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ABSTRACT

Due to increasing IS customer requirements, traditional IS management methods have to be refined. For this reason, companies enhance their IS management concepts by adopting known best practices such as the IT Infrastructure Library (ITIL), and by using service-oriented computing techniques such as web service technologies and service oriented architectures as enabler. Nevertheless, current implementations lack of consistency and comprehensiveness, resulting in unstructured, inefficient and ineffective IS management. Against this background a new, comprehensive IS management approach is suggested in this paper. The proposed approach is theoretically derived from industrial management, especially the SCOR-model (Supply Chain Operations Reference model), under consideration of the IS value chain and service-oriented computing techniques. By conducting a case study the proposed IS management approach is reflected in practice according to design science.

Keywords

IS Service, IS Management, ITIL (IT Infrastructure Library), Service-Orientation, Web Services, Operations Management.

INTRODUCTION

Like many times in Information System (IS) history, again, IS management methods are nowadays not sufficient for meeting current business requirements. In the late 1980s and 1990s, the trend from the development of single technology enabled solutions towards the evolvement of highly integrated, complex information systems was triggered by growing business needs for reliable and efficient solutions (Zarnekow, Hochstein and Brenner, 2005b). This need was based on the growing dependency on information technology along with higher quality requirements as well as increasing cost for information technology (Pohlmann, 2003). The further growing penetration of information technology in companies during the last decade, makes currently used IS management concepts obsolete again, as shown in the next section. Consequently, the demand for new concepts rises.

STATE OF THE ART IN IS MANAGEMENT

Traditional IS management concepts such as problem-oriented IS management methods (Applegate, McFarlan and McKenney, 1999; McNurlin and Sprague, 2002; McKeen and Smith, 2003) and task-oriented IS management methods (Österle, Brenner and Hilbers, 1991; Heinrich, 2002; Krcmar, 2004) lack an overlying alignment structure according to the value chain of IS. Instead IS management tasks are arranged by strategic, tactical, and operational layers. Thus, important parts of the IS value chain are not considered. Considering the value chain approach consisting of the phases source, make, and deliver (SCOR, 1998), traditional IS management concepts are mainly focused on the make phase. Thereby, methods for delivering and sourcing IS services are neglected. Although, there is discussion on sourcing aspects (Lacity, Willcocks and Feeny, 1996; Lacity and Hirschheim, 1998; Barthelemy, 2001; Willcocks, Hindle, Feeny and Lacity, 2004), a comprehensive

method integrated with the management of the entire IS value chain does not exist. Missing customer orientation and inefficient planning of IS resources are the results. Additionally, traditional IS management concepts have an emphasis on the management of applications. Nevertheless, the outcome of the IS value chain are not applications, but IS services, i.e. a technology and application based support for business processes. Thus, the focus of IS management concepts on applications should be substituted by a focus on IS services. This is one of the reasons for the recent emergence of service-oriented computing techniques (Papazoglou and Georgakopoulos, 2003).

The service orientation on technology layer as well as architectural layer enable a more flexible way of adopting the IS infrastructure and complex applications to new business requirements in a fast and cheap way (Cherbakov, Galambos, Harishankar, Kalyana and Rackham, 2005; Kano, Koide, Liu and Ramachandran, 2005; Bieberstein, Bose, Walker and Lynch, 2005). On the technology layer, standards such as XML, UDDI, WSDL or Grid Services enable a loose coupling of infrastructure services and application services (Booth, Haas, McCabe, Newcomer, Champion, Ferris and Orchard, 2003; Newcomer, 2002; Foster and Kesselman, 1998; Foster, Kesselman, Nick and Tuecke, 2002; Smith and Konsynski, 2004). On the architectural layer concepts such as Service-Oriented Architectures (SOA) facilitate efficient and effective composition of foundation services (Baglietto, Maresca, Parodi and Zingirian, 2005; Barry, 2003; Crawford, Bate, Cherbakov, Holley and Tsocanos, 2005). Thereby, the traditional development of complex information systems is increasingly replaced by the development of single IS services and their composition. This enables the possibility to mass customize IS services according to specific customer needs. However, there are only few concepts on how to manage single or composed IS services, i.e. how to determine cost, related with the delivery of these services, what quality do the customers of these services need and how to assure this quality, what kind of penalties are contracted if failures occur, how to manage the IS service portfolio, as well as other questions, relevant for the management of IS service providers. In 2003, Papazoglou and Georgakopoulos developed a three-layered model for service-oriented computing, which also points out the need for concepts dedicated to the management of IS services (Papazoglou and Georgakopoulos, 2003).

In addition to traditional problem-oriented and task-oriented IS management concepts, best practices for IS management evolved. Whereas in the field of IS development best practices such as CMM, SPICE or Bootstrap are used for many years (Dorling, 1993; Haase, Messnarz, Koch, Kugler and Decrinis, 1994; Paulk, Weber, Curtis and Chrissis, 1995), also in the field of IS management best practices emerged. Especially, the IT Infrastructure Library (ITIL) holds as a de-facto standard for managing IS services, simultaneously promoting an end-to-end view of the IS value chain and a focus on IS services instead of applications (Commerce, 2000; Hochstein, Zarnekow and Brenner, 2004; Macfarlane and Rudd, 2002). But also standards for IS security management (e.g. BS 7799 / ISO 17799) or IS compliance management (e.g. CobiT) evolved in the last decade (Saint-Germain, 2005; International Standards and Accounting Association (ISACA), 2004). These standards represent best practices developed by practitioners. In contrast to traditional IS management concepts the IS value chain as well as the service-orientation are considered and thereby Papazoglou and Georgakopoulos' demand for service-oriented IS management concepts (Papazoglou and Georgakopoulos, 2003) should be met. However, a comprehensive framework for using and integrating these standards in a systematic way is missing. Additionally, existing standards are neither complete nor consistent (Hochstein et al., 2004). Table 1 summarizes the existing IS management concepts and their weaknesses.

	service-orientation	IS value chain			comprehensiveness			consistent framework
		deliver	make	source	strategic management aspects	tactical management aspects	operational management aspects	
probelm-oriented IS management concepts	non-existent	non-existent	partly existent	non-existent	existent	existent	existent	partly existent
task-oriented IS management concepts	non-existent	non-existent	partly existent	non-existent	existent	existent	existent	existent
best IS management practices	existent	partly existent	partly existent	non-existent	non-existent	partly existent	partly existent	non-existent

Table 1. IS Management Concepts and Weaknesses

PROBLEM STATEMENT AND RESEARCH METHODOLOGY

Due to increasing dependency on information technology, traditional IS management methods have to be refined and a new IS management framework has to be developed respectively. This new IS management framework has to meet the requirements stated in section 2 and summarized in figure 1.

Often comparisons between IS management and industrial management have been made (Moll, 1994; Wang, Lee, Pipino and Strong, 1998; Zarnekow, Brenner and Pilgram, 2005a), but more and more single industrial management concepts are really adapted to IS management. Especially quality management concepts such as TQM or Six Sigma are used to improve the quality of IS management (Wang, 1998; Fehlmann, 2005; Zarnekow et al., 2005a). But also concepts from service industry are adequate for transformation to IS management, due to the intangible characteristics of IS services (Fähnrich and van Husen, 2004). Thereby, we analyzed existing industrial management concepts in order to identify a framework that satisfies the demands summarized above. Based on this analysis, we chose a qualified industrial management framework for creating a new IS management framework. Nevertheless, within the concepts of industrial management, there is no reference to IS management and therefore no possibility to test our results theoretically. According to design science, constructs can be evaluated through observational methods, such as case study methods (Hevner, March, Park and Ram, 2004). Therefore, we reflected our results on the basis of a case study.

Our research approach follows the concept of case study research as described by (Eisenhardt, 1989), (Stake, 1995) and (Yin, 2002). Selection of the case study object was based on the following criteria: a) availability of information about the company's IS management approach, b) the case had to deal primarily with the introduction of new IS management approaches, c) the new IS management approach had to follow current best practices (such as ITIL), and d) at least six months of experience with the new IS management approach had to be made. To initiate the case study, structured interviews were conducted with IS managers and subsequent extended telephone conversations took place. Company-specific documents, relating to the project were made available to the authors and were taken into consideration in the deduction of insights.

A NEW IS MANAGEMENT FRAMEWORK

As depicted in section 2 and shown in table 1 the requirements for the new IS management framework are the following:

- In addition to the view of traditional IS management concepts, the new IS management framework has to focus on IS services.
- The entire IS value chain has to be covered.
- In terms of the decision horizon (strategic, tactical, operational) comprehensiveness is required for the new IS management framework.
- The new IS management framework has to be consistent.

Based on these requirements we used the Supply Chain Operations Reference-model (SCOR-model) (SCOR, 1998), which is a standard framework for supply chains in industry, and adapted this model to the IS value chain under consideration of posed requirements (see figure 1).

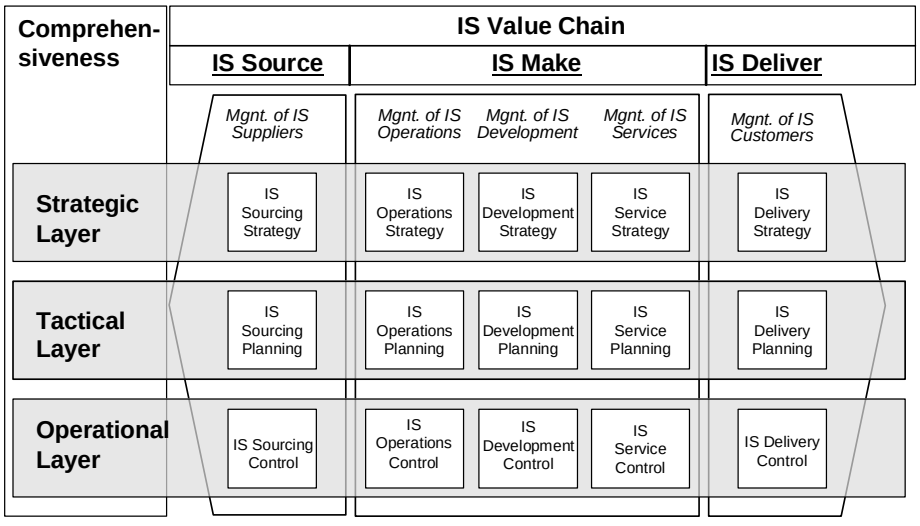

Figure 1. New IS Management Framework

Using a framework for supply chain operations, implies an analogy between IS value chains and operations value chains. This analogy has been studied before (Moll, 1994; Wang et al., 1998; Zarnekow et al., 2005a). Table 2 shows essential objects of operations management and their counterpart within IS management.

	operations management	IS management
products	• goods	• IS services
materials	• raw materials, preliminary products, lubricants, adjuvants	• data, adjuvants (date media, toner for printing et cetera)
manufacturing resources	• factory • machines, transportation facilities, warehouses, tools • CNC program, working plan, bill of materials	• data processing center • computers (server, mainframe et cetera), peripheral devices, networks, operating systems, drivers) • software code
manufacturing processes	• transport • stocking • processing (handling, converting et cetera) • testing	• transport (i.e. network traffic) • saving • computing (selection, calculating et cetera) • testing

Table 2. Analogy Between Essential Operations Management Objects and IS Management Objects

Based on the analogy of essential operations management objects the SCOR framework is adapted to IS management. SCOR describes the processes of any industrial value chain, by dividing source processes, make processes, and deliver processes. This structure has been taken over and aligned with IS management concepts described in section 2. In detail, the following aspects are considered within the new IS management framework:

- By introducing the column "Management of IS Services" the traditional focus on applications and technology is supplemented by a focus on IS services, thereby considering the current trend towards service-oriented computing.
- The entire IS value chain is covered. By using the SCOR-model, traditional IS management concepts are supplemented by the aspects of supplier management and customer management, which are neglected in problem-oriented as well as task-oriented IS management approaches.
- The strategic layer, tactical layer, and operational layer, known from task-oriented IS management concepts (Heinrich, 2002; Krcmar, 2004) have been integrated in the new IS management framework and thereby the planning processes described in the SCOR-model are considered.
- By integrating comprehensiveness in terms of the decision horizon as well as completeness in terms of the IS value chain, a matrix results, containing 15 modules (see figure 1).
- By combining consisting frameworks, such as SCOR and task-oriented IS management concepts, the consistency of the new IS management framework is assured.

The concretion of the new IS management framework is based on three sources:

- By using the SCOR-model from operations management, IS management is compared with operations management and the approach of industrialized IS management is regarded consequently. Thereby a systematic transformation of operations management concepts, such as Value Engineering (Brown, 1992), Design-for-Manufacturing-and-Assembly (Boothrody, Dewhurst and Knight, 2002), Plant Engineering (Rosaler, 2002) or Production Planning and Scheduling-methods (Fransoo and Rutten, 1994; Pepels, 2002) to IS management is enabled.
- Task-oriented (Österle et al., 1991; Heinrich, 2002; Krcmar, 2004) and problem-oriented (Applegate et al., 1999; McNurlin and Sprague, 2002; McKeen and Smith, 2003) IS management methods are used to describe IS management processes especially within the make phase.
- The trend towards standardization of IS management processes is considered by integrating existing best practices, such as ITIL or CMM within the new IS management framework. ITIL for example is partly used for definition of IS delivery control procedures, whereas CMM is partly used for definition of IS application planning procedures. By doing so, the new IS management approach does not compete against established standards, but integrates these.

Because of its characteristic as an IS management framework, processes defined within the different columns and modules are management processes, and therefore contain either planning or controlling activities. These processes and activities are

concerned with different IS objects depending on the particular module. These IS objects and their relationships are shown in figure 2. Our proposed IS management framework describes planning and controlling activities focused on depicted IS objects. Whereas on the strategic layer traditional IS management concepts are focused on the planning and controlling of the IS architecture as well as the IS infrastructure, our proposed IS management framework suggests the planning and controlling of an IS service portfolio aligned with the IS market demand. Thereby, traditional marketing concepts, such as the 4P-model (McCarthy, 1960; van Waterschoot and van den Bulte, 1992; Anderson and Taylor, 1995) are used and adopted to IS management. In addition the planning and controlling of an IS supplier portfolio is stressed in our proposed IS management framework in order to get the coordination across the entire IS value chain. The tactical layer of our proposed IS management framework is focused on the planning and controlling of customer specific IS service contracts. Based on individual IS customer requirements, IS services are planned and underlying IS solutions, IS resources as well as IS suppliers are aligned. Therefore, for example concepts such as production planning and scheduling (Fransoo and Rutten, 1994; Pepels, 2002) are used and transferred to IS management. On the operational layer, ordering, delivery, and production of the actual IS service instance are planned and controlled. Thereby, because of the intangible characteristic of IS services, especially existing concepts of service operations management (Parsa, 2001; Roth and Menor, 2003; Johnston, 2005) are used and adopted to IS management.

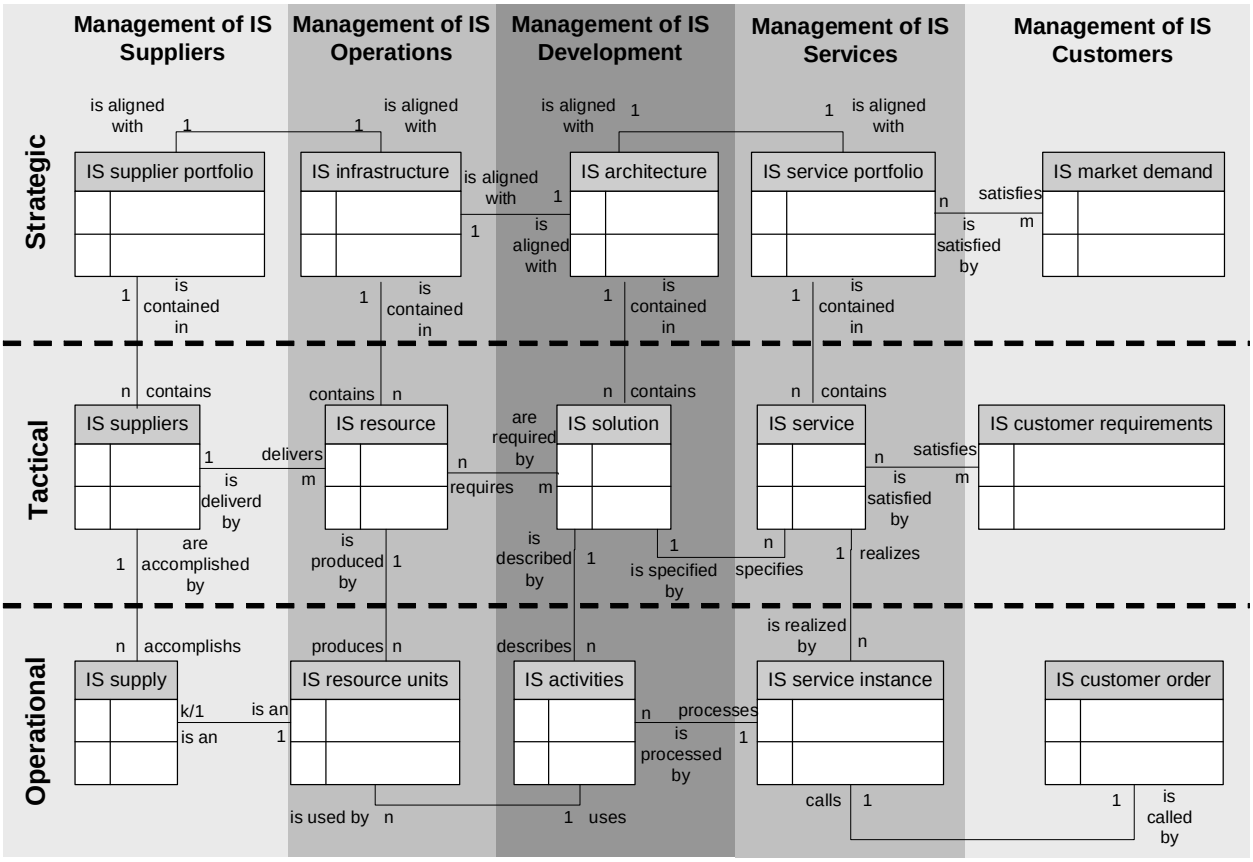

Figure 2. Meta Model for the Proposed IS Management Framework

Based on this specification of the proposed IS management framework, a case based validation according to design science (Hevner et al., 2004) can be conducted.

CASE STUDY

In order to verify the new IS management processes, we conducted a case study, which has been published before. In the following, the case will be briefly summarized, pointing out the aspects of most relevance to our analysis. First, the company background is depicted, followed by the specific challenge that lead to the introduction of new IS management processes. Furthermore, the implemented processes and the characteristics of relevance for our analysis are described.

Company Background

BASF IT Services was founded in April 2001, when all BASF IT activities in Europe were merged. The company, which is a subsidiary company of BASF AG, has more than 2,300 employees in 12 European countries. With a turnover in 2004 of €386 million, BASF IT Services currently operates computer networks for 50,000 users in 250 European locations and aims to continue to develop and standardize information technology, both for BASF AG and for new external customers. BASF IT Services offers a wide range of products and services, including innovative solutions and application development services in the fields of e-Business, Enterprise Resource Planning (ERP) and human resources management systems, as well as office support and consulting.

Challenges (as of 2001)

- BASF IT Services was not organized as a professional IS service provider, but as an internal IS department, managed as a cost center instead of a profit center. Thereby, activities for example as proposed in the 4P-model were not integrated. Because of this, BASF IT Services had no transparency about profit margins or about efficient and effective IS service delivery.
- IS management of BASF IT Services did not focus on delivering IS services but only on developing and running applications as well as resources. The column "Management of IS Services" and corresponding processes did not exist. Therefore, customer requirements were not met and customer satisfaction was decreasing continuously. In addition, IS service quality was not transparent for customers and no management of expectations was possible.
- BASF IT Services did not define centralized IS management processes and solutions. Synergies between departments were not realized. Controlling of IS management processes did not happen and weaknesses could not be identified.

Solution in Context of the New IS Management Framework

BASF IT Services implemented its new IS management solution in 2001. Thereby, the following concepts of the proposed IS management approach are considered: BASF's IS management structure corresponds to our proposed IS management approach. BASF IT Services plans and controls its IS service portfolio according to market demand. This is ensured by a strategic alignment process in the style of the 4P-model. Based on the defined IS service portfolio, IS architecture, IS resources as well as IS suppliers are planned and controlled. On the tactical layer, customer requirements are received, negotiated, and IS service contracts are signed. According to contracts, internal solutions, resources as well as suppliers are committed by defining operative agreements. On the operational layer, customer orders are received, IS service instances are created and activities for producing and delivering the IS service are performed by using IS resources and if applicable IS supply. BASF IT Services plans and controls the operational activities by conducting regular reports on performance and other key figures. In addition, service operations management concepts such as service capacity planning are integrated.

Experiences with the New IS Management Approach

BASF IT Services advanced from an internal IS department to the status of a professional IS service provider. BASF IT Services is now managed as a profit center and many processes, proposed in our new IS management framework, are integrated. According to Petra Scheithe (Director Service Management, BASF IT Services), after 2001 BASF IT Services is able to deliver and produce high quality IS services in an efficient and effective manner.

After introducing the new IS management approach, BASF IT Services is able to plan and control the delivery of IS services. Service specific quality parameters are defined and controlled. Thereby, for example, delivery time for IS support services could be increased by 42 percent within two years. Since then, customer satisfaction is increasing continuously. In addition, no false expectations are created on the customer side. By defining centralized IS management processes according to our proposed IS management framework, synergies between departments are realized and IS resources are planned according to planned IS service turnover and contracted IS service quality. Thereby, weaknesses and inefficiencies can be identified.

For further details about this case, see (Zarnekow et al., 2005b, pp. 315-328).

CONCLUSION AND FURTHER RESEARCH

Increasing IS customer requirements created the need for a new IS management. In this paper, the SCOR-model serve as basis for the derivation of a new IS management framework, concretized by using traditional IS management approaches, industrial management approaches and best IS management practices. A case study shows that the implementation of the proposed IS management framework creates benefits in terms of transparency and efficiency. Because of the lack of comprehensive IS management approaches, embracing current trends in IS management, companies do not have the ability to

initiate a consistent and all-embracing IS management. A lot of single reorganization projects trigger the adoption of best practices or service-oriented computing techniques. Thereby, the requirements described in section 2 are partly met.

Nevertheless, analysed companies do not use a consistent framework in order to structure their IS management. Because of this, a comprehensive implementation of a service-oriented IS management approach considering the entire IS value chain cannot be achieved.

With the proposed IS management framework the interrelationships between different IS management areas are stressed and companies are enabled to merge their single projects into one comprehensive IS management concept. At the same time, by introducing the new IS management approach, companies assure the implementation of logically derived IS management processes in a consistent way. Although, on a high level first implementations of our proposed IS management framework are observable in practice, not sufficient insights are gained into detailed IS management processes and their conformance to our proposed IS management, deduced from operations management. Single operations management processes and their adoption to IS management have to by studied in depth in order to recommend these for IS management. In addition, further case studies have to be conducted to validate the proposed IS management approach in different industries and cultures.

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