ERP for the IT Service Industry: A Structured Literature Review

Johannes Hintsch
Faculty of Computer Science
Otto von Guericke University Magdeburg
Johannes.Hintsch@ovgu.de

ABSTRACT
The industrialization of the IT service industry aims at transferring concepts of traditional manufacturing companies to IT service providers in order to achieve efficiency gains. Enterprise Resource Planning (ERP) systems have been irreplaceable for traditional manufacturing industries in achieving today’s efficiency level. As the provisioning of IT services exhibits parallels to traditional manufacturing the transfer of ERP concepts could be valuable in helping IT service providers become more efficient.

The current state of the art of academically researched, full-fledged ERP systems is assessed via a comprehensive structured literature review. The search space spanned 97 selected journals and 27 conferences from 1996 to 2012.

This review yields only six relevant publications which suggests that this is a niche topic in mainstream IS research. It is argued that a reference model for an ERP for the IT service industry would be beneficial to improve the efficiency of IT service providers.

Keywords
Enterprise Resource Planning, IT Service Management

INTRODUCTION
The industrialization of IT has been a much discussed topic in Information Systems (IS) research in recent years (Erbes, Motahari Nezhad and Graupner, 2012; Walter, Böhmann and Krcmar, 2008). Two of industrialization’s core concepts are standardization and automation. By standardizing product components the collaboration of the supply chain’s participants becomes possible. By specializing on certain components companies are enabled to focus on their core competencies. By automating production it is possible to establish economies of scale and thus to achieve cost reduction. These concepts should be transferred to the IT service industry in order to make service provision more efficient.

An IT service may be defined as “a service provided to one or more customers, by an IT service provider. An IT service is based on the use of Information Technology and supports the customer's business process. An IT service is made up from a combination of people, processes and technology and should be defined in a Service Level Agreement (SLA)” (Lloyd, 2008, p. 301). The management of IT services is defined as “the implementation and management of quality IT services that meet the needs of the business. IT service management is performed by IT service providers through an appropriate mix of people, process and information technology” (Lloyd, 2008, p. 301).

In order to support the IT service industry in its value creation process, ERP systems could be extended or redesigned. ERP systems are packaged application systems, integrating all processes and functions of an enterprise in a common database. They integrate participants of the supply chain and provide managers with a comprehensive view of the company’s state (Chen, 2001; Davenport, 2000, p. 2; Klaus, Rosemann and Gable, 2000). ERP functionality is often organized in modules according to specific industry purpose or general functional areas (module for utilities vs. accounting module).

In the following section the topic is further investigated and the research question formulated. Related work is stated subsequently. The fourth section describes the structured literature review, which was conducted to answer the research question. In the last section conclusions are drawn and an outlook towards further research is given.
ERP FOR THE IT SERVICE INDUSTRY

According to Betz, IT companies often have a multitude of isolated systems in order to support their business (Betz, 2011). In combination these systems form a company’s very large business application. An ERP system could integrate their functionality. With a standardized packaged application system that is “off the shelf” the costs for acquiring such a system could be lowered for all customers.

Traditional industries witnessed a concentration of the supplier market of products onto a few global companies (e.g. tire manufacturing). The same is likely to happen with IT companies when a company specializes in a particular service, achieves economies of scale and dominates a market segment (Heym, Montana and Elben, 2012). Large global companies become more difficult to manage. To achieve fault tolerance service centers are distributed globally. ERP systems can give managers a real time view of large global companies which is necessary to react to managerial challenges. The supply chain of specialized service providers requires systems that offer a way to design, maintain and contract relationships. Providing up to date and reliable services requires a workforce that is well trained. The global sourcing and human resource management capabilities are characteristics of ERP (Klaus et al., 2000).

ERP systems were extended from systems solely supporting production and planning control (PPS) of manufacturing companies to enterprise systems that support the processes of all kinds of businesses (Klaus et al., 2000). Pinnow suggests, based on work by Zarnekow (Zarnekow, 2007), the usage of PPS for supporting and automating the production of IT services (Pinnow, 2009). He shows that the capacity management of a data center can effectively be automated. Thus also in this aspect ERP systems may be used for the industrialization of IT service provisioning. However, implementing ERP systems will only be reasonable for IT service providers which have certain characteristics (e.g. production has potential for standardization, sufficient size, international service delivery etc.).

Based on the industries that are supported by ERP software, best practices and standards are incorporated respectively. Requirements for common modules, such as accounting, are similar between companies from different sectors. Thus general regulations and processes may be codified in them. Specialized industry modules, however, utilize specific process models. German energy utilities, for example, share a process model for keeping up energy delivery when customers switch providers (González Vázquez, Sauer and Appelrath, 2012). This model can be implemented in a generic ERP software and be used by all German energy utilities. Several frameworks for IT service management exist but with the IT Infrastructure Library (ITIL) the IT service industry has a de facto standard (Hochstein, Tamm and Brenner, 2005; Wu, Huang and Chen, 2011) of IT service management processes. Thus there is a set of recognized best practices that can be used as a foundation for operationalizing the business of IT service providers in an ERP system.

Research Question

The question that shall be answered by this structured literature review is: What is the current state of the art of enterprise systems using IT service management concepts to support the value creation of IT service providers? The goal is to find literature that describes the applicability of ERP in the domain of the IT service industry, because, as described in the previous sections, this transfer promises efficiency gains. Consequently it is not the goal to provide a review of the state of the art of ERP in general or to provide a general overview of the IT service industry and its related concepts but of ERP systems that are based on common IT service management practices to support the IT service industry’s value creation.

RELATED WORK

Becker et al. published a study in which they question employees of ten German IT service providers about their adoption of six industrialization principles (Becker, Poeppelbuss, Venker and Schwarz, 2011).

The first two are (1) standardization of processes and of (2) products. The majority of the ten companies sell IT services using catalogues. Furthermore, techniques of cost accounting are used by the majority of the companies, although not as pronounced as in traditional manufacturing companies. For process standardization the majority of companies use ITIL. (3) Modularization is used to build customized products while maintaining the capability for mass production using mass customization. Mass customization is partially practiced, but some companies find that customer requests are too specific. (4) Automated service delivery may be achieved by means of PPS systems. On average, the companies state that they automated 47% of the service delivery. PPS systems are used, but mostly for capacity management. Techniques of traditional manufacturing may be used in (5) outsourcing to identify suitable suppliers for intermediate products. However, such practices are not found amongst the interviewees’ companies. Hardware and software are perceived as commodities and are sourced by the majority of the providers, while IT services are only sourced by three of them. For quality management (6) most companies record their quality of service but only one company uses an established method such as Six Sigma.
The authors do not hint to any use of ERP but say that PPS systems are partially applied in the companies. However, they confirm that standardization and automation are important concepts for IT service providers. They plan to conduct a wider online survey in the future to gain representativeness of their results.

Many ERP literature reviews have been conducted (Botta-Genoulaz, Millet and Grabot, 2005; Eden, Sederer and Tan, 2013; Esteves and Bohorquez, 2007; Esteves and Pastor, 2001; Moon, 2007; Schlichter and Kraemmergaard, 2010). The most comprehensive among them is the study which was begun by Esteves and Pastor in 2001, extended by Esteves and Pastor in 2007 and was most recently taken up by Eden et al. in 2012. All three reviews use the same categorization framework and review the same journals and conferences. They cover a period from 1997 to 2012 with the exception that Eden et al. leave out one journal and add another. As they ignore conferences altogether they label their review as research in progress.

In 2007 ten conferences and 23 journals were analyzed. They used keywords like ERP and also names of large vendors to search in titles, keywords and abstracts. The three studies reviewed 838 papers in total. Categorization is done by classifying the papers according to the six phases of the ERP life cycle: adoption decision, acquisition, implementation, use and maintenance, evolution and retirement. Additionally the categories educational and general are used for papers that don’t fit into the classification scheme. The category which fits most papers is implementation: 43 % of all examined papers belong to this category. Most implementation related papers dealt with the success and failure of ERP implementations in organizations. The reviews contained no paper which is relevant to this research question.

Botta-Genoulaz and Millet provide an analysis of the usage of ERP systems in service companies (Botta-Genoulaz and Millet, 2006). They conduct a literature review and a case study in six companies with one software company amongst the firms (other service sectors: banking, insurance, telecommunication, gastronomy and health). The authors do not indicate how the literature review was conducted. The identified literature suggests that finance and accounting modules are used most often, and human resource modules are used more by service than by manufacturing companies. The leading vendors of ERP for service companies then were PeopleSoft, SAP and Oracle in descending order. The authors found that the studied software company was the only one using an additional ERP module apart from material management and accounting: a module supporting legal work. Although the paper is quite dated it confirms the usage of ERP systems by service companies. It also points out that ERP systems were not used to their full potential.

LITERATURE REVIEW

Seuring and Müller describe how a literature review can be conducted in four steps (Seuring and Müller, 2008): material collection, descriptive analysis, category selection and material evaluation. The descriptive analysis gives a formal description of the papers (e.g. number per year). During the category selection structural categories are to be defined. Based on the structural categories the material is analyzed in hopes of being able to come to meaningful insights.

Material Collection

In order to review up-to-date information, journals and conferences are analyzed. To collect the material three questions need to be answered:

(1) In what timeframe should be searched? A reasonable timeframe should be chosen to limit work load.

(2) What content is the search supposed to find? This question is answered by providing a set of plausible keywords.

(3) Where shall be searched? A list of publications or literature databases is generated.

(1) The search timeframe spans the years from 1996 to 2012. A revised specification of the CORBA standard was published in 1996 featuring a service for licensing IT services (OMG, 1998). This can be seen as a technical foundation for providing billable IT services. The selected timeframe seems plausible because at that time ERP and ITIL had also been around for a number of years (Cartlidge, Hanna, Rudd, Macfarlane, Windebank and Rance, 2007; Jacobs and Weston, 2007).

(2) Internet accessible databases are used and the search phrase is constructed from three dimensions that shall capture the research question. Each dimension is constructed of keywords that are linked with the Boolean operator OR. The three dimensions are linked with AND meaning that all retrieved documents must at least contain one keyword from each dimension (see Table 1). The first dimension describes who the ERP system shall be for or what these systems must be used for. The second dimension describes what the ERP system is used for. Thus the first two words of a number of terms like “IT service provider” or “IT service industry” are included. Also terms connected to cloud computing like “software as a service” or “application service provider” are included. This dimension is finished up by German spelled versions of IT service and IT service provider. The argumentation for including German literature is given answering the question of search location (2).
The second dimension contains instances of IT service management frameworks. It is indicated below each fragment of the dimensions in which source publication the frameworks were found. Some frameworks for governance or software engineering incorporate parts of IT service management (Johannsen and Goeken, 2011; Walter and Krcmar, 2006). Thus these were also included in order not to exclude relevant material. The proprietary framework “Perform” by the company CapGemini was not included because the English verb yielded too many results.

<table>
<thead>
<tr>
<th>AND</th>
</tr>
</thead>
<tbody>
<tr>
<td>↑ Source: (Hochstein and Hunziker, 2003)</td>
</tr>
<tr>
<td>&quot;IBM SMSL&quot;, &quot;IBM Systems Management Solution Lifecycle&quot;, &quot;IT BSC&quot;, &quot;BS 15000&quot;, […]</td>
</tr>
<tr>
<td>↑ Source: (Sallé, 2004)</td>
</tr>
<tr>
<td>↑ Source: (Walter and Krcmar, 2006)</td>
</tr>
<tr>
<td>&quot;ITUP&quot;, &quot;IBM Tivoli Unified Process&quot;, […]</td>
</tr>
<tr>
<td>↑ Source: (Galup, Quan, Dattero and Conger, 2007)</td>
</tr>
<tr>
<td>&quot;V-Modell XT&quot;, &quot;Val IT&quot;, &quot;Risk IT&quot;</td>
</tr>
<tr>
<td>↑ Source: (Johannsen and Goeken, 2011)</td>
</tr>
<tr>
<td>AND</td>
</tr>
<tr>
<td>↑ Terms used in first set of database queries</td>
</tr>
<tr>
<td>&quot;enterprise application&quot;, &quot;enterprise applications&quot;, &quot;enterprise information systems&quot;, &quot;enterprise information system&quot;, &quot;enterprise software&quot;, &quot;very large business applications&quot;, &quot;enterprise system&quot;, &quot;enterprise systems&quot;</td>
</tr>
<tr>
<td>↑ Terms added for second set of database queries</td>
</tr>
</tbody>
</table>

Table 1: The three dimensions of the search phrase (terms in the dimensions were actually linked with an OR not a comma)

The third dimension is composed of the keywords describing the systems that shall support the IT service industry. Based on existing knowledge of the author the first set of terms was compiled. Davenport argues that the term ERP originates from systems supporting manufacturing and thus suggests that the term Enterprise System (ES) is more appropriate (Davenport, 2000, p. 2). A first search was carried out using the entire search phrase and this keyword set for the third dimension. The literature was than analyzed. Based on the article keywords of the identified literature further terms used to describe ERP were added for the second set of database queries.

(3) For determining the publications or databases that were used, the following procedure was chosen: ERP has a strong relationship to the company SAP because they pertain to have been the first to sell ERP software (Chen, 2001; Leimbach, 2008). Thus it is important to include German IS research. To achieve this, all “A” and “B” ranked journals and conferences from a widely accepted ranking of journals and conferences (Wirtschaftsinformatik, 2008) were selected. Subsequently, databases which index the journals and conferences were identified. Such journals which have a primary focus on education, human computer interaction, media management, mobile computing or security were ignored. Also the “Journal of Internet Research” and the journal “Technology and Management” could not be found via catalog and internet search and were thus ignored. In total 97 journals and 27 conferences were used for database identification.
These are the databases that were used for the search:


Six journals were downloaded either in full or in abstract form because indexing databases could not be identified.

The querying was restricted to abstracts, titles and keywords. If this mode of search was not provided a full-text search was conducted. If the database didn’t support querying with the full search phrase, only the first or the first and the third dimension were used. These documents were downloaded and locally tested against the full search phrase (including the material of the six downloaded journals) – sorting out irrelevant findings.

Abstracts were read to decide for relevancy. If in doubt the entire article was read.

**Descriptive Analysis**

Six relevant publications were identified. Of these six results four were done by the same lead author (Ebert and Brenner, 2010; Ebert, Uebernickel, Hochstein and Brenner, 2007; Ebert, Vogedes and Uebernickel, 2009; Ebert, Vogedes, Uebernickel, Brenner and Heinz, 2008). The other two were from Wittgreffe et al. (Wittgreffe, Trollope and Midwinter, 2006) and Pilgram and Vogedes (Pilgram and Vogedes, 2012). Publication outlets were BT Technology Journal (BT), Proceedings of the Americas Conference on Information Systems 2007 (AMCIS), Proceedings of the Australasian Conference on Information Systems 2008 (ACIS), Proceedings of the Wirtschaftsinformatik 2009 (WI) and the Journal HMD – Praxis der Wirtschaftsinformatik (HMD). Figure 1 shows the publications over the years of publication.

![Figure 1: Publications by year, author and publication outlet](image)

Legend

1 Publications by lead authors: \(W\) – Wittgreffe, \(E\) – Ebert

2 see text for abbreviation of publication outlets

P – Pilgram
Category Selection and Material Evaluation

After reviewing the material, the following categories were inductively (Seuring and Müller, 2008) chosen to categorize the papers: partial approach for an ERP for the IT service industry and integrative approach. Figure 2 shows the categorization of the papers.

![Integrative approach Partial approach]

Figure 2: Categorization of papers

Wittgreffe et al. (Wittgreffe et al., 2006) describe how they designed an operational support system for British Telecommunications. The system consists of five different platforms using the service oriented architecture paradigm to integrate them in a sixth platform. The first platform manages services using ITIL best practice processes. An enterprise information platform provides reporting and business intelligence capabilities. An enterprise management provides accounting and resource management (such as workforce-project allocation). The fourth is the customer management platform and used for customer relationship managing and also ITIL support services. The billing and payments platform – the fifth – is used for revenue calculation and collection. The authors are able to integrate all relevant areas of their business. However, it is questionable how generalizable their approach is towards other IT service companies outside the telecommunications industry, or even other telecommunications companies.

Ebert and different co-authors publish a series of articles describing the applicability of PPS systems for the IT service industry. He starts out by developing a model for IT services which he claims could be the first step towards an ERP for IT service management (Ebert et al., 2007). He then justifies the need for PPS by services becoming more complex; by describing that the cost of operating and maintaining IT services is so high that budgets become too small for new developments or improvement and by suggesting that existing production capacities are poorly utilized. He develops an approach using existing PPS concepts and adjusting them to IT (Ebert et al., 2009, 2008). Evaluation is done with a fictional scenario developed during a case study at the German IT service provider T-Systems. It is synthesized that PPS methods are useful for IT services, but that further work needs to be done in order to support the planning of resources for contract based IT services as well as considering IT services that have execution dependencies (e.g. a running application which consumes the resource “server capacity”).

Pilgram and Vogedes add to the challenges of IT service management identified by Ebert. They cite experiences which, according to them, were gained by their institute during several case studies: In the companies they studied, IT service management is dominated by a technical view and not enough attention is paid to the service’s business purpose. Furthermore no order processing for service provisioning exists, standardization and reuse are seldom and no capable cost accounting is existent. The authors devise a business concept to cope with these problems. They claim that 80 % of their business concept can be implemented with the SAP’s ERP software. A test implementation in cooperation with T-Systems is cited that is supposed to validate their work. It is however questionable how generalizable their findings are, as T-Systems is the only company used for evaluation and it remains unclear how the cited challenges were come up with to construct the business concept.

Limitations

This structured literature review is limited in the sense that only one reviewer conducted the assessment of relevancy for each paper.
CONCLUSION AND FUTURE WORK

In order to capture the current state of the art of ERP for the IT service industry a structured literature review was conducted.

The small number of six identified relevant papers indicates that this is a niche topic in IS research. It is plausible to assume that ERP-like systems are used by IT service providers. Also vendors like SAP have comparable systems for the IT service industry in their portfolio (e.g. SAP Solution Manager). Thus the topic certainly has the industry’s attention. However, a scholarly discussion may take place in outlets that are less renowned (Wittgreffe et al., 2006): The paper about British Telecommunications’ OSS shows that ERP-like concepts are utilized in the industry while not using the term ERP.

As an ERP system for the IT service industry is strongly related to the IT service provider’s core business, companies may be reluctant to shed light on their systems. To further overall efficiency, however, standard systems would be beneficial. ITIL describes the processes and thus the business of IT service providers. An ERP system could operationalize these processes but the literature provides no common understanding of what functionality such a system needs to comprise and how it shall be architected.

Therefore, the development of a reference model for an ERP for the IT service industry is promising. Such a model would define the functionality required by the IT service industry, the architecture which combines the different modules or subsystems and the processes which would need to be operationalized. As ITIL is often called the de facto standard for IT service management, ITIL could serve as a basis. But in order to provide a reference model, further effort needs to be invested into clarifying whether or not ITIL sufficiently answers all questions related to IT service management.
REFERENCES


