

# **Strategic Learning and e-Business Solutions in a Pharmaceutical Organization.**

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## **Abstract**

This paper analyzes how e-business solutions facilitate strategic learning in a globally operating industrial organization. Because of confidentiality, the case company is called here The Pharmaceutical Company. The theoretical framework consists of strategic composition<sup>®</sup>, an interpretation of autopoiesis theory (the theory of self-producing systems). The framework emphasizes both interaction with the business environment and self-referentiality to ensure efficient utilization of accumulated knowledge.

The Pharmaceutical Company is a healthcare company that manufactures and markets pharmaceutical products and services for certain illnesses. It is not only a world leader in the care of one serious illness but also has a leading position in some other pharmaceutical product areas.

The Pharmaceutical Company has created comprehensive web-based solutions that are centrally coordinated, locally maintained, and enable interactive communication between the company, consumers and professionals.

Development of these solutions has resulted in much of the tacit knowledge becoming explicit, thus facilitating organizational learning both at the coordinating and local levels. The Pharmaceutical Company's web solutions have also facilitated interaction with consumer and professional communities, as well as provided a medium for education. Many parties outside the company have thus become more firmly involved in the learning processes and have gained the opportunity to improve their knowledge.

Although many regulations prevent using the information produced by the system, even that information available within the limits of the regulations has remained underutilized. The Pharmaceutical Company has many potential opportunities to learn from the interaction offered by its web-based e-business solutions.

## **1. Introduction**

### **1.1 E-business solutions as enablers for strategic learning and knowledge management**

For many firms, the major motivation for implementing e-business solutions is to increase efficiency and service capability, and to enable new business processes. This paper assumes that e-business can also increase innovativeness, learning and a capacity for renewal that are increasingly important factors affecting the competitiveness of a firm.

However, it is not clear how firms utilize e-business solutions for learning, knowledge creation and renewal. Motivation, opportunities and methods to apply e-business solutions may vary widely across various businesses. The firms could learn from their customers and markets by tapping into potential information and knowledge that can be channeled through e-business solutions. They could also learn from each other, by sharing knowledge about their plans, progress, experiences, and best practices. Big corporations have relatively good opportunities to acquire knowledge about feasible solutions outside the firm, to test them and to invest in them.

The theoretical background and key concepts, such as autopoiesis theory, the living composition<sup>®</sup> model, major knowledge flows, boundary elements, e-business and knowledge management will be defined briefly in Appendix 1.

## **1.2 Research project**

This paper is part of the research project "Strategic Management of Innovativeness, Renewal Capability and Knowledge, and the Role of e-Business", which aims to investigate three different internationally operating organizations that utilize e-business in their business relations. The project analyzes the following organizations:

- the case company of this paper is a globally operating pharmaceutical company that has developed a comprehensive and culturally sensitive business-to-consumer e-business solution. E-business solutions are also used to connect the firm with professionals.
- Metso Paper (part of Metso Corporation) is an example of a global corporation that is developing e-business solutions to support the

product life cycle of the paper machines supplied to customer firms.

- Outokumpu Copper Products OCP Europe - Electrical Power & Components Unit, has created a sophisticated business-to-business extranet solution for a relatively small number of customers. The customer relationships are based on long-term contracts, and interaction with them is complex by nature.

These companies were selected among internationally recognized innovators and frontrunners in the strategic application of e-business. The purpose is to create new knowledge and to facilitate benchmarking and learning from their experiences. They differ considerably from each other in the methods used to apply e-business.

The study applies a qualitative multiple-case study methodology, which can convey rich and dense data about complex, dynamic research phenomenon. Four persons were interviewed for this case study at Pharmaceutical Company eBusiness Department on June 7<sup>th</sup> 2002:

- Manager, eBusiness Department
- Project Manager, the communities' site
- Project Manager, the professionals' site
- Project Manager, an additional illness' site

The interviews were conducted in English, recorded and transcribed.

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### 1.3 Research question

It is not clear how firms utilize e-business solutions for their own learning and knowledge creation, and more importantly how they exploit e-business-enabled interaction with the customers and increased, more rapid access to new knowledge. Therefore, this study investigates two research questions:

*How does The Pharmaceutical Company learn and create new knowledge by utilizing e-business solutions?*

## 2. The Pharmaceutical Company

The Pharmaceutical Company is a healthcare company that manufactures and markets pharmaceutical products and services. It is a world leader in the care of a very

general illness, and also has a leading position in other product areas. The story of The Pharmaceutical Company started in the first decades of this century. The current company is a result of a merger. The company has production facilities in almost ten countries, and affiliates or offices in about 70 countries. The Pharmaceutical Company reaches out to almost 200 countries around the world. The company has about 20,000 employees.

The Pharmaceutical Company specializes in products and services for the treatment of a serious illness that can occur at all ages. The illness is becoming increasingly common in developed and developing countries.

## 3. E-Business Solutions at the Pharmaceutical Company

### 3.1 E-business strategy at Pharmaceutical Company

According to the manager of the eBusiness Department, the e-business strategy of The Pharmaceutical Company consists of three focus areas. One focus is corporate communication, which covers the corporate site and all the affiliates. The second area consists of websites that focus on patient communities and professionals, while the third area covers the products.

Although the content of Pharmaceutical Company's e-business solutions is basically local, it is based on shared structures and principles created at the eBusiness Department at the headquarters. The strong orientation towards localization allows for differences in culture and lifestyle, regulations, logistics, and other relevant aspects. In addition to the local pages, there is also an international version for the professionals' website.

We have the international one (version), yes. Because if we have people on the ground in each country we can include local events and local debate on the site, which we cannot do from the headquarters. Which is why we have the international one. But it needs some resources to maintain. And they are very expensive. (Project Manager)

The availability of Internet connections and the capability of the population to use it are improving, which has implications for the applications directed at consumers.

The challenge is Internet because most of the older people are not looking into the Internet today. But also that is changing. For example we can see that women in the age of 40 and up are looking into the Internet. Whereas the people over 60 years don't. But in the future people in that age will be familiar about the Internet and use it. (Manager)

The Pharmaceutical Company uses communities to increase the awareness of the company. The illness community is the largest one. ---. However, the representatives of Pharmaceutical Company emphasize that they are not allowed to collect information about the patients.

The heart of the e-business strategy is that the websites launched by Pharmaceutical Company are based on *a content management system*, which offers a useful user-friendly interface, where people can easily update the content if they have basic word-processing skills. The strategy also includes *local infomasters*. They are not technology specialists who do coding or maintain web services.

Local infomaster is responsible for moderating the community, making sure that there are always updated news on the front page and links to the interesting stories about local initiatives, facilitating the dialog and so on. That is a very important part of the site. And that's why don't call them the 'webmaster' which is the normal term, but an infomaster. We are more interested in a person with an information background or a journalist or something like that than a tech person. (Project Manager)

The website structure has become quite comprehensive, and the challenge is to ensure that consumers and professionals can find the right information.

We have been focusing on creating a lot of awareness and having a lot of sites in these areas and different countries. So right now we are in a situation where we have awful lot of sites. In each country they look similar and they got the same corporate visual identity (CVI). But now we are trying to re-think, because our corporate site has a lot of visitors. We have like 100.000 visitors a month. --- Right now I'm trying to focus on to find out how we can use what we have to get more traffic and to use all these sites in a better way, to link them together in a better way, so we can get our customers to the right places. So we are trying to re-think the portal or the corporate site and to use that as the main portal. (Manager)

The purpose is also to support the sales representatives in different countries where the regulations and cultures vary considerably.

### **3.2 Organizing e-Business Projects at The Pharmaceutical Company**

The eBusiness Department is a part of international marketing. The department has 13 full-time employees and 7 student workers. It coordinates the development of websites globally and provides the strategy. There is also

a group of about six persons in the US because they have special needs. The objective is that there is one web coordinator in each affiliate, but this is not always the case.

We have a central hosting of the web pages. We have a strategy trying to align the technology so that we're not having different content management systems in different countries. We are coordinating, trying to have a central platform. And it is our job to control that they are to the CVI. (Manager)

It can take ten years to develop new pharmaceutical products. The development process includes many phases, such as clinical trials. The development of marketing materials starts about three years prior to product launch. Therefore, the market research department works very closely with R&D. The eBusiness Department joins the process about one year before the launching of a new product in order to conduct communication planning. Each country is responsible for the local sales and promotion of products in individual countries, and the local managers are responsible for the launches. It therefore also makes sense that they manage their own campaigns. The websites form part of that campaign.

The department provides support for all the sites, but in principle it does not pay for the content. However, because some of the affiliates lack sufficient resources, the department has been working with the content as well as providing support. When implementing new project development and IT development, the department uses different web vendors, including The Pharmaceutical Company's IT department.

Corporate communication has responsibility for the public corporate website. The manager sits on the steering committee to ensure that the department can influence decisions concerning strategy for the new portal and other matters related to web services.

### **3.3 Architecture and infrastructure**

About 80 % of the Pharmaceutical Company's websites are based on Site Manager content management system, which is proprietary technology developed by a local software firm. The new development is taking place in a commercial system. Also other alternatives have been available. The content management market is not entirely mature market yet, and therefore The Pharmaceutical Company is working with several different systems. The purpose is to focus on off-the-shelf products that are supported by larger companies. The primary idea is that the system should be so easy to use that there is no need for technical persons but rather for journalists or communication person to work with the sites. (Project Manager)

### 3.4 The Pharmaceutical Company Websites for Patients and Patient Communities

The websites for patients are open to anyone in about 20 countries. The current version represents the third generation created since 1999. The eBusiness Department has developed a general platform or template and many different modules that the local affiliates can select and add on to their sites. All sites are published in the local language to enable local users to search and find information in their local language. There are also many cultural differences that have to be taken into account in the content of the webpages.

The websites do not include any recommendations for the patients. Instead, they provide patients with a tool to keep better track of their condition. All recommendations should come only from their own personal physician.

We are not collecting patient data, we only can use it to give the patient better information or better service. --- The person creating a profile (onto the website) has to explicitly tell if we can use the data. Otherwise the data is just locked and we cannot see it. But if we are allowed to look at the data we can check it to see how people use the site. --- We can use the patient's data for analysis and for developing new functionality of the site or whatever we find necessary. But today we don't use it. (Project Manager)

The webpages aim at creating user communities and facilitating interaction between The Pharmaceutical Company and the patients, as well as among the patients. The patients can be divided into two groups, each of which requires a different approach.

We are segmenting our consumers into groups, but mainly we have two groups. We have the **active patients** and typically they are people who are very active and do a lot of sports. They want to take care of their illness, they want to be able to perform. They also know about the illness. And they will go back to the doctor and try to influence and say "I have read about this product and this is something for me". And then you have another group, which is called the **more passive group**. (Manager)

The Pharmaceutical Company home page contains an '**I wish' theme**' with case stories about different patients from all over the world. They include statements such as "I wish no-one ever gets this illness again". The purpose is to demonstrate that the webpages are for the patients and that the company cares about patients and is involved in their stories, instead of just selling products.

The local front page typically contains much information, including a calendar of events, useful links, and

information about products and devices. The **library** (R&D) part of the site contains information about the illness.

Then you have a **dictionary**, the words people don't understand. The illness is quite complicated, there is a lot of complicated words and people can look at them here to see explanations for them. --- In this kind of site we have some **applications** as well. (Project Manager)

Users can create **personal profiles** and register information about themselves in order to use it in the interactive pages on the site. They can, for example, save their personal measurements in a **diary** and create a **scorecard**, as well as keep track of their doctors, specialists and all other persons involved in their health care. However, they only need to provide the information required to use or search that part of the site, in so far as it makes sense to ask information.

At this moment we are only providing graphs and so on, and the people have to do the conclusions about their illness themselves. (Project Manager)

All my values should be between certain values, within the green area. And if I have values below or over that, then I can see that this is not good. --- If the patients just use this tool as intended then they would be able to see some kind of development in their disease. --- This is part of the personal diary what we call the personal scorecard. The medical measures are interesting for the patients with this illness. And the patients can track this data. For instance they can set up a goal, and they can see how they are doing compared to that goal. If I get a "red traffic light" it means that I am in a high risk. We have some predetermined intervals where these values should be in according to the international diet lines to treatment of the illness. And if you are not between within these intervals then you would get these highlights, the red and yellow. (Project Manager)

As to the more **interactive parts** of the site, The Pharmaceutical Company has found that live chat is not easy to do when dealing with a relatively limited number of people. There is almost never anyone in the chat room. Therefore, the chat has been replaced by a moderated chat forum that is facilitated by the infomaster and the local affiliate.

Maybe the most successful module, especially in certain countries is '**ask the experts**' sites. In an affiliate, for example, 12 to 15 experts are connected to the sites as well as patients, doctors, nurses and all kinds of health care

professionals. And the users of the site can then ask whatever questions in life, and they send the questions to the site --- For example in one country the *infomaster* arranges a meeting with local specialists, and says that on Monday from 6 to 7 we have this chat with this person. And then people come and they discuss something with that person and they have questions and so on. But if we just have it as a local chat over time, then people drop in from time to time but there is never any real discussion. So it has to be a moderated chat with an interesting person. Otherwise it does not work. ... The other thing is the debate that it's separated into different topics. We have 'the café' and 'the children' and 'the young people' and 'the parents' at this moment. And then people just start discussions and share experiences and talk about their teenage kids and how they smoke and all the things they do that they should not be doing. --- People are interested in sharing their experiences and it just has to be started. (Project Manager)

Questions can be sent to the *expert panel*, with all questions being posted thereafter on the site together with their answers, since most of these questions can also be of interest to other users of the site. Thus, when submitting a question, users are always informed that all questions will be answered and all answers will be published on the website. The objective is to answer the questions within a week.

There are also many applications, such as a cookbook, that are useful for the patient.

I think we have a thousand recipes or something like that in English, approved by dietists and they can just take from these, have them translated locally and update. (Project Manager)

The web pages help in educating different types of patients. "We force the people to think themselves about their treatment, to improve their treatment".

And we have an interesting thing, it's a *quiz*, it's actually a *jeopardy about the illness*... and it's combining film and sport and music with topics related to the illness. And then it's a good way for teenagers and for young people interested in playing games to learn about the illness while playing. We have both a grown-up, a teen and a child version. (Project Manager)

The quiz is interrupted and I have a little *case story*. And based on this case I have to decide if I should take medicine, or should I exercise or whatever to get better. And then in this case I suggest that I need a little of juice. And then OK, that was right. And then I get back to the quiz. So at times the quiz is interrupted and you

have a case story where you have to decide something related to your therapy. (Project Manager)

This is *a game for smaller children*. ...And it's kind of based on the Tamaguchi idea. You have your own little Pet and you need to take care of it. You name it, so it is your own personal pet, it is called a Pet. And I can play with her, I can go roll skating. And there is a little game here. And all the time this Pet reacts, so I can always measure the indicators of her illness. I can go on the fridge. Now I give her some cheese and I measure again. And now it's better. ... And now the Pet is getting some of these symptoms of the illness. I can see the value is a way too high. And then I can give some medicine. So the Pet is taking some medicine. And this is basically a tool for the parents to play with the kids, basic things about taking medicine, doing other necessary things and a way to teach while you learn ... You also get emails from your Pet. And if you haven't been playing with your Pet for 10 days or something, you can get an email saying "I miss you, please come and play with me". (Project Manager)

In one country the site is focused on the *young people*. You can go in and there will be a movie about a guy - he is falling in love - how he is telling her he has this illness and so on. So, that's trying to focus with young people and how they live --- If you are a young person you know that you have to live with this for the rest of your life. It must be hard ... (Manager)

The '*Living with the illness*' sites contain lots of articles about the illness. The headquarters has made a basic pack of content for the site, and the local affiliate can add on to it.

In principle, the web pages do not include information about Pharmaceutical Company's products. Instead, they provide information about products in general.

And it is one of the core systems - CRM Customer Relationship Management systems - for the sales. We have learned from this that it is very hard job to sell things, that it is huge difference between marketing and sales. Because here the patient is not just buying books or cd's or things like that. Here they are buying things that they are putting into their own body. (Project Manager)

### 3.5 The Pharmaceutical Company's Websites for the Professionals

The "Illness information for the professionals" website is offered as a service from The Pharmaceutical Company

to health care professionals, such as physicians, nurses, pharmacists, and trainers. There is an international version, and a couple of national versions. The site contains professional information and research, such as up-to-date medical information, educational resources, and the latest research in the illness. An editor reads through medical journals and creates a short calendar describing events and current debate within the field. An abstract database allows physicians to search in journals for abstracts. An image bank provides images of body parts commonly affected by the illness. The site also includes an event calendar, praxis tools, and a monthly newsletter co-edited by an in-house doctor, a medical advisor who works for the website (but not as a 'netdoctor' directly serving patients).

And we don't get anything other in return than our corporate branding. There is no product branding in this service. The goal is to signal that The Pharmaceutical Company is "being there" and we actually do stuff for the doctors and not only for profit. And we try to improve the care of the illness. --- And I think actually that the project was launched to improve the care of the illness given our offering from our company to help patients. (Project Manager)

The US is a bit different because they have another way of looking at a disease. A different definition. (Project Manager)

Physicians are a difficult target group for a website, since the information should meet a high standard of quality and be highly relevant.

Actually most complicated aspect of this work is to find the right content and the right level. --- You have to put something relevant on the website for the doctors. If you put too much product information on this website it wouldn't look objective and then they wouldn't use it. --- If they click in a certain place they will get a screen that says "you are now leaving objective information and it's being product universe". So, the products are not far away, but they are not in the base all the time (Project Manager)

Education is one of the objectives of the site. Many guidelines already exist on topics such as how to treat the illness and how to educate the patients. The eBusiness Department does not write the content for such pages, because it is at such a high level, but rather hires opinion leaders to write the text.

We have some cooperation with some international organizations concerning the illness. We have people in house who have a lot of good contacts with these organizations. They prepared guidelines, which we have put on into the Internet for them as a service to the

organizations. --- We actually do not write the guidelines, it is the international organizations. So we actually just collaborate with them. They do the writing and we pay for some of the technical stuff. --- Then we use some vendors. A vendor in Holland produces news about the illness, and they have a panel of doctors who check out what is happening in the world of the illness. --- Then we have in some of our affiliates people hired to actually to write. They have journalistic background. (Project Manager)

It is very difficult to make a website like this because FDA - the US drug administration<sup>1</sup> - they have a very tight schema or rules of what you can tell or not tell. So, for example with this site in the US we have to be very focused on not mentioning our own products at all. But we can mention our competitors' products. (Project Manager)

Regulatory aspects are more difficult than the medical and legal aspects.

At the moment I am working together with the US affiliate and at the same time our IT department to get the US site up and running and to get the content on the site approved by our internal approval organ in the US. And there are so many regulations in the US, it's very long process. We have legal, medical and regulatory assistance. The regulatory people know what the FDA authorities in the US know and what their requirements are. So they tell that to me and say: "You have to do this and this and this". And they review this every time I come with something new and they have to review it. So that's one part of it, and another part is actually to get ideas for content. And that's very difficult because you work within this framework of rules and regulations. And then they of course check all that clinical stuff. (Project Manager)

### 3.6 Organizational Learning

The development and maintenance of the websites facilitate learning in several ways on both local and global levels. However, this capability is not fully utilized.

The most important part is that our *local affiliates* are learning about their customers from these questions. And we don't have any organizational rules or systems to handle this ... I mean saying as we probably don't have it when people take the phone and call into the company and ask questions about the product, then we

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<sup>1</sup> Food and Drug Administration

don't collect this information to learn and to develop products in a better way and so on. This is of course something that we have to deal with. --- But it is on the local level. It is on informal and local level and it is not coordinated globally. And that is of course a challenge because we have to find out how we can utilize all the information we can get out of these sites ... all the different questions and all the contacts when people use the contact part of the site (Project Manager)

The professionals' site is primarily a tool to get in contact with professionals and opinion leaders. The Pharmaceutical Company gets a lot of organizational learning via the site.

And the doctor might give us his comments on some of the articles or something like that. But also at conventions we have used that site to get in contact with them. And in general we work together with people who write stuff on the site. That's a good way to collaborate with the opinion leaders. (Project Manager)

As to the eBusiness Department, one of the objectives is to develop "Web intelligence" and to improve the services offered to the target groups.

If you look at my department we could be much more learning about ... I think we are focusing on it but we are on the first step of learning and ...because we have been so much focusing on getting in out there, and now we want to see what we can get back from it. It hasn't been the main focus until this year. I think it is very important, also the *web intelligence*: how we can get the information back now. --- Is to make sure the effect of the internet sites, to get that information back and then to use that as an evaluation of how the sites are doing, and if the sites are used the right way or if we should change something. We also want to see how much we can collect some of all the information we get about the users. In some cases we do collect a bit because we ask people to register on some of the pages but also here there are a lot of regulations and country specific regulations, so we have to be really careful. (Manager)

Actually, we have invested in a statistics system which is more like a reporting system rather than an intelligent system, but still we can get some information about how many users, where they go, on which pages and so on. So we just evaluated a product site and found out that there was really a bit interest for the site, but they only look on the front page and then they lost the interest. We could see how they lost the interest and they didn't go to the right pages, where the

real product information was. --- So we have evaluated the sites and we made a proposal on how we could change the content and make it more relevant for the customers. (Manager)

Actually there has been one online survey. We asked about what they think about the website and what they would like to read there, and asked them to compare it to other websites, and general comments. We got a lot of frustration of that. And then we have made a focus group where I think there was 12 people trying the website together with one person getting their comments. (Project Manager)

## 4. Conclusions

This case study aimed at investigating the research question

*How does The Pharmaceutical Company learn and create new knowledge by utilizing e-business solutions?*

### 4.1 How Does the Company Learn and Create New Knowledge by Utilizing e-Business Solutions?

The Pharmaceutical Company is a knowledge-intensive company. The success of the company is based on the development and application of explicit scientific knowledge. The development of the products occurs through a long and complex procedure overseen by R&D specialists. The Pharmaceutical Company has also developed comprehensive and interactive websites that cover the most important partners: the consumers and the professionals.

### 4.2 Classification

According to Skyrme's classification [2001], The Pharmaceutical Company's internet-based e-business solutions can be classified as interactive solutions and partially as trading solutions. They are not 'brochureware'.

### 4.3 Learning through design and implementation

During the implementation of the web solutions, a large amount of knowledge that was previously in tacit form has now become explicit. This has facilitated organizational learning both at the coordinating and local levels. It is most likely that designing and maintaining the websites has promoted organizational learning and increased awareness of company stakeholders at The Pharmaceutical Company. For example, the creation of community sites has made the eBusiness Department and the affiliates more sensitive towards the different perspectives of the various customer groups and

professionals, and of the cultural and regulatory differences.

The Pharmaceutical Company's web solutions also facilitate interaction within the consumer and professionals' communities, and promote their educational aim. These solutions have thus allowed The Pharmaceutical Company to reach many parties outside the company, to more tightly connect them to the learning process, as well as provide these stakeholders with an opportunity to improve their knowledge.

#### **4.4 Learning Through Continuous Utilization of the Websites; Websites as Boundary Elements**

The sites provide access to an extensive amount of data that is, to a large extent, protected from access by legislation and regulations. However, the legally available data has great potential as a source of organizational learning on global and local levels for market analysis, product development and other learning purposes. This potential has remained underutilized at The Pharmaceutical Company mainly due to the absence of a shared explicit framework or concept of organizational learning. Such a framework would help to coordinate various parties, processes, knowledge resources and ICT systems to facilitate the learning process.

Through the web solutions, The Pharmaceutical Company has become aware of its business environment and of many changes occurring within this environment. The websites serve as interactive boundary elements that help to distribute knowledge between the firm, user communities and professionals, as well as to monitor and collect information. The solutions facilitate the utilization of experts and opinion leaders within and outside the company.

Many regulations prevent the firm from using the information and knowledge produced by the system. However, even that information which could be used within the confines of the regulations has not been very efficiently utilized. These unutilized opportunities would allow Pharmaceutical Company to learn from the interaction enabled by its web-based e-business solutions. For example, using CRM Customer Relationship tools would require screening of essential information from the data for learning, R&D and marketing purposes.

In general, the creation of interactive websites can also support the development of business strategies. They have opened up possibilities to improve customer, partner and supplier processes, as well as enable extended reach, coverage, and presence.

Other types of boundary elements may also exist at Pharmaceutical Company, but they are not studied in this paper.

## **5 Benefits of the Research Project**

This research project will link e-business solutions to major knowledge flows and thus to organizational learning and renewal. This is a relevant approach because e-business solutions may facilitate innovativeness and learning. E-business may thereby become an increasingly central component in the innovativeness, renewal and underlying dynamics of the organization.

The research project contributes to the following areas:

- Strategic management, innovation capability and strategic learning.
- Knowledge and information management.
- Customer and market information management. 'Boundary' management.
- E-business, Internet technologies and interactive solutions.
- New organizational structures and processes. Digitalization of business processes.
- CAS Complex Adaptive Systems, self-producing systems and living organizations.

Moreover, the study helps to test and further develop the relatively new theoretical and methodological framework of strategic composition<sup>®</sup>. This project provides new evidence to support the use of autopoiesis theory (and Complex Adaptive Systems theories in general), a promising approach to organizational learning and renewal phenomena.

An earlier study (Maula, 1999) investigated four management consulting firms. This research project will introduce several new aspects, such as:

- Investigation of a manufacturing company.
- Focusing on openness, supported by interaction and knowledge flows, and linking it to learning and innovativeness
- Investigating openness in the light of e-business.
- Testing the generalizability of the existing theoretical and methodological framework.
- Focusing on selected strategic components, and especially e-business in the role of a boundary element.

In general, the study provides new empirical evidence on boundary elements, and especially on the role of e-business solutions for knowledge management and strategic learning.

## APPENDIX 1

### THEORETICAL BACKGROUND AND KEY CONCEPTS

#### *Autopoiesis theory*

The study is based on an interpretation of the *autopoiesis theory*, which combines general systems theory and complexity theory. The theory explains the properties and behavior of self-producing (autopoietic, living) systems ('auto'=self, 'poiesis, poein' = to produce, create; greek). The theory was developed originally by Humberto Maturana and Francisco Varela in the fields of neurophysiology and phenomenological biology [3], [4]. Autopoiesis theory and its implications have been described by Mingers [7]. It has been applied in the context of organizations, for example, by von Krogh and Roos [1], [2].

#### *Living composition<sup>®</sup> model and major knowledge flows*

The *living composition<sup>®</sup> model* is an interpretation of the autopoiesis theory in the organizational context [5], [6]. It provides a systematic, theoretically justified and empirically tested methodological framework for analyzing organizations as living systems. The main assumption is that living organizations are simultaneously open and closed (self-referential) systems. Living organizations are featured by two major knowledge flows:

- Knowledge flows that facilitate openness, innovativeness and interaction with the environment ('organizational senses').
- Knowledge flows that facilitate self-referentiality ('organizational memory') and enable efficiency.

In this study the focus is on 'organizational senses'. The main conclusion from the autopoiesis theory and living composition model is that knowledge-intensive organizations are *simultaneously open and closed* (self-referential) systems. The model explains how organizations can simultaneously operate both efficiently and innovatively if knowledge flows are organized properly [5], [6]. This means that the conventional dilemma between exploration (creativity, innovativeness) and exploitation (efficiency) can be re-framed in the light of the theory and model.

#### *Boundary elements*

An autopoietic system is a unity with identifiable boundaries and contained within and producing a boundary. The living composition<sup>®</sup> model identifies ten components that also include boundary elements. The boundary elements include various roles and functions that can be embedded not only in people but also in ICT

solutions (Maula, 1999, and forthcoming). The boundary elements have a central role in organizational renewal and learning capability. In a living organization, the connecting and absorbing boundary between a firm and its environment can provide new services for the customers, as well as new competences and learning capabilities for the firm itself.

#### *E-business*

E-business may have radical implications for the organizations' structures, business processes, products, services and knowledge flows among organizations and their customers and other parties. In this study, e-business is defined as electronic internal and external communication that can cover the whole value chain (business-to-business, business-to-consumer) and can also include the suppliers' and consumers' activities.

According to Skyrme [8, pp 42-43], internet-based e-business solutions undergo four phases on the way to becoming mature organizations:

1. *Brochureware* includes transferring marketing material onto the web.
2. *Interaction* means two-way information flow, however without any online integration into the firms' core systems.
3. *Trading* includes full e-commerce activities with online credit card payment processing, as well as good links to product and service information as well as non-competing specialist portals.
4. *Integration* means that the website is fully integrated with the organization's core computer systems including customer management, order fulfillment and finance systems. Web pages are customized and information flows seamlessly between the supporting systems.

By mid-2000, most of organizations were at the second or third stage on the e-business path.

#### *E-business and knowledge management*

Few organizations have fully integrated knowledge management into their main business processes and management decisions. Most organizations need to accelerate their progress along the e-business path in order to exploit the advantages of the Internet for capitalizing on their knowledge [8, pp. 25, 43]. However, even efficient utilization of the firm's own existing knowledge is not sufficient. A more general trend can be identified: the shift from inward looking perspective to an external one. Most knowledge initiatives aim at improving internal processes by utilizing existing knowledge. Thereafter, the focus shifts to knowledge creation and innovation, the creation of new and better products and services. The next logical move is to extend

the scope of knowledge management beyond the enterprise, which means that more information and knowledge flows across the boundary between an organization and its marketplace in both directions.

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