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State of the art: Managing costs and performance of Information Technology

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State of the art: Managing costs and performance of Information Technology

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ABSTRACT

The management of information technology (IT) is a complex task, particularly in the case of multinational corporations, where installations dispersed across distance and cultures can lead to a low level of transparency on costs and performance. Managing costs and performance of IT describes the discipline of ensuring the effective and efficient usage of IT resources. The aims of this are to provide a common understanding of the topic and delivering an overview of existing frameworks as well as actual research results. The structured literature review approach of this paper turned out that scientists as well as practitioner have not to full extent a common perspective of managing costs and performance of IT. Furthermore, existing frameworks are seldom covering aspects of federal organizations. Actual research results focus mostly on small facets of the entire topic. Particularly regarding governance and federal organization implications we propose further research. The paper concludes with a suggested research agenda for future research opportunities.

Keywords

Information technology, Performance management, Management accounting, IT-Controlling, Literature review, Cost management

INTRODUCTION

The fast ongoing development of IT, along with the globalization trend has had significant influence in the way organizations operate. These trends influence the corporate strategies and operational decisions of organizations. The International Data Cooperation (IDC) forecasts that worldwide IT expenditures will reach 1.48 trillion US Dollar in 2010, which is a growth of 3% compared to 2009 (IDC 2010). This underlines the trend that the worldwide annual IT investments have constantly increased over the past years (McAfee and Brynjolfsson 2008). Dependent on business sector, IT budgets already represent amounts between 3% and 15% of enterprises' revenues (IDC 2010). The majority of current and future business models are relying on the involvement of IT resources (Picot, Reichwald and Wigand 2009).

Always faster changing markets require a constantly adaption of business processes which leads to higher requirements for the IT organizations within enterprises. The rapid growth of IT investments has put increasing pressure on management to monitor investment risks and track payoffs in the decision making processes (Kim and Sanders 2002). This stresses the importance of clearly weighing benefits of IT investments against its costs. Therefore, controlling IT costs, assets and resources is an essential part of a value driven IT management (Krcmar 2009). Strategic management of IT represents an economic bridge into data processing and inherits a central role in planning, controlling and monitoring of cost-intensive IT-resources (Hansen and Neumann 2005; Krcmar and Son 2004). Putting it in a nutshell, the outlined increasing importance of IT influences significantly the strategic, tactics and operational decisions of organizations (Gunasekaran, Ngai and

McGaughey 2006). This furthermore underlines that decision makers need appropriate tools and frameworks to ensure that the business really benefits from IT.

In the field of managing costs and performance of IT several literature reviews have been conducted by IS scholars. The corresponding literature reviews cover research contributions focusing on research topics, research methods, perspectives or authors studying certain aspects (Brynjolfsson and Yang 1996; Frisk 2007; Gadatsch 2009; Rom and Rohde 2007; Schauer 2006). According to the authors' knowledge, no literature review focus particularly on German and Anglo-American literature. Nor does any literature review investigate the topic from a wide and holistically perspective.

The aim of this literature review is to establish a common understanding of the topic and to provide an overview of common frameworks including their different facets and characteristics. Besides consulting established and standardized frameworks, actual trends within the German and English speaking science community of information systems (IS) are highlighted. Moreover, the purpose of the literature review is to uncover the sources which are relevant to our topic under study and identify current research gaps within the area of managing costs and performance of IT.

LITERATURE REVIEW

Literature reviews are well known and their importance is widely accepted (Baker 2000; Cooper 1998; Fettke 2006; vom Brocke, Simons, Niehaves, Riemer, Plattfaut and Cleven 2009). According to Baker (2000) symbolizes a literature review the foundation for undertaking research project. The aim of this approach is to identify the relevant fundamental research literature which makes a vital contribution to the relevance and rigor of research (vom Brocke et al. 2009).

In the following paragraph a brief outline of the applied research methodology concerning the systematic literature search which is part of this paper, is provided. The process is arranged into five sub-processes which, if necessary, can be repeated individually or in total, to receive the required or desired quality of the literature search. The circularity in the process of literature search is inevitable (vom Brocke et al. 2009).

The process consists of five steps: (1) Definition of review scope, (2) Conceptualization of the topic, (3) Literature search, (4) Literature analysis and synthesis, (5) Research agenda.

Defining review scope

In a first step the scope of the literature review has to be clearly defined. Therefore we applied an established taxonomy for literature reviews such as that described by Cooper (1998). This taxonomy consists of six constitutive characteristics (refer to Table 1). Each characteristic contains certain categories. Thereby (1, 2, 3 and 5) can be independently combined, while (4 and 6) are mutually exclusive (vom Brocke et al. 2009).

Characteristic	Categories			
(1) Focus	Research outcomes	Research methods	Theories	Applications
(2) Goal	Integration	Criticism		Central issues
(3) Organization	Historical	Conceptual		Methodological
(4) Perspective	Neutral representation		Espousal of position	
(5) Audience	Specialized scholars	General scholars	Practitioners/ Politicians	General public
(6) Coverage	Exhaustive	Exhaustive and selective	Representative	Central/Pivotal

Table 1. Taxonomy of literature reviews (according to Cooper (1998))

The focus of the review is to identify latest research outcomes and their central issues. Thereby takes the paper a neutral stand. Furthermore, the aim of the literature review is to provide general scholars and practitioners the status quo on the topic managing costs and performance of IT. Hence, the coverage of the review is representative, due to the fact that we will focus only on leading scientific journals within the IS field.

Conceptualization of the topic

In a second step the conceptualization of the topic is conducted with the aim to extract a number of search keywords on which the field of managing costs and performance of IT can be explored. Vom Brocke et al. (2009) proposes different methods, such as the consultation of seminal books, encyclopedia or handbooks, but also the mapping of concepts.

In order to conduct a systematic literature search according to vom Brocke et al. (2009) substantiated basic knowledge about the topic to be investigated is necessary. The aim of the following explorative literature search is to provide an overview about standard literature in the field of managing costs and performance of IT. This explorative literature search concentrates on literature which providing an overview about the functions and methods of managing costs and performance of IT. Literature that is published before 2000 is not covered to ensure a focus on latest textbooks.

According to authors' knowledge and the aim of the paper to analyze German and Anglo-American literature, some differences in term definitions have to be clarified prior to the explorative search. The task of managing costs and performance of IT is known as "IT-Controlling" within German literature (Strecker 2008). Also the term "Controlling" itself is not established in both literature groups (Horváth and Reichmann 2003). "Controlling" is internationally referred to as management accounting, managerial accounting, management control systems or performance management (Kaplan, Atkinson and Morris 1998; Wagenhofer 2006). The Anglo-American scientific community refers task and responsibilities of IT-Controlling as "IT performance management", "IT/IS evaluation", "IT/IS investment evaluation", "IT/IS performance measurement" or "Measurement of IT/IS costs and benefits" (Schauer 2006; Strecker 2008). Moreover, the expression IT-Controlling is preferred used within this paper.

For the identification of first standard literature in the field of IT-Controlling a search via keywords in various catalogues of university libraries (University of St. Gallen, Technische Universität München and Massachusetts Institute of Technology) is conducted. The initial keywords (e.g. IT-Controlling, IT/IS evaluation, IT/IS performance measurement) were derived from relevant exiting literature reviews (Gadatsch 2009; Schauer 2006) and a journal article (Strecker 2008) which is referenced within the mentioned reviews. A number of textbooks covering the topic IT-Controlling were identified and with support of different citation databases on the internet (Web of Science and Google Scholar) a first refinement was done by the number of referencing publications. Further on, a reverse-search in anthologies and publications about IT-Controlling identified a number of additional relevant textbooks.

They are analyzed in detail according to the following criteria: Focus, Goals and Central tasks. Concerning "Focus" it is determined, if the emphasis is set on sub domains of IT-Controlling or if general IT-Controlling concepts are presented. The criterion "Goals" refers to the goals set in the textbooks which are addressed. And "Central tasks" covers tasks which are highlighted as central issues within the corresponding textbook. Table 2 shows the selected standard literature about IT-Controlling and their corresponding findings.

The majority of textbooks focuses on a sub domains of IT-Controlling and provided a high level of detail (Irani and Love 2008; Remenyi, Bannister and Money 2007). Only a few textbooks provide a holistic view onto IT-Controlling (Kargl and Kütz 2007; Krcmar 2009).

Consolidating the achieved findings of the explorative literature search allows drawing a common understanding of the topic. IT-Controlling is derived from the general controlling, a so-called concept for a specific problem set (Horváth 2009). It includes the controlling of information technology, operational information systems and data processing within the enterprises as well as the corresponding leadership processes of the resource information itself. In doing so the classical aspects of controlling such as data processing, planning, governance and coordination are being addressed (Kesten, Müller and Schröder 2007; Krcmar 2009). Furthermore, IT-Controlling shows interfaces to information management, management accounting, line management and leadership and is organized cross functional as well as cross divisional (Horváth 2009; Krcmar 2009)

IT-Controlling tries to construct transparency about information management and the usage of IT, which is required for entrepreneurial decisions about the composition of data processing and the input of technology (Krcmar 2009; Tiemeyer and Feil 2006). The central controlling objects are derived from the interfaces of IT-Controlling. Controlling objects from information management are among others projects, systems, services, standards, organization and personnel from IT areas or divisions (Horváth 2009; Irani et al. 2008; Krcmar 2009; Remenyi et al. 2007). The controlling objects derived from the interface of controlling are economically oriented and encompass among others the measurement of results or value contribution of IT resources used by the firm. Classical controlling objects such as budget, costs, achievements, risks and chances with an adoption to the corporate IT are as well addressed (Irani et al. 2008; Remenyi et al. 2007). Controlling objects derived from leadership are primarily IT supported business processes, goals, strategies and governance in the environment of the IT organization (Krcmar 2009).

Textbook	Focus	Goals	Central Tasks
(Horváth 2009)	Basic controlling principles, IT-Controlling as a sub domain, focused on the coordination between Controlling und IT-Controlling	Planning, governance and control of IT resources	Delivering management information, budgeting of IT, IT project controlling
(Irani et al. 2008)	IT-Controlling with an emphasis on value contribution, controlling of investments	Justification and evaluation of IT investments	Measurement of IT value contribution in general and of IT-projects
(Kargl et al. 2007)	IT-Controlling as approach for coordination and control of information coordination	Effective and efficient usage of IT resources	Structuring the IT strategy; Controlling of IT projects and IT portfolios; Controlling of IT services; Management of IT costs and service charges
(Kesten et al. 2007)	IT-Controlling as holistic approach from strategy down to IT operations	Measurement and governance of the IT value contribution	IT strategy: Identification of IT value contribution, analysis of opportunities and risks; IT projects: governance of multi and single projects, analysis of profitability; IT operations: governance of business partners, calculation and allocation of IT services
(Krcmar 2009)	IT-Controlling as part of information management with particular supervision and coordination responsibilities	Efficiency, effectiveness, functionality, quality, adherence to schedules	Controlling of IT portfolios, IT projects, IT services and IT infrastructure
(Remenyi et al. 2007)	Evaluation of costs and value contribution of IT resources	Efficiency and effectiveness of IT resources from a investment and cost perspective	Accounting of IT costs and activities; Evaluation of IT benefits; Controlling of IT investments
(Tiemeyer et al. 2006)	IT-Controlling focused on IT services and the improvement of the IT value contribution of thus services	Strategic planning and management of information systems	Controlling of IT services, IT resources and IT projects

Table 2. Overview of established IT-Controlling literature

The formal goals of IT-Controlling cover the safeguarding of the effective and efficient usage of the provided IT resources (Irani et al. 2008; Kesten et al. 2007). According to Krcmar (2009) this means to do the right things and among this to do the right things correctly. Next to formal goals, goals with regards to content are pursued, whereby quality, functionality and the meeting of deadlines in reference to the controlling objects, mentioned above, are advised.

Hence IT-Controlling covers the entire range of tasks from the preparation and planning of IT concepts, the planning of its architecture via management of project portfolios and project support to the supervision of the IT itself. To fulfill these requirements methods and tools of portfolio controlling, project controlling, product controlling, and infrastructure controlling are being used (Irani et al. 2008; Kargl et al. 2007; Kesten et al. 2007; Krcmar 2009; Tiemeyer et al. 2006).

Stamped by the relatedness of controlling and the goals as already described, the discipline can be structured into operative, administrative and strategic tasks (Horváth 2009; Krcmar 2009). In this context strategic tasks are among others the safeguarding of the mutual alignment of corporate goals with IT goals as well as the corporate strategy with the IT strategy (Horváth 2009; Krcmar 2009). The coordination of planning, governance, control and information tasks of the IT-Controlling discipline belong to the administrative assignments (Krcmar 2009). Some examples for the operative working area are the evaluation of the profitability of IT investments, the classical allocation of IT costs and benefits, the creation and governance of IT budgets and the provision of IT key performance indicators (Irani et al. 2008; Kesten et al. 2007; Remenyi et al. 2007).

Literature search

The antecedent explorative search and derived common understand of IT-Controlling have highlighted a number of relevant keywords. A diversion of the term IT-Controlling in the English language area is essential, as already discussed. Thus the following keywords have been set: *investment evaluation, performance measurement, performance management, performance evaluation, management control, management accounting, management control systems, measurement costs benefits*

For the German language area the following keywords were used: *controlling, wertbeitrag* (equivalent to: value contribution)

Journal title	Rating	Database
Information Systems Research (ISR)	A+	ProQuest
MIS Quarterly (MISQ)	A	EBSCOhost
Journal of Management Information Systems (JMIS)	A	EBSCOhost
Information Systems Journal (ISJ)	B	EBSCOhost
The Journal of Strategic Information Systems (JSIS)	B	ScienceDirect
Wirtschaftsinformatik (WI) (a.k.a. Business & Information Systems Engineering)	B	Web of Science & Springer

Table 3. Selected scientific journals for the literature search

The literature search is clearly focused on leading scientific information system journals. This ensures that the results are based on well-founded publications (Rowley and Slack 2004). A further limitation is carried out based on the common accepted journal ranking “VHB JOURQUAL 2” published in 2009. This ranking is based on a anonymous survey which was send to a large number leading scientists (Ulf Schrader and Thorsten Hennig-Thurau 2009). For the following literature search only journals with a minimum rating of B from the area of information systems and management (Rating categories from A+ to E) are selected. Table 3 shows the selected journals including their rating and corresponding database which was used during the literature search.

The extracted keywords above were searched within the abstracts of the selected high ranked scientific journals, while always all parts of the keywords were included. A chronological limitation was set on articles of the year 2000 or later to ensure the timeliness of the results. The interpretation and the qualitative analysis of the results is part of the fourth step which includes the literature analysis and the synthesis.

The number of search hits for the different keywords are below the expectations. Only once a keyword resulted in more than ten hits. (Search string: performance management / MIS Quarterly). Further details on the number of hits per keyword are presented in Table 4.

Search string	ISR	MISQ	JMIS	ISJ	JSIS	WI
investment evaluation	3	0	1	2	1	
performance measurement	3	5	5	0	0	
performance management	3	13	5	1	9	1
performance evaluation	0	2	1	1	0	
measurement costs benefits	0	4	0	0	0	
management control	2	0	2	4	2	
management accounting	2	2	0	0	1	
management control systems	1	1	1	3	2	
controlling						3
wertbeitrag						2

Table 4. Search hits per scientific journal and search string

Literature analysis and synthesis

The collected literature was analyzed and synthesized in a next step in order to taking only relevant article in consideration and finally deriving a research agenda. Relevant articles in the field of IT-Controlling only were found very scattered within the selected leading scientific IS journals. Subsequently the relevant articles are analyzed according their focus and publication date. In total 12 journal articles were identified as relevant for research within the IT-Controlling area.

Article	Short Outline
(Kohli and Devaraj 2003)	Measuring of IT value contribution and benefits
(Choe 2004)	Relationship between management accounting, information and the business performance
(Fichman 2004)	IT investment valuation with real options
(Gwillim, Dovey and Wieder 2005)	IT investments and their payoffs
(Tanriverdi 2005)	Business value of IT and knowledge management
(Rivard, Raymond and Verreault 2006)	Value contribution of IT from a strategic perspective
(Brandl, Bichler and Ströbel 2007)	Cost accounting of shred infrastructures
(Hakkinen and Hilmola 2008)	IT investments and their payoffs
(Zimmermann 2008)	Governance mechanisms within the IT portfolio management
(Becker, Knackstedt and Pöppelbuß 2009)	Fundamental framework to assess the current status of the corporate IT environment as well as the identification of improvement levers
(Gadatsch 2009)	Overview of established IT-Controlling frameworks
(Strecker and Kargl 2009)	Overview of established IT-Controlling frameworks

Table 5. Relevant journal articles on IT-Controlling

Based on the results of Table 5 two research streams within leading scientific IS journals can be identified. A significant role plays here the sub domain of IT-Controlling which is investigating the value contribution of IT respectively the evaluation of IT investments and their payoffs. These tasks of IT-Controlling are dedicated to the operative working area. Further on, 2 papers covering coordination aspects, governance within the IT portfolio management and the relationship between IT-Controlling and other disciplines.

Research agenda

The fifth and final step in the framework is drawing a research agenda. At this point the above mentioned circularity becomes obvious, since the individual steps have to be investigated once again – for example concerning the expansion on more keywords or on more target sources. Hence on the basis of the results from this literature search a research agenda can only briefly be defined yet. The usage of IT-Controlling on group level of multinational enterprise seems to be almost not covered by the current ongoing research, which emphasizes of existing literature review based on only German IT-Controlling literature (Schwertsik, Wolf and Krcmar 2009).

SUMMARY AND OUTLOOK

Based on the results of the explorative literature search a common understanding of IT-Controlling can be defined. The general aim of IT-Controlling is to ensure the effective and efficient usage of IT resources. The control objects of IT-Controlling arise from the interfaces of information processing, controlling and leadership, which are linked to the following formal aims effectiveness and efficiency, as well as the objectives functionality, quality and adherence to deadlines. Moreover it bridges the gap between the operation of IT resources and the specific roadmap of the IT strategy. Moreover IT-Controlling coordinates the management of IT related resources within the IT organization respectively organization. As last responsibility it offers methods to evaluate the value of current IT assets or future IT investments including the measuring of a corresponding value contribution. Finally this enables IT-Controlling to ensure a value oriented management of IT resources within organization.

Putting the results of the literature search in a nutshell the majority of scientific articles in this area focus on the value contribution of IT and decision support methods in the context of IT investments. Only a few, in numbers 2, concentrate on the interface between financial accounting and IT management respectively operations. The textbooks whether the identified articles do not cover the aspect of for example the implementation of IT-Controlling within a multinational federal organization.

This result allows at least two possible conclusions: first, the chosen keywords are not yet relevant and exact enough for the systematic literature search to identify more publications regarding the topic IT-Controlling. Hence one possibility would be to extend the number of keywords, but it has to be mentioned that possibly relevance could be lost. The employment of the sole term “costs” will most probably give more hits, but it is questionable, whether this is a qualitative improvement of the search.

Second the sources of data are another factor, which directly influence the quality and quantity of the results. In this case, the choice of relevant journals is the relevant parameter. Only leading scientific journals were considered within the literature search. We propose in a further iteration of the literature search to consider also journals which address practitioners. By this it can be elaborated, if the field of IT-Controlling has significant more attention among practitioners. A reorientation of the selected journals or keywords in order to narrow the topics within IT-Controlling, e.g. on IT-Controlling in federal organizations could be sensible to determine possible gaps in research more detailed.

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