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How Well Do Managers Know And Use Evaluation Methods For Assessing E-Business Transformations

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ABSTRACT

This paper investigates methods for assessing IT induced business transformations based on a quantitative empirical Austrian study. We show that decision makers are gaining more information about methods but are not equally applying their knowledge in practice. We observed a noticeable gap between levels of diffusion (known) and infusion (used) of evaluation methods. There remains a clear emphasis on tangible costs and benefits reflected by the highlighted knowledge and application of financial methods. Results would warrant renewed attention to the role of organisational change in evaluation practice and organisational learning in the context of analytical dynamic IT capacities.

Keywords: Decision Making Methods; e-Business Value; IT Evaluation; IT Justification; IT Projects

INTRODUCTION

Research has brought forward many different techniques, methods and procedures to assist a decision maker facing a complex decision scenario. This paper focuses on IT evaluation methods used to assess e-Business projects, which we broadly define as IT induced businesses transformations delivered by introducing an information system to support all or large parts of the business activities [11]. We focus on ex-ante evaluations during the proposal stage to support decision making and system justification which usually are connected with high levels of intangibility and subjectivity. Many of the IT evaluation problems identified by Irani [24] are prevalent today, exacerbated yet further by increasing IT expenditures [19] and associated risks [1, 30]. Contemporary views state that organisational managers as well as information systems (IS) professionals need to recognise IT evaluation as one of the important unresolved concerns in management [35]. Smithson and Serafeimidis [48] state that the existing literature has identified noticeable gaps between academic theories, commercially available methodologies and actual evaluation practice within organizations. Over the last decades we have seen a constant development of evaluation models and tools with the ultimate goal to increase decision making satisfaction in organisations. A research agenda for decision support systems consequently highlights the need for explicit efforts to apply analytic models and methods [46]. Consequently, within this paper we seek to present a current taxonomical account of decision making methods with the aim to report whether or not evaluation methods are known and also used. In other words we seek to explore the knowledge existing in organisations about methods (diffusion view) and the actual use of methods (infusion view). Infusion therefore is an expression for the depth of use and degree of usage of features provided [17], in this case features provided by decision support methods or methodologies. There is a difference between passive knowledge, i.e. being aware of methods, and active knowledge, actually using methods in practice. We need to understand where we are with method related capacities in organisations in order to increase the effectiveness of decisions in practice. Depending on the current state we could then either continue to improve methods or maybe rather focus on learning, i.e. absorbing existing method knowhow into practice, which would be a matter for knowledge management in the context of organisational learning theories. To answer these questions we conducted an exploratory empirical survey in Austria based on dominant methodological perspectives from IS literature. Furthermore the paper defines and explains decision support methods as a general concept. This is done by a theoretical discussion of decision making taxonomies, considering the number of decision makers, decision criteria and decisions [50], the field of application [53], and taxonomies focusing on classifications into classes of approaches such as financial or multi-criteria [40, 41]. The next section presents a brief review of literature offering method illustrations and taxonomies supported by the Annexe with method descriptions. This is followed by a concise presentation of the research methodology and empirical results. Finally, a discussion of the findings and conclusions are presented.

THEORETICAL BACKGROUND

IT appraisal taxonomies and methods

Many different attempts have been made to develop theoretical taxonomies of methods used in IT appraisals, which essentially constitute different views on the wide field of supporting methods and frameworks. The classification of methods can be guided by the type of IT investment decision and time of decision [39], type of evaluation support [9, 40, 53], purpose of evaluation, breadth of impact and evaluation complexity [50], relevance to IT practice [32], and other characteristics.

To get an idea of complexity decision support methods can be divided along three criteria: the number of decision makers; the number of decision criteria; and the number of decisions needed Other approaches can use the input or outcome of an evaluation process or the kind of support given to classify methods [9]. Many similar but in detail different taxonomies of this kind exist, such as a division of decision support methods into the following top-level classes: process models; choice models; information control techniques; analysis and reasoning aids; representational aids; and judgement refinement/amplification techniques. Every class was further divided into different sub-categories [53]. Another angle to view methods is their appropriateness to IT evaluation practice [32]. The shortcomings of traditional evaluation methods were criticised, which led to new adjusted traditional evaluation methods, new evaluation

techniques and mixed approaches deemed most needed to satisfy IT evaluation needs. Probably one of the most exhausting classifications presented methods as financial, the multi-criteria, ratio approach and portfolio approaches [40]. The financial category consists of traditional, quantitative approaches such as discounted cash flow calculations. Multi-criteria approaches cover methods that are based on pre-defined, but not only quantitative criteria. In an IT-context they are often strongly tailored to IT-decisions such as the Information Economics approach [36]. Ratio approaches are in this definition evaluation methods based on ratios mostly related to key-figures of IT-investments, e.g., IS-expenditures related to the total number of employees. Portfolio methods support the mapping of investment projects or already existing IT-services in a graphical representation. This approach is usually used in more strategic contexts. Another taxonomy aligns decision support methods among distinguishable and less overlapping groups while focusing on IT transformation projects [39]. Taxonomies may relate specifically to a certain evaluation stage, e.g., to ex-ante or ex post evaluation. It is established in literature that traditional appraisal techniques have limitations in IT appraisals regardless of the evaluation stage due to difficulties in quantifying relevant intangible benefits of IT [e.g. 24]. Methods of more contemporary nature are constantly brought forward but their consideration in practice is questioned [32]. Of growing concern is not only increasing evaluation complexity but also the problem of selecting which method to use out of the vast array of techniques [25]. Consequently, based on specific content, content and processes [45, 49] prescriptive guidelines and frameworks are appearing to guide the process of investment appraisals b, to develop a selection of appraisal methods within taxonomies and given structures [e.g. 8].

Chosen framework and methods

Based on our taxonomic review we based our four cluster taxonomy on two frameworks [39, 40] and considered a total of twenty one decision support methods in a four tier classification (see Appendix 1). Literature has suggested many more decision support methods, which, however, often seem to be extensions, combinations or variations of others. Here we focused on well-documented and representative methods with good support from literature. While we wanted to be comprehensive, the natural constraint we faced was the limited length of the research instrument. Some methods overlap and can be attributed to different classes of methods, such as the Balanced Scorecard approach that could be classified as multi-criteria approach as well as strategic method. The strategic category relies on methods that are useful for long-term planning analysing strategic value and risks without the necessity to assess short term impacts [15, 18, 34]. The fourth category of portfolio methods supports an integrated and broad view of what is to be evaluated and places investment projects or already existing IT-services into a multi-segment graphical representation [3, 52]. The financial category consists of quantitative financial approaches, such as Discounted Cash-Flow and Return on Investment considerations. Table A1 in the Appendix briefly introduces each selected method and refers to literature for a more detailed description.

RESEARCH METHODOLOGY

Survey design

The sampling frame for the empirical survey consisted of 850 randomly selected companies from the industry-independent target population defined as all enterprises in Austria with a reported last year's total balance sheet total of over € 5 million. We chose to use the Amadeus Database containing financial information on 7 million public and private companies in 38 European countries [12], which supplied as with representative and extensive list with contact information for the sampling procedure. The questionnaire was administered to managers in a multi-staged procedure, who had to be an "IT-decision maker or a person that has decision making authority concerning IT-investments", a statement used as a prelude. Depending on the structure and size of the company, this can as well be an IT manager as well as a general manager. All companies were initially contacted by phone and invited for participation. Only those who indicated their interest received the link and an email for participation. This procedure was necessary to comply with the Austrian telecommunication law on bulk-Emails prohibiting invitations to more than 50 companies per Email. As an incentive companies were offered the study results, to be informed about new developments in decision making and experimental case studies in their firms. We conducted three rounds of iterative pre-testing each composed of a review by respondents and after implementation of the changes an academic review resulting in eventual changes to almost all elements of the instrument.

Sample properties

The field work was concluded with a number of 114 completed questionnaires which corresponds to net return quota of 14.5% considering neutral dropouts (63 companies). Neutral dropouts that do not decrease the return quote refer to companies that could not be contacted because they ceased to exist or closed their business, or because the address was incorrect and they could not be found. Non-response bias analysis considered potential respondents and definite non-respondents and three characteristics: The number of employee; operating revenue; and total assets. Statistical analysis revealed no evidence for response-bias. We also tested for Common Method Variance (CMV) and did not find either a single factor or a general factor accounting for the majority of covariance among measures [37]. An aggregation of the industry sectors according to NACE, the Statistical Classification of Economic Activities in the European Community [16] to four groups leads a distribution of 54% of the respondents in any service industry, 26% in industry, 11% in public administration and 9% in commerce and trade.

Table 1 Managerial roles of respondents

Respondent title	Valid N	%
Top Management (Non-IT)	28	27
Top Management (IT)	36	34
Middle Management (Non-IT)	14	13
Middle Management (IT)	26	25
Other	1	1
Non known	8	
Total	114	

We regard the aim of the survey to reach top management with decision competencies on IT as almost accomplished. Of course the respondent title does not deliver exact information about the competencies and the organizational structure of the respondent's company, but distribution of the respondents is similar to other studies, that report 32.3% of respondents being a "Head of the IT Department" [55] compared to 34% Top IT managers in this study.

Table 2 Geographical scope of respondents

Company scope	Valid N	%
Local	4	4
Regional	17	15
Austrian wide	40	36
European	30	27
Global	20	18
Total	111	

As Table 2 shows 36% of the respondents argued to operate within Austria only, while 27% do business in Europe and 18% worldwide.

DIFFUSION AND INFUSION OF IT APPRAISAL METHODS

Next, we will show results concerning diffusion and infusion for each category of the model in turn.

Multi-criteria methods

The diffusion of multi-criteria supporting methods for IT-investment decisions is at 33%, where the biggest contribution comes from the usage of the Balanced Scorecard (24%), which again could also be seen as a strategic decision support tool rather than a multi-criteria approach, depending on the viewpoint. To some extent the Utility Analyses (16%) is also known among Austrian companies. In general multi-criteria methods are not widely spread for supporting IT-decisions. Interestingly, taken together 72% of businesses know at least one multi-criteria method, but only 34% apply at least one method. In our view this is a large gap between diffusion and infusion corresponding to actual use.

Table 3 Multi-criteria methods

Level of diffusion	AHP	BSC	IE	KUF	URM	"Siesta"
known (abs.)	24	67	19	3	61	6
Used (abs.)	6	27	4	1	18	2
known (%)	21	59	17	3	54	5
used (%)	5	24	4	1	16	2

Financial methods of investment appraisal

The diffusion of financial methods exceeds the diffusion of all other approaches. 75% of all surveyed companies use any kind of financial investment appraisal methods. Although much attention is paid to Real Options in theory, the diffusion in practice is minimal. The most often used tools, are the static investment appraisal payback period (46%) and the Return on investment (45%) methods. The net present value is only used by 38% of companies. However, most of the companies that use financial investment appraisal methods, do not rely on a single method, but often use more than one. The diffusion-infusion gap is not significant here, as 90% of the managers are aware of financial methods and about 75% actually apply those in practice.

Table 4 Financial methods

Level of diffusion	Cost / Benefit Analyses	DCF / NPV	Internal Rate of Return	Payback / Break-even
known (abs.)	69	71	54	81
used (abs.)	50	43	20	53
known (%)	61	62	47	71
used (%)	44	38	18	46
	Real options	**ROI**	**ROM**	**TCO**
known (abs.)	20	72	21	65
used (abs.)	2	51	1	38
known (%)	18	63	18	57
used (%)	2	45	1	33

Strategic and analytical techniques

Any kind of strategic or analytical technique is known by 63% of the firms and at least one method is used by 42% of Austrian companies. While decision trees are known by half of the decision takers, only 17% actually use them. SWOT-analysis is used by 36%.

Table 5 Strategic and analytical techniques

Level of diffusion	CSF	Decision Trees	SWOT	Scenario Technique
known (abs.)	46	57	66	43
used (abs.)	27	19	41	27
known (%)	40	50	58	38
used (%)	24	17	36	24

Portfolio methods

Portfolio methods to support decision making for IT-decisions are not widely diffused. Only 11% of Austrian companies use any of the proposed portfolio methods, while

37% are knowledge about at least one technique out of this class of methods.

Table 6 Portfolio methods

Level of diffusion	Bedell's method	Investment Mapping	Investment Portfolio
known (abs.)	14	23	32
used (abs.)	3	6	7
known (%)	12	20	28
used (%)	3	5	6

Overall method infusion

The data revealed that 22% of the surveyed companies do not adopt any method at all, 25% only adopt methods from one of the proposed categories, 28% of two categories and 21% of organisations use methods from three categories and 4% of Austrian companies consider methods from all four different categories. This means that the majority of decisions were supported with at least 2 different methods. Compared with a comparable previous evaluation study in the context of ERP, method knowledge and application in practice has improved only in terms of non-financial investment method categories [7].

Table 7 Overall method infusion

No. of used method categories	Total	%
0	25	22
1	28	25
2	32	28
3	24	21
4	5	4

Decision support systems and frameworks

The usage of decision support systems (DSS) and standardized decision support framework with prescriptive processes across the companies that took part in the survey is very limited. While 107 respondents gave an answer on whether they would use either a decision support system or any kind of standardized decision support process, only 14%, respectively 21% apply either of them and only 6% apply both.

Table 8 DSS and frameworks

Usage of …	Total	%
Decision Support System	16	14
Standardized DS Framework/Process	25	22
Both	6	5

DISCUSSION AND CONCLUSIONS

Evaluation of e-Business transformations currently is a major issue for both management and academics. This paper has introduced and defined approaches and methods used in IT investment evaluation with links into literature, which would give further insights into their application [e.g. 20, 27, 38, 40]. While these sources are relevant and insightful, they generally lack a comparative empirical investigation showing if they are known and used for e-Business decisions. We specifically add to current literature by reporting on current infusion and diffusion rates of methods. We also show that decision makers are gaining more information about methods but are not equally applying their knowledge in practice. We concluded with a link into Decision Support Systems and Frameworks showing that evaluation methods are often not combined with neither. We observed a noticeable gap between levels of diffusion (known) and infusion (used) of evaluation methods, which adds more differentiation to Smithson and Serafeimidis' [48] statement about gaps between academic theories, commercially available methodologies and actual evaluation practice within organizations. Compared to prior research [7] it seems that diffusion and infusion of more comprehensive and non-financial investment evaluation methods have increased over time. While multi-criteria decision making, and strategic and analytical techniques take a more important role in empirical IT decision processes, portfolio methods are still relatively less known and applied. A good level of inclusion of strategic and analytical techniques hint at a clearer examination of strategic value of IT, a long voiced academic prescription for IT evaluation practice [e.g. 15]. About a third of the IT assessments relied on multi-criteria methods, which promise a more holistic view and allow for a more systematic treatment of intangible benefits, another popular prescription from academia [e.g. 10, 54]. A broad assessment of what is to be evaluated called for by e.g. Ward [52] through using Portfolio methods seems to be largely missing in practice. There remains a clear emphasis on tangible costs, benefits and risks reflected by the highlighted choice and application of financial methods, which is consistent with literature [35]. The considerable gaps between diffusion and infusion rates in particular with regard to non standard financial investment analysis indicate that managers in practice seem to be aware of these methods but may have difficulties or reservations in applying them. This would warrant renewed attention to the role of organisational change in evaluation practice [45, 49], and organisational learning in the context of contemporary dynamic IT capability views [14].

Future research will aim at connecting the use of the methods with project effectiveness of and more extensively look at combined multiple method approaches in transformational IT evaluations. It is important to know which methods or combinations thereof increase satisfaction and efficiency levels. Contemporary studies call for methodological pluralism and normative standardisation [e.g. 6, 28]. Based on our findings presented in this paper future research should place an emphasis not only on new method development but also on how existing approaches can be used and combined in evaluation practice to complement the continuing trend of dominantly applied standard financial investment techniques in IT evaluation.

APPENDIX

Table A1 Descriptions of considered methods

Method and supporting references	Description
Analytical Hierarchy Process (AHP) [42, 43]	AHP is a process oriented multi-criteria approach relying on pair wise comparisons for all criteria and alternatives on pre-defined scales, which can be used to derive weights and utilities for single elements in a mathematical procedure such as the Eigenvector method. Consistency tests can be used to validate the estimated comparison matrices. The process spares the need for absolute measurements and subsequent scale transformations, and the problematic absolute estimation of attribute weight.
Balanced Scorecard (BSC) [29]	A BSC seeks to derive a structured scorecard of key performance indicators from a strategic viewpoint. These indicators can be aligned along the original four different perspectives: financial; internal business processes; learning and growth; and customer. In addition the BSC also features a cause-and-effect diagram, which displays antecedents and consequences of targets while connecting different perspectives of the scorecard with each other. It should be noted that the method can also be classified as a strategic instrument, rather than a multi-criteria approach.
Information Economics (IE) [36]	The IE approach was explicitly developed to evaluate IT-investments and essentially states that the value of an IT-investment is a sum of an enhanced Return on investment (improved operations, increased productivity, etc.), a business domain assessment (competitive advantages, management information, etc.) and a technology assessment (alignment with IS-strategy, risk measures for the project, etc.). To exercise this method weights for each factor are assigned and each factor from each alternative receives a value between 0 and 5 based on either ROI or management judgement. Factor values are multiplied with weights and summed up. Information Economics also features risk-related measures to assess the overall risk of each alternative.
Kobler Unit Framework (KUF) [23]	The KUF consists of four sequential stages comprising evaluating an investment against a checklist of critical success factors, estimating costs, evaluating business performance indicators and comparing relative benefits of alternatives. As in other multi-criteria approaches a decision is made based on weighted criteria.
Utility Ranking Method (URM) [54]	URM is rather broadly defined instrument composed of a set of alternatives, a set of criteria derived from defined targets, weights for each criteria and estimates reflecting how well an alternative performs relating to each criterion. Different aggregation methods are known to estimate a super scale used to rank the alternatives such as the weighted sum approach.
Strategic Investment Evaluation and Selection Tool Amsterdam (Siesta) [26]	The *Siesta* method features 20 criteria and strongly relies on the use of questionnaires and software to analyse the results. Similar to Information Economics the Siesta method is composed of domains (business and technological) and moreover three levels of decision making with a strong focus on strategic alignment.
Cost/Benefit Analyses (CBA) [33]	CBA is a decision making approach that compares the total costs against the total benefits expected from the investment alternative.
Net Present Value (NPV), Internal rate of return (IRR), Payback method [e.g. 21]	The cash flows should take the time value of money into account, which is the basic principle of most standard financial investment analyses methods such as for the NPV method where future cash flows are discounted based on a pre-defined discount rate. The IRR keeps the NPV at zero while establishing the according discount rate. The Payback Period looks for the break-even point of the investment.
Return on Investment (ROI) [e.g. 21]	Other financial performance measures include the *ROI* which in most forms compares investment returns and costs by constructing a ratio, which includes the total negative and the total positive cash flows.
Real Options (RO) [2]	RO are taking ideas from the world of financial options used in combination with the net present value to take managerial flexibility of investments into account. The NPV is enhanced with the values of managerial options.
Total Cost of Ownership (TCO) [31]	The TCO approach was originally developed to measure the total costs of an infrastructure and considers all direct as well as indirect costs of an investment over its whole life cycle.
Critical Success Factors (CSFs) [13]	The concept of *CSFs* in appraisals defines aspects vital for a company's success in light of the investment, which are no measures but rather activity statements.
Decision trees [51]	Decision trees use tree-like structure to display different alternative pathways of a decision using different types of nodes and information. The classical decision tree method assumes the future outcomes with discrete random variables and known probability functions. Input from other methods such as NPVs can be used. It supports different selection rules to arrive at an alternative selection
Strengths, Weaknesses, Opportunities and Threats (SWOT) analysis [22]	SWOT analysis is a widely applicable evaluation tool specifying the objective of the investment and identifying the internal and external factors that can be connected with that objective in each of the four areas.
Scenario technique (ST) [5, 44]	The ST is based on the development of scenarios for a company's external environments. During the process scopes of planning possible forecasts and their impacts on the decision outcome are examined.
The Return on Management (ROM) [47]	ROM is the ratio of productive organizational energy release divided by management time and attention invested. It is a directional and qualitative metric of the payback from manager's time and attention.
Bedell's method (BM) [4]	BM is a characteristic method for portfolio analysis that explicitly deals with IT decision making balancing effectiveness and importance of IT. The assessment is based on the activities and processes that the IT solution supports and in the original method covers four variables for effectiveness issues and five determining importance. As a portfolio method the contributions of alternatives are visualised in a two dimensional portfolio.
Investment mapping (IM) [40]	IM displays the investment orientation and the benefits of the investment in a portfolio. The investment orientation covers infrastructure, business operations and market impact. The benefits are decomposed into enhancing productivity, risk minimization and business expansion.
Investment Portfolio (IP) [40]	The IP evaluates IS-investment alternatives against their contribution to the business domain, their contribution to the technology domain and the financial consequences of the alternatives drawing on NPV. The contributions to the business and technology domains represent the axis of the portfolio, while the NPV is represented by the size of the circle.

REFERENCES

[1] Aloini, D., Dulmin, R., & Mininno, V., Risk management in ERP project introduction: Review of the literature. *Information & Management*, 2007. 44(6): 547-567.

[2] Amram, M. & Kulatilaka, N., *Real Options: Managing Strategic Investment in an Uncertain World*. 1999, Boston, Massachusetts: Harvard Business School Press.

[3] Bartezzaghi, E. & Ronchi, S., A portfolio approach in the e-purchasing of materials. *Journal of Purchasing and Supply Management*, 2004. 10(3): 117-126.
[4] Bedell, E.F., *The computer solution: Strategies for success in the information age*. 1984, New York, USA: McGraw-Hill.
[5] Bell, D.E., Potential contributions to decision analysis. *Decision Sciences*, 1982. 13(4): 534-540.
[6] Bernroider, E., Obwegeser, N., & Stix, V., Analysis of heuristic validity, efficiency and applicability of the profile distance method for implementation in decision support systems. *Computers & Operations Research*, 2011. 38(5): 816-823.
[7] Bernroider, E.W.N. & Koch, S., ERP selection process in midsize and large organizations. *Business Process Management Journal*, 2001. 7(3): 251-257.
[8] Bernroider, E.W.N., Koch, S., & Stix, V., Elements of Comprehensive Assessments of IT Infrastructure Projects in the Austrian Ministry of Finance. *Lecture Notes in Computer Science*, 2010. LNCS 6267: 84-91.
[9] Bernroider, E.W.N., Koch, S., & Stix, V., *Rahmenmodelle und Methoden zur Messung des Nutzens von IT-Investitionen*, in *Evaluierung von oeffentlichen IT-Investitionen - Modelle und Methoden zur Messung von Informationssystemen in der oeffentlichen Verwaltung*, Promberger, Janko, and Ihle, Editors. 2008, Neuer wissenschaftlicher Verlag (NWV): Vienna. 33-96.
[10] Bernroider, E.W.N. & Stix, V., Profile distance method - a multi-attribute decision making approach for information system investments. *Decision Support Systems*, 2006. 42 (2): 988-998.
[11] Beynon-Davies, P., *E-Business*. 2004, Basingstoke: Palgrave.
[12] Bureau-Van-Dijk. *Analyse MAjor Databases from EUropean Sources (AMADEUS)*. [Company Database] 2003 January].
[13] Daniel, R.D., Management Information Crisis. *Harvard Business Review* 1961. September/October.
[14] Doherty, N.F. & Terry, M., The role of IS capabilities in delivering sustainable improvements to competitive positioning. *Journal of Strategic Information Systems*, 2009. 18(2): 100–116.
[15] Earl, M., *Management Strategies for Information Technology*. 1989, Cambridge: Prentice Hall.
[16] Ec, *Statistical Classification of Economic Activities in the European Community, Rev. 2 (NACE Rev. 2)*. eurostat - Methodlogies and working papers. 2008, Luxembourg: European Communities
[17] Eder, L. & Igbaria, M., Determinants of intranet diffusion and infusion. *Omega - The International Journal of Management Science*, 2001. 29(3): 233-242.
[18] Frenzel, C.W. & Frenzel, J.C., *Management of Information Technology*. 2004, Boston: Thomson.
[19] Gartner, *Enterprise IT Spending by Vertical Industry Market, Worldwide, 2008-2014, 2Q10 Update*. 2010, Gartner Research: Stamford, CT. 14.
[20] Gunasekaran, A., Ngai, E.W.T., & Mcgaughey, R.E., Information technology and systems justification: A review for research and applications. *European Journal of Operational Research*, 2006. 173(3): 957-983.
[21] Hansen, D.R. & Mowen, M.M., *Management Accounting*. 3 ed. 1994, Cincinnati, Ohio.
[22] Hill, T. & Westbrook, R., SWOT Analysis: It's Time for a Product Recall. *Long Range Planning*, 1997. 30(1): 46–52.
[23] Hochstrasser, B., Quality engineering: a new framework applied to justifying and prioritising IT investments. *European Journal of Information Systems*, 1993. 2: 211–223.
[24] Irani, Z., Information systems evaluation: Navigating through the problem domain. *Information and Management*, 2002. 40: 11-14.
[25] Irani, Z., Love, P.E.D., & Correspondence, Developing a frame of reference for ex-ante IT/IS investment evaluation. *European Journal of Information Systems*, 2002. 11(1): 74-82.
[26] Irsel, H.G.P., Fluitsma, P., & Broshuis, P.N.A., Evaluatie van IT investeringen: het afstemmen van vraag en aanbod. *Informatie*, 1992. 34(11): 716-726.
[27] Jadhav, A.S. & Sonar, R.M., Evaluating and selecting software packages: A review. *Information and Software Technology*, 2009. 51(3): 555-563.
[28] Kaplan, B., Evaluating informatics applications--some alternative approaches: theory, social interactionism, and call for methodological pluralism. *International Journal of Medical Informatics*, 2001. 64(1): 39-56.
[29] Kaplan, R.S. & Norton, D.P., The Balanced Scorecard – measures that drive performance. *Harvard Business Review*, 1992: 71-79.
[30] Ko, H., Jeanne, S., & Ellen, N.S., Avoiding ERP pitfalls. *Journal of Corporate Accounting & Finance*, 2006. 17(4): 67-74.
[31] Krämer, S., *Total Cost of Ownership – Konzept, Anwendung und Bedeutung im Beschaffungsmanagement deutscher Industrieunternehmen*. 2007, Saarbrücken: Vdm Verlag Dr. Müller.
[32] Milis, K. & Mercken, R., The use of the balanced scorecard for the evaluation of Information and Communication Technology projects. *International Journal of Project Management*, 2004. 22(2): 87-97.
[33] Nas, T.F., *Cost-benefit analysis: Theory and application*. 1996, London: Sage Publications.
[34] Neirotti, P. & Paolucci, E., Assessing the strategic value of Information Technology: An analysis on the insurance sector. *Information & Management*, 2007. 44(6): 568-582.
[35] Nijland, M. & Willcocks, L.P., *How IT evaluation methods are used: Examining case research from an ANT perspective*, in *Evaluating Information Systems*. 2008, Butterworth-Heinemann: Oxford. 49-77.
[36] Parker, M.M. & Benson, R.J., *Information Economics: Linking Business Performance to Information Technology*. 1988, London: Prentice Hall.
[37] Podsakoff, P.M., Mackenzie, S.B., Lee, J.-Y., & Podsakoff, N.P., Common Method Biases in Behavioral Research: A Critical Review of the Literature and Recommended Remedies. *Journal of Applied Psychology* 2003. 88(5): 879-903.
[38] Reiner, J. & Stix, V., IT-transformation Decision Processes: A Conceptual Framework for Efficiency/Effectiveness Optimization. *Communications of the IIMA*, 2006. 6(3): 51-62.
[39] Reiner, J. & Stix, V. *IT appraisal models and methodologies: a critical literature review*. in *15th Information Ressource Management Association International Conference*. 2004. New Orleans.

[40] Renkema, T.J.W. & Berghout, E.W., Methodologies for information systems investment evaluation at the proposal stage: a comparative review. *Information and Software Technology*, 1997. 39(1): 1-13.
[41] Ross, J.W. & Beath, C.M., Beyond the Business Case: New Approaches to IT Investment. *MIT Sloan Management Review*, 2002. 43(2).
[42] Saaty, T.L., *The Analytic Hierarchy Process*. 1980, New York: McGraw Hill.
[43] Saaty, T.L., *Decision Making for Leaders - The Analytic Hierarchy Process for Decisions in a Complex World*. 3 ed. 2001, Pittsburgh: RWS Publications.
[44] Schoemaker, P.J.H., Multiple Scenario Developing: Its Conceptual and Behavioral Basis. *Strategic Management Journal*, 1993. 14(3): 193-213.
[45] Serafeimidis, V. & Smithson, S., The management of change for information systems evaluation practice: Experience from a case study. *International Journal of Information Management*, 1996. 16(3): 205-217.
[46] Shim, J.P., Warkentin, M., Courtney, J.F., Power, D.J., Sharda, R., & Carlsson, C., Past, present, and future of decision support technology. *Decision Support Systems*, 2002. 33(2): 111-126.
[47] Simons, R.L. & Davila, A., How High Is Your Return on Management? *Harvard Business Review*, 1998. January.
[48] Smithson, S. & Serafeimidis, V., Information systems evaluation as an organizational institution - experience from a case study. *Information Systems Journal*, 2003. 13(3): 251-274.
[49] Symons, V.J., A review of information system evaluation: Content, context and process. *European Journal of Information Systems*, 1991. 1(3): 205-212.
[50] Thrall, R.M., A taxonomy for decision models. *Annals of Operations Research*, 1984. 2(1): 23-27.
[51] Tufekci, S., Generalized decision trees: methodology and applications. *Computers & Industrial Engineering*, 1993. 24(1): 109-124.
[52] Ward, J.M., A portfolio approach to evaluating information systems investments and setting priorities. *Journal of Information Technology*, 1990. 5(4): 222-231.
[53] Zachary, W., A cognitively based functional taxonomy of decision support techniques. *Human-Computer Interaction*, 1986. 2(1): 25-63.
[54] Zangemeister, Z., *Nutzwertanalyse in der Systemtechnik – Eine Methodik zur multidimensionalen Bewertung und Auswahl von Projektalternativen*. Diss. Techn. Univ. Berlin. 1976, München: Wittemann.
[55] Zhu, K., Kraemer, K.L., & Xu, S., Electronic business adoption by European firms: a cross-country assessment of the facilitators and inhibitors. *European Journal of Information Systems*, 2003. 12(4): 251-268.