Adoption of ERP system for operations management in SMEs

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Abstract. The fast development of the IT in the society of today has led to that more SMEs rely on ERP systems. Especially, IT has facilitated the management of the flow of goods within and between organizations and have made lead times more effective and also have increased the overview of the flow of goods. This will help SMEs obtain a competitive advantage. The aim of this paper is analyze the factors influencing SMEs adoption of ERP systems. A qualitative case study is conducted within a company which both is engaged in manufacturing and project work. The company runs service projects for its customers and at the same time they produce articles both for sale and for use within the service projects. An ERP system can also serve as an overall system for the administration, the production and inventory management in the company. However, there are important factors to take into account in the adoption phase, related to the technological infrastructure, the organizational challenges as well as environmental relations in order to decide on an implementation on an ERP system. It is of a critical importance that the SME really change their routines in order to follow the processes implemented in the ERP system. Otherwise, the company runs the risk to be stuck in its previous and ineffective inventory management processes, regardless of investments in the ERP system and the technological infrastructure.

Keywords: ERP systems, implementation, adoption, pre-adoption, operations management, inventory decisions optimization.

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1 Introduction

The fast development of the IT in the society of today has led to that most of the organizations rely on any kind of ERP systems. ERP systems are supporting companies and other organizations in many different ways, and are often used for many different processes and for the integration of processes (Al-Mashari, Al-Mudimigh & Zairi, 2003). Especially, IT has facilitated the management of the flow of goods within and between organizations and have made lead times more effective

and also have increased the overview of the flow of goods (Beheshtia & Beheshti 2010). Thus, the processes for the flow of the goods can be visible both within and outside the organization without performing manual and time-consuming manual processes. According to ERP systems the opportunities to make effective decisions of the inventory will lead to decreased costs, higher availability of goods, increased quality and a more efficient warehousing and flow of goods (Fredholm 2013). Large enterprises (LEs) have adopted ERP systems to a great extent. Small and medium-sized enterprises (SMEs) have not yet widely adopted ERP systems, based on limited resources and specific characteristics that make their case different from LEs (Haddara & Zach, 2011).

There are many theories used in IS research about technology adoption and implementation. To mention a few widely used, there are TAM (Technology Acceptance Model) (Davis, 1989), UTAUT (Unified Theory of Acceptance and Use of Technology) (Venkatesh et al, 2003) and DOI (Diffusion on Innovation) (Rogers, 1995). However, most of the studies are at the individual level, but few are studied the firm level. Previous studies have focused mainly on the ERP implementation phase (Granlund & Malmi, 2002; Newell et al., 2003; Scott & Wagner, 2003). Consequently, this paper is focused on the firm level of adoption, and more precisely the initial adoption phase, of ERP systems. The adoption is here perceived as the stage when companies decide on investing in an ERP system (Haddara & Zach, 2011). However, some authors perceive adoption a final stage in which users accept the ERP system. The process of ERP adoption within a SME is critical to deriving the benefits of ERP systems (Karahanna, Straub & Chervany, 1999). SMEs are found to be influenced by technical and organizational factors. Thus, SMEs need a perceived relative advantage, an ability to experiment with ERP systems before adoption, top management support, organizational readiness to adopt ERP systems (Ramdani, Kawalek & Lorenzo, 2009). Pre-adoption is a crucial phase influencing the SMEs in whether to implement an ERP system.

Still, there are many SMEs that are not aware of the benefits of an ERP system for its performance, and for its operations management especially. Therefore, those companies are not struggling with adopting and implementing ERP systems for its business processes at all, and perform most of its processes as paper-based. Those companies find it convenient not to change routines and will proceed in the old ways of doing things. They are not willing to change, because they are not willing to be challenged, and to force the employees to learn to perform the processes in new and innovative ways. However, those SMEs will miss the chance to derive benefits from the implemented ERP systems (Zhu, Li Wang, Chen, 2010).

The aim of this paper is to analyze the factors influencing SMEs adoption of ERP systems. This will especially relate to the pre-adoption phase of ERP systems in SMEs. To accomplish this research a qualitative case study has been conducted. This case study will highlight the pre-adoption phase of an ERP system. An analysis has been done within an initial adoption phase to investigate how an ERP system can support a SME with its operation management. The study is also shows that an ERP system will bring large changes into the organizational processes of the operation management. The information is needed as a basis for decision making and support the SME in planning inflow of goods, in order to effectively use resources and space (Nenes, et al, 2010).

The paper is organized as follows. First, there is a theoretical framework that states the theoretical lens from which the case study research is performed. Next, there is a description on how the empirical data was collected and analyzed. Then, the empirical setting is described. This is followed by the analysis of the factors influencing SMEs adoption of ERP systems for its operation management. Finally, the conclusion of the findings is presented.

2 Theoretical Framework

This section will provide a theoretical conceptualization for the adoption of ERP system for SMEs, in implementing such systems for operations management.

2.1 *Implementing ERP systems for Operations Management*

ERP systems can be defined as standardized enterprise-wide support systems to support the value chain (Lengnick-Hall et al., 2004; Magnusson & Olsson, 2010). In order to be enterprise-wide it means that the organization have an overview and control of its processes with support of the ERP system. Then the aim is that the organization can make effective and efficient decisions in order to support the organization to obtain a competitive advantage. However, issues of operations management control related to ERP systems have gained only little attention in previous research (Granlund, 2011).

Implementation of ERP systems involves integration of operations and processes in a standardized way. The implementation is challenging and the promise of its benefits may always be realized in practice (Teittinen, et al., 2013). Moreover, the implementation usually involves broad organizational transformation processes, with significant implications on the organization and its structure, management style and culture, and particularly, on people (Dixit & Prakash, 2011).

The performance improvement potential for the operations management is not always clear before the implementation of an ERP system. In cases when the ERP system does not suit an organization, it is very difficult to find a solution or a way out from the system (Dechow & Mouritsen, 2005). Implementation of ERP systems are often consisted of ambiguous processes, where social processes are the first and foremost subject for change (Hyvönen, et al,. 2009). Teittinen et al (2013) describes that ERP is an organizational development journey, rather than a system implementation project.

The operations management should presuppose that for example the inventory management is dealing with tasks related to the administration and information of goods. It is important that the goods within a company is at the right place at the right time, and that the balance of the goods is in harmony with the consumption (Mattsson, 2004).

Traditionally the manual activities have been dominant within the operation management in SMEs. Thus, purchasing, storing, manufacturing and selling have included processes that are performed manually (Fredholm, 2013). According to

Fredholm (2013) it is possible to divide the inventory management into three parts; incoming logistics, production logistics and outgoing logistics. The first part, incoming logistics, describes how the raw material or the purchased material are coming in from the supplier into the organization and how this process are conducted. The second part, production logistics, describes how the conversion and the production are handled within the organizational business processes, where the incoming material is followed until the produced article is handled. The last part, outgoing logistics, describes how the produced article is handled from the time it is produced and until the article will leave the inventory (Fredholm, 2013). This process can also be somewhat complicated within companies that both are producing articles for its own use, and also for selling the articles.

2.2 The TOE Theory

The Technology-Organization-Environment (TOE) Theory can be used to explain the adoption, implementation, and use of an ERP system by an organization (Tornatzky & Fleischer, 1990). It is suggested that adoption is influenced by technological context (Kauffman & Walden, 2001), organizational characteristics (Chatterjee, Grewal & Sambamurthy, 2002) and environmental aspects (Kowath & Choon, 2001). Adoption of ERP systems is affected by these factors related to technology, organization and environment (Zhu, Li, Wang & Chen, 2010). During the adoption process, the organization identify its business and technical needs, and recognize the need for an ERP system. The earlier sequence of activities within the adoption process is called pre-adoption, where activities are conducted where the adoption decision of implementing an ERP system or not is taken (Haddara & Zach, 2011).

The *technological context* refers to both internal and external technologies relevant for the SME. This involves current practices at the SME and internal equipment as well as external equipment available. This concerns core capabilities, the pool of technologies inside and outside the SME, quality of the technologies, the ERP system's technical and organizational compatibility, and perceived relative advantage of the ERP system for the SME. Capabilities with sound characteristics make the foundation for easy integration of the ERP system, and for the realization of the benefits for the SME. Moreover, effective project management and sound system configuration can also be seen as aspects relating to the technological context (Awa, Ukoha & Emecheta, 2012; Oliveira & Martins, 2011; Zhu, Li, Wang & Chen, 2010).

Organizational characteristics describe measures about the SME, such as the SME's business scope, business complexity, organizational culture, size, leader characteristics relating to change, managerial structure and support. Moreover, the organizational characteristics also capture the quality of human resource, internal slack resources and specialization. This refers to a good organizational climate and the organizational readiness to adopt the ERP system. The SME needs to build a favourable atmosphere for the use of the ERP system and the SME need to gather sufficient resources for the operation of the ERP system as well. Thus, organizational readiness relates to the necessary preparations for an effective implementation of the ERP system (Awa, Ukoha & Emecheta, 2012; Oliveira & Martins, 2011; Zhu, Li, Wang & Chen, 2010).

Environmental aspects refer to the arena where the SME conducts its business, the industry, competitors, suppliers, customers and other dealings and conditions. External organizations may affect the integration of the ERP system in the SME. In adopting an ERP system deep knowledge is required, and external organizations can play important roles. Competitive pressure, business partners' readiness, socio-cultural issues, government encouragement, technological infrastructures, and quality of IT consulting services are included in the environmental aspects. (Awa, Ukoha & Emecheta, 2012; Oliveira & Martins, 2011; Zhu, Li, Wang & Chen, 2010).

The technological context has shown importance for adoption of ERP systems in SMEs. It is also important to gather necessary organizational resources and involve the organization members in the adoption. Haddara and Zach (2010) highlight that SMEs' adoptions of ERP systems are more influenced by organizational and technological factors, than on environmental aspects. However, the higher collaboration within a network the more likely the SME adopt an ERP system, as the SME get more environmental influence. External organizations can help the SME to improve and prepare for the implementation of the ERP system.

3 Research method

This study has been conducted by using a qualitative approach, as a case study (Merriam, 1994; Yin, 2014). This is an approach well used in studies of the use of information systems within organizations. The data collection has been focused on different ways in gathering information in order to get a deeper insight into the different operational management processes in the company. Especially the processes related to the inventory logistics management have been studied. The primary data sources have been interviews, studies of internal documents, observations, informal discussions and participation in meetings within the company. When studying their work in the workplace there have been opportunities to see what people do, to hear them explain their work and to get an insight into their routines, dilemmas, frustrations and relationships within their daily work (Myers, 1999). Questions were asked by the researchers, in case if questions would appear during the observations (Repstad, 1999).

We have during the study also customized an ERP system, and developed a prototype according to the perceived needs of the company. The study also includes the analysis of the ERP systems customization in order to value its prospective effects in the company. The customized ERP prototype is configured to support the inventory logistics management, the invoicing and the administration of production orders. This analysis has taken into account the routines and processes at the company and has given a suggestion on how to change the routines at the company to be aligned with the ERP system's implementation.

Thematic analysis was used to find patterns and themes related to the inventory logistics management (Braun & Clarke, 2006). Different themes were found in the empirical collected data. The themes are also related to the aim of the paper and to the theoretical framework used in order to analyze the empirical data. From the aim of the paper related to analyzing the factors influencing SMEs adoption of ERP systems, we

have crystallized the three different themes; technological infrastructure, organizational challenges and environmental relations.

4 The Empirical Setting

The case study is conducted at a company in the western part of Sweden, employing 25-30 persons. This is a company that are producing articles for tube cleaning. The articles are called “pigs”, and comprise of about 15 different sizes of bristle-based artefacts. The employees of the company use these pigs for their own work within customers’ tubes, and they also sell new pigs to customers. The consumption are thousands of pigs per year. These are the company’s main activities. The company also conducts quality controls of wells, pressure gadges and welds. The company does not have any ERP system for the inventory logistics management. However they use a kind of ERP system for the bookkeeping and for administration of salaries. The inventory management is operated by a paper-based system where each employee should make a note each time any pigs leave the inventory. The employees take a number of pigs from the inventory when they are going to a customer in order to do conduct an ordered project. However, problems occur when the employees do not follow the routines of making notes. Thus, it will be very difficult to know how many pigs are stored in each size, and then how many to produce. It can be said that the paper-based system does not work.

The company may need an ERP system that could handle the inflow of raw material, the production of articles, as well as the outflow of articles. The company also needed some other functionality in the ERP system; to have control of the inventory levels for raw material, to have control of the inventory levels of each article, to make an external order of raw material, to make an internal production order, and to make a sales order of articles.

5 Analysis

5.1 Technological infrastructure

The IT support the management of the inventory is related to the information about the goods, as descriptions of the goods, the number of articles in the inventory and the price of the goods. This information can be handled within the ERP system, and can be easily accessed. ERP systems can support the SME with inventory management and with optimization with inventory decisions (Lengnick-Hall et al., 2004). However, the complexity of the inventory management in the company is rather high, and then it is required some configuration and adaption of the ERP system. Pricelists and lists of products are paper-based, and the ERP system has to be configured in order to cover all details. However, it is important to find an ERP system of a moderate size, to not implement any over-sized standardized ERP system. Then it

may be enough to configure a few ERP systems modules to only support the inventory management, and then integrate this module to the bookkeeping and the salary systems.

As the company is using another smaller ERP system today, an ERP system not established as an enterprise-wide system, for the administrative routines as book-keeping and payment of salaries, as these are the only activities that are based on an ERP system today. Consequently, there are only computers at the office, and not at all at the warehouse or in the production building. Accordingly, the technical infrastructure is not built as an internal network, just connection to the internet from each computer. Therefore, the company need to find an ERP system of a suitable size, taking care of all the processes within one ERP system. The implementation of an ERP system is thus challenging, and resources have to be dedicated to such a project to install a technological infrastructure (Teittinen, et al., 2013).

If the company decide to invest in an ERP system the company also has to be aware of large investments in computer and network hardware, and all this have to be installed and configured. The core capability at the company in computer and network technological matter is rather low, so investment will be dependent on external knowledge in this respect (Awa, Ukoha & Emecheta, 2012)

5.2 Organizational challenges

The routines within the company are not clear as the employees are not consistently keeping track of the use of pigs, as they are not always signing when taking pigs from the inventory (Mattsson, 2004). Therefore, before trying to implement an ERP system the management of the company need to make the employees to understand the importance of following routines (Fredholm, 2013). If the employees cannot follow the old paper-based routines, and not understand why they should follow them, it will be very difficult to make them follow new IT-based routines, with means to register within an ERP system when they take pigs out from the inventory.

An implementation of an enterprise-wide ERP system will force the SME to change its business processes, and make the employees responsible for following the new processes. The routines of the employees have to be radically changed. However, the routines could be changed before implementing the ERP system, in order to optimize the inventory. Thus, the success of an ERP systems' implementation also depends on the capacity of the management to make the goal with an ERP system clear for the employees. If an ERP system will be introduced before the manual routines are implemented, organizations run the risk to worsen the situation, and get a decreased overview of the inventory. Also, with an ERP system it could be more inferior to fix mistakes than to fix mistakes within a manual paper-based system, if the SME have a low knowledge level in using the ERP system. Therefore, the organizational readiness to adopt the ERP system in the SME is currently not so high, and that requires some preparation before a decision on implementing an ERP system (Zhu, Li, Wang & Chen, 2010).

However, if the organization can clarify the goal with an ERP system to get a more effective and efficient inventory management, then an ERP system could be more easily implemented (Magnusson & Olsson, 2010). However, the cost for the

ERP system adaption is often not allowed to be too high for the organization. Therefore, the SME also should try to adapt their processes to suit the standardized ERP system (Hong & Kim, 2002)

5.3 Environmental relations

There are many different ERP systems at the market, and most of them are including enterprise-wide functions. Most of the organizations are choosing to implement an ERP system, and thus to adapt the ERP system to its own processes as much as possible. The SME has to establish relations to a few suppliers of ERP systems, in order to analyse which ERP system should suit the organization's requirements. The SME also has to invent what quality of IT consulting services there are available at the regional market (Zhu, Li, Wang & Chen, 2010).

As Haddara and Zach (2011) point out, SMEs are not influenced by environmental aspects to a great extent. This correspond strongly to the situation for the SME in this study. The dependence to suppliers and customers is not very strong related to integration into inter-organizational ERP systems

6 Conclusions

ERP systems can be very useful for organizational support. ERP systems can support organizational inventory management and optimization. Manually performed processes can be made much more effective and efficient. However, if it is effective to implement a configured ERP system also depends on how the prepared the organization is. The employees need to be aware of the importance of following the routines, unless they are manually paper-based or if they are based on an ERP-system. Thus the success of an ERP systems' implementation also depends on the capacity of the management to make the goal with an ERP system clear for the employees.

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