. For example, the information can be applied to manufacturing integration for advanced planning and scheduling, supplier integration, and quality management systems, or to product integration for product design management and project management. Mainly, three advantages can be derived.

(1) Synchronize sharing of exact information. The conventional supply chain promotes the pull-type supply chain which builds up partnership to maximize the total value of the supply chain. It is important that the information on sales, operating, and financial data can be shared in real-time to enhance high degree of trust among partners. The RFID-enabled supply chain equips the supply chain with the information sharing via corporate database as well as RFID. The second source of information carried by RFID can only be acknowledged when the materials are physically arrived. Upon arrival, the data carried via RFID can activate the data kept in the company Intranet and supply chain Extranet. Ideally, the data in Intranet is used for internal use while the data stored in Extranet are shared among partners with appropriate access control, and the useful and related data stored in Extranet are activated and extracted from the information provider upon request, which can be either up stream or down stream partners.

(2) Polarize physical and information flow of partners. In the conventional enterprise system, the unmatched material flow and information flow is particularly a problematic issue when both information and materials are moved across supply chain partners separately. Fortunately,

RFID can help logistics information system to acquire real-time data of logistics and distribution, field service, warehouse, shipping, and transportation from partners. In this way, many activities can be synchronized and thus many benefits, such as competent make-to-order or engineering-to-order manufacturing, efficient vendor management inventory, and better demand management for customers, can be derived.

(3) Standardize on-demand services. When both information flow and materials flow are standardized over the supply chain partners, many serviceable events can be provided because of easily reconciling orders, generating shipping reports, providing pallet verification and inventory status, enhancing service and sales, and integrating account payables and receivables. This can achieve full sales support, forecasting integration, order integration, quoting and promising deliveries, and strategies planning.

IV. GLOBAL ADOPTION

As supply chain adoptions across industries, the focus shifts, i.e., from supply chain integration to the integration of supply chains, or business chains in general. Other new opportunities that are not feasible will no doubt come into play in this global adoption phase. In this phase, as physical flows trigger data capturing from each business chain, product movement will be filtered into a repository in the Internet. As is now proposed by EPCglobal, such a neutral service-oriented (Web-based) information agent, the EPC Network, will act as a repository, directory and broker of EPC-RFID-based data and information. The EPC Network collects all RFID on-tag information from individual EPCIS's, tracking all physical movements of products in business chains, and product consumption around the globe. This information, when combined with product-specific, corporate-specific, chain-specific and market-specific data and information, could provide a powerful much-needed knowledge base that has evaded management decision-makers before.

There are domain-specific information agents currently online and under development that are vital to enrich the knowledge mineable from the product-based EPC Network and vice versa. For example, a logistics service platform (such as DTTN in Hong Kong) can provide additional service that facilitates the sharing of information on the top of logistics services. As e-Business moves into global adoption phase, we will find the following advantages in the RFID Internet:

(1) Targetable global information sharing. Information sharing in a global scale with hooks (EPC) to allow the mapping of any specific business process in terms of

- a. time – bottleneck, and loose ends?
- b. demands – continuous, real versus expected?
- c. supply – scalable supply chains?

This definable sharing of any targets will be a welcoming information source for businesses to further

reduce uncertainties (if and when the product arrives, consumes and returns in a different time zone) in global trade.

(2) Scalable Business Chain Network. The physical flow and information flow of business chains can now provide a clear and present view of existing business chain networks. At the same time, other competitive players, in a global sense, can now be comparative, complementary, and substitutive with respect to existing networks. Business chain network can now be scalable and no doubt flexible.

(3) Weaveable knowledge and services. Knowledge generation is no longer pre-set and based on static and/or past information. Knowledge can now be multi-dimensional with common glue (i.e., EPC or its derivatives). That is, EPC-RFID-based information can now be mined at different levels of details and at different aspects. Thus, knowledge can be weaved from different dimensions accordingly and glued into an information mesh. This mesh of multi-dimension provides comprehensive business intelligence to enterprises, or to third-party information agents that brokerage on-demand targeted services to individuals.

V. A ROAD MAP TO THE SUCCESS

The current proposed EPCglobal network addresses the issues of data exchange standards, infrastructure standards, and physical object exchange standards. For data exchange services, issues such as tag data schema, ONS service and directory service will be defined while data capture and filtering are managed in infrastructure standards and physical object exchange standards will resolve reader and tag management issues. However, the framework focuses on the approach suitable for standalone adoption and global adoption rather than supply chain adoption since it does not considered the needs of specific industries and partner access control. More important, the framework is a top-down approach that forces the adaptors to be bound by this standard in the first place. It is also noticed that ONS, similar to the domain name service on the Internet, introduced by the Software Action Group of EPCglobal is hosted by VeriSign (www.verisign.com) since January 2004. The inquiry is designed to send to the Root ONS to locate the data owners, and then re-directed to the local ONS of the data owner. This approach involves an issue is that unlike the neutrality in operating Internet IP service, the RFID ONS service involves content service. It is a kind of sensitive to a company that its corporate information is maintained by a service provider. In contrast, the three phase's adoption approach presented in this study argues that only minimum information to be maintained in each layer of RFID Network, i.e. intranet, extranet, and Internet. That means, only minimum data are kept in extranet database to expedite the company collaboration and in Internet database for providing various web services.

We can expect the standalone adoption become more popular in 1 to 3 years. In this phase, the factory layout, workflow process, and some technical issues (readers, materials, software, etc.) of a company need to be resolved. For example, the layout should be designed to capture the tag information and streamline the operations smoothly. The workflow needs to consider the real-time information sharing among different departments. It is important to note that the workflow will be changed dramatically since the physical flow will drive information flow upon adopting RFID. Furthermore, the RFID tag standard, format, readers, hardware, materials, and access privilege are all important issues needed to be resolved. However, adopting the proprietary hardware and standards eventually will hinder the adoption in the next phase. From IT perspective, both enterprise resource planning (ERP) and manufacturing execution system (MES) are benefited from the responsive and accurate of data. An intranet should be built to share information and interfaces to both users and machines. Therefore, both event management and query optimization for the information sharing are managed. Although cost remains the major concern in standalone adoption, the company that wishes to adopt RFID individually should aware that innovative business models can be implemented after streaming internal operations.

The supply chain adoption will happen in 3 to 5 years. The adoption will start from those companies producing high value and short life cycle products. A RFID Network to share information associated to RFID among partners for track and trace and information sharing will be built. The extranet can be limited to close partners at the beginning of adoption, such as suppliers or buyers, and can be extended to all parties in the industries. The access control for sharing data among partners is an important issue in this phase. However, to successfully build the community, having the determination from a strong initiator, such as Wal-Mart, or an organization, such as Rosetta Net, is crucial. The cost can be justified by the benefits gained from participating the RFID Network easily. However, how to set up a well accepted standard is a difficult issue to be resolve, especially when some well established partners have operated by their proprietary standards.

The RFID-enabled supply chain is a pull-type supply chain which involves two sources of pulling forces: information and materials. Therefore, two platforms need to be built and integrated: a platform connected community partners for information sharing and the other is RFID Network that mainly serves as providing regional object name services (ONS). It has to be pointed out that ONS should accomplish not only the name services associated to RFID tags but also fundamental information retrieved via the object names. In this case, a web-base integrated information platform is needed while services such as query processing and help desk services are provided. The query processing is operated as an even-driven management system where the event can be triggered by either machine or

human query. Similarly, the help desk service can respond to requests and resolve conflictions. Moreover, to successfully adopting RFID in the supply chain, on-tag data management is important. This is because the RFID tag itself is both physical and information venerable and therefore a tag should not keep highly sensitive information. A proper design of access control to protect both privacy and security of participants is crucial.

The global adoption in phase 3 adoption expects to be completed in 5 to 10 years. There are issues that stemmed from this wealth of information in an open network. Two most pressing issues, if unresolved at the outset, could be the barrier of entering into RFID global adoption.

(1) Privacy and security issues. If privacy is not properly defined and enforceable online, then information sharing in a global scale would lack the important trust factor, and on-demand services would not be possible.

(2) Global standards issues. Data and its format must be properly specified to remove inconsistent decoding and incorrect interpretation, while information item must be properly label to avoid fictitious knowledge generation. These are just two undesirable characteristics in the RFID Network if standards are not developed and sanctioned by the global community.

VI. CONCLUSIONS AND DISCUSSIONS

The adoption involves the participation of four pillars, i.e. peoples, public policy and standards, organizations, and web services. Peoples include buyers, sellers, end consumers, intermediaries, and other service providers. The peoples need to be willing to accept the benefits brought up by the new technology with the price of compromising some degree of privacy invasion. No double, the adoption of RFID brings up the privacy issue that was raised whenever a new technology is introduced. However, it should be notices that the adoption of RFID will not sacrifice more privacy than the use of Internet and mobile phone where the users' behaviors and locations are traceable at all time. Public policy is crucial to the success because the real-time location information should not be abused to become the intruder to human's life, such as receiving spam mail. This relies on the effort of setting considerable and sound public policy. Organizations include supply chain entities, associations, government who are the key entities to move forward the use of RFID technology. Having good reference cases are always good way to promote the acceptance. For example, Hong Kong airport adopts RFID to streamline the baggage handling, Singapore uses it in public libraries, and Japan applied to construction industry. These reference cases are encouraging and are benefited to the followers. Finally, the intelligent web services allow the information to locate and share among users efficiently. This relies on having good IT infrastructures and technical standards.

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Towards Seamless Product Structure Information Integration

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Although B2B integration is nothing new, interoperability is still a big issue in product data communication. However new technologies are introduced and existing standards evolve to better support all operations to improve the situation. In this paper we introduce a product structure information exchange case from automotive supply chain. Current integration has proprietary XML interface between partners and the integration has constantly errors requiring manual checks for the incoming information and interface have been inflexible to changes in the systems. We review relevant technical and content standards to solve this case. The traditionally used message validation technologies such as DTD or XML Schema lack the expressive power to solve some problems and thus we present a practical case for new semantic web service technologies.

Keywords: Automotive industry, B2B integration, product structure information, semantic web services, standards

I. INTRODUCTION

The Automotive industry has a long tradition in systems integration related to order delivery processes, where the first Electronic Data Interchange (EDI) standards were built already in the 1970s. However, the lack of integration is still a big challenge. Especially for contract manufacturers, as they have to integrate both with their Original Equipment Manufacturers (OEM) and with component suppliers. Furthermore, the contract manufacturers are included already in product development phase to improve the manufacturability of the product. This results in need to transfer a lot of product structure data. The OEMs have heterogeneous systems and power to dictate integration details causing the flexibility challenge to contract manufacturers. A study in the US automotive supply chain [1] estimated that one billion dollars is yearly lost due to poor interoperability in communicating product data between design systems alone.

There is a lot of manual work involved in the current integrations for product data. This is partly due to lack of standards or lack of expressive power in the current technical standards underlying the content standards. EDI standards have very limited support for validating the messages. The newer XML-based standards have easier validation mechanisms, but they have also limitations in what can be expressed. It is a truism of computing that to map between dissimilar data structures a more powerful data representation is needed [2]. The new formal semantic

web service technologies introduce languages to provide more powerful validation. Here we compare the approaches of using existing traditional XML standards and semantic web service to tackle the practical challenges in integrating product structure information between an OEM and a contract manufacturer.

We also take a look at prominent electronics and automotive industry standards as both industries are advanced in their integration solutions. Electronics and automotive industries have developed own standards for B2B integration. However, the industries are getting closer to each other as both increasingly use same electronic component suppliers as the new car models have increasing amount of electronics. We make initial comparison of the content of product structure data in RosettaNet, STEP and Odette ENG DAT standards. We look how they support the exchange of product structure information. Methodologically this work follows guidelines of design science research in information systems [3] as an IT solution to practically relevant problem is the goal of this study. However, our solution is still a concept and thus the evaluation part of the research is still very limited.

This paper is structured as follows. Section II presents a case for product structure integration from a current situation. Section III introduces base technologies in the integrations and presents how the different B2B standards fit the requirements for the product structure exchange. Section IV discusses the initial solution to the problem using XML Schemas and semantic web service technologies. Section V positions this to related work and Section VI discusses the expected benefits. Finally, Section VII concludes the paper.

II. CURRENT SITUATION

Automotive industry designs the car and its modules currently merely in 3D models, which cannot be utilized without the product structure information. The 3D models are combined with the positioning in the coordination system, which is a part of the structure data. The models are needed in all planning including packages for the parts, tooling for the production, simulating the production processes and measuring the parts and constant engineering change processes. Furthermore, contract manufacturers are continuously calculating offers for the quotes they get from OEMs. To be able to do the calculating properly the manufacturer needs to get the 3D models with their

structures as input.

The product structure data is very challenging for integration, while it can vary a lot depending on the systems and companies producing them. The information includes distance and position information. The different design systems use support differing accuracy to represent decimal numbers and thus export the position information differently. If the companies would have similar design systems, the replication of the databases could solve integration needs. However, as OEMs use different systems, the contract manufacturers should need all possible similar system, which in practice is often impossible due to costs.

Figure 1 shows the current situation between an OEM and a contract manufacturer. The integration uses mainly EDI or custom ASCII-based integration between the order management systems. This integration is characterized by lots of small messages exchanged uses Odette File Transfer Protocol (OFTP) using network operators instead of public Internet. The 3D model integration uses dedicated servers to handle the potentially large CAD files. This is based on OFTP-based ENG DAT protocol that is specialized for design data files exchange.

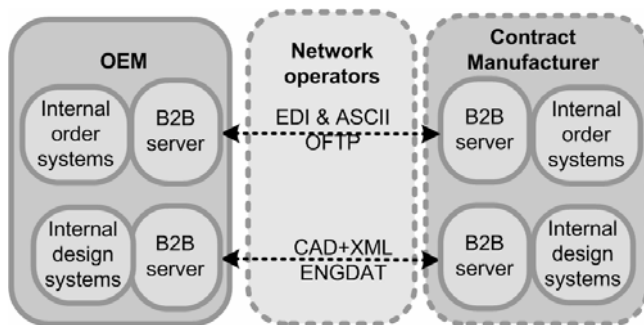


Figure 1 Current information exchange

The product structure currently comes in a proprietary XML message resulting from exporting data from OEM's product design systems. However, this integration has constant problems from the contract manufacturer's point of view as they need often to manually fix the incoming data in order to get the information to their own design systems. This is manual work resulting from poor interoperability considering position matrix information. The position matrixes have inaccuracies as the sending system has less meaning numbers in defining the matrixes. The contract manufacturers design systems report errors when the square sums of row and column values are not accurate enough – the square sums of columns and rows should be exactly one or otherwise the systems do not take in the models. Currently an IT administrator needs to manually check to see whether the error was significant or not and then manually take the files to their internal systems. Most of these error situations are actually non-significant but all this results that the person needing the files need to wait for the IT administrator to manually check these files before they get to work on the information. Table 1 shows an extract of XML file position

matrix information coming from OEM's systems. The extract also contains state and time information that comes directly from the OEM's product design application, as well as the position information. The timestamp is in UNIX datetime format. Some information has been omitted from the example and for instance name and identifier information have been removed as for the problem the specific part is not important. The square sum of the coordinate (x,y,z) rows and columns should be 1 - in the example they are not if there are more than 11 decimal used for accuracy. The contract manufacturers system expects the accuracy with even 17-18 decimals but the product design management system at the OEM only use 10-12 decimals. This creates sometimes error situations that are not too significant but currently the contract manufacturer cannot detect these situations automatically.

TABLE 1 XML INSTANCE EXTRACT

```
<object state="Aktiv" timestamp="1088171275"
xx="0.0366871538" xy="-0.0526438196" xz="-0.9979392171"
yx="0.9993267998" yy="0.001932653" yz="0.036636213" zx="0.0"
zy="-0.9986114826" zz="0.0526792833"/>
```

Problems in this integration interface were highlighted as a recent design system upgrade by OEMs resulted in slightly different XML structure file. OEM did not test with the contract manufacturer before implementing the changes nor was there any data validation in place. So changing attribute name and removing two other attributes broke the integration at contract manufacturer's end. This motivated this study to improve the current situation. As the current B2B interfaces are not based on standards, the integrations are very specific with the systems. Furthermore, the problem with position matrix is still there although the proprietary file has been fixed to make the basic B2B integration work.

In this paper, we compare different standards to establish standard message interface that does not need to change as internal systems or their versions are upgraded. We further describe, how the currently unsolved error situations with position matrixes could be solved using more expressive languages for validating the incoming information.

III. KEY TECHNOLOGIES AND STANDARDS FOR B2B INTEGRATION

In this section the main standard building blocks used for B2B integrations especially in automotive industry are introduced. First the underlying technologies EDI and XML are handled and also new and semantic web service technologies are introduced. Then relevant B2B standards supporting the interoperability are introduced.

A. Electronic Data Interchange

There are two main EDI syntax standards in use. The first standards of U.S. version of EDI, American National Standards Institute's (ANSI) X12, were published in 1983. The EDI for Administration, Commerce and Transportation (EDIFACT) was originated in 1985 to address the problems caused by different standards on both sides of the Atlantic.

The EDIFACT standard development is United Nations (UN) lead. The X12 syntax is the most used EDI syntax in North America, while EDIFACT is the dominant standard in the rest of the world. Besides, there are EDI formats, such as Verband der Automobilindustrie (VDA), that have been developed before these international EDI syntaxes.

UN/EDIFACT syntax (ISO 9735) defines the structures that are used for interchange of data. The UN/EDIFACT syntax, in its earliest versions, used batch data transfer and predefined, structured messages. Later capabilities for interactive data transfer and transmission of binary data have been added together with a set of comprehensive security mechanisms. When EDI was introduced, the information exchange was expensive. Therefore, the EDI syntax is very compact in size. This makes them hard to read and maintain as codes are used to represent complex values. The EDI messaging uses often Value Added Networks (VAN) operators although EDI does not limit transport mediums. These special connections have been quite expensive. The recent advances in EDI messaging standards, such as EDIINT specifications have enabled companies transacting EDI over Internet rather than the pricier VAN making it affordable for smaller companies.

The automotive industry's use of EDI standards and the benefits obtained have been documented [4] [5]. EDI is based on predefined message contents and the validation for it is not supported directly by the standard but rather it is a part of applications "parsing" EDI documents. With EDI, there are different standards defined in Europe with Odette based on EDIFACT syntax since 1996 and US with Automotive Industry Action Group (AIAG) based on X12 syntax since 1985. Both Odette and EDIFACT have had their further development of the standard to XML technologies [6]. Also ODETTE and AIAG has been having some collaboration in this, but the concrete common specifications are missing.

B. XML technology

XML was introduced in 1998, and since it has been claimed to be replacing EDI in B2B integration. Many standardization activities have shifted from EDI development to XML technologies. The XML technologies make it easy to validate the structure of XML documents using Document Type Definition (DTD) or XML Schemas. A DTD specifies the structure of the XML message by defining the elements of the message, occurrences of the elements and a hierarchical order between the elements. XML Schema defines same issues to DTDs, but it has more expressive power. XML Schema offers a number of built-in datatypes to support how date values or currency enumerations should be in the valid messages. It is also possible to present cardinality constraints, such as choosing exact amount of the optional elements or having choice between possible elements. There are also other useful XML applications for B2B integration to make it simple to produce, transform and connecting to service end-points. web service technologies, SOAP and Web Service Description Language (WSDL) make it easy to call services from different applications as the SOAP clients

generation is partly automated from the WSDL description making it fast and easy to make such integrations.

C. Semantic web service technologies

Semantic web service technologies tackle interoperability by introducing rich formal languages for describing the integration end-points. They extend the capability of current web service technologies that basically only help in messaging and do not support defining the content exchanged. Semantic web service technologies have more expressive power than current XML Schemas. If there are complex relations between element values in the document, the XML Schema lacks the power to define the validation rules needs and thus custom program code would be needed. Using a declarative language to specify validation rules is a good option due to easier maintenance.

The Web Service Modeling Ontology (WSMO) provides a conceptual model and a language for describing the relevant aspects of web services [7]. The goal of such markup is to enable the automation of tasks involved in both intra- and inter-enterprise integration. The markup of services according to the WSMO conceptual model is expressed in the Web Service Modeling Language (WSML) family of ontology languages [8]. WSML consists of a number of variants based on different logical formalisms. WSMO is the underlying model of the Web Service Execution Environment (WSMX) [9]. WSMX is an integration platform conforming to the principles of a Service Oriented Architecture (SOA) which facilitates the integration between different systems. The languages such as the Web Ontology Language (OWL) or the Web Service Modeling Language (WSML) have the needed expressive power to assign rules for documents for which the DTD or XML Schemas are not enough.

D. Standards for product structure information

There are several content standards for integrating heterogeneous enterprise information systems that are defined on top of EDI or XML technologies. Standards hold the promise of reusing integrations with different partners and they make the integrations more loosely coupled from specific applications used. As the standards define B2B integration interfaces between the partners, the partners can change their internal processes and information systems without a need to change the B2B integration interface. Here we concentrate on message interoperability making sure that parties understand the exchanged information as guided by the standard. We also mention the standards used to secure transportation of the messages.

Electronic Data Interchange (EDI) standards, such as VDA, AIAG and Odette have been around over decade and are widely used for B2B integrations in the automotive industry. There are also many active XML-based standardization efforts for automotive industry. The amount of different standards is a challenge as it creates a problem of deciding on what standard to base own solutions. If multiple standards are needed for logically similar interactions, it decreases the value of having the standard.

Implementing support for any standard is a non-trivial task as significant effort is needed to ensure that the systems can produce and consume the standard documents [10]. Here we present Odette ENG DAT and STEP as prominent standards for the automotive industry and product data exchange. We also introduce RosettaNet that is very important in the electronics industries and it also defines standard messages for product development phase communications.

E. Odette ENG DAT

Odette ENG DAT (<http://www.odette.org>) is a standard for transferring product data between organizations. Odette International is a standardization body formed by the automotive industry. The ENG DAT defines an envelope, which wraps the engineering data. The content can consist of several files, such as CAD, MS-Word, XML and STEP. The content of the files stay as they are, the ENG DAT envelope is only telling, what kind of files and what are the names of them that it is transferring and thus does not standardize the meaning of the engineering data messages exchanged. Odette defines also EDI messages and is working on XML-based definitions for the needs of automotive industry. Odette is mainly based in Europe whereas AIAG and JEDAC represent similar efforts in US and Japan respectively.

As ENG DAT only defines the envelope, it does not help in standardizing the content needed for information exchange. Content definitions and validation support would be needed to help in the case situation.

F. STEP

STEP - Standard for the Exchange of Product Data - is also an ISO standard (ISO 10303). The STEP standardization started already in 1984 and first standards were published in mid-nineties. In 2001-2002 a second major release of STEP was released. STEP includes a number of application protocols (AP) for different industry sectors based on common integrated resources and provides also solutions for exchanging product models. STEP effort has created EXPRESS language with textual and graphical notation to define STEP standards.

STEP AP 214 titled "core data for automotive mechanical design processes" is used currently in parts of the automotive industry for exchanging design data.

STEP uses own data formats that are not easy to read and understand. XML was not around when STEP development began. Only recently there are specifications how STEP EXPRESS schemas are represented in XML. STEP is concentrated in providing standards for messages and does not introduce any solution similar to Odette ENG DAT for secure messaging. STEP has been a global effort.

STEP seems potential but the cost of the specifications has slowed the efforts so far to get in-depth understanding what problems it might solve. STEP is in use in automotive industry for similar purposes but e.g. whether it can help in position matrix is still unknown. Most probably it cannot solve all the issues as the problems with the position matrixes. Still it might well provide support for describing

the information needed in the message.

G. RosettaNet

RosettaNet (<http://www.rosettanet.org/>) is an electronics and information technology industry-driven consortium for B2B standardization. The most important components standardized in RosettaNet are Partner Interface Processes (PIPs), dictionaries and RosettaNet Implementation Framework (RNIF). The PIPs standardize the message contents and the processes, where the messages are exchanged. The PIP messages are described by using DTDs and additional message guidelines or XML Schemas with the most recent PIPs. The messages are similar to e.g. what Odette defines for automotive industry. The RNIF is functionally very similar to ENG DAT as it acts as the envelope to send the PIPs between the partners securely over the Internet and accepts all kinds of files as attachments. RNIF is typically implemented directly by the companies and therefore network operators are not needed for the information exchange.

Compared to many standardization efforts in automotive industry, RosettaNet is really global in its reach of the IT industry. All the standards are available as free downloads from the Internet.

RosettaNet can be used to product development phase communication [11]. For example standards for material composition are already used in companies who also provide electronics for automotive industry. RosettaNet have partly defined needed terms in its data dictionaries to support date and time representations and product life-cycle information. However, the required definitions for position matrixes are not included in RosettaNet dictionaries and messages respectively. Furthermore with the current technologies the validation needs of contract manufacturer are not covered with the basic RosettaNet technologies. For 3D model exchange RosettaNet does not provide currently any special solution, basically just document transfer as for any other binary document.

IV. PROPOSED SOLUTION

In this section, we propose a solution for the case. The solution should be based on standards to provide common terminology (ontology) for the messages exchanged and would already solve issues related to tight-coupling of existing applications. The benefit of standard-based approach is to make the integration less specific to current version of the integrated systems used so that system upgrades would not break the integrations. However, the Odette ENG DAT or RosettaNet do not cover all the information needed for exchanging product model data. About STEP AP 214 we cannot say anything definite yet without further analyses.

Here we present a solution of own schemas done according to currently exchanged XML messages to show what XML Schema can check automatically from incoming information. We further discuss how different existing standards fit with the solution and a case for semantic web service technologies to tackle the more complex validation

needs.

XML Schema as in Table 2 can help to check that the date is in agreed format or that the individual values are decimal numbers between -1 and 1. The schema can also check that the timestamp is a numeric value as it should in UNIX timestamps and that the life-cycle information in the model is according to the enumerations. For checking the square sums XML Schema cannot be used or in general that if another value within the document further constraints. So the problem with position matrixes is still the same. The XML Schema is not expressive enough to check complex contents such as position matrixes although these checks already can automatically catch erroneous inputs.

TABLE 2 XML SCHEMA EXTRACT

```
<xs:element name="objekt">
  <xs:attribute name="state" type="lifeCycle"/>
  <xs:attribute name="timestamp" type="xs:integer"/>
  <xs:attribute name="xx" type="coordValue">
  <xs:attribute name="xy" type="coordValue">
</xs:element name="objekt">
<xs:simpleType name="coordValue">
  <xs:restriction base="xs:decimal">
    <xs:minInclusive value="-1"/>
    <xs:maxInclusive value="1"/>
  </xs:restriction>
</xs:simpleType>
```

Standards are needed to guide how information should be presented. Otherwise e.g. considering the life-cycle states, the systems can present a same state using different terms (active vs. aktiv) or semantics. As semantic difference different companies can have different meaning for attribute active – for one it can be approved for production for others just that the 3D model is checked. Also timestamps should be guided as the dates can be put differently in different systems e.g. considering time zones and one needs to know whether the timestamp refers to the last change of 3D file or file approval. Standards such as RosettaNet, STEP or Odette can guide in these semantic interpretations, the companies just would map to the common standard data model and this isolates further changes of the application to not change the integration interface.

Table 3 presents an extract of ontology in WSMML that can check that the square sums of rows and columns are within accepted limits. For WSMML reference, see [8]. This is possible as WSMML language contains built-in functions that enable performing needed calculations as shown in the example. This enables that designers can specify acceptable limits for the incoming information. The expressive power enables thus automatic checking of constraints.

TABLE 3 WSMML EXTRACTS

```
// Count square sums of coordinates
wsml#numericMultiply(?xx2, ?xx, ?xx)
wsml#numericMultiply(?xy2, ?xy, ?xy)
....
// sums up the rows and columns.
wsml#numericAdd(?xrowt, ?xx2, ?xy2) and
wsml#numericAdd(?xrow, ?xrowt, ?xz2)
..
// Check that the values in acceptable limits 0.99999 < value < 1.00001
wsml#numericLessThan(?xrow, 1.00001)
wsml#numericGreaterThan(?xrow, 0.99999)
...
```

The existing XML messages need to be translated to ontology language as in [12, 13]. This is design-time activity that needs to be performed once. Then reasoners supporting WSMML can perform the calculations to check the validity of incoming information at run-time. This approach is similar to one used in [12, 13, 14].

V. RELATED WORK

The general benefits of integrations are well documented. The benefits of EDI technology has shown the impact of integration and measured the savings. Mudhopadhyay made a thorough study at Chrysler, where the benefits of EDI integration amounted to more than 100 \$ per vehicle produced [5].

There is also already work done discussing the use of semantic web services to enhance current automotive B2B standards. Anicic et al. [12] describe how current XML Schema-based automotive B2B standards (AIAG and Star) are described using Web Ontology Language (OWL) based ontology to tackle the interoperability between both standards. They translate the XML messages to OWL instances to perform the equivalence tests between elements and enable checking better that the messages comply with the restrictions. Their experiences indicate that currently available tools for semantic web are clearly not sufficiently robust and scalable to warrant risk-free development to support industrial interoperability efforts. However, the rate of maturation and adoption of these tools is encouraging and it seems that these issues of robustness and scalability may be addressed in the near future. This is similar to our experiences that the tools are still developing and full support for complex operation is still lacking.

The general benefits of semantic web services to B2B integration has been studied. Preist et al. [10] provide a case on managing supply chain during the integration life-cycle. [13] present how RosettaNet standards could be enhanced using more expressive languages. Both discuss how RosettaNet and EDI standards can benefit from the new technologies.

Tanaka and Kishinami [14] study Product Data Quality (PDQ) and concentrate on a quality diagnosis method of the shape data of the product model. The file is described with STEP technology using EXPRESS-X language, which is the mapping language between STEP models. The geometrical shape compatibility between two different interoperating systems is important as is the structure information for the placing of the model in the coordinate. They propose also a certification data model of the product

data to help in the validation process. It helps to validate that the incoming model information is accurate enough so that the receiving system can check it. This certification data is described with XML and using commercial EXPRESS-X execution environment. Getting such information from the OEM make the process of checking model correctness straightforward and the EXPRESS-X environment could even have similar functionality to the WSMX validation proposed to check the acceptable tolerances in the 3D model information.

VI. DISCUSSION AND EXPECTED BENEFITS

It is unrealistic to assume the mapping problems with heterogeneous systems go away quickly. Mapping particularly from less expressive to more expressive can cause problems as the use of decimals here presented. The integration the other way would be simpler as the less accurate system would not have similar problems in reading in the data.

However, there are technologies to better manage the heterogeneity. The new technologies make it easier to introduce rules to tackle the problems now requiring manual handling. For these rules to work in the case, the domain experts need to assign the acceptable limits of acceptable values for position matrixes. This includes codifying the rules related to there expert area for automatic checks, and the situations where a manual handling is really needed, which is about 10% of the current error situations. The current situation means unnecessary manual activities and they slow down the processes as the information needed does not reach the users requiring the information before these issues are manually solved. This waiting has more significant cost effects than just the avoided manual activities as engineering change processes in the company networks increase the need of product data communications making manual checking harder to scale.

Even with semantic web services, common understanding of the terms is needed. Selecting and negotiating the use of standard can be time-consuming compared to pair-wise agreements, but it also allows extensibility. The problem is that often standards do not define readily all the needed concepts for messages causing still problems fitting the information to the standards.

The knowledge of semantic web service languages is small and the languages and execution environments, such as WSMX, to support all the features of these languages are still under active development. Same applies for the tools, such as the Web Services Modeling Toolkit, to support working with these languages. However, we are very close to point where the technologies can be applied to real cases. The solution can extend current interfaces and thus does not require that e.g. the OEM should start using these new technologies to obtain the benefits. In the long run, the whole communication could use formal semantic web services languages and for this the existing B2B standards should use these more expressive languages.

VII. CONCLUSIONS AND FUTURE WORK

We presented a concept of solving current integrations problems using standards-based integration. We pointed out shortcomings in the traditional integration technologies and showed how semantic web service technologies are able to overcome existing interoperability related problems. Our solution is still descriptive and needs further evaluation, but the contribution of this paper is to show:

- The role of standards such as RosettaNet or STEP in practical integration efforts. The major benefit of standards is extensibility of integration solution and flexibility to changes in the partners systems. The downside is that standards do not always support adequately the needed interactions and selecting a standard takes time and effort.
 - How semantic web technologies enable better validation of incoming messages and can automatically resolve some errors. There are already individual efforts to showcase the use of semantic web ontologies to extend current B2B integrations [10, 13, 14]. Although the technologies might not be yet production use ready, they are moving to that direction.
 - Differences between current B2B standards in the automotive supply chain and IT industry in what they cover related to message standardization and secure messaging. Automotive industry is more fragmented in defining the standards where as RosettaNet is more industry-wide. There are also differences in the openness of the standards.
- Our future work includes taking this example further to demonstrate a practical showcase on how B2B integration can be accomplished better than currently. We still need to make further evaluation on the suitability of STEP AP 214. Furthermore, more evaluation using semantic web service tools is needed to see what percentage of existing errors we are able to find with our solution.

ACKNOWLEDGEMENT

This material is based upon works supported by the Finnish Funding Agency for Technology and Innovation (Tekes) and the Graduate School for Electronic Business and Software Industry.

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Trust, Risk, Privacy, and Security in e-Commerce

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Abstract — The concepts, Trust, Risk, Privacy and Security, are widely used in various studies done by multiple disciplines, and they are often incorrectly referred to almost as synonyms. The aim is to clarify the concepts from the consumer viewpoint in e-commerce. The findings of our qualitative study suggest several relationships between the four concepts and serves as building blocks for further research.

Keywords — trust, risk, privacy, security.

I. INTRODUCTION

E-commerce has gained wider popularity among consumers during the 20th century. The domain area is researched in many alternative ways and by multiple disciplines. However, there seems to be confusingly many studies of trust and trusted third parties, of trust and risk, of privacy and security in e-commerce. These concepts of trust, risk, privacy, and security are used for many purposes and with many meanings. It is important to understand that these concepts serve different purposes: trust and risk are human-related concepts, while security is mainly used in a technical way. Security in that sense is the means to achieve and support consumer privacy. Security could also mean a consumer's feeling of being secure, safe. So, there is a need for clarifications.

Studies concerning consumer trust, privacy, and security are often theoretical in nature [1]. Therefore, there is a lack of empirical evidence to support different models. Furthermore, according to [2] there is no unified view on the relationship between the concepts of consumer trust and risk, even though they are seen as the two key concepts of the phenomenon of consumer trust [3].

The aim of our study is to generate an understanding of what meanings consumers give to the concepts. This objective will be reached through three goals. The first goal is to review literature concerning the four concepts. The second goal is to empirically investigate the meanings that consumers give to the four concepts. The third goal is to provide theoretical building blocks for further

research based on the integration of our empirical findings and current literature. Achieving these three goals will result in an advanced understanding of the four concepts, which will provide researchers opportunities for further research.

The paper is structured as follows. Firstly, the theory of trust, risk, privacy, and security are discussed. Secondly, data collection, methodology, and the analytical approach are introduced. Thirdly, the findings of our study are presented. Lastly, the paper concludes with a theoretical discussion, indications for further research, and managerial implications.

II.

THEORIES OF TRUST, RISK, PRIVACY, AND SECURITY

A. Trust

The concept of trust has been heterogeneously defined by many authors in the fields of economics, social psychology, sociology, management, marketing, and information systems [4]-[5]. One of the most accepted definitions of trust is stated as follows: "the willingness of a party to be vulnerable to the actions of another party, based on the expectation that the other will perform a particular action important to the trustor, irrespective of the ability to monitor or control that other party." [3, pp. 712]. In this paper, trust is approached based on this definition.

Literature concerning consumer trust in e-commerce treats trust as a multidimensional construct including three elements; 1) institutional, 2) interpersonal, and 3) dispositional trust [6]. *Institutional trust* refers to an individual's trust in institutions, like the laws in a society or in the case of e-commerce, the technology itself [7]. *Interpersonal trust* refers to an individual's trust in another specific party or the trustworthiness of a third party, like an e-vendor, a newspaper publishing an article concerning an e-vendor, or a friend who gives recommendations about an e-

vendor. [6], [8]–[9]. The concept of *dispositional trust* is based on research in the area of psychology [10]. Dispositional trust means an individual's ability to trust in general, and is based on an individual's belief that other people are well-meaning and reliable [6], [11]. The disposition to trust is usually considered to be a personality-driven feature of an individual. That is, an individual's personality determines his/her propensity to trust in general. Furthermore, an individual's disposition to trust may be endogenous or it may develop during life experiences [12]. The disposition to trust is especially important in novel situations, such as using e-commerce [11].

B. Consumer- Perceived Risks

The nature of the specific relationship between trust and risk is poorly understood, and it has escaped theoretical detailing. Although the field has made important advances in defining trust and conceptualizing trust from different theoretical perspectives, future research may scrutinize the role of risk and trust in the context of consumer-based electronic commerce [1].

What is consumer-perceived risk and why it is important in terms of trust? First, risk is defined as a consumer's subjective experience of an uncertain consequence regarding an action the consumer took [13]. Secondly, if we take apart the definition of trust, we can see that it starts with the notion that trust is "the willingness of a party to be vulnerable to the actions of another party.." [3, pp. 712]. This willingness to be vulnerable means willingness to engage in a relationship that includes an element of uncertainty, that is, to take a risk. Thus, the concepts of trust and risk seem to be tied together, which makes the concept of risk important in terms of trust. More specifically, consumer-perceived risks could be seen as an antecedent of trust, because the need for trust arises only in a risky situation as [3] argue. For that reason, the concept of consumer-perceived risk is important in terms of trust.

C. Privacy

The literature includes several definitions of privacy. Privacy can be understood as a legal concept and as the right to be let alone [14]. Privacy can also mean "the claim of individuals, groups, or institutions to determine for themselves when, how, and to what extent information about them is communicated to others" [15, pp. 83]. From a privacy standpoint, trust can be viewed as the customer's expectation that an online business will treat the customer's information fairly [16].

There are four basic categories of privacy: information privacy, bodily privacy, communications privacy, and territorial privacy [17]. Internet privacy is mostly information privacy. Information privacy means the ability of the individual to control information about one's self. Invasions of privacy occur when individuals cannot maintain a substantial degree of control over their personal information and its use.

People react differently to privacy problems. One reason for these differences might be a cultural viewpoint. For example, researchers have pointed out that consumers in Germany react differently to marketing practices that people in the USA might consider the norm [18]. It is also important to understand their views regarding privacy in general, their personal expertise in Internet technologies, and how they view the role of the government and the role of companies in protecting consumer privacy. An individual's perceptions of such external conditions will also vary with personal characteristics and past experiences [19]. Therefore, consumers often have different opinions about what is fair and what is not fair in collecting and using personal information.

D. Security

Different threats in e-commerce, like data transaction attacks and misuse of financial and personal information, generate security threats [1]. Thus, security is protection against such threats [20].

Information security consists of three main parts: confidentiality, integrity, and availability. CIA as an abbreviation is a widely used benchmark for evaluation of information system security also in the e-commerce environment [21]. All three parts of security may be affected by purely technical issues, natural phenomena, or accidental or deliberate human causes.

Confidentiality refers to limitations of information access and disclosure to authorized users and preventing access by or disclosure to unauthorized users. In other words, confidentiality is an assurance that information is shared only among authorized persons or organizations. Authentication methods, like user IDs and passwords that identify users, can help to reach the goal of confidentiality. Other control methods support confidentiality, such as limiting each identified user's access to the data system's resources. Additionally, critical to confidentiality (also to integrity and availability) are protection against malware, spyware, spam and other attacks.

Confidentiality is related to the broader concept of information privacy: limiting access to individuals' personal information.

The concept of *integrity* relates to the trustworthiness of information resources. It is used to ensure that information is sufficiently accurate for its purposes. The information should be authentic and complete. For example, forwarding copies of sensitive e-mail threatens both the confidentiality and integrity of the information. *Availability* refers to the availability of information resources. The system is responsible for delivering, processing, and storing information that is accessible when needed, by those who need it. An information system that is not available when you need it is at least as bad as no system at all. It may be much worse if the system is the only way to take care of a certain matter.

III. METHOD, DATA COLLECTION, AND ANALYTICAL APPROACH

In order to bring out consumers' views on the introduced theoretical concepts, we decided to adopt a qualitative method, namely a semi-structured theme interview. Furthermore, our decision to adopt a qualitative method is supported by the fact that a qualitative method is useful in a situation where a rich amount of data is needed to generate possibilities to understand the phenomenon as broadly as possible and to generate new insights.

Since electronic commerce includes many different contexts, we decided to conduct the interviews in three different contexts: electronic grocery shopping, electronic health care services, and electronic media. The reason to choose these contexts was that we expected that trust, risk, privacy, and security would attain different meanings in different contexts. For example, electronic health care services can be assumed to be services where consumers' privacy and data security concerns could emerge more than in the context of electronic media. By conducting the interviews in different contexts, we wanted to gain a wider point of view concerning the four concepts than would be possible by only interviewing consumers in one context.

The data for the analysis was collected during the summer of 2004. Three interview sets included altogether 30 informants. Eighteen of the informants were women and twelve were men. Six were under 30 years old, twenty were between 30–50 years, and four were over 50.

The informants were recruited by advertising on the web sites of a local newspaper and an electronic grocery shop, through the mailing list of a local health care district, and in one seminar. The informants had different backgrounds and experiences with e-commerce.

The duration of the interviews varied from 30 minutes to two hours. The interviews were conducted in the interviewees' workplaces and homes. The interviews started from a general discussion about the interviewee's background as an e-commerce consumer and continued to a discussion about e-services in the specific area (grocery, health, media). All the interviews were tape recorded and fully transcribed, and the findings were discussed in a multidisciplinary research group.

The analysis of the empirical material was conducted as follows. First, the transcriptions were read several times. Secondly, the empirical material was sorted according to the themes (concepts of trust, risk, privacy, and security) presented earlier in this paper. Thirdly, in order to clarify the concepts from a consumer viewpoint, we compared the literature and our findings from the interviews. Lastly, the quotations and our analysis were sent to the informants in order to confirm that we had interpreted their thoughts correctly.

IV. FINDINGS

In this section the findings of our study are introduced. Starting with consumer trust and risk in e-commerce, we will discuss what meanings the consumers gave to the four theoretical concepts. The relationships between the different concepts are also discussed.

A. Trust and Risk

In the theoretical part of this paper, consumer trust in e-commerce was divided into three different elements, namely interpersonal, dispositional, and institutional trust. Furthermore, we discussed that consumer-perceived risks and trust are seen to be close concepts and that risk is a prerequisite to trust [3]. For that reason, in the empirical part we treat these two concepts as a whole. Next, we present the informants' views on interpersonal, dispositional, and institutional trust. Furthermore, the relationship between the three elements of trust and risk is also discussed.

The following quotation illustrates interpersonal trust. The informant's view on the e-vendor's strong brand is presented in more detail.

“Researcher: Well.. Have you any experience in using e-commerce.. Have you ordered or paid anything via the Net?”

“Informant: I have not ordered anything.. paid mostly via the e-bank.. well, of course it is not the same as ordering products..” (Jaana, 43, female)

The quotation illustrates the informant’s trust in banks. The informant has not used any other e-services than bank service. The quotation also presents the role of perceived risks, although the informant does not directly say she has not used any other e-services than bank service because she perceives too many risks related to e-commerce.

The next quotation is quite similar to the former.

“Researcher: Have you ordered anything via the Net? You know.. like products?”

“Informant: No, I have not..”

“Researcher: Ok.. I see.”

“Informant: “And if I think carefully.. well, I have used Finnkinno’s e-service.. bought some movie tickets via their service..” (Viljami, 27, male)

First the informant does not remember ordering anything via the Internet, but then he remembers that he has used Finnkinno’s (Finnish movie agent) e-service. In this case, the strong brand influenced the informant so much that the level of perceived risks was surpassed, which enabled the informant to engage in a risky relationship. More specifically, the informant trusted the brand and had the courage to use the e-service, although he does not usually use e-services.

Despite the fact that the two preceding quotations emphasize the role of a well-known brand in building trust in an e-vendor, these two quotations could also be interpreted as manifestations of low dispositional trust, because the two informants did not want to use e-services they were not familiar with, and thus they perceived the risks related to less-known e-vendors to be relatively high.

Compared with the preceding two informants, who perceived risks related to e-services and used only e-services offered by a well-known e-vendor, the next two quotations from two other informants offers quite a contrary point of view in terms of risk

perception and trust.

“Researcher: Ok. Well, would you usually like to test an e-shop when you get to know about it? You know, before actually using it?”

“Informant: Well, No. I believe they function if they are put on the Net.” (Heidi, 39, female)

Researcher: Mmm.. well.. What is your opinion about e-services that gather your information?

Informant: I do not know.. I do not really care. It does not stress me, you know.. If someone knows what I use and has my information. (Kari, 30, male)

What is interesting in the informants’ views is that they are not interested in the possible risks included in e-services. The first informant believes if an e-service is on the net, then it is functioning properly. The second informant is not stressed if his information is available to someone.

One possible explanation for the informants’ opinions could be high dispositional trust. In other words, the informants do not perceive risks related to e-service as strongly as some other informants.

The next quotation illustrates how the informant perceives risks associated with registration. The informant does not understand why some e-services demand registration. It is interesting that, although she understands that registration is not a bad thing, there still remain some thoughts that something harmful could happen if she registers with the e-service. This could be interpreted as low dispositional trust, because the informant displays some unexplainable and perhaps irrational fears concerning registration. She mentions that even an e-vendor with a strong brand (Keltainen Pörssi) does not convince her about the trustworthiness of the e-vendor.

“Informant: I do not generally, I do not know.. if a service demands registration.. In such cases I do not understand why, but I just do not want to register, even if it is the Yellow Pages or Keltainen Pörssi or something like that.. Then I feel that in some way I am noticed.. and even though it would not be so horrible if they notice me.. but somehow I just feel that if I register, then I am attached to that service in some way.. And I feel much more comfortable if I can just check the service without joining it.. And in some services I do not understand what the registration means.. “ (Maija, 27, female)

The next quotation illustrates institutional trust from one informant's point of view. The informant does not want to give his credit card number to foreign companies. This could be interpreted as a manifestation of institutional (dis)trust, because the informant does not consider foreign e-vendors as trustworthy. One explanation for her view could be the strict Finnish consumer protection law that protects consumers.

"Informant: No, I do not want to give my credit card number to foreign companies in any case.. It is never a good thing. From a customer's point of view it is always better to charge with an invoice.. You know, then you can pay it later.. but I don't know what the companies' attitude is towards the matter.." (Seija, 39, female)

The informant's thoughts furthermore reveal the relationship between institutional trust and consumer-perceived risks. It is logical to interpret her unwillingness to use foreign e-services as a perception of too high risks related to e-services. In other words, the informant is not willing to engage in a risky relationship with a foreign e-vendor, that is, she is not willing to trust in foreign e-services because of the level of perceived risks.

Also the next quotation serves as evidence of institutional (dis)trust. More specifically, trust in technology.

"Informant: But I am concerned about how it functions in practise.. Is it just like that, you check a box and then the bill comes home or.. Then you have to give your personal information.. addresses and everything.. You could also put someone else's address.. that concerns me.. You know, how it really works in practise.. And how trustworthy it is.. but if I want to buy something, then of course you have to believe that the product will come home in some way.. you know... And when you get the product, then you pay.. that is a fair deal.."

"Researcher: Ok..."

"Informant: And you do not have to pay it in advance from your bank account.." (Maija, 27, female)

The informant experiences a lack of trust in technology. She is not convinced that the ordering system will function properly. In addition to that,

she is concerned that someone else could use the technology in some harmful way, such as ordering products using someone else's address. It seems the informant perceives many risks associated with the technology. Furthermore, the quotation illustrates well the relationship between institutional trust and risk. More specifically, the informant perceives many risks related to the technology, and for that reason she is not convinced about the trustworthiness of e-commerce.

C. Privacy

The third theoretical concept we discussed in addition to trust and risk was privacy. In this chapter, the informants' views on privacy are discussed. Furthermore, the relationship between privacy, trust, and risk are addressed.

The following quotation illustrates the most common privacy concern: e-mail addresses and personal information can be used for marketing or other purposes without the informant's permission.

"Researcher: What did you think about this kind of registration?"

"Informant: Of course, there are always risks... Those ads come after that, but few..." (Mikko, 42, male)

Some informants said there can be hackers (as they referred to teasers on the Internet) or the e-vendor may not take care of their information, but they trusted their own e-vendor in privacy questions. It is interesting that the problems with privacy seem to generate risks. It raises a question of the interrelationship between the two concepts. At least some relationship seems to exist, which serves as evidence that an interrelationship between the two concepts may exist. The next quotation illustrates the interrelationship between privacy and risk.

"Informant: Well, I really do not like to visit these sites... sometimes, when this kind of mail comes that I have not ordered, I just delete them without opening..." (Sirkka, 51, female)

The informant said she does not open some e-mail that she has not ordered. Her opinion could be interpreted as a manifestation of the relationship between privacy (right to be left alone) and risk, because the unwanted e-mail generates risks related to e-commerce and its trustworthiness.

Some of the interviewed consumers commented that sometimes changing personal information given

to an e-service is difficult, remembering user accounts and passwords is not easy, and e-vendors ask things that are not essential. They felt there is a risk in giving this kind of personal information, and it can be troublesome.

“Informant: There are many forms for registration: fill in this area, fill in this area, fill in this area, then I don’t. I think, let it be. However, I don’t have the energy to write my whole curriculum vitae in some registration.” (Eveliina, 29, female)

In these situations it is easier from the consumer point-of-view not to give any information to the e-vendor. Besides the risk of losing personal information, there is a risk of wasting time. The informants were so concerned about giving personal information to e-vendors that almost all of them said they sometimes give incorrect personal information. The following quotation presents the most common way to ensure privacy and avoid risks if the consumer does not trust enough in the e-vendor.

“Researcher: Do you give your personal information?”

“Informant: I cheat.”

“Researcher: Ok, can you tell me more?”

“Informant: Well, I write wrong dates of birth and so on. I do not know how long they allow that... --- I have that Hotmail, I use...” (Sari, 45, female)

The informants liked to have more surveillance on the web so hackers can be caught. But, at the same time they wish for more privacy for themselves. The next quotation illustrates how registration is important in preventing financial risk, although there can be privacy problems.

“Researcher: What do you think about this kind of electronic newspaper that requires registration?”

“Informant: ...If you pay, for example --- you should have some sort of password and that. If I pay and everybody sees the newspaper with this same price, it is not ok...” (Eveliina, 29, female)

Some of the interviewed consumers noted that ordering from abroad is not safe, or they would not give their personal information abroad. The

informants had very strong views on security in different countries and the opinions were alike. Some also wanted to reveal that they had knowledge from media. The next quotation from one informant illustrates this issue.

“Informant: I take this somehow very carefully, for example this bank matter. By the way, I looked that... yeah, it was on the Finnish Broadcasting Network’s pages... I looked at a kind of manuscript of a program where they tell precisely about these cheatings on the Internet (-), from everything I have read, so I have understood that you cannot very easily give your personal information just anywhere.” (Marjatta, 57, female)

The informant’s thoughts revealed her interest in privacy hazards. The increased knowledge concerning privacy increased her understanding of what kind of risks are related to e-commerce. More specifically, the quotation illustrates the interrelationship between privacy and perceived risk.

D. Security

In the theoretical part of this paper the concept of security was divided into confidentiality, integrity, and availability. In the interviews, confidentiality is mainly a problem when a consumer is afraid of using a credit card because of the risk of intercepting the credit card number. The nature of this security problem seems to be very technical. The next quotation illustrates how one informant relies on a familiar brand and her own banking systems (not a credit card) in her homeland.

“Researcher: In this Anttila’s (Finnish e-Shop for clothes and home goods) order, how does this (payment) happen?”

“Informant: Well, there is a link to bank services and you can pay it there

“Researcher: What do you think about it?”

“Informant: It is really convenient --- I like this, however, Finnish services are secure. I would not go to really strange foreign shops. Of course, there are also known shops but... However, everyone cannot give there all of their personal information.” (Eveliina, 29, female)

The preceding quotation serves as a manifestation of the interrelationship between institutional trust and security. The informant considers that the security threats are handled more or less efficiently based on the e-vendor's nationality.

According to the informants, because of viruses, integrity problems can occur in e-services. The next quotation presents one opinion about information leaking to suspicious third parties.

"Informant: For some reason, I got an e-mail from somebody I have never met, but that happens --- There is this risk when there are these viruses and... They can come and when many of them are classified documents --- it is somehow risky." (Sirkka, 51, female)

The informant's thoughts can be interpreted as a manifestation of the relationship between security and perceived risks. More specifically, the informant is not sure about the security of her system in a situation where a virus attacks her computer. This kind of possibility generates risks.

The third element of security is availability. As an example of availability, one informant highlighted a problem related to logging in to e-services.

"Informant: On a couple of occasions I have sometimes entered the wrong password, and I have not remembered the right one." (Eveliina, 29, female)

This availability problem concerns privacy, because the password should not be so easy that others can guess it. There is a risk of losing personal information or, for example, personal account services. The next quotation presents another kind of registration problem.

"Researcher: Have you visited a place where you should give personal information? "

"Informant: I have tried --- It wasn't a long time ago --- But I understood, that I cannot go forward from here if I do not have something. I do not know what it is that I should have." (Marjatta, 57, female)

In the preceding quotation, the availability problem was that the informant did not know how to register. This kind of security threat can have an influence on the level of dispositional trust, because bad experiences related to the functionality of e-commerce might decrease the consumer's trust in e-commerce in general.

Additionally, technical problems can block availability.

"Informant: I have not been very frustrated with these, but I know many others who are. For example, when you cannot get in some registration or if there is something wrong with the server or the user's own computer. And the second is: when that Messenger makes an update, you cannot go on the net for some time. And when a Windows Update comes to these controls, there are many days when it doesn't work." (Sari, 45, female)

The preceding three quotations illustrate how security affects perceived risks and trust in e-commerce. For example, the problems with the availability of the technology could be interpreted as generating risks related to technology. Furthermore, the consumer's disposition to trust might decrease if problems with technology emerge continuously.

V. DISCUSSION

Our findings revealed several issues concerning consumers' views on trust, risk, privacy, and security. According to our findings, all four concepts are somehow linked together. For instance, our findings indicate that consumers' perception of the trustworthiness of the e-vendor is related to perceived risks. Furthermore, perceived security and privacy are also linked to the concept of perceived risks and thus, indirectly to the concept of trust. Our findings also indicate that security might have a direct influence on trust, as the quotation related to the e-vendor's nationality addressed. So, there is nothing to wonder about in the confusion related to these concepts.

In order to organize these concepts, we could broaden our insights and also borrow something from disciplines other than IS. The literature related to consumer-perceived risks could be useful in generating an understanding of these complex concepts and the relationships between them. For example, the concept of perceived risks is quite well defined and organized in the literature on consumer research. Already in the 1960s, researchers in consumer research divided the concept of perceived risks into four categories, namely financial, time, social and performance risks [22]. Later the categories of physical and psychological risks were included [23]. In the past two decades, when technological products and especially the use of the

Internet became widespread, the technological dimension was also included in the concept of perceived risks [24]-[26]. Nowadays, the concept of risk in the context of e-commerce has been seen to include five dimensions, namely financial, social, psychological, technological and physical risks [26].

What is interesting in the concept of perceived risk is that in consumer research literature it includes the concepts of privacy [26]-[27] and security [28]. For instance, privacy is considered a dimension of psychological risk and security a dimension of financial risk [29]. Our findings indicate the same. Our informants said they are concerned about privacy and security. These concerns were mainly related to technology, but the concern about privacy was also addressed to, for example, financial risk. Thus, our findings and current literature indicate that security and privacy have some relationship with risk. It seems that security and privacy can have an effect on different dimensions of risk, like financial and psychological risks. For that reason, we suggest that the concepts of privacy and security should be understood as elements that have an influence on risk, not only on technological risk as is usually thought, but also on other dimensions of risk. For that reason, security and privacy have an indirect effect on consumer trust in e-commerce too, because it seems that security and privacy influenced the risks that our informant perceived. Thus, in line with [3] thoughts, which indicate that perceived risks are a prerequisite to trust, the effect of privacy and security on risk perception might also have an influence on consumer trust in e-commerce.

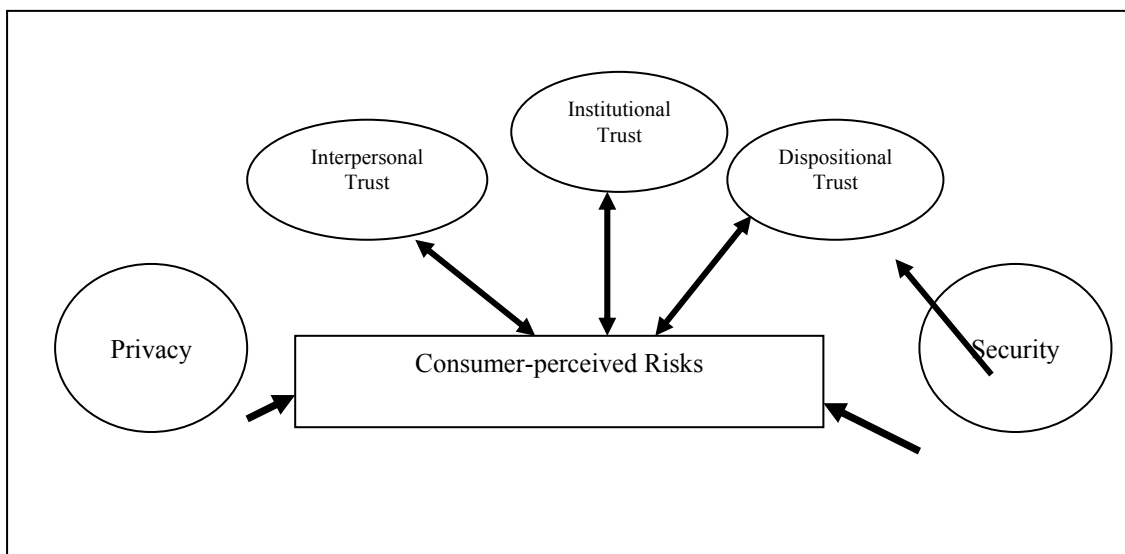
Figure 1. presents a model based on our findings and current literature, which illustrates the relationships between the different concepts. As discussed in the previous chapter, privacy and

security have a relationship with the concept of perceived risks. Thus, they have an indirect effect on consumer trust in e-commerce. More specifically, privacy and security have an effect on institutional and interpersonal trust, because consumers perceive risks related to technology (institutional aspect) and the e-vendor (interpersonal aspect). It could also be argued that security has a direct effect on trust, as our findings indicate. More specifically, our findings indicated that security has a direct effect on dispositional (consumers might feel some suspicions related to e-commerce in general, which may lead them to not trust in e-commerce without any specific reason), and institutional trust (security is perceived based on the e-vendor's nationality). Our model also suggests that trust and risk have a duplex relationship. The logic behind this is that trust could be seen as dynamic construct. For example, the consumer might trust in an e-vendor, but if something harmful happens in the relationship, trust might decrease and risk increase.

VI. INDICATIONS FOR FURTHER RESEARCH

This paper deals with four important concepts in e-commerce research. In the current literature, these concepts have been used as synonyms and there has been confusion between the concepts and their relationships. In the current study, a qualitative method was used to reveal consumers' views on different concepts.

Figure 1. Relationships between Trust, Risk, Privacy, and Security



Our findings indicate that the concepts of perceived risk, security, and privacy are not very different. It seems that privacy has direct effect on perceived risks and indirect effect on trust via perceived risks. Security has direct effect on risk and on trust.

Security and privacy are usually linked to technology and technological risk. This raises a question of why we should treat the concepts of privacy and security as technology-related? As our findings revealed, there seem to be links to other dimensions of risk, too. Thus, future research could concentrate more on the relationship between security, privacy and, for example, psychological risk.

The same applies to the relationship between security, privacy, and trust. In our opinion, more research is needed to understand the relationship between consumer trust, risk, security, and privacy. For example, in [1] research concerning an integrative model of consumer trust in Internet shopping the concept of risk was excluded, but perceived security and privacy control were treated as attributes of the trustworthiness of the Internet merchant. The exclusion of risks makes evaluation of the results quite difficult, because risks have such a powerful impact on consumer trust. For that reason, we suggest that when trust is an issue, then the concept of risks should be included in the study.

What is common to the research on trust and risk in e-commerce is that they miss the social and psychological side of the issue. For example, how does the perception of social risk in using an e-service affect trust, or how does the psychological risk in (for example, hurt feelings) e-commerce affect the perception of trustworthiness? Yet, these issues have not been studied much, although they could have a significant effect on the relationship between trust and risk.

Understanding consumers' views on these conceptions is also important in research. For example, [1] claim that their findings did not provide empirical support for the effect of perceived privacy control of Internet merchants on consumer trust in Internet shopping. They have proposed a theoretically-grounded integrative model of consumer trust in Internet shopping and they have collected data using a questionnaire. However, they have concentrated on the vendor (giving or selling personal information to other parties), but our results showed that only a minor part of fears of invasion of privacy was directly focused on the

vendor. For example, the informants were afraid of anonymous surveillance, spam (other than that related to their vendors) and hackers using viruses. For that reason, it could be useful to use more qualitative methods in order to gain a deeper understanding of consumers' views concerning the different concepts.

VII. MANAGERIAL IMPLICATIONS

Trust, risk, privacy, and security are concepts that are seen to affect consumers' willingness to use e-commerce. Because of fierce competition and the ease with which consumers can change the e-vendor they are using, e-vendors have to develop services that consumers see as trustworthy. One way to do this is to build a strong brand, as our findings indicate. There are also other ways to convince consumers about the safety of the e-service. For example, in order to alleviate the risks consumers perceived as being related to e-services, e-vendors can offer a secure way to pay for the products or services offered (perhaps not the most convenient, but the most secure way is to provide an opportunity to pay by invoice), which can allure those consumers who perceive the most risks in e-shopping. Also, third party verifications, by Visa or a bank, for example, can decrease risks and increase trust.

In the sense of security and privacy, consumers do not want to register in every service, because they fear what will happen to their personal information. For that reason, if registration is not absolutely obligatory, then perhaps it is not needed. The misunderstanding of why consumers have to register could cause some suspicious about the trustworthiness of the e-vendor. Of course, in some services it is necessary to collect consumers' information in order to complete the order, but in these services too, it could be useful to offer a possibility for consumers to get familiar with the service (i.e. to test the service's functionality, to browse the products) without registering. This kind of possibility could increase consumers' perception about the trustworthiness of the e-service.

Consumers might also perceive social and psychological risks related to e-services. For instance, consumer might feel that using an e-service could be socially harmful, which leads to declining the purchase. In order to decrease these kinds of risks, e-vendors could, for example, offer a discussion forum related to their service and products. When the consumer can take part in a

discussions s(he) might feel the e-service is more socially preferable, which can alleviate the social risks. Furthermore, e-vendors could also take part in the discussions and provide answers to consumers' questions. This kind of action could make consumers feel appreciated and create a positive perception about the trustworthiness of the e-vendor, on condition that the e-vendor is really trying to serve consumers, not advertise its service or products.

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UNDERSTANDING E-COMPETENCES IN ADOPTION AND ASSIMILATION OF E-SERVICES

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Keywords—competences, adoption, assimilation, e-services.

Abstract. *This article investigates competences in adoption and assimilation of business-to-business e-services. An in depth case study of an e-service system, the e-service provider and e-service customers is conducted. The results show that two main competences, vision and control, are important at top management level for the adoption of e-service. At individual level, eleven competences categorized as technical, interpersonal and conceptual were found important for the successful assimilation of e-services.*

I. INTRODUCTION

A number of studies have investigated competences (e.g. Nordhaug, 1998), IT competences (e.g. Van der Heijden, 2000) as well as technology adoption (e.g. Zaltman et al., 1973). After the advent of the World Wide Web e-services such as e-banking, web-based reservation systems and web-based library services are becoming daily routine in our daily lives. Also many corporations are starting to develop or adopt e-services in order to increase efficiency, save time, decrease costs. E-services are defined here as services that are provided and/or consumed through the use of Internet-based systems. Normally the consumption or the provision of a service requires the interaction between the service provider and the user of the service. Traditionally this has been based on personal interactions, most often face-to-face interactions. In e-services, the consumption and the provision of services takes place through the intermediation of an Internet based system and therefore they become separated in time and space. That is a user can consume an e-service without the provider being involved in the moment of consumption. Vice-versa the provider can update and adjust the service provision without the customer presence. That is the relationship between the provider and the consumer becomes virtual, mediated by the Internet-based system.

This opens up the need to investigate the competences required to adopt and successfully assimilate e-services in organizations. A considerable body of literature exists about competences, both at individual, organizational and industry level as well as a number of studies have particularly investigated IT-related competences (e.g. Lee and Trauth, 1995; Sambaburthy and Zmud, 2000). The purpose of this paper is therefore to contribute to the understanding of competences in e-services adoption and

assimilation in a business-to-business context. The basic research question to be investigated is: What are the competences required both at managerial and individual level for a successful adoption and assimilation of business-to-business e-services? To answer the research question an in-depth case study of an e-service system is conducted. The results show that two main competences, vision and control, are required at top management level, while a number of competences are found at individual level. The paper is structured as follows. This section presents the main purpose and motivation of the study. The second section discusses the concept of competence, while the third presents theories of adoption and assimilation. This is followed by the research method as well as the analysis and presentation of results. Finally the last section presents some concluding remarks.

II. THE CONCEPT OF COMPETENCE

The concept of competence has been much discussed in different types of research such as psychology, management, human resources and information systems and much confusion there is regarding the definition of competence. Also the concept of competence has been used at different analytical levels: for example task-specific competences, firm specific competences or industry specific competences or similarly “competency”, “meta-competence” or “supra competence” (Nordhaug, 1998). Competence has often also been identified with performance. But if performance has been used as a proxy for competence due to the difficulty of measuring competence, often mixing competence with performance implies mixing the outcome with the process. However a large amount of literature distinguishes between competence and performance and this is especially in relation to competence as a specific skill. Marcolin et al. (2000) define user competence as “the user’s potential to apply technology to its fullest possible extent so as to maximize the users’ performance on specific job tasks”. Competence is also seen as a personality trait, and might include generic knowledge, motive, trait, social role, or skill of a person linked to superior performance on the job (Haynes, 1979). Competence has also been associated with knowledge, and in this view competence is not only task specific, but embodies the ability of transferring knowledge across tasks, thus becoming interactive and dynamic (Brown, 1994). In human capital theory, the concept of competence has been related to specific firm technologies and to the execution of tasks that are related to the technology and the routines required to use that technology.

However, according to Nordhaug (1998) this approach to study and conceptualize competences does not take into account the need for flexibility and change that characterize the modern organizations as well as such a narrow approach to competences does not take into consideration those competences related to organizational aspects of the firm such as organizational culture, interpersonal networks, that are therefore not task specific. Furthermore in the literature there are many different typologies of competences. For example Yukl (1989) develops a typology that consists of technical, conceptual and interpersonal competences. Technical skills or competences represent knowledge about methods, techniques and processes required to conduct a specific activity and the ability to use the tools and equipment necessary to explicate that activity. Interpersonal skills include knowledge about social skills, ability to communicate, ability to cooperate as well as empathy. Finally, conceptual skills include creativity, efficiency in problem solving, analytical capability and capacity to understand opportunities and problems.

A. IT Competence

As with the concept of competence in general, also the concept of competence related to IT has been defined in different ways and has focused on different levels of analysis. The stream of literature focusing on organizational level (e.g. Feeny and Wilcocks, 1998; Van der Heijden, 2000) is influenced by parallel studies in the management literature and especially by the resource based view of strategic advantage (e.g. Prahalad and Hamel, 1990; Barney, 1991). The other stream of research focuses on the individual level. For example Basselier et al. (2001) study IT competences in business managers and identify a concept of IT knowledge that is decomposed into explicit IT knowledge and tacit IT knowledge. Explicit IT knowledge is knowledge that can be read, taught or explained to others. Tacit IT knowledge is more difficult to explain and to do so they use the construct of experience and cognition. Experience represents the know how of managers, while cognition involves more than doing things, and refers to working models of the world that an individual forms, including acumen, beliefs and viewpoints. However, this kind of literature has not focused on other factors related to competences such as communication, social or leadership skills. Please refer to table 1 below for a summary of the studies of IT competence.

	Tacit Knowledge	
Lee and Trauth (1995)	Critical Knowledge and Skills	Individual level (IS professionals)
Bharadwaj, Sambamurthy and Zmud (2000)	Critical IT Capabilities	Organizational Level
Van der Heijden (2000)	IT core capabilities; organization specific routines, skills, resources and processes	Organizational Level and IT management)
Sambamurthy and Zmud (1994)	Capabilities, skills and tacit know-how	Organizational Level and IT management
Feeny and Willcocks	IS core capabilities; organization specific routines, skills, resources and processes	Organizational Level and IT management

Table 1: A summary of studies of IT competences

B. The approach to competence used in this paper

In this study competence is both managerial as well as individual. Managerial competences become the basis for the firms' norms, values, beliefs and strategies in adopting e-commerce. Individual competence is considered in relation to the specific task of adopting and using an e-service system. Competence is therefore the ability to act in situations (cf. Docherty and Marking 1997, Ellström 1992). Thus not only includes knowledge and expertise, but also the capability to solve problems in concrete situations. Further, competencies include social abilities. These are important, for example, when taking into consideration the consequences of one's action on other people in the organization, which again requires knowledge about others' situations. More specifically in this study I will draw on the broad taxonomy developed by Yukl (1989) in the identification of groups of competences.

Author	Definition of Competence	Individual/Organizational Level
Basselier et al. (2001)	IT related explicit and	Individual level (Business Manager)

III. ADOPTION AND ASSIMILATION OF E-SERVICES

Adoption is defined here as "the decision to make full use of an innovation as the best course of action available" (Rogers, 1995, p. 21). According to a study conducted by Zaltman et al. (1973) innovation adoption within

organizations often occurs in two stages. The first is a firm-level decision to adopt the innovation also called primary adoption; the second is the actual implementation that is the individual adoption by users also called secondary adoption. At the first level, managers identify objectives to change some aspect of their business and look for innovations that fit their objectives. Then they make the primary adoption decision (Gallivan, 2001). Once the primary adoption decision has been made, the implementation and use of the innovation at individual level occurs. According to Gallivan (2001), management may proceed by three fundamentally different paths to ensure secondary adoption: (1) they can mandate that the innovation be adopted throughout the organization at once; (2) they can provide the necessary infrastructure and support for users to adopt the innovation, while allowing it to diffuse voluntarily; or (3) they may target specific pilot projects within the firm, observe the processes and outcomes that unfold, and decide whether to implement the innovation more broadly later on. This two-stage adoption model has also been defined as a contingent adoption decision, meaning that employees cannot adopt the innovation until primary adoption has occurred at a higher level of authority, often managerial or top management level (Zaltman et al., 1973).

Assimilation is defined as the extent to which the use of a technology diffuses across organizational work processes and becomes routinized in the activities associated with those processes (Tornatzky and Klein, 1982). Moreover it is important to look at assimilation because the adoption of a technology at a company level does not automatically leads to assimilation and use. Fichman and Kemerer (1999) for example show that most information technologies exhibit an assimilation gap, that is their rates of organizational assimilation and use lag behind their rates of organizational adoption.

The structuration theory of technology assimilation describes how firms act as institutions in shaping the behaviours and cognitions of the individuals in the corporation in facilitating or preventing them from assimilating a technology. According to Chatterie et al. (2002) institutional theory identifies three ways in which the organizations influence individual cognition and behaviours:

1. Structures of signification, where prevailing institutional structures yield meaning and understanding. Individuals apply these structures as guides to understand how they should behave/act with respect to new technology assimilation.
2. Structures of legitimization, where prevailing institutional structures validate specific behaviours as being appropriate in the organization and consistent with the goals and values of the organization. Individuals draw upon these structures as normative templates to reassure

themselves about the organizational legitimacy of their assimilation actions.

3. Structures of domination, where institutional structures regulate individual actions and behaviours. Individuals draw upon these structures to ensure that their assimilation actions do not violate institutional rules and to avoid being the target of organizational sanctions. (Chatterie et al., p. 68)

Furthermore, according to Pervis et al. (2001) two sets of actions characterize the dynamics of technology use and assimilation in organizations: individual structuring actions and meta-structuring actions. Individual structuring actions refer to the individuals' use of the institutional structures of signification, legitimization, and domination to make sense of the technology, gain the resources and competencies needed to infuse it into work processes, business strategies and undertake the improvisational actions needed to assimilate the technology.

Meta-structuring actions refer to the possibility that senior management has to manipulate the institutional structures of signification, legitimization, and domination to influence or motivate individual structuring actions. These organizational actions are called meta-structuring actions because they either reinforce the existing institutional structures or alter those structures to create conditions more conducive to technology assimilation. Examples of meta-structuring actions include senior management incentives, rewards, and explicitly articulated visions and mandates for technology use (Orlikowski et al., 1995; Purvis et al., 2001). For example senior management can develop a new organizational vision to highlight the strategic importance of information technology or mandate rules and policies about the assimilation of a technology. In so doing senior management can either encourage or discourage individual structuring actions.

The goal of this paper is to investigate the competences required at top management level and individual level to successfully adopt and assimilate e-services both at primary and secondary level. This paper does not consider other types of adoptions as for example where technological innovation adoption occurs due to employees' involvement or the product champion. Top management is the institutional enabler of the structuring actions of individuals in assimilation of e-services. Through their beliefs, top management can offer visions and guidelines to managers and employees in the companies about the opportunities and risks in assimilating technological innovations. For example, in firms where top managers believe that e-services offer a strategic opportunity, their beliefs serve as powerful signals to the rest of the firm employees about the importance placed on the e-services. This makes them to use their time and energy in making sense of e-services or exploring ways in which the technology's functionality could be leveraged to improve the company efficiency, routines, business value or simply decrease costs.

IV. METHODOLOGY

A. The Research Method

To investigate the competences required for the adoption and assimilation of e-services, a case study was conducted where the object of analysis was the e-service (Yin, 1989). Specifically, the case has been a web-based travel reservation system developed by the travel agency TQ3. TQ3 is a travel agency selling business-to-business travel solutions. Recently they have developed a web-based system that can be used by the client companies to make the reservations and buy their travel tickets by bypassing

Company/Information	Type of Business	Number of Employees In Denmark	Number of persons interviewed and relative position
TQ3	Provider of Web-based Travel Solutions	12,000 Worldwide	(8) Director of the Danish Office, Account Manager, Online System Administrator
B	Paint and Varnish Business		(1) Secretary and responsible of travel reservations and expenses
C	Research and Development of Human and Animal Medical Products	140 in Denmark	(1) Full Time Travel Manager (Responsible for all travel reservations and expenses)
D	Producer of Cleaning Equipment		(1) Secretary and responsible of travel reservations and expenses
E	Engineering consulting	100	(1) Secretary and responsible

			of travel reservations and expenses
F	Production and service of plastic card products	150? in DK	(1) Secretary and responsible of travel reservations and expenses

Table 2: Companies Interviewed

the employees at TQ3. To understand the e-service in question and the competences required for its successful adoption and assimilation, interviews have been conducted both with the e-service provider and with the customer companies or adopters of the e-service. The research design is thus composed of two phases: the first step is to understand the e-service and the e-service system and the second to understand the competencies required to successfully adopt e-service in the customer companies. Face-to-face qualitative interviews were used to collect the data, which were primarily of a subjective kind. In both phases, the main data collection method was qualitative interviews. The e-service provider has given information about the property of the e-service system, the way it is used both by TQ3 and by the customers as well as information about the customers' motivation and reasons to adopt the e-service. Also a temporary password to the e-service was provided to the researcher to get acquainted and understand the system. The director of TQ3 has suggested the people to interview within the company, while the system administrator had suggested the customer companies and established the first contact. The sampling was purposeful. All the customers suggested had been successful in adopting and assimilating the e-service. The customer companies provided information about competences and strategy and policies regarding the adoption and assimilation of the system. Please refer to Table 2 for detailed information about the people interviewed at the service provider and the customer firms.

The bookers at TQ3 were interviewed with the intention of getting information about the problems that the customers had with the e-service. A total of five customer companies were interviewed. The person making the booking was interviewed in each firm. The interviews lasted between 45 and 90 minutes, were tape recorded and fully transcribed by a research assistant.

In the customer firms, the qualitative interviews consisted of two parts. The first part was based on a semi-structured interview guide aimed at collecting information about the institutional enablers of the e-service adoption and assimilation and their competences. The semi-structured interview guide was only a checklist and the interviewees were allowed to formulate their own statements and stories.

The second part of the interview specifically aimed at understanding the competences required to successfully use and assimilate the e-service at an individual level. This was done by applying the critical incident technique. Interview results have been analyzed with intuitive text analysis.

1) *The Critical Incident Technique*

The critical incident technique is a research method used to collect data specifically related to competences. This technique was first developed by the US air force to select competent pilots (Flanagan 1954) and has been used in a great number of studies investigating competencies. Critical incidents are defined as episodes or behaviours deemed to have a special positive or negative impact in a situation. The critical incident technique gives a detailed description of what happened, why it happened and what specific actions were taken to solve the problem. In this project the critical incident technique has been applied by asking the interviewee to tell about a very specific situation where he/she had experienced problems while using the e-service or a positive situation where someone had learned something. Normally the interviewees talked about a situation where they themselves faced problems or had a positive learning experience. Sometimes they told about how another person faced such a situation. The critical incident technique is a way to explore critical requirements in a specific situation. According to Flanagan (1954):

“By critical incident is meant any observable human activity that is sufficiently complete in itself to permit inferences and predictions to be made about the person performing the act. To be critical, an incident must occur in a situation where the purpose or intent of the act seems fairly clear to the observer and where its consequences are sufficiently definite to leave little doubt concerning its effects” (Flanagan, 1954 p. 327).

This method begins by defining specific situations and aims connected to such situations. The classical example is a flight crew performance during difficult bombing expeditions (where the aim is to be able to respond adequately to certain typical problems during such an expedition so that the whole expedition becomes successful), but it could also be a secretary performance in using e-services.

By following Flanagan (1954) in this research concrete incidents with a positive or negative impact with respect to make a reservation by using the e-service (the aim of the situation) have been identified. The incidents that were found were then grouped into fewer themes that can be interpreted as general requirements of action or “competencies” that have a positive or negative impact on the users’ ability to use an e-service.

The analysis suggests a number of competences both at top management and individual level required for the successful adoption and assimilation of e-services in the customer companies.

First of all a competence called “vision” was present at top management level. This envisioned how a web based travel booking system could add value to the company and contribute to the company business and strategy such as decreasing operational expenses, including travelling expenses. The main idea of TQ3 web based reservation system is that it should create value both to the producer and the consumer as it should reduce costs for both. For TQ3 the web-based system should decrease personnel costs and allow the company to concentrate on the customers with special needs. For the e-service users it should reduce the company total travelling costs as they get a discount when they book their travel themselves, without contacting TQ3. It is argued here that vision was the first necessary competence to be in place in order to take at all into consideration the possibility of adopting e-services. This was clearly pointed out by the account manager at TQ3, as well as by the single employees interviewed in each customer company. Other authors (e.g. McGowan et al. 2001) have advocated for the competency of “vision” in order for management to be able to understand the opportunities and the value that technology contributes to the company and thus make a proactive effort to adopt it. Once the vision has been developed and the decision to adopt e-service has been made, senior management has developed a new competency to encourage and enforce assimilation at individual level. Similarly to Durkin and McGowan (2001) I will call this competence “control competence”. It includes not only the development of the rule or policy to induce the use of the e-service, but also its enforcement in the company. For example all the 5 companies interviewed said that they had to use the web-based reservation system due to the wishes of top management to decrease travel costs and the company policy of cutting costs. The company policy consisted not only in the fact that the company had to make the reservation themselves thus bypassing the company and getting the discount on the travels, but also that the employees should travel as cheap as possible. These companies were characterized by the fact that employees were travelling a lot. After e-service adoption at top management level has taken place, a set of competences at individual level are required for the e-service to become integral part of the company’s routines and culture. In this study by drawing upon Yukl (1989) the competences at individual level have been grouped into the three main categories of technical, conceptual and interpersonal competences.

A. *Technical skills*

Two competences were found as belonging to this category: knowledge competency and transfer competency. *Knowledge competency.* According to Basselier et al (2001) IT knowledge can be divided into two components: tacit knowledge and explicit knowledge. Explicit knowledge is

V. ANALYSIS AND RESULTS

formal knowledge that can be acquired through formal training, can be read or explained. Examples of IT knowledge related to e-services could be web related skills and knowledge about how to use the system. Tacit knowledge is instead gained through experience and experiential training. Furthermore experience increases memory of how to undertake an activity, which in turn increases competency levels in relation to that experience. The combination and variety of experiences influence the level of tacit knowledge. In our study both components of knowledge are present. The users of the TQ3 reservation system interviewed in this study were all first time users of such an online reservation system. Four of them are employed as secretaries in their daily job and one of them had been employed as travel manager for circa 7 months at the time of the interview. The one employed as travel manager had experience in the tourism sector, but more from the software development point of view (implementing web pages). Given that they were all new to the use of e-service systems, it could be expected that knowledge regarding the use of the system could be very important. As a matter of fact, this competence has been expressed by all five interviews. In all five companies the acquisition of both explicit and tacit knowledge in learning how to use the e-service system was extremely important. Explicit knowledge was acquired through a formal learning session constituting of a 1 day training seminar organized by TQ3 after the system was installed at the customer site. Tacit knowledge was acquired through learning by doing, once the e-service user came back to the company and started to use the system. This for example is showed by the following statement by the person interviewed at company D:

Resp: You do by trying it, when you for ten times have been sitting and writing your user name, then you become tired of it. Then you ask yourself whether it is possible to make it easier..

Transfer Competency. This competence is defined here as the capability to transfer the skills learned and knowledge acquired in a given context to a new context. This can be for example transfer of general Internet skills to the specific e-service system in question, transfer of previous expertise in the travel sector and IT to online booking. An example of citation from company B is:

Int: Are you more used (then your colleagues not willing to use Webbuster) to use this type of technology.

Resp. Yes. And it is also that, I believe, that make the difference. I do not believe it is a problem to sit and reserve a flight on the Internet, where others believe that it is difficult...

Int. Do you use generally Internet a lot also in your private life..

Resp. Yes, I do. I use also netbank at home and everything, whatever I have to book as ferry tickets or

what we do..concert tickets that I do often on the Internet. All those kind of things..and then I use it also here in all possible contexts.

Competence Category	Competence	Individual or Managerial
	<i>Vision</i>	Top Management
	<i>Control</i>	Top Management
Technical Skills	<i>Knowledge competency</i> <i>Transfer Competency</i>	Individual
Interpersonal skills	Social Competence (2) Empathy Communication Competence	Individual
Conceptual skills	Logic Competence Judgement Competence Creativity Competence Straddle Competence	Individual

Table 2. List of Competencies and corresponding companies

B. Interpersonal skills

Social Competence. This competence is defined as the capability to use other people competences when insecure or facing problems in solving a specific task. This for example can be the capability to negotiate with the travel agency what to do with the ticket if the system goes down during the reservation process. Other examples can be calling the help desk or the local travel agency for help. For example the person in company E uses often TQ3 help desk or the local travel agency when unable to solve the problem by herself. This is showed by the following statement:

Then I call this number (help desk) and say who I am ..in the process of doing something on Webbuster and I cannot go further.....And I can also contact our own travel agency if I have a problem ...

Empathy. This is the capability to understand and take into consideration other colleagues needs and wants with regard to travel and economic restrictions. The following citation from company F illustrates the capability to take into consideration colleagues' preferences:

Resp. It is very different what people believe it is good. I try to find it out what they prefer. That makes it also easier for me...

On the other hand the travel bookers find themselves in the dilemma of accommodating the travel wishes of the colleagues, for example travelling at specific times and dates, have specific seats, minimize travel time, as well as taking into consideration the company's policy with regard to reducing travel expenses. This can be sometimes difficult. The following citation from company D points out the capability to take into consideration people preferences in relation to the economic restrictions imposed by the company's travel policy:

Resp: But there is a little back and forth sometimes, that they prefer one solution, and then you say "Yes, that is possible, but it is so expensive, but we have a travel policy in the company...."

Communication competency. This is here defined as the capability to communicate with others. This distinguishes itself from social competency because the focus here lies in the ability to understand what other people say and make yourself understood, for example discuss things with colleagues or help desk at TQ3. An example that illustrates this is the following citation from company D:

Resp... I think that they were very good at speaking so that we could understand that.

Int. So they could understand what your problem was and you could understand, what they said?

Resp. Yes, exactly.

Another example of how it might not be easy to communicate is from company F is:

Int. ...That means that you have to communicate with them, that have to travel, when you go into the system, and say, what possibilities there are.

Resp... the best for me is to make them to stay behind the computer monitor, so they can see what possibilities there are....so I have the communication immediately.

C. Conceptual skills

Logic Competence. This is defined as the capability to understand and follow the instructions from others. For example to follow the instructions provided by the help desk in solving a problem. This competence is different from the social competence because some people can call for help, but they are not able to follow the instructions to solve the problems. A citation from company B is:

Resp. ..Then I got a good help (from help desk) that guided me through....Then I do what they say ..and that is it...or they do it for me

Creativity Competence. This is the capability to search for new information, to use and understand other sources, capability to navigate and relate to the IT system, to understand when the information and the knowledge at hand is not enough and need to find more. Clearly this requires a certain degree of reflection, whether conscious or unconscious, about what is known and how to go to get further information or knowledge. An example of looking for more information in the system manual to solve a certain task is given by the following citation from company C:

Int: Had you tried, before calling them (help desk), to look at the manual or other sources?

Resp. Yes, I had been in the system and looked at what I have printed here..(the manual)

Judgement Competence. This can be defined as the capability to judge different kinds of situations and make a decision as for example when to stop trying to solve a problem by yourself and when to ask others instead. To judge when it is good to use the online system to book a travel and when it is better to do it manually. To judge when it is the system that has made a mistake or when it is us making a mistake. To judge when it is not possible to use the system from the information at hand. To judge the validity of the information you get from the system. An example of the capability to question the validity of the information you get from the system is the following citation from company F:

Resp.Yes, I believe that they make it look nicer then it is (talking about the hotel information that she can find in the system), some hotels do, for sure..they exaggerate.

Flexibility competency. This can be defined as the capability to solve and find solutions to unforeseen problems, being able to spring out of routine work, getting used to new ways of doing a job or task. For example a citation from company B illustrates the capability to solve unforeseen problems:

Resp. ...the system could simply not find that out, it comes back and says, that there are some problems with the number, so I try some different ways.

Straddle competency. This is defined as the capability to handle multiple sources at the same time, for example dealing with different people at different call centres simultaneously, or handle multiple tasks at once as for example the capability to do other things while waiting for the system to respond. This can be illustrated by the following statement of company C:

Resp. So it has also something to do with being able to keep many balls in the air, certainly....Because you have so many tickets running at the same time. And

you have so many arrangements.I would say that my memory has become sharper after I have come here.

VI. DISCUSSION

The analysis has showed that for a successful adoption and assimilation of e-services within a company it is important to develop appropriate competences both at top management and individual level. In this study two competences at top management level were found: vision and control. Through vision top management can understand and highlight the strategic importance of e-services and create the condition for its primary adoption. Through control top management can create the conditions for employees to adopt the e-service (secondary adoption), thus reducing the assimilation gap. In fact according to Chatterije et al. (2002) top management by mandating rules and policies about the assimilation of a technology can either encourage or discourage individual structuring actions. In all the companies interviewed in this study this was achieved by formulating a company policy to reduce travelling expenses. This had to be achieved in three ways: first the web based system had to be used for all the travels as this allowed for a discount respect to the price charged by the travel agency; second the employees had to travel as cheap as possible; third all the travel reservations had to be centralized in one person, the one designated as responsible to make travel arrangements in the company. This had therefore created the conditions for the e-service adoption in the companies at individual level: all employees had to respect the policy of centralization of travel arrangements in one person and the employee responsible for such travel arrangements had to respect the policy of using the e-service as much as possible and make the cheapest possible reservation by keeping into consideration the travellers' wishes. In order to use and assimilate the e-service a number of individual level competences have been identified in this study. These competences can be technical as for example knowledge regarding how to use the e-service system, interpersonal such as the capability to communicate or conceptual such as judgement and creativity competences. The company travel policy functions in this case as structures of domination according to structuration theory, by regulating the individual actions and behaviours. The travel Booker draws upon this policy to ensure that his/her assimilation actions in using the web-based travel system do not violate the institutional rules. Finally a number of psychological reactions were identified that were also important in adopting the e-service at individual level: for example the capability to understand personal limitations and delegate a task when necessary; the capability to be patient when the system is slow; the capability to be enthusiastic about new things, new situations or the capability to get over a feeling of insecurity.

VI. CONCLUSION

This study is important because it has showed that both top management and individual level competences are important in e-services adoption and assimilation. Furthermore this study has identified a number of competences at top management and individual level that are necessary for the successful adoption of e-services. Competences at top management level are important in order to make the initial decision to adopt the technology and enforce or facilitate its use in the company. Competences at individual level are important for the successful assimilation of e-services in the company. The main managerial implications of the study can be summarized as follows: 1) for the successful adoption and assimilation of e-services it is important to develop a competence called "vision" at top management level for how such e-service has to contribute to the company's strategy or business value; 2) once the vision has been developed, it is important to develop a "control" competence to ensure that the e-service is adopted at individual level; 3) a number of competences have to be in possess or have to be developed by the individuals responsible for the use of the e-service. Some can be acquired through formal training, others have to be acquired by experiential learning. Finally this study presents a number of limitations. First of all, the study of five customer companies is very limited to be able to make any generalization regarding e-services adoption and assimilation in other companies. Further research could extend this study to a larger sample of companies having adopted this web-based reservation system. The e-service in question is a web based reservation system, so it might be difficult to generalize to other type of e-services such as for example e-banking. Also the companies participating to the study were all successful adopters of the web-based travel system. Further research could focus for example on companies that did not succeed in adopting the e-service, to understand major reasons for failure. Finally there might be other approaches to understanding and conceptualizing competences than the one used in this study. Nevertheless this study gives some good insights into the competences required at top management and individual level to adopt and successfully assimilate e-services within a corporation. These results might be of interest to other researchers as well as corporations' managers interested to adopt e-services as a strategic or value adding technology.

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Understanding E-procurement: Qualitative Case Studies

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ABSTRACT

E-procurement is constantly receiving attention from industries, business and government agencies. Analysts believe that utilization of e-procurement can lead to enormous cost saving and efficiency in procurement process. E-procurement also enlarges customer base, broadens the search for raw materials to lower its production cost. Though, it has benefited the global business tremendously, its expected growth rate has been moving downwards. While E-procurement can be used for the purchase of indirect or direct materials, the risks associated with the e-procurement has been holding the companies from adopting it. The purpose of this paper is to understand the e-procurement process by focusing on benefits, risks, practices and strategies of e-procurement and its emerging usages in the current business to business (B2B) environment. A qualitative method was used for the case studies in which two companies each from India and Sweden were studied and analysed.

The results showed that cost benefit was the main driver for companies to implement e-procurement. Other benefits included were transparency and visibility across process, better internal and external relations and streamlined buying process. The problems of implementation and integration of existing infrastructure and security and control risks were holding back companies from wide usage of e-procurement. But most of all, lack of managerial commitment hinders the adoption process. Company's needs were the deciding factor for the kind of approach they will follow regarding the adoption of e-procurement and emergence of a new approach. This paper compares the works of different authors in the field of e-procurement and its implications for the B2B.

Keywords — e-procurement, ICT, e-commerce, case study

I. INTRODUCTION

In today's dynamic global business competition scenario, web based technology is no longer an after thought, rather it is a must. It is vital for companies to provide its customers with cost effective total solution and life-cycle costs for sustainable value. With emergence of Internet, and

information and communication technology (ICT) applications, the companies are strained to shift their operation from traditional way to the virtual e-business, e-procurement and e-supply chain philosophy [1]. E-commerce is seen as the new tool that will revolutionize business as we know it today. Although, the business to customers (B2C) has received attention from the rise of companies like Amazon.com, and eBay Inc, still the bulk of e-commerce remains to be the B2B [2] [3]. IT publications and business analysts alike have been full of the promises of B2B e-commerce. At the center of all this hype was the possibility of what e-procurement could offer a company as means for companies to control costs [4]. Does e-procurement really save cost and time for companies? Well this question can clearly be understood by an example from [5], "one might not think it would matter to an 8.5 billion company, how it buys its pencils. But, when they have upward of 60,000 employees in 100 countries purchasing those pencils, not at mention desk, computers, and spare parts for oil fields equipment, the time and cost can easily mount. Rather than trying to centralize such purchase into some worldwide purchasing office, Schlumberger and other big companies have chosen or are choosing to take advantage of the burdening market for e-procurement". Many authors have defined e-procurement in there own wordings. Some interesting definitions are stated below:

A technology designed to facilitate the acquisition of goods by commercial or government organization over internet [6].

E-procurement is a technology solution that facilitates corporate buying using the internet. It has the power to transform the purchasing process because it pervades all of the steps identified by the supply manger [7].

The terms procurement and purchasing has been quite often mixed with each other or used interchangeably. However, they differ significantly in their scope. Purchasing refers to buying materials and all activities associated with the buying process. Electronic purchasing addresses only one relatively minor aspect of the procurement problems faced by companies. Procurement on the other hand, is broadly defined to include a company's requisitioning, purchasing, transportation, warehousing, and in-bound receiving processes. Recent procurement strategies focus on restructuring the entire order-to-delivery process rather than on specific tasks

within the process [8]. Thus, e-procurement is not just an addition of technological aspect to traditional procurement. E-procurement system in essence, mirror the procurement process through the provision of two distinct, but connected infrastructures, internal processing (corporate intranet) and external communication processing (internet based platforms) [9]. The critical difference is that these systems allow individual employees to order goods directly from their personal computers through the web on real-time. Requests and orders are channeled through various forms of hubs or database. It also allows individual employees to search for items, checks availability, place and track orders and initiate payment of delivery [10]. E-procurement had been the subject of a great deal of research, but again this has tended to focus on the development of inter-organizational electronic networks. Inefficient and maverick buying habits, redundant business processes and the absence are symptoms of poor procurement practices [11]. The world of e-procurement is changing at a dizzying pace and B2B procurement is rapidly becoming the most efficient way to conduct all these modes of business.

E-procurement's benefits fall into two major categories: efficiency and effectiveness. E-procurement's efficiency benefits include lower procurement costs, faster cycle times, reduce maverick or unauthorized buying well organized reporting information, and tighter integration of the procurement functions with key back-office systems. The benefits of E-procurement effectiveness include increased control over the supply chain, proactive management of the key data, and higher-quality purchasing decision within organizations [8]. Although, the benefits of e-procurement are frequently discussed, it has its share of risks. In addition to the technology risks, there are risks associated with the integration of these technologies with existing information systems, with the business models that these technologies impose on supplier-customer relations and with the security and control mechanisms required to insure their appropriate use [12].

The purpose of this paper, is to understand the e-procurement process by focusing on benefits, risks, practices and strategies of e-procurement and its emerging usages in the current business to business (B2B) environment.

The article is divided into five parts including introduction which is section 1. In section 2, the literature review: previous research conducted within the areas and the overall purpose is given, which will serve as theory for the study. Section 3 includes the methodology and the next section will handle the case studies, which consist of findings from Indian and Swedish companies and final section includes conclusions and implication for future research.

II. THEORY

A. Benefits with E-procurement

Normally, *cost savings* are the main motivator for companies to implement e-procurement solutions. As cost

per transaction using e-procurement can be reduced by 65% compared to traditional procurement transaction [12]. Cost reduction and negotiation are the reason for transaction costs fall so precipitously with e-procurement. Reductions in labour costs in the purchasing process, increase in purchase volume, leads to better price from supplier and better negotiation i.e. suppliers are ready to reduced the price as they get the assurance of transaction from the buying company. The effect of e-procurement on inter-organization enhances the benefits of e-procurement within an organization. Companies using e-procurement have reported savings up to 42% in purchasing transaction cost associated with less paperwork, which translates into fewer mistakes and more efficient purchasing process. In a labour intensive, paper-based purchasing process, transaction costs can range from \$70 to \$300 per purchase order. For example, GE (General Electronic) saw those costs drop to 30%. Other firms have experienced even greater reductions [7]. Cost reduction is also influenced by control over *maverick spending* i.e. purchase of goods from suppliers with which the organization does not have formal relationships.

E-procurement users also report a reduction in the number of suppliers, associated cost benefits of lower managerial complexity, lower prices and a headcount reduction in the purchasing process. Cutting those cycle times helps in *streamlining the process* and has a significant impact on the revenue generation potential for the firms because products get to market faster, allowing the firm to position it to capture market share from a first to market position [7]. Different authors have elaborated on the benefits that accrue from adopting e-procurement technologies. These benefits are expected to accelerate the rate of adoption of these technologies once the uncertainties that remain around e-procurement are reduced to levels that encourage significant resource commitments leading towards higher *process efficiency* [12]. E-procurement solutions do not always require additional technology, dedicated personnel or staffing resources. Rather, existing technology infrastructure, including equipment and computers with Internet connectivity (which may already be in place) can be used [6]. E-procurement and related technologies promise major improvements in the management of procurement. These improvements are achieved by slimming the supply chain and by acting on (or perhaps creating) markets at either end of that chain. Also, *buyers and sellers are able to share information* in real time to build specification that add value to resulting product and build strong relations.

The use of e-procurement is known to have implications for information asymmetries or impact on inter-organizational relationships, in particular for search and monitoring costs. Alternative explanations for the benefits of e-procurement arise from the resource based perspective through which the resources of the firm may be leveraged to achieve competitive advantage with electronic commerce presenting opportunities to enhance firm resources [13] [14]. Finally, there is also impact on firm's asset base and

the *inventory level* can be significantly reduced. There are no problems like stock outs, wrong product ordered faster delivery, etc, and there is better inventory control. An effective e-procurement strategy for example, extranets link the system of buyers and suppliers over the Internet facilitate real time exchange of the information in the buyer's production schedule and develops capabilities that allow a degree of flexibility with suppliers [7]. Various studies explicitly done on the benefits through implementation of e-procurement system are briefly explained in Table 1.

B. Risks associated with E-procurement

As mentioned above, e-procurement has lot of benefits but still its expected growth rate has been revised downwards. Recent market observation indicated that the adoption of e-procurement technology into the business mainstream is occurring in a much slower rate than expected. One reason is the implicit association made by investors between e-procurement technologies and the B2C models responsible for the internet bubble bust. More often, the slow down has been associated with technology-related issues [12]. Internet-based e-procurement systems and B2B electronic market solutions need to be compatible to the greatest possible extent with the existing technologies, to have a reasonable chance to be widely adopted in the marketplace this leads to problems like investment cost [15]. A study by the conference board (2000), pointed to the problem in the implementation side and concludes that organization are finding (e-procurement) implementation more complex, expensive and time consuming than they originally envisioned' and that consultants have been 'widely criticized for overstating the business case of e-procurement' [18]. Companies were jumping into the e-procurement bandwagon without fully understanding the inter-organizational collaboration and network effects underlying these technology models, the investment required to move the right information from suppliers to employees, and the complexities of integrating these technologies with existing enterprise resource planning (ERP) system [19]. The analysis indicated that the slower-than-predicted growth is not the consequences of a single problem. Rather, e-procurement technologies are still in there early stage of the traditional technology S-curve, where alternative technology models are rapidly evolving and users are still sorting out the winning model. Because, a well-defined business process is still unavailable, companies are using different strategies to approach these technologies. The perceived risks that are holding back companies from investing in e-procurement technologies are numerous. These risks mentioned by [12] are:

- *Internal business risks:* Companies are uncertain about having the appropriate resources to successfully implement an e-procurement solution. Implementing an e-procurement solution not only requires that the system itself successfully performs the purchasing process, but it integrates with the existing information infrastructure

TABLE 1
MAIN BENEFITS IDENTIFIED BY DIFFERENT AUTHORS

<p><i>Leonard and Cochran, 2003 [16]</i></p> <ul style="list-style-type: none"> • Ability to implement "just in time" strategy • Streamlining of supply chain by removal of inefficient intermediaries • Better access to information and transparency in markets • Removal of market barriers like time difference and geography
<p><i>De Boer et al, 2002 [11]</i></p> <ul style="list-style-type: none"> • Cost saving directly related with production or service delivery • Cost reduction of non production goods and services • Reduced cost of operational purchasing activities e.g. ordering, expediting and requisitioning • Reduced cost of tactical procurement activities e.g. formulating specification, selecting suppliers, negotiating with suppliers, contracting, disposals etc • Reduced Cost of strategic procurement activities – e.g., spend analysis, transaction analysis, market analysis, planning, developing purchasing policies etc • Internal benefits arising from investments in particular inter-organizational relationships • The contribution of investments in particular inter-organizational relationships to revenues
<p><i>ITRG, 2002 [17]</i></p> <ul style="list-style-type: none"> • Process efficiencies amounting to annual savings. • Ability to link into existing systems, such as ERP. • Reductions seen in lead times within the procure-to-pay cycle, in some cases by 50%. • Self-invoicing on behalf of clients can add to the bottom line. • Month-end reconciliation can end the problem of the wrong items being ordered or the wrong prices being offered as business process have been streamlined and all was working off the same catalog. • The buyer is engaged in more strategic product management, leading to better contracts being negotiated. • Maverick spending is reduced. • Reduction in stock levels can lead to savings of millions of dollars
<p><i>Davila et al, 2002 & Presutti, 2002 [12] [7]</i></p> <ul style="list-style-type: none"> • Cost savings • Process efficiency • Better information flow between buyers and supplier • Reduced Maverick spending • Streamlined process • Better inventory level

- *External business risks:* E-procurement solutions need not interact with internal information

systems, but also need to collaborate with external constituencies; mainly customers and suppliers. External constituencies need to develop internal systems that facilitate the communication through electronic means, an issue that demands technology investments as well as incentives for these constituencies. For e-procurement technologies to succeed, suppliers must be accessible via the Internet and must provide sufficient catalogue choices to satisfy the requirements of their customers. Suppliers, especially in low margin industries, may be hesitant or even unable to meet such demands without guarantees of future revenue streams.

- *Technology risks:* Companies also fear the lack of a widely accepted standard and a clear understanding of which e-procurement technologies best suit the needs of each company. The significance of this risk factor seems to suggest the need for clear and open standards that would facilitate inter-organization e-procurement technologies. Without widely accepted standards for coding, technical, and process specifications, e-procurement technology adoption will be slow and fail to deliver the benefits as expected.
- *E-procurement process risks:* Another set of risks has to do with the security and control of the e-procurement process itself. Organizations must be confident, for example, that unauthorized actions will not disrupt production or other supply chain activities when committing to e-procurement technologies.

C. E-procurement practices, strategies and models

There are different practices, strategies and models related to e-procurement implementation and it is essential to understand them as they bring out practical aspects of e-procurement. The theories have been rather vague in relation to these specific topics, but the authors have tried to bring some insight.

E-procurement Practices:

In the procurement circle, the line is often drawn between *direct* and *indirect materials*. Indirect materials constitute what are typically referred to as maintenance, repair, and operation (MRO) goods, where direct materials are those that are closely linked to production or service delivery. It is common to find direct purchases aimed at external customers with largely unpredictable purchases (based on the current need of the firm). They have a large order size compared to indirect material that are aimed at internal customers, the purchase are internal driven and have a smaller order size. However, for direct purchases, where a firm sends 80% of its total dollar for the total number of purchase order is only 20% compared to indirect purchases. The total dollar sent is 20% but the total number of purchase order is 80%, making it more desirable [20]. The [21] have shown consistent growth in the adoption of Web-based methods for indirect purchases.

Much of this is due to the fact that firms both in the services and manufacturing sectors are increasingly making routine purchase for operating and office supplies through online sites, either independently or as part of hosted catalogs. However, when the ISM/Forested results are looked closely, it can be seen that the driving force behind this overall shift to sourcing indirect goods and services via Internet is the largest purchasing organizations. It must be remembered that the exact breakdown on what is a direct purchase and what is an indirect one varies even within companies and even depending upon the timing and circumstances of the purchase. Although purchases of indirect goods may be often outpaced spend on direct materials, acquisition of MRO goods has therefore not been looked upon as a strategic issue [22].

E-procurement Strategies:

The E-procurement market is still evolving with the development of technology and new models to serve the needs of the market. There are various strategies that companies adopt towards e-procurement technologies. The majority (70%) are taking a “wait and see” approach (strategy). These companies are either aware of the developments, but not committing resources (37%) or investing selectively until the best e-procurement model can be identified (33%). These companies do not perceive the current state of development merits shifting their established procurement process to the e-world; never the less, they are active in experiments and widespread. The strategy reflects active experimentation but no sizeable investment until the best E-procurement model is defined [12].

A smaller set of companies (4%) adopting a more *passive strategy* of observation without experimentation. Their adequacy (and risk) will depend on how quickly organisational learning can be absorbed without creating the “absorptive capacities” that the wait and see companies seem to be developing [12]. A moderate number of organisations are taking aggressive strategy (27%), stating that they are adopting e-procurement technology declaring that they are ‘investing significantly to gain a competitive lead (3%) or moving ‘fast into e-procurement solutions (24%). This strategy however is defined as riskier in the absence of any well defined solution and companies may end up betting on the wrong technology [12].

According to the results from one study, one-third of all respondents believe that at least 40% of their competitors are implementing or have plans to implement an e-procurement strategy. Among organisations pursuing an *aggressive strategy*, over 50% believe that their competitors are doing the same [12].

E-procurement Models:

According to [23], e-procurement is the amalgamation of sales and purchasing business models and calls for differentiation based on application and functions. The first application is the “*buy-side procurement*” which refers to one organization using electronic systems to purchase goods, such as office stationary, from contracted suppliers.

These suppliers are also using e-procurement systems for management of all processes relating to purchase. This is simply coalescing of the corporate procurement portals and business to employees (B2E) applications. Also these models are generally driven by the specific requirements of the buying organizations than other models.

The second application is “*sell-side procurement* “. This term is used to describe how one supplier sells to a number of buying organizations using electronic systems such as, using e-procurement systems and e-commerce technology. This model is also referred to as “e-sales”. Seller side procurement models are often used extensively in B2C (business to consumers). Well designed seller side solution is usually offering a higher level of customizations for each buyer than their B2C retail counterparts. This type of model attracts big suppliers firms that have a stronger position in relationship with their buyers.

The third application is “*e-marketplace and trading hubs*” which is a combination of industry consortium and the trading exchanges. The marketplace model brings together many different buying and selling organizations in one trading community. The most popular e-marketplace function is auction used for variety of product category. This type of model often helps to increase collaboration between companies in a single industry sector or providing the opportunity of e-procurement to companies, who would normally be too small to benefit [23].

D. Research problem and emerged frame of reference

Based on the above mentioned purpose of the study and along with the thinking of [12], [7], [20], [23], we are able to come up with some intriguing research questions, which need further clarification.

- How can the benefits associated with implementation of e-procurement in B2B organizational setting be described in a specific global context?
- How can the risks associated with adoption and integration of e-procurement in B2B organizational setting be described in a specific global context?
- What e-procurement practices, strategies and models adopted by organizations in B2B settings in a specific global context?

To show the relation between three research question and purpose of the study we developed a frame of reference (Figure 1), which shows that benefits are the drivers for companies to implement the e-procurement. Once a decision is made regarding adoption of e-procurement it is important to adopt these decisions related to practices, strategies and models by companies. Risks are present throughout the process both in the beginning and after the implementation of e-procurement. Risks help the organisation to identify the pit holes and prepared for the problems that come with implementation of e-procurement. And all these components interact together which takes place within the e-procurement environment.

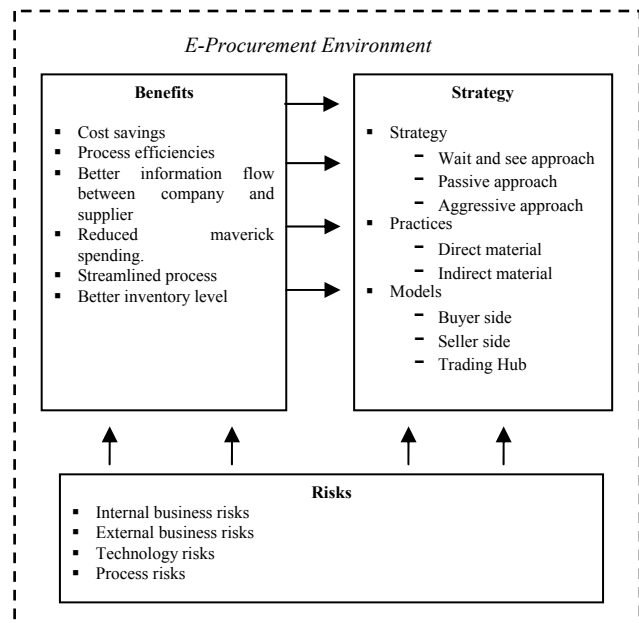


Figure 1: Emerged frame of references

III. METHODOLOGY

The method used for gathering data to answer the above stated research questions is an in-depth, qualitative multiple case study approach. This kind of longitudinal approach is recommended to the authors, who want to study new technology related subjects in B2B context [24]. Qualitative study includes a great closeness to the respondents or to the source that the data. It is characterized by gathering abundant information and to investigate several variables from a few numbers of entities. To make use of the possibility to gather high quality data, the most common way to do this is with the use of case study and interviews, where no set answering alternatives are being offered. The qualitative approach was found to be more suitable for the purpose of this paper, as the purpose is to gain better understanding of how e-procurement is used in a B2B setting. For doing so, we need close contact with the subject, instead of generalization. Finally, as the intention of this paper is to describe, and to find complete and detailed information, qualitative approach is the most suitable method. Further, being descriptive helps us fulfilling our intention to describe the area of research and try to explain the data collected in order to find out the differences and similarities with frame of reference. But we are exploratory in our research and we also, begin to be explanatory. We have stated a purpose of the study that makes us exploratory.

For this study, we used multiple-case sampling, because multiple cases could add confidence to findings. By looking at a range of similar and contrasting cases, we can understand the case finding, grounding it by specifying how and where and, possible, why it carries on as it does [25]. The sample selection used the criteria that companies should have implemented an e-procurement solution or helps to provide an e-procurement solution to other companies. The reason for taking these two perspectives is

that, when a company is implementing e-procurement, it is easy to get in-depth information. And when a company is providing e-procurement solutions, it is easier to get wider information about its customers (companies) and adoption of e-procurement. These two perspectives are further compared from Swedish and Indian companies' views.

While selecting the e-procurement solution, providers from Sweden and India, it was considered to study an established company (A company that is using e-procurement or providing e-procurement service for at least 3 or more years). The reason for this choice is due to the recent e-procurements evolution in the business community. The companies approached for the study were first contacted via mail and telephone. The company's selected for this paper was e-procurement solution provider from Sweden (A) and from India (C) which qualify under these criteria; both companies were founded around the year 2000. Also, both are leading e-procurement service provider in their respective country. While selecting users of e-procurement, it was purposeful that the user company should be related with the service provider company. So, a banking company (B) was selected for Sweden as company A provides the e-procurement solution to company B and company B is a share holder of company A. Further from India, Steel manufacturing company (D) was selected as company C provides e-procurement solution to them and company D also has a share in company C. Another reason for selecting these companies was due to their involvement in the B2B sector. In addition, it was purposefully tried to take not only companies from different countries, but also, different industry as this widens the scope of the study for a better understanding of the e-procurement phenomena.

Finally, the people approached in each company were not strictly based on their job profiles, as in most companies there is no any particular position or person that handles e-procurement. Hence, the selection of interviewee was left on the company. Companies were approached and the right person was searched after briefing them about the needs of the interview (For details on methodology please refer to [26])

All the four companies formed 4 cases that will be presented in the next section. According to [24], it's beneficial to conduct multiple case studies, instead of single as it gives the opportunity of comparisons. By investigating similar and contrasting cases, the researchers have the opportunity to better understand the findings than if they came from a single case [27]. Data collection of the paper was done using interview and documentation. Interview was conducted personally or via telephone with follow-up e-mails. Websites of each company was used as an important source for documentation and information.

IV. CASE STUDIES

A. Findings from Swedish cases (Company A and B)

Cost saving is recognized in accord with the theory presented by different authors, in company B. High purchase volume helps in getting better price and higher

savings from supplier. Company A also, supported this theory, and identified *cost saving* as the main factor for companies to adopt e-procurement. Moreover e-procurement assures the suppliers and buyers making negotiation natural. Company B partially allied with the theory relating to *Process efficiency*. It helps in getting market overview, transparency throughout the company and reduction in the overall purchasing. They also associated process efficiency with reduction in numbers of suppliers i.e. in invoicing and other information from suppliers. Similar views were shared by company A, establishing that process efficiency enables better business control, professionalism in work and clears up other processes within the company. Further, they suggest time convenience as a vital benefit, users can utilize their time at work rather than purchasing.

Regarding *better information flow between buyers and suppliers*, company B agreed with the theory completely whereas, company A partially agreed. They explained that e-procurement solutions enable end-users to search for products to create requisitions and to place orders with supplier. But, the employees/buyers may not always know the supplier. Thus no direct relationship may come to exist and information flow might be restricted. Both company A and B fully approve *reduction in maverick spending* due to e-procurement. They acknowledged contract compliance i.e. purchase only from suppliers with whom they already have some relationship, which leads to reduced maverick spending. Similarly regarding *streamlined process* both company feel that e-procurement connects employees with a single process making it smoother, information flow effortless, easier to handle and the whole process is streamlined. This leads to automating requisitions, minimizing data errors, routing all documentation. With reference to *better inventory control*, company A agreed with the theory company B believes it is not the only major benefit of e-procurement since it deals in indirect material. Finally, the *most important benefit* of e-procurement for company B was cost savings as non-cost savings are rather intangible. Whereas, company A did acknowledge non-cost benefits to be not existing and better price to be the main motivator. It also rates contract compliance and process savings as important benefits.

Company B partially relates *internal risks* with the implementation of e-procurement, as suppliers have shown interest in integrating e-procurement but found it to be very expensive to integrate with their existing system. They had to provide training and educate to their employees on proper usage of e-procurement. However, they did not have any problem with the integration and uncertainty of its current IT solution. For company A, internal risks did not exist; this was due to technological advancements, training the employees and other services. They found something new to add to the theory; identifying other internal risks like lack of managerial commitment, and need for change in behavior and management. Company A did not support the theory of *external risks* the only visible external risk were the suppliers not wanting to join the system (mostly a

risk for smaller companies rather than large companies) while other risks related to the suppliers are taken care of before any transaction. Companies B, believe there can be risk while dealing with new suppliers, as they may not be interested in a marketplace that is expensive. It is seen as extra burden for suppliers for delivery which might discourage suppliers; buyers on the other hand may get confused who to choose from the large supply base. *Technological risks* were not of great concern to both company A and B as e-procurement technology standard are common and widely accepted, hence this risk is obsolete. But, both companies were more or less threatened by *process risks*, company B gave high priority to security which should not be neglected. They have a separate security and audit department. As the information is vital it should not be visible to competitors, despite the security, measures good communication between all players in the market place is essential. Company A, rated risks linked to security and control issues very low, solitary related to operation risks.

Company A, diverges from the theory and according to them there is a different strategic approach taken by companies now-a-days. They believe “*Wait and see approach*” was quite common one year back in the industry. But now a different approach is adopted by companies regarding implementing e-procurement. It is some were between *passive and aggressive* strategic like a “moderate approach”. Companies consider business case or business analyses before making the decision but companies are positively implementing e-procurement. They feel that this transformation is due to change in company’s overview regarding e-procurement, as it is not just a new software solution. Risks have significantly reduced and communication of E-procurement has become easier than ever before. Company B, followed ‘wait and see approach’ when they first implemented e-procurement system. They ran a test pilot with just 25 users and few suppliers in 2001. And it did not take them long to understand the benefits associated with e-procurement and the initial risks conquered. The users got compatible with the system and within a year they changed their strategy to aggressive. They widely implemented the solution by June 2002 and added 600 users; across all branches in Sweden. By Nov 2002, all the employees of company B in Sweden were able to use e-procurement solution.

Although the current use of e-procurement is for *indirect material*, there is a rise in the purchase of *direct material*. It can be seen that in near future more transaction of direct material will be done. The acceptance of e-procurement solutions has got suppliers more interested to get involved. Company B supported the theory as their current e-procurement technology is used only for indirect material due to the needs of their business process.

Company A provides *buy-side* e-procurement model hence agreeing to the theory. They explained it is easy to motivate suppliers, if you have big companies as buyers (e.g. Ericsson, SEB, Novo Nordisk, and etc). Suppliers have assurance on the adoption of e-procurement will yield

them better relations and more money. Making it easier to sell it compare to *sell side or trading hubs*. Also company A’s main stakeholder are its customers and all are big buyers. The model adopted by company B is a buy side mode and the reason for choosing this specific model is influenced by need for more specific solution for company B. Sell side model or trading model is not considered because both did not satisfy the need of the company’s procurement needs.

B. Findings from Indian cases (Company C and D)

Both companies C and D, partially concur with the theory, *cost savings* is recognized, other related benefits are volume buying is made easy, more options are available and negotiation for a suitable price is easily done. Further, reduction is recognized in fixed cost, man power cost, variable cost through technological intervention. Company C added something new to the theory regarding process efficiency, they stressed on the value of visibility and transparency across the entire process and knowledge management as the imperative benefits along with cost benefits. Company D believes *process efficiency* leads to substantial reduction in lead time for purchasing of materials, simplifying paper work and procedures. Regarding better relationship between buyer-supplier both companies agreed and stressed on *better buyer-suppliers relationships*, which contributes to maintaining better relationship, savings from investments and generation of revenue. This leads to standardization of best practices, increased responsiveness to customer’s demands and selling. *Maverick spending* was a benefit recognized by both companies, as transactions are made easy and profitable by using large qualified supplier’s base. Company D has *streamlined* the entire purchasing system and suppliers, by higher utilization of e-procurement in centralized purchasing. Company C realize benefits like reducing procurement cycle which streamlined the inventory or workflow integrating new technology to the existing process to avoid duplication within the company. Company C recognized increase in optimal *inventory level* as benefit of e-procurement. Company D identifies real time exchanges through electronic invoicing, lower prices and better inventory control. The whole process used to take two months before and can now is done in two hours, leading to time saving, higher profitability and productivity. Finally, company C recognized cost saving as the *most beneficial*, while for company D acknowledged cost saving, sales relationship with its customers both internal and external as most beneficial.

Company C and D both partially agreed with theory, *internal risk* relates mostly to the early phases of adopting a new technology. This could be due to non-acceptance to change, which makes the scope of the risk very limited. The vital risk identified is responsiveness to e-procurement, the need to develop a strategy for adoption and integration of technologically advance process. It values the adoption, implementation and training employees for better integration of technology and improving previous relationships. Regarding *external risks* company C did not

identify this risk, according to the interviewee. E-procurement leads to transparency between buyers and suppliers, which are accepted by both the parties. This facilitates a degree of standard and quality for the organization. Thus any external risk does not exist.

For company D, the decision to adopt is directly related to investments and suppliers, which is an important consideration as most of its suppliers are still new to adoption of e-procurement and situated in remote areas. Both companies again correlated to the theory regarding *technological risks*, as there is lack of acceptance of technological standards in India, which is still a developing economy. Hence, here traditional and modern business coexists. It was agreed that with training employees and operational flexibility across organization technical efficiency can be achieved. Also, large unorganized sectors, lack of infrastructure makes quality and delivery capabilities a farfetched inspiration. Finally concerning *process risks*, is not identified largely by company D as the roles are defined within the organization. And company C, acknowledges that process risks may arise during the initial stages which lead to transparency and visibility that delegates control all across the organization.

According to company C, companies have moved on from the early scenario of *wait and see and passive approach*. Where not many companies were ready to take risk, but now they are surer about the e-procurement solution. Most of them are changing to *aggressive adopters*, for those who have already adopted the solution it is about moving one step forward. Company D's adoption strategy was aggressive as they wanted to expand on the first mover advantage in their industry. They identified the need to accept new technology and gain competitive edge. It successfully set company C to acquire resources, save money and achieve higher efficiency. The adoption of e-procurement within company D started with only one department and in time was adopted across the organization. It was a deliberate and strategic attempt to take on the aggressive strategy rather than passive or wait and see approach.

Company C mentions that most Indian companies consider *direct material* purchasing takes longer cycle and longer wait before the result can be judged and benefits can be identified, while with *indirect material* results can be viewed immediately. There is a shift in the market towards direct material, similar to the auto industry. However it is quite slow due to lack of technological and low acceptance by buyers and suppliers. The user company D is among the few companies in India that has implemented e-procurement for both direct and indirect material. Most of its procurement takes place for direct material (raw material like steel) but its slowly moving towards indirect material (MRO materials). This has led to better buyer supplier relationships and improved long term associations.

According to company C, *trading hubs* were most widely used by companies before. But due to diverse market segmentation, the buyers and suppliers communication could not be brought on a single platform. Now most

companies are adopting a buy side model which allows the companies to purchase goods from contracted suppliers, while the *sell side model* is not so popular due to the fewer adoption capacities of the suppliers. Company D adopted the '*buy side model*' which complements the needs of the organisation and better price. In the initial stages trading hubs were also considered as an option. This was quickly rejected due to the lack of technical development and supplier's willingness to adopt the technology while still striving to build sustainable competitive advantage.

V. CONCLUSION AND IMPLICATION

The purpose of the article was to provide better understanding by focusing on the benefits, risks, practices and strategies and its emerging usage in the current B2B environment. By conducting an extensive yet not exhaustive review of previous studies on e-procurement phenomena, three research questions were formulated. These research questions were the guidelines for the whole study and for selecting the methodology used in the study. By use of case and cross case analysis [27] the findings were compared with the theory and between the cases. Conclusion contains the cross case analysis between the companies. Whereas implication for future research deals with specific research that can be visualised after this study.

A. Conclusion

Our research indicates benefits are the drivers for companies to implement e-procurement solution. Although the risks are present throughout the process, the benefits clearly over power them. *Cost saving* has been identified by all four companies as the main motivator for them to implement e-procurement. It is easy to speak about cost benefits compared to other benefits as its effect can be seen immediately in companies' savings. According to the Swedish firms, *process efficiency* is not just about less paper work and fewer mistakes, but reduction of suppliers used for the procurement process before implementation of e-procurement solution. It stressed that e-procurement leads to professionalism in work, better business control and cleans up the processes within the company. Researches indicate an agreement between most companies regarding the benefit of *better information flow between buyers and suppliers*. Some of the main points worth mentioning are increase in number of transactions, transparency in process, standardization of best practice and increases in responsiveness to customers. A relation between better information flow and saving from investments and generation of revenue were also acknowledged. A consensus between the companies was documented regarding the *reduced maverick spending*. They confirmed using a recognized supplier for purchasing products, leads to control and regulation of spending, and transaction easier and less expensive for company purchasing. Same trend were recognized in reduction of maverick spending with benefit from *streamlined process*. Some points worth mentioning are: single process makes

the process smoother and effortless information flow, minimizing data errors, automating requisitions, and reduction of procurement cycle.

Another related effect can be noticed in integrating new technology to the existing process is to avoid duplication within the company. Indian and Swedish companies had different views regarding *inventory level*. They recognize real time exchange helps in reduction of problems like stock out and delivery problem thus leading to *time saving*. But this benefit is not that valuable as it has become an accepted norm. It is acknowledged that specific benefit of inventory level is mostly related with companies using e-procurement for direct material purchase. For companies, that are using e-procurement system for purchasing indirect material it's not that beneficial. Cost benefit was mostly recognized as *important and essential benefit* of e-procurement. However, company A stressed on contract compliance and process saving. Similarly, Indian companies identified sale relationships with both internal and external customers to be beneficial. Consolidation of purchasing practices leads to greater discounts and better service from suppliers.

Our research indicates that, while most companies have accepted the risks involved in adoption of e-procurement others have moved forward and have identified additional risks associated with e-procurement. Regarding *internal risks* companies identify the need to provide proper training at all levels for better understanding and collaboration across the organization. Investigation of the Sweden based e-procurement provider enlightens the lack of managerial commitment constraining the adoption of e-procurement. Hence a need to change the overall behavior and management is acknowledged. The research recognized *external risks* associates with e-procurement, which mainly constitutes - customers and suppliers. There are risks of dealing with new customers with no previous records, lack of integration between the system used by the suppliers and the companies and connectivity. Adoption of e-procurement is slow and results are delayed mostly due to lack of technological standards. A similar view was shared by the companies in India, but the Swedish counterparts felt that *technological risks* are ever present. They also concluded that in countries like Sweden, adoption of e-procurement is standard and commonly accepted. Individual companies differ in their specific way to deal with risks related to *security and control*. Based on the finding, both Sweden and India it can be understood that these risks are more fundamental during the initial phases of implementation of e-procurement, but once the roles get defined it becomes part of a system or process.

Regarding the adoption strategy, it was felt that companies change their *strategic approach* to suit their needs. We conclude that the three different approaches identified by theory are not necessarily different as one could start with an approach and changes it on later stage to convene its current requirements. Regarding the e-procurement *practices* adopted by companies, we found that both direct and indirect materials are purchased from

the e-procurement solution. Regarding e-procurement practices theory suggests that indirect materials are more likely purchased by e-procurement solutions. However there is a rapid change in the market scenario in both countries towards direct material purchase. The research indicates that when compared, e-procurement *models* used by companies to the theories in all the case studies were surprisingly similar. Companies recognised all the three models in the adoption of e-procurement; the buy side procurement model was mostly implemented. As specific requirement of the buying organisations are met by this model compared to other models (e.g. sell side or trading hubs). Other factors that helps in influencing this decision are large customer base for suppliers, big players assure suppliers of better revenue and relations.

From this study we gather the correlation between companies dealing with e-procurement and how they identify the benefits, risk and strategies. This area is not fully developed in literature and possibilities to expand the research would be motivating. Conversely, we anticipate that the findings from the study could serve as the base for constructing a hypothesis, which can be tested and used to produce generalized results.

B. Implication for future research

Some interesting propositions for future researches to indulge in the field of e-procurement are summarized below:

- The dissimilarities regarding e-procurement amongst companies could be an area for future research to be undertaken.
- The dissimilarities regarding e-procurement due to location (country) and its culture can be an interesting area for further research
- A quantitative study in e-procurement would be interesting in making the research area border

ACKNOWLEDGEMENT

The authors are grateful to the support and encouragement from Professors Mats Westerberg and Professor Tim Foster during the preparation of the manuscript.

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V2C-apparatus – a shared context for professionals

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Abstract—The role of venture capital finance is significant when ideas, or ventures, are developed to new companies. To make ventures and venture capital meet there is also niche for venture-to-capital (V2C) operative. The network of mutual and organisational relationships consisting of (i) entrepreneurs or venturers, (ii) V2C operatives or venture knowledgists, and (iii) venture capital operatives or venture capitalists form an activity system based on social capital and mutual trust. These three groups are the key stakeholders of the growth company process. Ventures, venturers and knowledgist form a community of practice that is based on notion of mutual benefit from working together. It could be stated that venturer holds expertise on practice, venture capitalist on finance, and V2C operative holds expertise on relationships.

In the context of the growth company process, social capital should be taken in account as the sum of mutual acquaintance and recognition or network of social exchanges between operatives or the actors engaging in transactions. Moreover the three dimensions of social capital affecting any actor in that process are (i) structural, i.e. presence or absence of interaction, (ii) dimensional, i.e. mutual trust and trustworthiness, and (iii) cognitive, i.e. shared understanding of common goals and proper ways to act.

At least partial role of V2C is to enable learning, i.e. transfer of explicit and tacit knowledge. The activity theory approach emphasises such process based on interaction. Moreover, most operatives in V2C are professionals in their fields, thus there is presupposed leverage effect if the activity system is functional.

The aim of the paper is to elaborate theory of V2C by examining knowledge and expertise in V2C context and by approaching V2C-apparatus as a knowledge transferring community of practice. The empirical part of the paper consists of interviews and participant observation of different operatives or actors in V2C-process in Finland and Russia. Along the conceptual analysis, the research problem set is approached by describing the knowledge transferring processes, analysing different types of knowledge transferred in the process, and finally analysing the system as a

professional community of practice or an activity system.

Keywords—Venture Capital, Human Capital, Community of Practice, Activity Theory

I. INTRODUCTION

A contemporary notion of post-modern business environment suggests failure in two vast governance experiments, partial failure of corporate capitalism and total failure of state socialism. Moreover, there is tendency to go back to basics, i.e. back to entrepreneurial structures. The reason for that is not the lack of ideas, but difficulties to motivate, incentivise and monitor individuals in rigid corporate reality. Therefore, the role of venture capitalists is significant when ideas, or ventures, are developed to new companies. Moreover, to make ventures and venture capital meet there is also niche for venture-to-capital (V2C) operative e.g. [1]. The network of mutual and organisational relationships consisting of (i) entrepreneurs or venturers, (ii) V2C operatives or venture knowledgists, and (iii) venture capital operatives or venture capitalists form an activity system based on social capital and mutual trust. These three groups are the key stakeholders of the growth company process.

In the context of the growth company process, social capital should be taken in account as sum of more or less institutionalised relationships of mutual acquaintance and recognition or network of social exchanges between operatives or actors engaging in transactions. Moreover the three dimensions of social capital affecting any actor in that process are structural, i.e. presence or absence of interaction, dimensional, i.e. mutual trust and trustworthiness, and cognitive, i.e. shared understanding of common goals and proper ways to act [2], [3], [4], [5].

Earlier studies on venture capital [6] and venture-to-capital [7], [8], have taken the issue of social capital in account, but there is a lack of research. In general earlier studies on social capital in growth venture context have been fragmented and usually based on single case studies or studies of certain group of individuals e.g. [9], [10], [11]. In some studies, e.g. [12], there has been more general approach, yet the results have been very impressive in statistical sense, but lacking details on behaviour.

II. THE CONCEPT OF VENTURE-TO-CAPITAL

Traditionally incubators, business angels and various kinds of advisors – operating in so-called informal venture capital market – have played a key role in growth and development of fledgling companies. A key objective in their work is to provide ventures with financial and managerial support, thereby assisting them to cross the gap and eventually become ‘investable’ in the eyes of the formal venture capital players. Herein, the informal VC players refer to Venture-to-Capital (V2C) players. They, however, also have limitations in their work and cannot fully address the capital and knowledge gap problems [12]. To bridge these gaps a new breed of professional V2C players is emerging.

An essential common nominator in newly emerged V2C operating models is that the operative acquires equity in the target company. The purpose on the bottom of this is to create long-term commitment for making the co-operation successful. Naturally, sharing the potential success means a sacrifice for the entrepreneur, but in many cases the benefits surpass the drawbacks. Examples of new V2C operating models will be examined in following section. Of course not all the ventures, V2C players nor venture capitalists are similar. They all have their own ways of acting, individual goals and earning logic i.e. a different strategy logic. Anyhow, there are some similarities within all of these groups, and therefore some archetypes should be taken under consideration.

There are several V2C players that can be easily recognised (see [8], [7]). As the normative strategy logic for venture capitalist is interim-owner, the normative strategy logic for V2C player should serve interim-owners. So ideal V2C player has to think, what it is that interim-owners want and need. The goal for V2C player is to find prospective companies and assist them in becoming ‘investable’.

Anyhow the V2C field is highly diverse at the moment. It includes at least *business angels*, who are hobbyists in certain ways; *incubators*, who are mainly public sector based and therefore under the public eye with limited risk taking abilities and little space for making mistakes; *advisors*, who are mainly focused on their own short-term gains; and *corporate venture capitalists*, that are not usually seeking direct financial gains rather than indirect strategic gains such like technology development. Still another form of V2C is *corporate venturing*.

The basic assumption is that all of these V2C players mentioned above (excluding corporate venturing) concentrate on making prospective ventures ‘investable’ in the eyes of venture capitalists i.e. they help ventures to cross the capital gap. It also seems that their main customer is entrepreneur. Furthermore, those V2C players are not interested in what happens after the venture has got a venture capital financing: after that it’s venture capitalist’s task to push the venture ‘listable’.

As mentioned before, none of the above seems to be established for serving venture capitalists (and even less interim owners) but entrepreneurs. So there is a need to sketch some kind of ideal V2C player and his or her strategy logic to serve the both ends of the value chain.

Operational logic of a V2C player should be approached from two perspectives. Firstly, what is the value to entrepreneur i.e. what are the ‘actions’ perceived by the ventures? Secondly, how does a V2C player provide better and more ‘investable’ ventures to capitalists? V2C player adds value to venture by knowledge on certain operational or strategic issues, which usually are not the core competence of entrepreneur. Also by acting as an advisor V2C player gains insight of a venture, thus accumulates information and knowledge for the capitalists. As V2C player operates as a medium between two different actors, the match making is critical process. By exposing ventures to capital new businesses can be created.

Ventures, which want to get financed and guided by venture capitalists or V2C players, have to accept the rules set by venture capitalists, which originally derive those rules from stock market [13], [14]. The normative venture capitalist, interim-owner, requires ownership in the company and a board seat, so that its financial gains and control are secured. The ultimate goal of interim-owner is successful exit. The task of V2C player is to select and guide ventures that are willing to accept these conditions. In this process ventures are seen as raw material and venture capitalists as customers. The process described above is considered to be an ideal V2C process.

However V2C player’s role is more than just translating the conditions and rules set by venture capitalists. They have to prepare those prospective ventures to survive in dynamic business environments by providing at least businessman wisdom, growth management skills, managerial advices and entries to networks.

III. SOCIAL DYNAMICS OF VENTURE-TO-CAPITAL ACTIVITY

Social capital theory proposes that networks of relationships are a valuable resource for both individuals and organizations. According to Arenius [16] those networks are for interaction and for gaining access to assets required. Nahapiet & Ghoshal [17] have observed that the value of the social capital is in its ability to make possible the achievements, which would be impossible without it or would be very costly, thus the value of social capital relies on its usability. Social capital is invisible, ubiquitous, and hard to pin down, so it is usually studied in terms of its manifestations and effects [16]. Social capital can operate at the level of an individual, a team, an organization, an industry, a community, a nation, or an entire economy. In the context of V2C the individual, organizational and communal levels are the key to observe social capital, as the focus is on the key stakeholders of a growing company.

According to Arenius [16] the social capital theory suggests that players are able to gain access to various kinds of resources that accrue to them by virtue of their engagement in various kinds of relationships. Resources are available through the contacts or the connections that networks bring. As well as conveying resources, social capital is a means of enforcing norms of behaviour among individuals or corporate actors, and thus acts as a constraint. In the context of V2C-process resources refer to knowledge and financial capital that is required to boost growth of a business venture.

One perspective to V2C is that it is primarily issue of transferring knowledge, i.e. human capital, and only secondarily issue of transferring financial capital. In inter-organizational relationships, social capital facilitates learning because it offers access to knowledge and enables knowledge transfer [17]. More social capital, i.e. interaction between the different actors, trust and mutual understanding there is, the more efficient is the process of transferring explicit, and especially tacit knowledge. Gaining capital, both human and financial, is one of the most important meta-processes in a growth process of a company.

In the context of the growth company process, social capital should be taken in account as sum of more or less institutionalised relationships of mutual acquaintance and recognition or network of social exchanges between operatives or actors engaging in transactions (e.g. [1], [11],[9]). Moreover the three dimensions of social capital affecting any actor in that process are structural, i.e. presence or absence of interaction, dimensional, i.e. mutual trust and trustworthiness, and cognitive, i.e. shared understanding of common goals and proper ways to act [2], [3], [4], [4]

In the context of V2C -activity, i.e. process of learning and transferring intellectual capital, the three key stakeholder groups have different needs and perspectives. By taking the dimensions of social capital and actors together a delineation of expected gains as described in table 1 can be made.

TABLE 1
GAINS OF THE THREE DIMENSIONS OF SOCIAL CAPITAL TO V2C ACTORS.

Stakeholder	Structural	Dimensional	Cognitive
Venturer	access to capital and access to knowledge on managerial etc. issues	ensures contract	ensures a single goal, i.e. contract on what is desirable
Knowledgegist	entry to network as a legitimate actor	ensures that the network will hold	knowledge on legitimate moves, how to act
Venture Capitalist	access to ventures and possibility to reduce risk	ensures contract	ensures a single goal, i.e. contract on what is desirable

Structural dimension of social capital is often emphasized when V2C is considered as relationships of mutual acquaintance that forms a basis for active value creating process. From the perspective of a venturer gains are twofold as recognition and knowing different V2C operative knowledge on managerial and strategic issues are available. Moreover, knowing venture capitalist a possibility to get funded is established. The perspective of venture capitalist is analogical to perspective of venturer, as social capital serves venture capitalists in seeking for investable companies. For the knowledgegist structural social capital offers access to the field. Without relationships of acquaintance the mission of knowledgegist cannot be fulfilled. One might even claim that structural social capital is the source of the first move in the growth process.

Dimensional aspect of social capital is most important in early stage growth process. Venturer must be sure that any information she or he submits to knowledgegist or venture capitalist will be kept confidential. Moreover, as it is not possible to make covering juridical contracts in this phase, trust helps the process going on. From the perspective of venture capitalist dimensional social capital is the issue of trustworthiness, i.e. if a venture is funded, the venturer will share the mutual interest. It is the issue of commitment to the decided goal. Because knowledgegist acts between other two actors dimensional social capital is both issue of trust and trustworthiness. Other actors must trust knowledgegist as his or her effort is required in facilitating the growth process. On the other hand knowledgegist is interested in commitment of the other two, as the network based on structural social capital cannot hold if there is commitment to other goals than the explicitly agreed.

Cognitive dimension of social capital consist of the social exchanges between actors engaging in the process. It is the issue of understanding on “where we are now, and where we are going”. Cognitive dimension is shared understanding on what is the primary goal. Between venturer and venture capitalist it is recognition of meaning or rationale for their interaction. Usually the rationale is to enable both to create value to their assets, idea and capital. From the perspective of knowledge cognitive dimension is the recognition of mutual goal and knowledge of legitimate ways to achieve the goal. It is more or less issue of what can and should be done. Moreover, it is also knowledge on who to know, i.e. how the network should be build for successful growth process. The cognitive dimension can be considered supportive to other two dimensions, as it contains the shared norms. Having knowledge on how one can and should behave in certain situation is important, because without that knowledge networks can be ruined and trust lost.

IV. ACTIVITY THEORETICAL APPROACH TO V2C

Engeström [15] states in general that community of practice or community of people, is a model of conception of activities, hence *activity theory*. Blackler [17] states that any knowledge creating and transferring activities form such *activity system* described by Engeström and predecessors. As main point in V2C activity is to transfer relevant knowledge on business, finance and technology, which put together constitute a firm, the V2C activity can therefore be examined from activity theoretical perspective.

There is also rationality to see action, i.e. making conscious or unconscious acts according to intellectual capital, as ultimate expression of knowledge. Blackler [17] gives attributes to active intellectual capital. Knowing is mediated, situated, provisional, pragmatic and contested. Blackler (ibid.) also suggests equivalent categories for knowledge, which could be attached to forms of intellectual capital. Embrained knowledge is knowledge about, i.e. know-what. Embodied knowledge is knowledge how. Encultured knowledge is shared understanding, thus it refers to both know-how and know-why. Embedded knowledge is systemic attribute, hence it is attached to recognition of structures and action according to them, i.e. know-why and know-who. Encoded knowledge is information attached to signs and symbols, i.e. know-what. Embrained and encoded knowledge have the nature of human capital, yet knowing what is not sufficient. Hence human capital also requires embodied knowledge. Social capital is encultured knowledge. The role of embedded knowledge lies between social and structural capital as it is attached to persons and structures. Quinn et al [19] approach intellect of a knowledge worker from the same perspective. Intellect is cognitive knowledge (know-what), advanced skills (know-how), systems understanding

(know-why) and self-motivated creativity (care-why). In some sense knowledge work can be considered successful if knowledge worker causes action by possessed and acquired knowledge.

As stated above, in V2C activity the process of growth can also be considered as an activity system. It consists of subject, object and community. In addition there are rules, instruments and division of labour. The rationale of the activity system in V2C is to transfers competence in addition to capital. Taking the classification by Blackler [17] following categorisation can be made. Embodied knowledge is related to action and is only partly in explicit form, i.e. businessman wisdom. Encultured knowledge is shared understanding. In V2C context it refers to shared goal and shared understanding on the proper ways to act. Embedded knowledge is the action in the system, how people behave, and what the desirable way of acting is. Encoded knowledge is information mediated by symbols, i.e. formal instructions and procedures.

Subject in the system is V2C operative, as they act as medium between the driving forces of growth venture, i.e. idea and capital. Object in the system is the venture as it is the entity to be affected. Community consist of investors and surrounding society. In addition there are rules, instruments and division of labour. Rules consist of formal legislation, contract between different actors and informal customs or acknowledged ways to act. The instruments are different models of growing firms. Division of labour or roles is established to maintain the functionality of the system, as each stakeholder provides scarce resource to the system.

The activity system helps to transfer financial capital and intellectual capital. The financial capital transferring functions are somewhat easier to comprehend, thus they are not the issue in this paper. The transfer of intellectual capital is more complex phenomenon as there are three very different set of intellectual assets transferred: social capital, knowledge, and skills. Especially from professional perspective the transfer of intellectual capital is essential.

The role of social capital is to make the division of labour transparent as one of the primary goals is to maintain the functionality. Transferring it is one of key functions of V2C activity as social capital plays important role as discussed above. Each actor in the process should have clear idea of one's role in the process, and more important to have clear idea of one's contribution. The transfer of skills is almost as difficult as the transfer of social capital. Skills, especially so called businessman wisdom, are the motor in the embryonic phase of a firm. The transfer of skills usually requires close interaction between the stakeholders. It even requires active dialogue between all three. The activity system is in central role in dialogue as it acts as a dialogue rising apparatus.

In the V2C activity knowledge is a true issue as it is a scarce asset. The activity system plays significant role

when codified knowledge is transferred to the venture (i.e. the object in the system). Transfer of knowledge decreases friction in the process and prevents unnecessary work. Transfer of knowledge can be considered as a learning process that benefits both object and the source of knowledge (cf. the concept of double-loop –learning introduced by Argyris and Schön). In addition to joint learning, the activity system makes learning more economical as the sources of knowledge have prior knowledge of what is relevant to the process.

According to informants a typology considering the nature of knowledge transferred can be established as follows. The two axes are formal – informal and explicit knowledge – tacit knowledge. According to that the value of activity system can be described and evaluated. As the most important aim is to create value, only relevant embodied knowledge counts. However, there are lots of sort of ‘residual’ knowledge, that lies below the surface. Therefore, the activity system transfers also knowledge that is useful in other context and in different setting. In figure 1 a typology is introduced. To delineate the scope of this study a brief introduction of results of interviews is made according to informants.

FIGURE 1
TYPOLOGY OF KNOWLEDGE TRANSFERRED IN V2C
PROCESS

	explicit	tacit
formal	Knowledge on how	Knowledge on who, how and why
informal	Knowledge on who and what	Knowledge on who and how

At least to some extend the typology above can be explained as follows. Knowledge on how considers information on the legislation or other official ways of acting. Therefore it is important to act according to that knowledge, yet it only sort of restraints the actions. Tacit and formal knowledge considers business wisdom, i.e. it is the most important piece of knowledge transferred. It is knowledge on who are the most important persons for the success of the venture, or how to develop the venture, or sort of insight on why the venture is worth of developing. Formal and tacit knowledge is the essence of gaining success. Explicit and informal knowledge is common

knowledge for everyone in the business, yet it considers, at least to some extend, important notion on the position of a prospective venture.

There might be a bias in that kind of knowledge, but it helps venturer in positioning oneself. Informal and tacit knowledge is the most important piece of knowledge to be transferred, but it is also most incomprehensible one. According to informants, the key to success is to know right people and act according to their desires. The notion might be somewhat in contradiction with the idea of V2C, and therefore the logic of knowledge transfer does not fully go along the logic of social capital. Explicitly the transfer of knowledge should diminish serendipity and make the growth process more controllable. Implicitly asymmetry in information makes others better off than others, therefore someone will eventually gain more success to ones venture. As a community of practice V2C-apparatus is a means for professional learning along the incubation of new firms. The process is facilitated by mutual interest, yet strong interdependency between the actors.

V. CONCLUSIONS AND DISCUSSION

Activity theoretical approach emphasises transformation of knowledge in practical situation, i.e. learning by doing or learning by cooperation. Cooperation can be considered true manifestation of social capital, as it requires recognition and willingness to maintain the relationship. However, in V2C-apparatus the situation is not as complicated as there is also rewarding scheme present. Social capital, as the main driving force, can be used to explain moves of different actors in growth company process as it was stated above: facilitating growth of a company is more issue of good contacts and trustworthy alliances than capital. The logic of the beholders of social capital in new, emerging businesses should be identified in order to better utilise the potential of social capital as a vehicle to gain access to other resources.

The description above took functional approach to growth company process and it did not pay attention to dysfunctions of inclusion and exclusion in rather wretched field of venture capital, as acceptance or rejection is often an issue of acquaintance. Possible dysfunctions may also consider lack of trust or difficulties to agree on goals or desired ways to act. Moreover, there might be dysfunctions caused by different points of view by the actors in V2C-process. Venturer does not always speak or understand economics or capitalist does not understand technical finesses. The role of V2C-actor is to bring those two worlds closer to each others.

As presented above the idea of the logic of social capital is easily comprehended, yet it requires more analysis to gain normative results. The notion of existence of social capital is sufficient if the scope and motivation to activity does not require management of social capital or the system based

on it. On the other hand, the functionality of the activity system is the key phenomena. This paper was a conceptual delineation and an attempt to tackle one of the most important catalysts of company growth. Future research on the issue of this paper level should concentrate on following themes in empirical level beyond description: How social capital exists in the context of growth venture? What are sources of social capital to different operatives? How does structural, dimensional and cognitive social capital affect the growth company process? What is the role of social capital as “glue” in activity system? How does social capital affect the dynamics of the activity system? And, how transfer of intellectual capital can be measured and managed?

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Views and practices on inter-organizational learning in innovation networks

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Abstract — In this paper, the aim is to study inter-organizational learning in innovation networks. We will particularly concentrate on different currently important or increasingly important approaches and views on organizational learning which are particularly relevant from the standpoint of networked innovation. The approaches can also be considered to be rather fundamental and general perspectives that lie behind many other learning perspectives. We aim to analyze the different learning approaches and evaluate their suitability in various situations and conditions of innovation networks in particular. We also suggest some practices in the case of each learning approach.

Keywords — Learning, inter-organizational learning, innovation, network

I. INTRODUCTION

In recent years, effective learning and knowledge generation have been acknowledged to have an important effect on successful innovations and innovative processes in organizations.

Since the research and development activities of organizations are increasingly organized in networks of several participants from outside the organization, innovations in product or service development are born especially in the boundaries that combine different areas of expertise and operations [1]. These networks typically consist of parts of several separate organizations working together but in distributed locations. They need to be in constant contact with each other to be able to coordinate the innovation activities.

This form of organizing in networks is challenging for the participants on both organizational and individual level for many reasons, particularly from knowledge creation and sharing point of view. The knowledge creation, information gathering and sharing activities within innovation networks have a great importance, since they help the organizations to learn about and from each others. The organization's learning capabilities also have crucial importance in generating innovations [2]. Learning enables the organizations for example to renew themselves, and to keep up with competition. Furthermore, learning faster and more effectively than the competitors may be the only source of

sustainable competitive advantage in competitive markets [3].

As the amount of actors in a network grows and the changes in the environment become faster, the complexity of the innovation process increases significantly. This, in turn, increases the need for effective learning. For example in industries which have been described as highly information intensive and where changes in the operating environment are fast, the ability to learn effectively in a network can be very important.

The theories of organizational learning are in this study extended to particularly discuss organizational learning in a wider setting, between several organizations and organizational networks or partnerships. The applicability of organizational learning to the inter-organizational level is a starting point for this study, although in the inter-organizational and network environment the learning process may be significantly more complex to be managed.

Inter-organizational learning and learning in networks can be seen as complementary views, so that generally, inter-organizational learning can mean learning that takes place between any two organizations, e.g. also competitors, and learning in networks takes place between several participants operating in a more or less formal partnership. Another feature in learning is that it is either based on one partner learning from the other(s), or the partners create something new together and learn something that is new for all of them. Learning together in a reciprocal learning alliance is said to be more effective and faster than learning alone, enabling also faster results [1].

In this paper, the aim is to study inter-organizational learning in innovation networks. We will particularly concentrate on different currently important or increasingly important approaches and views on organizational learning which are particularly relevant from the standpoint of networked innovation. The approaches can also be considered to be rather fundamental and general perspectives that lie behind many other learning perspectives. We aim to analyze the different learning approaches and evaluate their suitability in various situations and conditions of innovation networks in particular.

First, to have an overview of learning in networks, the paper presents several fundamental learning types, based on division between behavioral and cognitive learning. In the

next chapter, selected important approaches of organizational learning from the network perspective are introduced and evaluated according to their emphasis on the behavioral and cognitive components of learning as well as in respect to their similarities and differences. The suitability of each theoretical approach for various situations or conditions in inter-organizational innovation networks is discussed, and some preliminary ideas on practices to support effective learning in innovation networks are proposed.

The results of the paper contribute both to academic community and practical innovation management, since the subject has not been studied very exhaustively and the present literature is rather scattered and ambiguous despite recent growing interest in organizational learning and innovation processes.

II. TYPES OF ORGANIZATIONAL LEARNING

Organizational learning and various organizational learning approaches can be thought to consist of and be based on some basic or fundamental concepts and types of learning. Such concepts are briefly introduced in this chapter.

A. Behavioral and cognitive learning

In pedagogical literature mainly concerning learning on an individual level, learning theories have traditionally been divided into two different categories, depending on how learning is seen to take place. According to behaviorist view, learning requires an observable change in behavior. In the cognitivist view, however, an explicit change in behavior is not necessary for learning to have occurred. The cognitivists state that a change on the cognitive level, potentially leading to a change in behavior, is enough for learning to have occurred. A change in behavior can also be a result of something else than learning, i.e. mere adaptation to the situation without any lasting impact. The corresponding theoretical views are named behavioral theories of learning and cognitive theories of learning.

As a result, on an organizational level there are also rather diverse views on the topic of when an organization learns. One rather common perspective in literature is that organizations learn when their knowledge in the form of rules and standard operating procedures are changed [4], see also [5], i.e. their actual behavior changes. From another perspective, information processing perspective, an organization or another entity learns "if, through its processing of information, the range of its potential behaviors is changed" [6]. Drawing from this, Sinkula [7] does not view overt change as a necessary condition for learning to have occurred, nor does he view actual decision making as a necessary condition for learning.

B. Single loop and double loop learning

Several models on organizational learning have been presented in the literature [8],[9], [10],[11]. One of the most well-known is developed by Argyris and Schön [8]. This basic model of organizational learning describes two

levels of learning, the single loop and the double loop level. The basic premise here is that organizations learn and make decisions and adjustments often through the mechanism of feedback [4]. Argyris [12] states that whenever an error is detected or corrected without questioning or altering the values of the system, it is defined as single loop learning. Double loop learning occurs when the mismatch in the system is corrected by first examining and altering the governing variables of the system, designating changes in organizational processes and structures, while according to McKee [13], double loop learning is based on questioning the existing structures, norms and values. According to Argyris [12] both types of learning are needed in organizations. He concludes that where single loop learning is mostly addressed to the simple and operative actions, double loop activities are related to the complex and strategic organizational processes, which often control the effectiveness of the system.

The needed type of learning needs to be considered in innovation context, since different kind of objectives in the development work lead to different kinds of requirements for learning. The needed type of learning always depends on the situation, since new and radical innovations are possible with double loop learning that challenges the mental models of the actors, whereas sometimes single loop learning might be enough. So the optimal level of learning has to be defined for each situation in order to learn effectively.

It is important that an organization is able to utilize both types of learning and define the appropriate level of learning, depending on the situation. It can be said that in creating innovations, the single loop, corrective learning is sufficient for incremental improvements, but to achieve radical innovations, the organization must also have the ability for double loop level learning [13]. Adjusting this idea to include a partner relationship or to larger networks of several participants, this means that the network as a whole needs to have the ability to utilize both levels of learning. In other words, they should be able to correct their actions based on experiences, but also be able to question the foundations of the common beliefs and norms. This requires, that a common understanding and interpretation of the basic operating rules exists between the partners.

C. Framework for organizational learning types

Nemeth [14] presents a framework for different types of organizational learning, originally developed by Crossan in 1991 [11]. In this framework, cognitive change and behavioral change are combined as different axis of a quadrangle, and depending on the type of learning, cognitive and / or behavioral changes take place. The framework is illustrated in Figure 1 and explained in more detail according to Nemeth [14] in the following.

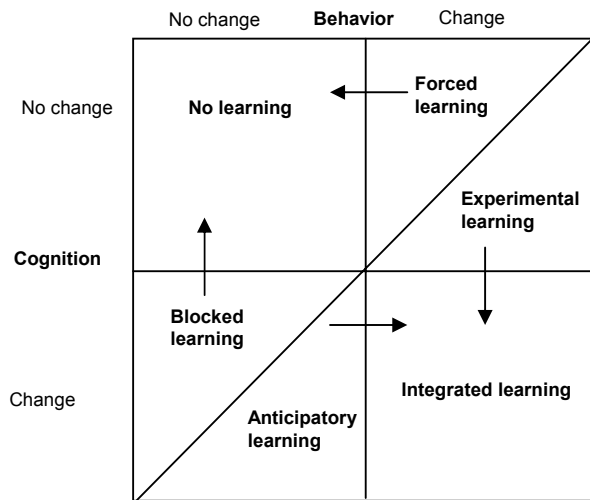


Figure 1. Types of organizational learning according to cognitive and behavioral change. [14], original model presented by Crossan [11].

When both cognitive change and behavioral change are missing, the framework suggests that no learning has occurred at all. On the contrary, when both cognitive and behavioral changes happen, this is seen as integrated learning. There are also different degrees of cognitive and behavioral change pictured in the other quadrants of the Figure 1, as well as differences in the durability of the changes that are the result of learning. Integrated learning can be seen as the most desirable, because its effects are relatively permanent.

Forced learning, in the top right section, occurs when there is a change in behavior but no cognitive change. The learner has been forced to change but does not change its own cognitive models. In experimental learning, the learner suspends its beliefs to try a new behavior. If the experience with the new behavior is positive, experimental learning can develop into integrated learning where the change in behavior also leads to a rather permanent change in cognition.

Blocked learning, in the lower left section involves cognitive changes that do not lead to behavior changes, because some conditions exist in the organization, that prohibit the change in behavioral level. Blocked Learning cannot be observed from outside, and may not even be conscious. Anticipatory learning, in contrast, has changed the learner's cognition and may result in a change in behavior or actions later, and therefore change into integrated learning. This means that the organization has some internalized knowledge that it recognizes as potentially useful.

Integrated learning, as described above, is learning that combines both cognitive and behavioral change. To achieve sustainable changes as a result of learning, there is a need for a balance between both cognitive and behavioral components of learning.

The importance of this framework is based on the knowledge that different types of learning exist that combine the elements of behaviorism and cognitivism, and that they can be used to achieve different types of

organizational goals. Integrated learning is seen as the predominant type for lasting effects and thus might be desirable, but there are conditions in which forced learning or anticipatory learning might work best in an organization and be more suitable to achieve the wanted results.

When considering innovation activities in networks of organizations, it becomes important to recognize the need for different types of learning as well, and which type of learning would be most suitable for the situation of the innovation network.

III. VIEWS OF INTER-ORGANIZATIONAL LEARNING

In the following, several different theoretical views on organizational learning that are seen as important from inter-organizational perspective will be presented. Finally, the theoretical views are combined with the previous framework of different types of learning, and the implications to efficient learning in networked innovation will be discussed.

A. Organizational learning theories and approaches from inter-organizational perspective

All of the selected different views on inter-organizational learning presented in this paper (see Table 1 in the Appendix) are often highlighted in the literature related to organizational learning, or specifically learning in networks. They have been referred to by many different authors and have gained attention in the areas of innovation and networks. They can be regarded as currently important or rising theories or viewpoints on learning, they all have a significant amount of empirical research behind them that has proved them to be valid in the scientific perspective, they can be considered to be rather fundamental and general perspectives that lie behind many other learning perspectives, and they have been published in various important academic journals. Also we are deliberately including in this study different types of views to highlight the differences that they have and to have possible implications from a broad spectrum of views.

Conversion of explicit and tacit knowledge [10], [5] is based on the idea that the key to knowledge creation is in the mobilization of organizational tacit knowledge, and to enable this there is a need for conversion between tacit and explicit knowledge types in the knowledge creation processes. Knowledge creation processes between explicit and tacit knowledge are needed also between organizations, and should be designed from the beginning of a network.

Exploitative and explorative learning [15], [16] says that organizational learning occurs primarily via organizational routines (i.e. actions, procedures, norms, and models). According to Levinthal and March [15] organizational learning should aim to cope with the problem of balancing the competing goals of exploration, i.e. the development of new knowledge, and exploitation, i.e. exploiting current information, knowledge and organizational competencies. Much of this knowledge is embedded in the different organizational routines and procedures. Between

organizations and in networks, it should be noted that the importance of exploitation and exploration varies dynamically and dialectically in the different stages of the network relationship.

Absorptive capacity, relative absorptive capacity [17], [18], [19] This view is based on the similarity of previous knowledge to the new knowledge. Previous knowledge enhances the learning of similar knowledge, and learning is most effective when the new knowledge to be assimilated is related to the existing knowledge. In a network, the greatest potential for learning comes from learning from teachers with similar basic knowledge but different specialized knowledge. Routines can be made more effective by enhancing partner-specific (ability to absorb knowledge from specific partner) or relative absorptive capacity.

Organizational memory [20], [21], [22] Organizations are assumed to create, use and store information and knowledge in a similar way as individuals do. Learning occurs via doing and experiencing, and is stored in organizational work and core processes, as well as products, services or other constructed artefacts. Thus, between organizations, the creation of inter-organizational routines (formal or informal, e.g. social or business), and creation of formal and informal networks as well as common databases and other forms of storing knowledge is important.

Systems thinking [9], [23], [4] Interactions and interdependencies are an important focus of interest in this approach to learning, and feedback is an essential prerequisite for effective learning. Capability of systems thinking enhances the capability for double loop learning. Senge [9] defines the learning organization as an organization that is continually expanding its capacity to create its future. The capability to innovate and being innovative, as well as learning from the future can be therefore seen as a fundamental element of learning organization. It is important to recognize the whole structure of an organizational system and also to identify virtuous and vicious loops. In a network, the partners should have a common and in-depth understanding of their mutual interdependencies and the larger system they are part of. Continuous, regular feedback and approaches that support the utilization of feedback are important.

Dynamic capabilities [24], [19] This approach is based on the ideas of the resource-based view of the firm and complementary assets, and the continuous ability to renew and adapt competencies dynamically according to the changing situation through learning. From a network point of view, an organization's critical resources that are rare, valuable, complementary and hard to imitate may extend beyond firm boundaries. In this view, partnerships enable inter-firm learning by helping to recognize dysfunctional routines and develop them.

B. Organizational learning views in the cognitive / behavioral framework

In the following Figure 2 we have located all of the above mentioned views on organizational learning in the cognitive / behavioral framework presented in the previous

chapter, according to the authors' perspective on how the two components are shown in each view. This is done to reflect the fundamental orientation of each theory or view, according to whether they implicitly or explicitly emphasize the change in behavior or cognitive level. There are of course many ways to classify the presented views and so the locations of the views in the figure are not exact but give an idea on the type and emphasis of learning they most likely resemble. Part of the views can be classified under multiple types of learning, and the important fact is that organizations should be able to combine and utilize several of the learning views simultaneously. The reasons for locating each view in the framework are described in the following.

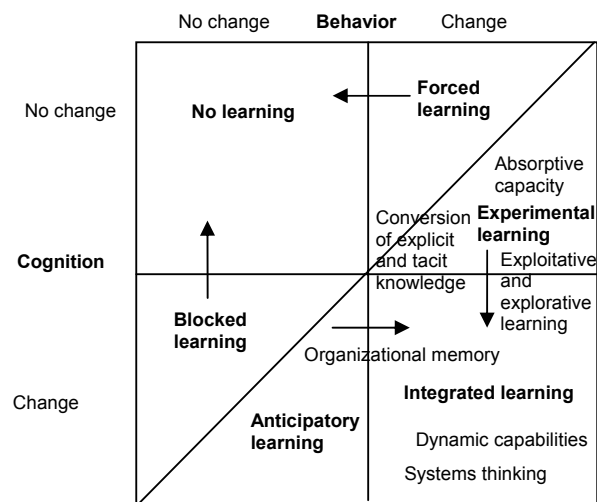


Figure 2. Location of selected views on organizational learning within the cognitive / behavioral framework.

Starting from the top right corner of the quadrangle, where changes occur mainly in behavior but not so much in cognition, single loop learning described by Argyris & Schön [8], can be seen as forced or experimental learning, since it is based on changing behavior without a change in the existing mental models (cognition).

Conversion of explicit and tacit knowledge [10] can be classified into any of the learning types that change the behavior of the learner or the learning organization(s), depending on which stage of the conversion process is active. Thus, this view can be classified as forced, experimental or integrated learning.

Absorptive capacity and relative absorptive capacity view [17], [18], [19] changes in the first stage the behavior of the organizations, and if the experience is positive then also cognitive changes can happen. This is natural for experimental learning.

Also exploitative and explorative learning [15],[16] can be seen similar to this, although it might more easily turn into integrated learning, so it is pictured nearer to this category.

Moving to the lower right corner of the quadrangle, where both types of changes are possible, double loop learning, as seen by various writers [8], [9] changes both

the cognitive framework and the behavior of the entity in question, so it is easy to see as part of integrated learning type. However, it can also be seen as anticipatory learning, since the changes in behavior might come later than the change in cognition, meaning that it takes time to act on the change.

Organizational memory view [20], [21], [22] is similar to double loop learning in the sense that creating a common organizational memory form also the cognitive capacity is changed, and this enables changes in behavior, either in the same time or at a later time. In any case, the organization has created some valuable and useful knowledge it might utilize.

The dynamic capabilities view [23], [19] is in this model located as an integrated type of learning, because it requires on-going evaluation of the cognitive, mainly knowledge based resources of the organization, and also immediate changes in the behavior of the organizations according to the results of the evaluation.

Systems thinking view can be located as integrated learning, since it is a holistic approach to organizational learning which changes both the cognitive and the behavioral level [9]. Senge [9] emphasizes seeing and changing the structures (mental models, cognitive level) behind the actions (behavioral level) and Sterman [24] sees feedback as a requirement for learning to take place.

C. Features of inter-organizational learning

As a synthesis from the presented views on learning, we have identified some fundamental features that can be found from several of the above described learning views. It seems that the similarities and differences of the selected views on learning in organizations and between organizations can be described at least with regard to following factors, and these issues should be answered when designing the learning approach in organizations.

Feedback process. Feedback is seen as a requirement for learning in many different approaches, but in some views it is left without attention, so it is not seen a critical requirement. However, in an organizational setting and especially between organizations, it is an important factor to take into account.

Routines. The results of learning can be stored in the behavioral routines of the organization or network. The routines developed can also be seen as an outcome of the learning process, not only as a feature of the process.

Mental models and assumptions. In some views, the existing mental models and underlying assumptions are changed as a result of learning, or in some models they are left unchanged. The situation of the organization defines how much it should possess the ability to question the existing structures.

Knowledge integration. There are similarities and differences between different views on how they see the method of knowledge integration, how knowledge is integrated from individual to organizational and finally inter-organizational level.

Coordination. How is the knowledge acquired by learning being coordinated, in order to allow efficient use

by different members of the organization? Here the basic choices are either centralized or distributed coordination. The same applies in the case of networks of organizations, and is often complicated by the matter of knowledge ownership between the partners.

Knowledge on "Who knows what?". Since the expertise and mainly tacit knowledge is distributed in the organization, between persons working there, the meta-knowledge on who possesses which kind of information is valuable and helps in utilizing the knowledge. In networks of organizations, this knowledge has to be somehow managed and transferred between the organizations and between individuals working in the separate organizations.

IV. INTER-ORGANIZATIONAL LEARNING IN INNOVATION NETWORKS

A. Suitability of the selected learning views in different situations

We cannot directly recommend any single approach to be used in specifically certain types of situations, industries or other contexts in innovation. However, each studied approach covers some important aspects of learning, and the different views and theories emphasize rather different types of approaches that should be drawn attention to and focused on when organizations and networks aim to develop their learning abilities in innovation. No single standpoint or approach alone can provide a basis for effective learning in the case of any individual organizational network or any individual situation.

Effective learning with sustainable, long-term impact on organizational competitive advantage can be achieved most likely when various aspects and standpoints of learning are simultaneously taken into consideration when planning inter-organizational network cooperation. However, we have more carefully analyzed when certain approaches of learning should be emphasized in the facilitation of learning in networked innovation.

Roughly speaking, the conditions affecting the learning approach emphasis can be divided into two categories:

- network-specific factors (internal for the organizational network; factors that the network and the individual network participants more directly have influence on)
- factors concerning the business environment of the organizational network (external for the network; factors that network has no influence on, or can influence only / mainly indirectly)

In this chapter, we have evaluated the described learning approaches and their interrelationships with factors internal and external for the network.

Conversion of explicit and tacit knowledge. Since this (or 'Nonakan') approach emphasizes the mobilization of tacit knowledge, its use should be emphasized particularly when a network operates in a field or an industry in which a significant amount of existing knowledge is tacit-based, or in which tacit knowledge has a particularly large importance for the business. Such cases include knowledge-intensive industries like ICT and biotechnology.

For another thing, industries which experience significant effects due to generation-change (such as the Finnish forest industry), or are in a fear of losing critically important and rare tacit knowledge for instance in the form of rare experts or other specialist due to e.g. pensioning or the result of head-hunting, should focus on Nonakan types of learning approaches. Such cases include e.g. hi-tech SMEs with narrow specialization and few centrally important experts. Furthermore, networks that for certain reasons involve significant barriers for transferring tacit knowledge, such as international multi-cultural business networks (see e.g. [25]), or virtual or “imaginary” organizations [5], and other networks which involve participants with large cultural and/or cognitive distance like organizations with clear focus on utilization of virtual teams [26] from different organization-cultural or other cultural backgrounds should focus on this approach.

Exploitative / explorative learning. According to Gilsing and Nooteboom [27], exploitation implies the focus on incremental innovations and codified knowledge, as well as rather formal, stable and delocalized networks, while exploration usually implies more focus on radical innovations and tacit knowledge, together with informal, unstable / dynamic and relatively locally embedded networks. The above focus areas should also be strongly reflected in the way that organizational and inter-organizational learning activities are carried out: for instance, exploitation requires relatively low frequency of interaction, contract or institution-based trust and single loop learning, while exploration relies more on higher levels of interaction, personal or relation-based trust and double loop learning [27]. The balance between exploitative learning and explorative learning and the related learning-oriented activities should be continuously re-evaluated, as the exploitation and exploration are dialectical and dynamic processes. In particular, the re-evaluation should be carried out regularly when the networked operations or the network maturity, or the business and the markets of the network, or the products of the network develop rapidly. According to Nooteboom [16], in networks of exploration the future uncertainty of structural change should be taken into account, this requiring the innovation of new business concepts, products, and services [28]. In networks emphasizing exploitation of present knowledge, the benefits of more static efficiency are sought after.

Absorptive capacity (AC). The AC-based or relative AC-based learning, and the commonality of potential partners, should be given particular note for when companies or networks are planning on outsourcing some of their R&D-related activities or competencies (e.g. when globalizing their activities and R&D), and e.g. when an organizational network or its individual participants are in need to look for new ways of co-operation or suitable new close partners either from inside or outside the network. In such outsourcing situations, there is also a risk of outsourcing a part of a firm's and networks learning capability (i.e. absorptive capacity). In addition, according to Lane and

Lubatkin [18], relative AC may be useful also in leveraging a firm's core competences across its business units especially in complex, transnational corporations (see [17], [18]).

Organizational memory. Generally speaking, the development of various forms of organizational and common inter-organizational memory forms is important in all network forms that really aim to adopt a networked way of operation in innovation. However, e.g. according to Koistinen [22], when the complexity of commonly developed products or the business setting increases significantly, there is a need to emphasize particularly the development of business and social routines as the specific forms of organizational memory. On the other hand, for instance when the roles and the core competencies are not carefully determined and understood collectively, or they are very challenging to be defined explicitly considering the overall goals of the whole network, the organizational memory form called transactive memory (who knows what in the network) should be carefully emphasized in the development of the network. An example of a networking form in which the role of transactive memory is further emphasized is “the communities of practice” [29].

Systems thinking. Systems thinking approach is particularly relevant when the organizational network is complex, it includes various and complex interrelationships between network actors, or the boundaries of subsystems within the network or larger systems outside the network are not well defined and understood by the network participants. The recognition and definition of virtuous loops should be given attention to when the competition is hard, and when there is a significant need to support the recognition and creation of various sources for sustainable competitive advantage, and the recognition of vicious loops for instance when innovative activities and product development are jeopardized by continuous fire-fighting and emphasis on short-term instead of long-term planning, for instance in networks characterized by complex multi-project environments [30]. In addition, systems thinking approaches should be noted for when the network has a need to shorten development time by moving into more parallel type of innovation processes and followingly, when the related product and process architectures should be modularized in order to minimize the inter-dependencies and communication needs during innovation projects, for instance when the participants in networked innovation activities are located in geographically distant places or different countries. Double loop learning should be emphasized instead of mere single loop learning particularly when there is a clear need for more radical innovations [13] in the network firms, for instance in the case of very novel industries / markets, or very mature industries which feel the need for growth by new types of innovations.

Dynamic capabilities. This approach to learning should be emphasized particularly when the networks face markets, competition and business environments that are relatively highly turbulent, weakly predictable, and fast-

changing [23], such as in the electronics and ICT industries. Also when the capabilities and resources of the network are not easily coordinatable, for instance when it is not easy to define the core competences of individual network participants for efficient definition of the expertise-based roles of the network, this approach should be specially given attention to.

B. Practices for supporting inter-organizational learning in innovation

In the following, we have collected some examples of general practices or actions in organizations and networks that can be seen as important and that are typical for each of the selected organizational learning views, especially applied to inter-organizational learning and innovation (see also Table 1 in the Appendix). These practices can be used for supporting effective inter-organizational learning in innovation activities.

Conversion of explicit and tacit knowledge highlights the importance of mobilization of tacit knowledge and building the processes for knowledge creation. This means that the participants in the network need to be able to identify the important tacit knowledge from the network point of view, and to create both formal and informal processes to enable the flow of information. Formal processes can be meeting procedures, documents or instructions, or for example documented objectives for learning. Informal processes give the possibility to share knowledge in an informal setting, for example events that only focus on people getting to know each other, and these can even be organized by the employees themselves.

Exploitative and explorative learning assumes that the routines needed for learning change with time, and the suitable balance between exploration and exploitation needs to be evaluated in different stages of the network development. Learning also requires commitment between the partners, to keep the relationship alive.

Absorptive capacity view implies that the similarity of the knowledge base plays an important role in learning between partners, so the identification of own basic and specialized knowledge gives a starting point to evaluate similarities between partners. Also future goals and plans should be considered, and maybe modified to find possible common goals in the network.

Organizational memory view sets the creation of a common memory for the network in different forms such as routines and databases as a goal, and thus every member of the network should be able to identify and describe its current processes and routines. As part of the organizational memory, also the knowledge on who possesses certain kind of knowledge (transactive memory) is important. In a network, developing new processes and routines is important, not only copying existing processes.

Systems thinking approach emphasizes seeing the bigger structures, and in this case it means the ability to describe the network and the role of each participant as well as interdependencies between partners. The aim is to establish a shared understanding of the network to allow efficient learning, and also establish feedback processes in different

stages of the innovation process. The identification of virtuous and vicious loops can also be utilized. In innovation activities, it is possible to design the product, service and process architecture together with other network partners to minimize interdependencies and communication needs during innovation projects, for instance when the participants in networked innovation activities are located in geographically distant places or different countries

Dynamic capabilities view requires that the critical and valuable resources in the network are identified, also from the network point of view, and re-evaluated regularly to enable necessary changes. Learning is based on improving and developing routines and this can also be done together with the partners.

V. CONCLUSIONS

Organizations' ability to learn faster and better has become an essential element of competitive advantage. The increasing interconnectedness and complexity of the business environment requires effective learning, both within and between organizations.

In the pursuit of a competitive advantage, learning in the context of innovation and innovation-related networks is a particularly challenging but increasingly more important task for companies. Efforts put into the development of inter-organizational networks that support effective learning in innovation can provide as much as a basis for a relatively sustained competitive advantage for companies. In the extant literature, we have found very few articles on the subject of learning in inter-organizational networks.

In this paper we have studied organizational learning from the standpoint of inter-organizational networks and innovation in particular. Instead of exploiting just one standpoint on the topic, we have studied this subject from the standpoint of rather diverse views and theories.

In the literature, there are diverse views on the concepts of learning and organizational learning. We selected and described different currently important or risingly important approaches and views on organizational learning which are particularly relevant from the standpoint of networked innovation, as well as having a significant amount of empirical research behind them that has proved them to be valid in the scientific perspective. The approaches can also be considered to be rather fundamental and general perspectives that lie behind many other learning perspectives.

We then analyzed the different learning approaches and views a) concerning their fundamental learning orientation in respect to cognitive and behavioral learning with the help of an analytical and illustrative framework by Crossan [11], and b) concerning their suitability in various situations and conditions of innovation networks in particular. Concerning the managerial perspective, we also suggest rather pragmatic guidelines to be considered in each type of studied learning approach (see also Table 1 in the Appendix).

Since innovation is a particularly challenging and

important task or process from the standpoint of knowledge creation and innovation, several standpoints should be recognized and used when aiming at effective learning. Attention should be focused on the effective facilitation of learning particularly in information and knowledge intensive industries, the competitiveness and future of which depend on their ability to learn and to renew themselves.

On the basis of this study, it seems that effective learning with sustainable, long-term impact on organizational competitive advantage can be achieved most likely when various aspects and standpoints of learning are simultaneously taken into consideration when planning interorganizational network cooperation.

Even though we cannot directly recommend any single approach to be exclusively used in any certain types of situations, industries or other contexts in innovation, we found clearly that several network-specific internal and external factors affect the suitability and emphasis of selected inter-organizational learning approaches. Each studied learning approach seemed to cover some important aspects of learning, and the different views and approaches emphasize rather different types of organizational learning that should be drawn attention to and focused on when organizations and networks aim to develop their learning abilities in innovation.

From the standpoint of effective knowledge creation, accumulation and learning in innovation networks, it is important for managers to clarify network-specific and external factors that affect the choices of suitable learning approaches and their mutual emphases, and attempt to build, accordingly, suitable learning practices into their organizations.

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APPENDIX / TABLE 1

DIFFERENT VIEWPOINTS ON INTER-ORGANIZATIONAL LEARNING AND THEIR IMPLICATIONS AND SUPPORTING PRACTICES IN NETWORKED INNOVATION (modified from [28]).

<i>View / perspective</i> (Authors)	<i>Implications for inter-organizational learning:</i>	<i>Implications for networked innovation from the standpoint of effective learning:</i>	<i>Examples of typical/specialized practices to support inter-organizational learning in innovation</i>
Conversion of explicit and tacit knowledge (Nonaka & Takeuchi, Holmqvist)	Knowledge creation processes between explicit and tacit knowledge are needed also between organizations.	Knowledge creation processes should be built-in explicitly in both formal and informal innovation processes.	<ul style="list-style-type: none"> - Identification and mobilization of important tacit knowledge for the network - Formal processes: meetings, written documents and instructions, objectives for learning - Informal processes: possibility to share knowledge in informal setting, employee-organized activities
Exploitative and explorative learning (Levinthal & March, Nootboom)	Balance between exploitation and exploration varies in the different stages of the network relationship.	The importance of routines for exploration increases as a source of innovation.	<ul style="list-style-type: none"> - Identify and evaluate the needed balance between explorative and exploitative routines in different stages of the relationship, first need for more explorative and then exploitative learning - Learning requires commitment, keeping the relationships alive on personal and organizational level
Absorptive capacity, relative absorptive capacity (Cohen & Levinthal Lane & Lubatkin Dyer & Singh)	Greatest potential comes from learning from teachers with similar basic knowledge but different specialized knowledge. Routines can be made more effective by enhancing partner-specific absorptive capacity (ability to absorb knowledge from specific partner).	Partners should possess similar type of knowledge bases, similar organizational structures and compensation policies, similar knowledge-processing style, as well as similarity in the companies' commercial objectives.	<ul style="list-style-type: none"> - Identification of basic and specialized knowledge by taking stock of the existing knowledge base => possibility to evaluate similarity - Talk about objectives and future plans with the innovation partners; find possible common present and future goals for network participants - Identification of one or more suitable participants as possible teacher
Organizational memory/ (Walsh & Ungson, Moorman & Miner, Koistinen)	Creation of interorganizational routines, and creation of formal and informal networks as well as databases etc.	Creation of common, commonly understood innovation processes and routines, as well as the creation of other important memory forms.	<ul style="list-style-type: none"> - Creation of common organizational memory for the network as a goal - Model and describe current processes and routines of individual organizations, as well as formal databases - Transactive memory: important to learn efficiently who knows what. Centralized / distributed control. - Instead of copying processes from others, try to create new processes together
Systems thinking (Senge, Sterman, Argyris)	Common and in-depth understanding of their mutual interdependencies and the larger system they are part of. Continuous, regular feedback and approaches that support the utilization of feedback are important.	Enables questioning the existing mental models as well as creating radical innovations. Identifying the virtuous or vicious loops in innovation processes and taking advantage of the loops in questioning the present thinking as well as in creating new ways to innovate.	<ul style="list-style-type: none"> - Describe the network and its objectives together to establish a shared view of each participant's role in the network - Recognition and description of interdependencies of network participants - Establish feedback processes in different stages of the innovation process - Design the product, service and process architecture together with other network partners to minimize interdependencies and communication needs during innovation projects, for instance when the participants in networked innovation activities are located in geographically distant places or different countries - Identification of virtuous / vicious loops
Dynamic capabilities/ (Teece & Pisano & Shuen, Dyer & Singh)	Firm's critical resources (rare, valuable, complementary, hard to imitate) may extend beyond firm boundaries. Partnerships enable inter-firm learning by helping to recognize dysfunctional routines and develop them.	Identification of critical resources in innovation process. Strategic integration of complementary capabilities in innovation networks leads to better chances for radical innovations.	<ul style="list-style-type: none"> - Recognize and describe own capabilities and critical resources, particularly knowledge based resources from the network point of view; continuous re-evaluation - Develop routines together with partners