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Towards a Research Framework for VLBA Operation Management

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ABSTRACT
Operations Management for Very Large Business Applications? What’s behind this? By looking at the IT (Information Technology) industry, more and more providers of IT-based services like mail service or business software providers are trying to make their offerings more convenient and easy to use and to leverage their production. When looking at other industries like the automotive industry, they had similar questions almost 100 years ago. Efficient supply chains are a vital necessity for many companies. Aim of this paper is to explore these questions. This is done by considering key aspects of industrialization and IT services under the perspectives of the SCOR model. We present the SCOR model shortly and provide a current view on IT service production from an industrialized perspective of the software industry. Along the five key processes of the SCOR model, we discuss aspects of IT service industrialization and provide a conceptual model of industrialized IT for further research approaches.

Keywords
Very Large Business Applications, IT services, IT industrialization, SCOR.

MOTIVATION
In the early 80s, the American and European automotive industry were characterized by a high proportion of self-manufacturing. Nearly 40 percent of production takes place in the manufacturers themselves, the suppliers have played a much smaller role than today. Associated with this high production depth was a low level of standardization in terms of both production processes and the components. So it was, for example, within the Mercedes-Benz Group, for the different rubber components they often have different mixing ratios. But then the Western automotive industry has been shaken by the unexpected competition from Japan. The local auto manufacturers were able to produce quality vehicles at relatively low cost. Their benefits were mainly that their production and work organization was more effective than their Western competitors and that parts of them were outsourced to production to subcontractors (Lean Production). The basis for such cooperation was essentially the standardization of processes and components. Similar problems as the automotive industry in the 80s today is IT: It is faced with global competition in the operation of application systems, servers, networks, etc. However, the competitors will not come from Japan, but from India or China. The companies then benefit from a date in comparison to Western Europe and the United States, low wages, they also strive to ensure efficient production, which allows them to offer their services cost-effectively.

These emerging markets are leading induced by increasing the comparability of services to users of IT services costs put pressure on their services. At the same time, the management of the CIOs expect that the price reduction is reflected in the IT service costs and either the total IT budget decreases or increase quality and value proposition of IT significantly. Reinforced this claim by the fact that also IT can exploit economies of scale: Large and high-volume suppliers of standardized IT services achieve significant cost advantage over smaller competitors such as the company's internal IT organization. CIOs have to consider whether it is still useful in the future to source the IT commodities from an internal service provider or not. It's not just about infrastructure, or standard desktop applications, but also to the entire business process outsourcing (BPO) or single, standardized information services (Enterprise Services).

The use of such economies of scale is a professional management of IT, regardless whether it is the IT service provider or the CIO organization. It can be established concepts and methods from the industrial production of goods and services from the management transferred to IT. For example, an end-to-end application of the Six Sigma concept may lead to significant successes, who rated the IT service processes from the user to the IT service provider in this manner, can significantly increase the quality of service. The well-known methods from the industrial business process of cost accounting lead to more
transparency. Production planning systems (PPS) guarantee higher utilization rates and will lead to more efficient IT operations. Especially in industrial goods production in the last century a new phenomenon was observed: there Industrialization led to large productivity gains. Increasingly, external and internal IT service providers are trying to reproduce this development.

To elaborate on this phenomenon, a structured approach in conducted to investigate the concepts and opportunities of industrialization on IT service providers. This is done by taking the concept of supply chain management as research framework. Supply chains are networks which organize manufactures, service providers and distribution sites that supply raw material, perform a transformation of raw material into both intermediate and finished products and distribute them to the customers(Lee und Billington 1992). Supply chain management (SCM) denotes all task related to manage the supply chain like planning and control, organizational structuring, product and information flow facility structure, management methods and risk and reward structure(Cooper et al. 1997). With regards to a short term perspective, supply chain management is primarily to increase productivity, reduce inventory and inventory cycle times. On a long term perspective, supply chain management should lead to increasing market share, customer satisfaction and increasing profits for all participants in the supply chain (Tan et al. 1998). Therefore, this concept might be useful to examine the first preliminary ideas.

The paper is structured as follows: in chapter 2, the research method is described. In chapter 3, a research background is given to operations management, IT industrialization and the SCOR model. In chapter 4, a conceptual model for IT service providing is developed, and an assessment of this model is made on the different aspects of IT industrialization. This assessment is structured by the different perspectives of the SCOR model. In chapter 5, the results are discussed, and implications are derived from the discussion. Chapter 6 closes with a summary and a research outlook.

RESEARCH METHOD

Aim of the paper is to give IT service providers a comprehensive process implementation guideline by means of an operations framework. To achieve this, an industry-standard model – SCOR – was chosen and investigated of its suitability to supply chain management processes of IT service providers. This was done by means of a comprehensive literature review on the characteristics and concepts of supply chain management, operations management and IT service providing, enhanced through market knowledge and leading expert opinion. Based on this literature study a new conceptual model was developed in a design science approach (Hevner at. Al.). This new model was substantiated by a reflection of current literature. Since this is an exploratory work on a new topic, the real justification of the conceptual model will be part of future research.

RESEARCH BACKGROUND

Operation Management

Operations management is defined as “Activities that relate to the creation of goods and services through the transformation of input to output” (Heizer und Render 2011). Drawing the big picture of operation management, one can go back to the 16th century to learn first aspects of operations management ideas (Voss 2007). This article might not be the place for a comprehensive historical perspective on the development of operations management, which has already been done by Sprague (Sprague 2007). The core statement is: operation management has a long tradition, is well-established and contains strong concepts. It is still a challenging area of advanced research. To cut it short, the authors just would like to mentioned some of the core concepts: “management” according to Frederick W. Taylor (Taylor 2006), “assembly line” according to Henry Ford (Ford und Crowther 1988), “Theory Of Constraints (TOC)” according to Eliyahu M. Goldratt (Goldratt 1990) and “Material Resource Planning (MRP / MRP II)” according to APICS. These are just a few of the concepts which led to significant improvements in production processes. But, they all have in common that these concepts work for tangible goods. Answers to the question, which concepts may be transferable to intangible goods, are just at the beginning.

Reflecting these operation management concepts in traditional industries may lead to the opinion, that the transfer of these concepts to the IT service industry may be straightforward and will lead to the same results as it can be observed in the last decades of the classical industry. Roth and Menor (ROTH und MENOR 2003), however, stated, that it is necessary to change the viewpoint when working on operation management for service-oriented industries. They proposed three factors as a framework for future research in operation management for service industries: target market, the service concept and the service delivery system design. Following this, it might be an appropriate way to re-think established concepts from the classical industry through the lenses of these three factors.
Industrialization of IT Services

Some year ago, the first discussions about the industrialization of IT service providing were started in practice as well as in the scientific community (Lamberti 2004; Mertens 2006; Brenner et al. 2007). The base of these discussions was the enormous success of industrialization achievement in traditional industry sectors. According to Brenner et al. (Brenner et al. 2007) there are four principles, which are responsible for the success of industrialization in traditional industry sectors:

- **Standardization and automation**
  Production costs of products may be decreased significantly through increasing the proportion of standards in products as well as in business processes. Central factors of the production processes are division of labour and assembly line production.

- **Modularization**
  Dividing products in modules and components enable a customization of a product although production process are highly standardized. This leads to a customer-oriented production with low production costs.

- **Continuous Improvement Processes**
  By means of various quality concepts like Kaizen, TQM or Six Sigma companies tried to improve their production processes. Furthermore, companies used these quality concepts to enable the measurement of the quality improvement.

- **Concentration on core competencies**
  During the last decade, companies have decreased their vertical range of manufacturing. Inefficient production steps have been outsourced to other providers with a higher potential for specialization and scale effects.

Looking at these four principles from an IT service perspective, one can see, that in the IT industry, there are already several concepts, which might be appropriate to serve as an enabler for the accordant industry principle (see table 1):

<table>
<thead>
<tr>
<th>Industry principle</th>
<th>IT concepts</th>
</tr>
</thead>
<tbody>
<tr>
<td>Standardization and automation</td>
<td>Cloud Computing, IaaS, PaaS, SaaS, CMMI, ITIL, COBIT</td>
</tr>
<tr>
<td>Modularization</td>
<td>Virtualization, Grid-Computing, Blade-Computing, Utility-Computing, SOA</td>
</tr>
<tr>
<td>Continuous Improvement Processes</td>
<td>SLA, OLA, CIO, Six Sigma</td>
</tr>
<tr>
<td>Concentration on core competencies</td>
<td>IT-Outsourcing</td>
</tr>
</tbody>
</table>

**Table 1: IT concepts aligned to industry principles according to (Brenner et al. 2007)**

Mertens (Mertens 2006) has provided a first structural model of an IT service provider as a so-called „IT-factory“. For this structural model, relevant processes were identified and put in the context of a production environment of IT services (see fig. 1). This model shows a first idea about how to develop a holistic concept for the production of IT service processes in an industrial way.
Reflecting these first results it seems, that the adoption of industrial principles to the IT service industry is fairly straightforward. But, on the other hand, there are some differences and restrictions. From the perspective of generating IT services, there are differences in the development processes and production processes for material goods and products which have an intangible outcome like IT services (Böhmann und Krcmar 2007). Intangible goods are simply to re-produce with no or small production costs (Picot et al. 2010), they are in general not stockable (Engelhardt et al. 1993). From the viewpoint of a scientific discussion, the discussed concepts and models have to be investigated and completed in the context of an industrialized IT service providing. Justified solutions for this research gap may simplify the design of IT provisioning and reduce efforts and costs while increasing customer satisfaction. The current state of the art is not able to provide the answers needed for improvement.

SCOR model

There exist several business process frameworks to structure supply chain management processes in the literature. Hewitt gave a framework consisting of 14 business processes which are used by supply chain management executives in practice (Hewitt 1994). Cooper et al. identified eight supply chain processes: customer relationship management, customer service management, demand management, fulfillment, procurement, manufacturing flow management, product development and commercialisation and reverse logistics (Cooper et al. 1997). In order to obtain a holistic view on the opportunities of industrialization in supply chain management processes, we decide to take a more high-level framework. The framework chosen for such a holistic approach is the SCOR model (Supply Chain Operations Reference-model) (Poluha). This model was designed by the Supply Chain Council as a reference model for describing business processes in the Supply Chain (Supply-Chain Council 2008). It draws on both corporate as well as enterprise-wide business processes described. SCOR has established itself as a model for the market, especially shown by the fact that more than 1000 companies worldwide have joined the Supply Chain Council. The SCOR model includes five key supply chain operations Plan, Source, Make, Deliver and Return and is organized into four levels of observation (see figure 2):

![SCOR Model Diagram](image)

**Fig. 2. SCOR reference model (Supply-Chain Council 2008).**

The level 1 is the process level and thus represents the highest level of the model defined here. The scope of this level is the organization and the content of its supply chain. There are five processes are considered (see table 2):
<table>
<thead>
<tr>
<th>Process</th>
<th>Content</th>
</tr>
</thead>
<tbody>
<tr>
<td>Planning (plan)</td>
<td>the interplay of supply and demand</td>
</tr>
<tr>
<td>Sourcing (source)</td>
<td>procurement of products, components and services for service provision</td>
</tr>
<tr>
<td>Manufacturing (make)</td>
<td>the manufacture of products, intermediate products and services to different manufacturing</td>
</tr>
<tr>
<td>Delivery (deliver)</td>
<td>the supply of products and services to the customer with the appropriate accompanying</td>
</tr>
<tr>
<td>Return (return)</td>
<td>to receive a faulty product or return of primary products or raw materials to the supplier</td>
</tr>
</tbody>
</table>

Table 2. Processes and their content of the SCOR model

The second level of consideration is the configuration level. On this level of observation, the core processes are divided into process categories. A distinction is made in planning processes, implementation processes and support processes. Linking these two levels of observation produces a connection matrix. This matrix represents the set of all process combinations that should be used for the establishment and development of a supply chain between the different business partners.

The detailing of these processes takes place in the level 3. On this level of consideration of the specific process steps, the sequence and the input and output information are described. This level of consideration, referred to as a design level, completes the SCOR model. The viewing plane 4 is the implementation level, which is not included in the model. In this level, it is about company-specific considerations, not by general considerations concerning all types of companies.

**SCOR-ALIGNED INDUSTRIALIZED IT-SERVICE PROVIDING**

First efforts have shown, that it might be appropriate to transfer concepts and models from the traditional industrial environment to the context of IT service providing. To elaborate on this issue in a structured approach, a conceptual model of IT service providing in an industrial environment is proposed. This model was build first on the four industrial principles standardization and automation, modularization, continuous improvement processes and focusing on core competencies. Second, a core concept of ITIL was taken. Following this aspect, there is a direct link from business services, which represent the customers' aim, to the required IT resources by linking them together through IT services. These IT services are linked to the business services through a business service catalogue and are linked to the IT resources through a technical services catalogue. Third, the core concept of SCOR was taken to achieve a holistic approach to IT service providing. The result of combining these three concepts to one conceptual model is displayed in figure 3.
The growing market acceptance and the first successful demonstration projects show, that industry aspects in IT service providing have a growing influence on the design of IT services itself and IT resources used to provide these services. Now companies are raising the question of how to achieve this issue to achieve sustainable competitive advantages. For this purpose, the five key processes of the SCOR model in the context of the proposed conceptual model are considered separately.

**Main Process: Plan**

The process design of the process Plan includes the planning and management processes. In this case, a consultation between the existing resources and future needs is done. Furthermore, plans for the entire supply chain and procurement processes for exporting, manufacturing and delivery are created. This leads to the management of the business rules, evaluating the performance and various other aspects of the supply chain such as logistics management and risk management. Finally, an alignment of the plans of the supply chain has to be made to the financial plans of the company (Supply-Chain Council 2008). The starting point of professionalism is a sophisticated portfolio management. It compares the calculated cost pays basis for any IT service value proposition in its respective business processes. The term Build-Run IT integration pursued today is often a concept, that has long been in use in the industrial goods manufacturing. It's called Design for Manufacture and Assembly (DFMA). With its help, for example, a car manufacturer is able to determine in the development phase of a new design already the effect that certain decisions on the upcoming production will have. This concept is just as good to use for the development of application systems and IT services. It helps from the widespread problem, that causes subsequent release upgrade high costs and develop applications in the subsequent operation of an expenditure that is neither anticipated nor desired. The analysis of cost structures over the life cycle of applications shows two things: the phase of planning and development activities of only 20 percent, but 80 percent of total operating costs. Simultaneously caused everything to determine all of the operating costs, in the later stages of life-cycle cost ten times as high as in the development stage.

**Main process: Source**

The process Source includes the acquisition, receipt and inspection of incoming material. In addition, it includes the procurement processes and the identification and selection of appropriate suppliers. The management of business rules, supplier performance and the processing of specific aspects such as supplier contracts and risk management complete the purchasing process. The heavy cost pressure for IT organizations is only met by restricting themselves consistently on their core competencies. Many IT service providers and IT organizations, that are currently offering commodities, have to outsource these areas and focus on the efficient production and the successful sale of niche products. This obviously has consequences for the internal structure of the service provider or the CIO organization. They defined their main tasks...
previously considered plan, build and run application systems, these are called the future Source, Make, and Deliver. It is partly a by the automated production of standardized and modular IT Services (Make). Other services should be purchased from suppliers, if they can deliver them in high-quality and low cost (Source). Third, the IT service organization or the self-produced and / or externally sourced sub services to bundle and sell IT services within or outside the company (Deliver). To remain competitive, the IT organization appropriately limited to the provision of IT services to which it is highly specialized. An IT unit in the chemical sector is likely to have, for example, unique knowledge regarding the support of industry-specific business processes in the chemical industry. Other IT services should be procured from third parties. In the course, industrialization must modify both the IT organization to changing working practices as well as new value chains. Unlike the automotive industry, IT tried to resolve the issue of focusing on core competencies by outsourcing to arbitrary problem areas. This had nothing to do with a selective economically motivated and well-considered decision. A systematic analysis of the core competencies, the consideration of transaction costs, the calculation of potential synergies or the precise definition of interfaces have been woefully neglected.

**Main process: Make**

The process Make includes processes such as production planning, production design, assembly, quality control and packing. IT has only just begun to standardize their products. They still primarily concerned with the standardization of complete applications. The client must then decide which parts of the application he is using, or whether all the functions it needs are covered in the standard. Nevertheless, standardized solutions for ever more and ever more specialized areas are offered and used. Still not widespread is the use of standardized business processes based on enterprise services. Chances of solutions are used by partners of the leading platform manufacturers. For example, the pharmaceutical company Bayer reported that he, such a solution for optimizing use stock as they come from the SAP partner SmartOps, and be easily integrated into a Netweaver environment. Detailed information about customizing effort and total cost of ownership (TCO), though not before. In full swing, the standardization of processes is generally based on ITIL (IT Infrastructure Library) or CMMI (Capacity Maturity Model Integration). Frameworks such as ITIL or CMMI are a solid start. But they are insufficient to cover the topic of fully industrialization. For example, they are not sufficient to allow one to standardize procedures and processes for the integration of development and operating phases. Next, there is the automotive industry with its concept of DFMA (Design for Manufacture and Assembly), which anchors the integration of build and run in the processes. The same applies to the processes in the customer management and sourcing: They also get into the IT best practices only marginally. But there are also established concepts from other fields that can be transferred to IT: the Supply Chain Reference Model (SCOR) or the Customer Chain Reference Model (CCOR). With regard to the standardization process so there is still much room for improvement. But it appears from the existing research results also, that IT organizations are quite willing to make their processes more professional.

**Main process: Deliver**

The delivery processes include order processing and warehouse and transportation management. In analogy to the highly industrialized sectors such as automotive now pursue the IT organizations the goal of "Mass Customization". This ambition is reflected not only in technical and conceptual innovations, but also in new processes and even if only tentatively existing “industry standard” way of thinking. Ultimately it will change the trend of industrialization and the global market for IT services. As a technical and conceptual "enabler" for the mass customization, component standards and platforms are used, that can be connected the standardized components. In industrial manufacturing, standards such as DIN binding lead to generally accepted standards. In IT industry, for example, standards for Web services exist, both industry-specific as well as cross-industry standards. In addition, the large software vendors provide the necessary platforms are already available as products. The use of Web services, the implementation of IT platforms and a consistent implementation of service-oriented architecture (SOA) not only lead to positive effects, which the companies expect from the mass customization. Rather, also the appropriate governance processes to be established. IT organizations in both the internal and the external need to make in the face of industrialization thoughts about their primary business model and its underlying portfolio of IT services. If they want to remain competitive, they should be limited to the provision of IT services that fall within the scope of their core competencies. Other services are better repurchased by a third-party provider. IT units, which currently exist as an internal full-service provider of the parent company, will in the future not be able to compete with the economies of scale external providers. Alternatively, they could also make it their business to support industry-specific business processes using information technology. It is conceivable, for example, that IT units of logistics companies develop innovative products from their particular expertise area, which they offer not only within, but also outside the group.
Main process Return

The return processes include the return and the withdrawal of unwanted or no longer needed goods. Return in IT industrialization means ending of services, service level agreements and similar concepts. It also means to get data back and business process components to build a similar service in another environment. In IT industrialization, the topic of return is not discussed at all at the moment. Due to the absence of substantial concepts, this will be part of future research.

DISCUSSION AND IMPLICATIONS

Today, many IT organizations focus all of their energies on making their processes more transparent and more professional. They use increasingly concepts, methods and instruments that have been established in other industries. Standard processes with little strategic importance can be left outside vendors. This raises the question, how such specific business processes can be supported more efficiently. Give an answer even here the principles of industrialization: the purpose of mass customization can be more complex products or IT services efficiently produce or procure, or bundle, cheap, since it would be possible to increasingly specialized products or services in IT to provide favorable.

The media industry is currently discussing the phenomenon of the "Long Tail". Web sites such as YouTube and iTunes provide the opportunity to add songs from unknown groups to offer them inexpensively to a large mass of consumers. The rule is, that 20 percent of the titles is leading to 80 percent of sales. A large percentage of these providers thus results from songs that are downloaded extremely rare. The music retailer Rhapsody achieved 40 percent of its revenue from titles that are less than 700 times demand, and thus can also hardly be found in well-stocked music stores. Digital "storage" and favorable sales processes on the Internet create a new market for niche products, which it terms of revenue potential can accommodate almost even with the traditional market of "big hits". This principle can be applied in the course of industrialization on the IT industry transfer. Virtualized and service-oriented IT landscapes represent a favorable opportunity to provide specialized IT services in the future. At the same time, these specific services can be obtained on standardized platforms that integrate into the existing system landscape and bundle them into user-specific products. In consequence, a new market will develop for niche products. Innovations that were not previously economically enforce may soon be a reality. Above all, industry-specific IT organizations, the possibilities of a market for IT-based niche products cannot be neglected or underestimated. Even if the individual demand will be less for IT services, it can be realized thanks to the variety of specific services such as sales with comparable commodities. This requires that the product but the business management processes and models in the industry know and strive to use the plug to the revenue, and extend it through innovation. Despite the clear steps toward industrialization, IT is only at the beginning of this development. With regard to the conditions and procedures, they can learn a lot from traditional industries like the automotive industry. However, intangible benefits accounted for the often complex logistics chains that allow for tangible products, the manufacturing and service processes only. For intangible services, which aim to obtain information or coordination (eg. management services, monitoring, analysis, consulting, etc.), the availability of the service at the required times and in the languages required a success factor (Böhmann und Krcmar 2007).

SUMMARY AND OUTLOOK

Aim of this paper was the study of concepts and opportunities of industrialization to the enhancement of IT service providers. Therefore, a structured assessment has been conducted by using the SCOR model as an assessment perspective. The SCOR reference model was taken to identify the associated concepts and learnings from industrialization in other industries in every single process step of the model. These concepts have lead to a new conceptual model for industrialized IT service providers. A structured literature review has shown, that industrialized concepts may serve as enabler for future requirements in every main process of the process model. It could be shown, that the potential of industrialization in the Plan, Source, Make and Deliver processes, is significant, whereas we see a lack of support in the Return process. This structured assessment hardens the conceptual model as a starting point for future research.

Future research will take care of a more in-depth view of the subprocesses of the SCOR model to identify single process steps which may be enhanced significantly through cloud computing technologies. In addition to this, a comprehensive market analysis will be conducted to evaluate existing concepts of industrialization to the requirements of current and future IT service provisioning.

REFERENCES


