

Enterprise Resource Planning and IT Governance in Perspective: Strategic Planning and Alignment, Value Delivery, and Controlling

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Abstract: This article assesses key aspects of IT governance comprising strategic planning especially alignment, value delivery, and control objectives through an empirical study of Austrian medium sized and large enterprises. Enterprise Resource Planning (ERP) systems are in general seen as key information systems supporting e-business processes. The findings show an underdeveloped IT governance competence in the Austrian market place in particular reflected through low levels of strategic alignment and strategic decision making, as well as missing ERP control procedures. Nevertheless, in term of value delivery a positive impact of ERP in a holistic, multi-dimensional assessment was observed covering ERP benefits, organisational performance effects, and key performance criteria used in an ERP balanced scorecard (BSC).

Keywords: Business Infrastructure Management, IT Governance, Enterprise Resource Planning, IT Controlling.

I. Introduction

Today's (e-)business requirements, in particular in terms of enhanced liability and accountability demands, have moved IT governance into the focus of attention. The core processes underlying effective and comprehensive IT governance are the same as those for enterprise governance [6]. IT activities have become critically important to all aspects of the enterprise. This in particular applies to enterprise resource planning (ERP) systems which are in general seen as key information systems supporting e-business processes. ERP is a fine expression of the inseparability of IT and business. As an enabling key technology as well as an effective managerial tool, ERP systems allow companies to integrate at all levels and utilise important extensions, in particular in terms of e-business functionality. They represent large, complex, computerised and integrated systems, which can strongly influence long-term business success. Although e-business is rapidly changing the basic paradigm under which businesses operate, the full potential of e-business can only be realized if e-business technologies (Internet, Intranet and WWW technologies) can be successfully integrated with backbone ERP systems. A review of the work published in the main information systems journals and conferences sho-

wed that research conducted in the area of ERP systems has concentrated on issues related to the implementation phase of the ERP lifecycle [5]. Work contributing to actual ERP operation comprised numerous factors that influence ERP usage depending on users-systems interactions over time based on structuration theory [13] and the behavioural-based theories, frameworks for classifying benefits [16], and barriers and challenges to the attainment of ERP benefits [7]. The latter article indicates that implementations do not live up to their expectations and do not provide the expected range of benefits. Another article on ERP performance indicates based on the sample of 50 companies implementing ERP packages from 1993 to 1997 a significant increase in costs as a percentage of revenue and a decrease in the number of employees as a percentage of revenue in the year after ERP implementation. It was reasoned that cost drivers connected to the ERP technology such as (external) ERP system engineers and on-going fixes and fine-tuning elevate costs.

This research project is concerned with the following three key aspects of IT governance [6, 11]:

- (i) strategic planning and alignment as well as top-level management responsibility,
- (ii) IT value delivery, and
- (iii) IT controlling (employment of criteria and standards for decision making and controlling for continuous improvement of IT enabled business processes).

Through an empirical study, it seeks to assess the levels of achievement in each category with respect to ERP system management. Motivated by the many critical perceptions of ERP system operation provided by research, a main goal of this article is to assess the organisational impact of system implementation through a holistic multi-dimensional approach. The framework draws on classifications of possible ERP benefits, on general firm level success measures, and on key performance indicators used in a balanced scorecard adopted to control ERP operation.

Due to the pervasive nature of ERP systems, our results should be of interest for a wide range of professional and scholarly communities apart from the information systems (IS) field. The results presented should assist business management facing the important task to monitor and control ERP system operation. At least, this work raises the awareness for relevant factors that need to be assessed in ERP environments.

II. Methodology

The methodology employed is an industry independent empirical survey undertaken in the years 2003 to 2004. The target group was defined as containing Austrian small to medium sized enterprises (SMEs) as well as large enterprise (LEs) allowing for controlling the size of the company in data analysis. Austria is an example for a well-developed country within the European Union. To avoid under representing the large enterprises in the sample, a stratified and disproportional sample with subgroups according to company size was defined. One thousand Austrian SMEs and LEs were randomly selected from firms listed in a comprehensive, pan-European database containing financial information on 7 million public and private companies in 38 European countries [2].

The questionnaire developed for this study was based on a previously undertaken ERP related study [1], on a review of the literature and on recommendations of a panel of ERP experts from two universities in Austria and the United Kingdom. Following an empirical design method, the panel was asked to critique the questionnaire for content validity [3]. According to their suggestions, the questionnaire was revised and used in Pre-Tests applied in the UK and Austria. Responses were examined to optimize the formulation of each question and ensure consistency in the way they were answered. The questionnaire contained a general section assessing the background information on the company especially IT/IS related and performance related questions. The assessed topics were structured in four sections following the ERP system lifecycle: adoption decision, acquisition, implementation, use and maintenance. Companies were contacted through a multi-staged procedure. A cover letter, the hardcopy questionnaire, and a self-addressed stamped return envelope were sent to business management of the 1000 companies. The package explained the purpose of the study, promoted participation in the survey, assured confidentiality, and offered an ERP-related collection of material on CD as well as a summary of the results together with an opportunity to engage in further research activities with our research department. The questionnaire was also provided in an electronic version to further strengthen the participation. Two weeks after the initial mailing, follow up calls were made to all companies that could not be identified as respondents, asking them for their interest in participating and if cooperative for an email address. Short after these calls, reminder/thank you emails were sent out. The next round of contact consisted in reminding 400 randomly selected companies via telephone calls that they had not yet responded, and again giving them the address and logins for the online questionnaire. Finally, 209 valid returns were registered, resulting in an above average response rate of 22%. Some companies could not be contacted, because they had ceased to exist, the address was wrong or could not be found, etc. These neutral dropouts (49 companies) were considered in the calculation of the

response rate and therefore did not decrease the return quota. To test for non-response bias, known distributions of variables available through the used corporate database were assessed. The analysis revealed no significant different characteristics between non-respondents and respondents. The data was analyzed using a statistical package offering the ability to work on complex samples.

III. Empirical Results

III.1 Sample Demographics

Following a commission recommendation of the European Communities concerning the definition of micro, small and medium-sized enterprises [4], this research classified as SME an enterprises which employs fewer than 250 persons and which has an annual turnover not exceeding EUR 50 million. Table 1 denotes the firm size and branch distribution of the data sample. The branch classification was based on the core codes given in brackets of the North American Industry Classification System (NAICS) which has replaced the U.S. Standard Industrial Classification (SIC) system in 1997 [12].

Table 1. Firm size and branch distribution

Size	No. of companies (rel. in %)	No. of companies (abs. unweighted N)
SMEs	92.8	129
LEs	7.2	79
Total	100	208
Branch		
Trade (42,44-45)	22.6	58
Manufacturing (31-33)	21.0	60
Construction (23)	20.5	20
Services (54)	15.7	30
Transportation and Warehousing (48-49)	7.6	8
Information (51)	4.5	8
Health Care and Social Assistance (62)	1.9	4
Management of Companies and Enterprises (55)	1.4	8
Other	4.8	12
Total	100	208

The observed distribution of management structure is given in Table 2. The traditional functional management structure was observed in 64.7% of the cases followed by the project/team structures in 16.1% of the enterprises.

Table 2. Management structures

Management structure	Rel. in %
Functional	64.7
Divisional	5.1
Geographic	1.0
Project/Team oriented	16.1
Matrix	7.6
Network (core and periphery)	0.8
Virtual	0.0
Other	4.7

ERP diffusion along the system’s lifecycle stages is denoted in Table 3. 15.5 % of all SMEs have already selected an ERP system, i.e. have reached at least the stage of implementing the system, comparing to 67.6 % of all LEs. As expected, the observed differences between SMEs and LEs are highly significant (χ^2 , $p=.00$). The company’s positions in the lifecycle correlate positively with organisational size ($\text{corr}=.16$, $p=.03$).

Table 3. ERP diffusion among SMEs and LEs

Stage	All companies		SMEs		LEs	
	%	cum. %	%	cum. %	%	cum. %
Consideration	6.6	6.6	6.6	6.6	6.4	6.4
Evaluation	.5	7.1	.3	6.9	2.0	8.4
Implementation	1.2	8.3	.4	7.3	10.5	18.9
Stabilisation	1.8	10.1	1.8	9.1	2.0	20.9
Usage and maintenance	13.4	23.5	11.4	20.5	39.0	59.9
Extension	2.9	26.4	1.9	22.4	16.1	76
No ERP	73.6	100	77.5	100	23.9	100

III. 2 Strategic Planning in Perspective

Business management has in only 25.8% of all cases explicitly defined their IT/IS strategy (regardless of their ERP utilization stage). Among LEs, the rate is 48.2%, still a remarkable low number. The mean rate of alignment of corporate respectively business strategies and structures with IT/IS strategies and infra-structures on a scale between 1 (very bad) to 5 (very good) is 3.13 revealing a slightly positive assessment. Selection criteria were derived from the strategic goals of the company in 65.3% of all cases. Again, the number increases among LEs, which in general are known to possess a better developed managerial competence. An indicator for top-level management responsibility is the inclusion of the CIO in the board of executives. In 41.9% of all cases, the IS/IT division is represented at board level.

Table 4. IT/IS strategic guidance

	All	SMEs	LEs	p (χ^2)
IS/IT division represented at board level	41.9%	41.8%	43.6%	-
Explicitly defined IT/IS strategy	25.8%	23.8%	48.2%	.00
Strategic Alignment ¹	3.13	3.11	3.51	.04
Strategic concept driving the choice of selection criteria	65.3%	63.7%	76.9%	-

¹ Rated on a scale between 1 (very bad) and 5 (very good), * $p<.05$, ** $p<.01$; N (SMEs) = max 39, N (LEs) = max 59

III. 3 ERP Value Delivery in Perspective

A comprehensive list of ERP decision making criteria were evaluated according to expectations/targets set prior to system implementation. The expectations of business management were most likely met in terms of the system related features “Y2K readiness”, “systems reliability”, and “EURO currency conversion”. The first and the third criteria were among the most important drivers for ERP software growth in the last decade. The expectations of ERP as technology enabler (including e-business, CRM, and SCM) were considered as the least successful aspects. According to the inquired list of all other remaining factors, expectations were at least met at the desired level in the mean case. The list of remaining factors comprised (given in the order of achieved success): “advanced technology”, “enabler for desired business processes”, “business process improvement”, “improved service levels”, “integrated and better quality of information”, “system interoperability”, “system usability”, “organizational fit”, “increased organisational flexibility”, “enhanced decision making”, “incorporation of business best practices”, “reduced cycle times”, “increased customer satisfaction”, “short implementation time”, “internationality of software”, “software costs (licenses, maintenance, etc.)”, “operating system independency”, and “improved innovation capabilities”. No substantive differences were detected in the perceptions given by managers of SMEs and LEs.

An often mentioned short term effect of large scale software introductions is a decline in process efficiencies, respectively organisational performance. This was confirmed by data analysis (see Table 5) and a significant difference was observed between SMEs and LEs (χ^2 , $p=.00$). While the majority of SMEs are faced with short term declines, only a minor number experience long term problems, and no SMEs has stated that the performance level prior to ERP were not recovered. The situation is different among LEs where a considerable proportion faced long term performance problems, while a minor, but nevertheless existing, proportion does not recover to past performance levels.

Table 5. Decline in organisational performance after switching to ERP

Decline in organisational performance	All (%)	SMEs (%)	LEs (%)
not noticed	30.7	25.1	52.2
experienced over a short period of time	60.6	69.3	26.8
experienced over a long period of time	8.3	5.6	18.8
experienced and not recovered	.5	.0	2.2

The question whether ERP is aiding to the organisation to gain a competitive edge was answered with yes by 83.1% of all enterprises. The view is clearly more optimistic in SMEs, i.e. the distribution is significantly dependent on the size of the organisation (χ^2 , $p=.01$). The rate increases to 88.1% for SMEs and decreases to 65% for LEs.

III. 4 ERP Controlling in Perspective

In terms of ERP controlling, only 3.4% of the enterprise in the survey have implemented an instrument to control ERP system operation. In evaluating the performance in the usage stage traditionally two different perspectives, the financial and the technical view, can be defined. The balanced scorecard (BSC) is a well known approach used for controlling based on multiple attributes aligned along four different perspectives. It was first proposed in 1992 [8] and soon after applied [9]. The BSC is a well established measurement method which links strategic objectives and performance measures. Its application promises strategy mapping between each of the perspectives. The idea of a BSC is to find a set of measures that maintain a balance between short- and long-term objectives, between lagging and leading indicators, between financial and non-financial criteria, and between internal and external performance perspectives [10, 14]. To assess the performance in system usage, this study has drawn on suggestions provided in academic literature, mainly on [15] where the BSC was developed for ERP controlling. denotes the four considered ERP controlling perspectives with attributed measures (see Table 6). Based on the gathered data, the overall conclusion is that ERP impact in terms of all measured dimensions provided positive effects in SMEs as well as LEs.

Table 6. Control variables in relation to the situation prior to ERP across balanced score card perspectives

	All comp.		SMEs		LEs	
	ME	SD	ME	SD	ME	SD
Financial perspective ¹						

Procurement costs	3.36	0.88	3.33	0.90	3.48	0.85
Inventory holding costs	3.21	0.99	3.14	1.02	3.46	0.91
Transportation/logistics costs	3.16	0.76	3.12	0.77	3.30	0.77
Hardware/Technology costs	2.93	0.80	2.95	0.84	2.87	0.70
IT/IS maintenance costs	2.83	1.14	2.96	1.11	2.39	1.23
Overall IT/IS costs	2.79	0.96	2.94	0.87	2.31	1.13
IT/IS consulting costs	2.67	0.91	2.74	0.85	2.41	1.11
Customer (supplier) perspective	ME	SD	ME	SD	ME	SD
Coverage of business proc ²	3.94	1.18	4.03	1.12	3.81	1.35
Transactions (deliveries,...)	3.62	0.71	3.62	0.71	3.64	0.77
Problems with order	3.56	1.04	3.61	1.07	3.41	0.96
Communication with supplier ¹	3.17	0.85	3.06	0.83	3.61	0.84
Internal process perspective²	ME	SD	ME	SD	ME	SD
Availability of ERP services	3.96	0.84	3.98	0.88	3.89	0.77
Average time to upgrade	3.31	1.05	3.36	1.07	3.11	1.04
Release levels lagging behind ³	1.34	0.76	1.19	0.62	1.54	0.91
Effectiveness/Productivity	3.86	0.70	3.87	0.62	3.84	0.97
Efficiency/Profitability	3.82	0.79	3.84	0.72	3.74	1.05
Financial close cycle	3.55	0.96	3.46	0.94	3.84	1.01
Probl with reports on demand	3.53	0.95	3.55	0.95	3.47	1.01
Probl with warehouse proc	3.41	0.90	3.42	0.91	3.40	0.93
Probl with standard reports	3.37	1.05	3.28	1.06	3.66	1.05
Exploited ERP functionality ⁴	66.1	20.7	61.73	19.0	73.39	23.4
Innovation and Learning perspective⁵	ME	SD	ME	SD	ME	SD
Training hours per developer	3.24	0.88	3.29	0.86	3.02	1.03
Training hours per user	2.94	0.76	2.93	0.73	2.95	0.96

¹ Rated on a scale between 1 (poor rating/higher costs) and 5 (good rating/lower costs) in comparison to the situation prior to ERP adoption

² Rated on a scale between 1 (poor rating/decreased) and 5 (good rating/increased) according to planned level of support

³ Rated on a scale between 0 (no lag) and 3 (3 levels behind)

⁴ % of the implemented ERP system functionality

⁵ Rated on a scale between 1 (increased) and 5 (decreased) in comparison to the situation prior to ERP adoption

IV. Conclusion

This article delivers an empirical overview of main components in IT governance with respect to ERP.

First, and often seen as most important, the rationale behind ERP was analysed in a strategic context. The main pre-condition of IT-governance – the alignment of business and IT strategy – is still underdeveloped in the Austrian marketplace. Only a minority explicitly defines their IT strategy. Approximately 25% of the large enterprise have evaluated and selected an ERP system without considering the strategic needs of their company. IT governance implies the IT responsibility of the executive board, but the data showed that CIOs are not regularly seen as members of the board (41.9%).

Second, ERP value in perspective shows that ERP in general meets and often exceeds expectations with respect to almost all assessed areas. Only in terms of enabling other applications such as customer relationship management (CRM) and supply chain management (SCM), ERP seems to fall short in terms of expected utility. This finding contradicts the critical perception of ERP success reported in academic literature given in the introduction of this article.

Organisational performance has declined in 60.6% of the enterprises shortly after implementation, but has recovered in almost all cases to prior levels (known as short dip in organisational performance after switching to ERP). A large majority (83.1% of the cases) believes that ERP is aiding to the organisation to gain a competitive edge.

Third, the quasi non-existence of ERP control procedures in the Austrian market place contradicts the need for IT-controlling (and –governance) mechanism, which is communicated in international IT/IS practice. Due to the documented importance of installed ERP systems respectively of the data and business processes they support, their omission in IS/IT controlling seems critical. This paper can help to introduce controlling in organizational practice through a BSC based approach by providing a list of reference with performance indicators. The empirical data revealed distinct positive effects of ERP in terms of all four BSC perspectives. The financial perspective showed that while IT/IS related costs have approximately remained unchanged, related costs in functional areas, e.g. procurement or logistics, have been reduced due to ERP. The positive valuation of ERP effects becomes more pronounced beyond a financial assessment, e.g., in terms of process efficiency and effectiveness gains.

To summarize, the main findings comprise the observed positive impact of ERP in a holistic, multi-dimensional perception and underdeveloped IT governance principles in Austria. The latter area constitutes a large market potential for consultants who deliver IT re-organisations especially based on new standards (COBIT, ITIL, ISO) or regulations (Sarbanes-Oxley, Basel 2). Future work will concentrate on compliance and substantive tests within case studies with regard to the mentioned frameworks.

References

- [1] Bernroider, E. W. N. & Koch, S., "The decision making process concerning investments in ERP software - results of an empirical study in Austrian organizations," *Wirtschaftsinformatik*, 2000, 42(4), 329-338.
- [2] Bureau-van-Dijk, E. P., "Amadeus," Bureau-van-Dijk, 2003.
- [3] Dillman, D. A., *Mail and telephone surveys: the Total Design method*. New York: John Wiley and Sons, 1978.
- [4] EC, "Commission Recommendation of 6 May 2003 concerning the definition of micro, small and medium-sized enterprises," *Official Journal of the European Union*, 2003, 46(L 124), 36-41.
- [5] Esteves, J. & Pastor, J., "Enterprise Resource Planning Systems Research: An Annotated Bibliography," *Communications of the Association of Information Systems*, 2001, 7(8), 1-52.
- [6] Hamaker, S. & Hutton, A., "Principles of IT Governance," *Information Systems Control Journal*, 2004, 2.
- [7] Hawking, P., Stein, A., & Foster, S., "Revisiting ERP Systems: Benefit Realisation," *Proceedings of the 37th Annual Hawaii International Conference on System Sciences (HICSS'04)*, Big Island, Hawaii, 80227a, 2004.
- [8] Kaplan, R. S. & Norton, D. P., "The Balanced Scorecard – measures that drive performance," *Harvard Business Review*, 1992, 71-79.
- [9] Kaplan, R. S. & Norton, D. P., "Putting the Balanced Scorecard to Work," *Harvard Business Review*, 1993, 134-147.
- [10] Kaplan, R. S. & Norton, D. P., *The Balanced Scorecard - Translating Strategy into Action*. Boston, Mass.: Harvard Business School Press, 1996.
- [11] Kordel, L., "IT Governance Hands-on: Using COBIT to Implement IT Governance," *Information Systems Control Journal*, 2004, 2.
- [12] NAICS-Association, "NAICS - North American Industry Classification System," vol. 2003, 1997.
- [13] Orlikowski, W. J. & Robey, D., "Information technology and the structuring of organizations," *Information Systems Research*, 1991, 2(2), 143-169.
- [14] Protti, D., "A proposal to use a balanced scorecard to evaluate Information for Health: an information strategy for the modern NHS (1998-2005)," *Computers in Biology and Medicine*, 2002, 32(3), 221-236.
- [15] Rosemann, M. & Wiese, J., "Measuring the Performance of ERP Software – a Balanced Scorecard Approach," *Australasian Conference on Information Systems*, 774-784, 1999.
- [16] Shang, S., "A Comprehensive Framework for Classifying the Benefits of ERP Systems," *Americas Conference on Information Systems (AMCIS)*, Long Beach, USA, 1005-1014, 2000.