3-31-2009

Identifying And Improving Deficient Business Processes To Prepare SMEs For ERP Implementation

Maria Christofi
Department of Information Studies, University of Sheffield, UK

Miguel Baptista Nunes
Department of Information Studies, University of Sheffield, UK, j.m.nunes@sheffield.ac.uk

Guo Chao Peng
Department of Information Studies, University of Sheffield, UK and Department of Strategy and Business Systems, Portsmouth Business School, University of Portsmouth, UK, alex.peng@sheffield.ac.uk

IDENTIFYING AND IMPROVING DEFICIENT BUSINESS PROCESSES TO PREPARE SMEs FOR ERP IMPLEMENTATION

Maria Christofi
Department of Information Studies, University of Sheffield, UK

Miguel Baptista Nunes
Department of Information Studies, University of Sheffield, UK
Email: j.m.nunes@sheffield.ac.uk

Guo Chao Peng
Department of Information Studies, University of Sheffield, UK
and
Department of Strategy and Business Systems, Portsmouth Business School, University of Portsmouth, UK
Email: alex.peng@sheffield.ac.uk

Abstract

The study reported in this paper aims to identify, explore and improve hitherto deficient business processes for SMEs in order to prepare them for ERP implementation projects. When business process improvement is traditionally perceived as a task that is particularly related to the ERP project phase, this paper argues that broad changes of business processes should actually be performed well before implementing the system. The research took a Cypriot SME as a case study, and adopted in-depth interview as the main method of data collection. The qualitative data collected was analysed by using an inductive thematic analysis approach. The findings identified that business deficiencies and problems, which can impact potential ERP adoption and usage in SMEs, can be localised across business processes, e.g. sales ordering and stock controlling processes. Disregarding these deficient business processes and business drawbacks in the ERP preparation stage will have implications not just for the subsequent ERP project, but also for the long-term ERP usage.

Keywords: ERP, preparation, pre-implementation, business process improvement, small and medium sized enterprises (SMEs)

1.0 Introduction

Enterprise Resource Planning (ERP) systems are "configurable information system packages that integrate information and information-based processes within and across functional areas in an organization" by using a single comprehensive database (Kumar and Hillegersberg, 2000). Due to technological and economic restrictions, only large companies could afford and implement ERP in the past (Deep et al., 2008). In contrast, ERP adoption rate in small and medium sized enterprises (SMEs) was

low. Nevertheless, over the past few years, the large enterprise market has become saturated (Gable and Stewart, 1999). Also because of rapid reduction in the cost of IT and IS (Gable and Stewart, 1999), there has been a substantial and continuous growth in the use of ERP systems by SMEs in recent years (Deep et al., 2008; Everdingen et al., 2000).

However, the implementation of ERP is never a straightforward task, due to the facts that these systems are "large and complex, expensive, take over a year or more to install, use new technology, and impact significantly on the organizational culture and existing business processes" (Willcocks and Sykes, 2000). In truth, about 90% of ERP implementation projects are late or over budget, and almost half fail to achieve the desired results (Martin, 1998). Zhang et al. (2002) reinforce that, ERP implementation success rate is only about 33% in general. The success rate of ERP adoption in SMEs seems to be even lower, owing to a variety of common drawbacks and barriers that are prevalent in this type of firm, e.g. lack of resources, insufficient IS expertise and ERP understanding, and irregular business procedures and roles, etc (Deep et al., 2008; Harindranath et al., 2008; Achanga et al., 2006; Premkumar, 2003).

In order to increase the chance of ERP success and achieve the "promised" ERP benefits, it is often critical for SMEs to improve and modify existing business processes and organisational structure to fit in the new ERP environment (Newman and Zhao, 2008; Markus and Tanis, 2000; Jarrar et al., 2000). In particular, IS researchers, such as Jarrar et al. (2000), Martin and Cheung (2000) and Loh and Koh (2004), stress that fundamental and iterative improvement and even redesign of business processes should be carried out during the ERP implementation project, as well as when the system evolves and is being used in the post-implementation phase. However, Nah et al. (2001) and Lee et al. (2003) argue that broad improvement of business processes should actually be performed well before implementing ERP, and even before choosing the system.

In truth, according to Deep et al. (2008) and Koh and Simpson (2005), SMEs often have an inherent lack of efficient business processes and regular business procedures. These authors go on to state that roles and responsibilities of actors involved in

diverse business processes may also often be ill-defined and ambiguous. Deep et al. (2008) thus conclude that, the existence of these drawbacks will not just affect efficiency of an ERP system, but may also lead to complete ERP failure in SMEs. Consequently, it becomes clear that, in order to enable the ERP implementation project to be conducted successfully within time and budget, it is vital for SMEs to identify and improve any problems and deficiencies hitherto existed in their business processes during ERP preparation/pre-implementation. However, there is currently very little research addressing this particular ERP issue in SMEs.

Consequently, the study presented and reported in this paper aimed to address this research gap by identifying, exploring and improving deficient business processes for SMEs in order to better prepare them for ERP projects. The study adopted a single-case study of a Cypriot firm to conduct in-depth investigation and to draw recommendations and conclusions from the lessons learned. The paper is structured as follows: the next section presents a brief review of the literature, followed by a discussion of the research question and research design; subsequently, the findings derived from the case study are presented and discussed, with conclusions drawn.

2.0 A Brief Review of the Literature

The study presented in this paper is concerned with two prevalent research topics, namely ERP and business process management (BPM). According to an extensive literature review, there have been growing numbers of studies focusing on these two research areas either individually or coherently in recent years. Nevertheless, despite a rich amount of studies on these areas, the literature review identified three important research gaps that need to be further addressed by researchers.

Firstly, current research studies on ERPs cover a wide range of issues, ranging from vendor selection processes (Bernroider and Koch, 2001), to system implementation and project management aspects (Wong et al., 2005; Zhang et al, 2005; Yusuf et al, 2004), to system post-implementation barriers and risks (Peng and Nunes, 2008a; 2008b). However, these studies focus mainly on larger enterprises (Poba-Nzaou et al., 2008). In contrast, ERP adoption by SMEs has traditionally received less attention from IS researchers (Premkumar, 2003; Poba-Nzaou et al., 2008).

On the other hand, as illuminated by O'Neill and Sohal (1999), BPM in the literature is also often referred to as business process reengineering (BPR), core process redesign, business process improvement/innovation/transformation, etc. Regardless the actual term being used, studies in this field focus mostly on tools, models, methodologies and techniques for improving business processes (e.g. Doomun and Jungum, 2008; Yu and Wright, 1997). However, there is a scarcity of empirical studies that report and explore: 1) details of deficient business processes that are prevalent in modern companies in general and in SMEs in particular; and 2) actions and solutions taken to address these deficient processes.

Finally, and more importantly, studies linking BPM and ERP generally emphasise on the system implementation phase. For instance, in a case study of ERP in Rolls-Royce Plc., Yusuf et al. (2004) illuminate how the company conducted an internal BPR programme during the implementation of SAP R/3. Moreover, many other IS researchers (e.g. Loh and Koh, 2004; Jarrar et al., 2000) consider BPM as a critical success factor that is particularly related to the project phase of ERP. However, as discussed above, business process improvement should not merely be performed during ERP implementation. It is in fact essential for companies to make an attempt to identify and address any deficient business processes in the system pre-implementation stage, in order to increase the chance of ERP success. However, there is very little research addressing this later aspect.

Consequently, the realisation of these research gaps led the researchers to conduct the study reported in this paper.

3.0 Research Methodology

3.1 Research Question

The main aim of the study reported in this paper was to help SMEs to have a more efficient preparation for ERP implementation by improving hitherto deficient business processes. In response to this research aim, the following research question was formulated:

"How to improve current business processes of SMEs in order to prepare them for ERP implementation"

In order to answer this research question, the study aimed at identifying inappropriate business processes and areas that can affect future ERP adoption in the context of SMEs. It also aimed to explore the causes and consequences of the deficient business processes identified. Consequently, based on the findings generated, the researchers attempted to propose and establish a set of remedies to address the identified problems.

3.2 Research Design

Because the success of ERP innovation relies heavily on the context of application (Newell et al, 2000; Xue et al, 2005), it is impossible to delineate an explicit line to separate ERP from its application context (Xue et al, 2005). According to Robson (2002:146), a case study is "a strategy for doing research which involves an empirical investigation of a particular contemporary phenomenon within its real life context using multiple sources of evidence". Yin (2003:13) reinforces that "a case study is an empirical inquiry that investigates a contemporary phenomenon within its real-life context, especially when the boundaries between phenomenon and context are not clearly evident". Additionally, as highlighted by Saunders et al. (2000:94), case study is an approach particularly suited to generate answers to the "why", "how" and "what" questions. Consequently, case study was adopted as a suitable approach to answer the established research question of this study.

This research project involved a single-case study of a Cypriot company, namely A.C. EUROBLINDS Ltd. EUROBLINDS is a private company and is also one of the most well known SMEs in Cyprus. The company has two branches located in two of the most important economic cities in Cyprus, namely Nicosia and Limassol. EUROBLINDS is a manufacturer and trader of internal and external shading systems (e.g. external blinds, awnings, sun breakers, venetian blinds and roller blinds, etc). Currently, the firm has more than 100 employees, and is estimated to hold 75% to 80% of the local market (http://www.made-in-china.com/traderoom/costas-christodoulou/companyinfo/A-C-Euro blinds.html).

EUROBLINDS was selected to be the case company due to two main reasons. Firstly, the company is planning to use an enterprise-wide ERP to replace its isolated legacy systems, which mainly supported the processes of ordering, stock controlling and accounting. The legacy system was designed and developed by a Cypriot software company seven years ago, and thus has become less efficient in supporting EUROBLINDS to retain competitive advantage. At the time of conducting this research, the firm was at the pre-implementation stage of ERP (e.g. vendor selection). Secondly, the company intended to fully implement ERP in all key functional divisions, including sales, production, accounting, inventory, purchasing and logistic areas. Consequently, EUROBLINDS was identified and evaluated to be appropriate in answering the research question and achieving the research aim.

In order to identify, explore and improve deficient business processes and areas in the selected company, this case study followed an inductive approach. In-depth interview was used as the main method of data collection. Interview questions were open-ended designed and focused on four main aspects:

1) Characteristics of current business processes of EUROBLINDS;
2) Problems and drawbacks associated with current processes;
3) Causes and consequences of existing problems;
4) Potential solutions.

Moreover, trigger questions were used in the interview whenever appropriate, in order to stimulate discussion and trigger interviewee's thinking. Interviewees were encouraged to raise issues at both organisational and departmental levels. Consequently, six in-depth interviews were conducted with key members of the management team, namely the managing director, the IT manager, the production manager, the purchasing supervisor and 2 supervisors in the sales division. All interviews were tape recorded and then transcribed for data analysis.

Subsequently, the qualitative data collected was analysed by using an inductive thematic analysis approach. This approach is one of the predominant techniques for analysing qualitative data. It is "a method for identifying, analysing and reporting patterns (themes) within data" (Braun and Clarke, 2006). By following the principles of inductive thematic analysis, the researchers went through a process of searching, identifying and exploring codes and themes that emerge as "important to the

description of the phenomenon" (Daly et al., 1997), through "careful reading and re-reading of the data" (Rice and Ezzy, 1999:258). Consequently, through this thematic analysis, the researchers identified ten themes associated with ten business areas that are currently problematic in EUROBLINDS:

- Stock control
- Sales order processing
- Purchase order processing
- Bill of materials
- Production planning
- Workshop planning
- Warehouse management
- Cost measurement
- Product installation
- Dispatch point control

Furthermore, concept maps were used to represent and highlight concepts associated with these identified problem areas. Concept maps are "graphical tools for organizing and representing knowledge [and…] include concepts, usually enclosed in circles or boxes of some type, and relationships between concepts" (Novak and Cañas, 2006). These maps are useful exploratory tools and an efficient method to share, discuss and represent concepts and findings derived from qualitative data analysis (Nunes et al., 2005). Consequently, ten concept maps were developed to represent the ten problem areas identified. These concepts maps are then used as the basis for reporting the research findings, as exemplified below.

4.0 Research Findings

Among the ten business areas identified in the case company, sales order processing and stock control proved to be the most critical areas that should be tackled. These two areas are therefore selected as exemplifications to be addressed in further detail in this paper. Issues associated with these two problem areas are presented and discussed below, by using related concept maps as the infrastructure. Moreover, the following sections also analyse and discuss, with support from the literature, how current business problems in EUROBLINDS may affect future ERP adoption and usage in the company. A set of recommendations to address the identified issues are also proposed.

4.1 Sales Order Processing

Current issues

As a leading player that possesses 75% to 80% of the local market, EUROBLINDS receives a large amount of sales orders daily. Nevertheless, order-taking is currently a time-consuming process, in which sales staff have to firstly write down the order on paper and then transfer it into the legacy sales system after a while (Figure 1). However, as shown in the case study reported by Palaniswamy and Frank (2001), this issue can often be easily addressed when the company is equipped with better hardware and software facilities after ERP implementation.

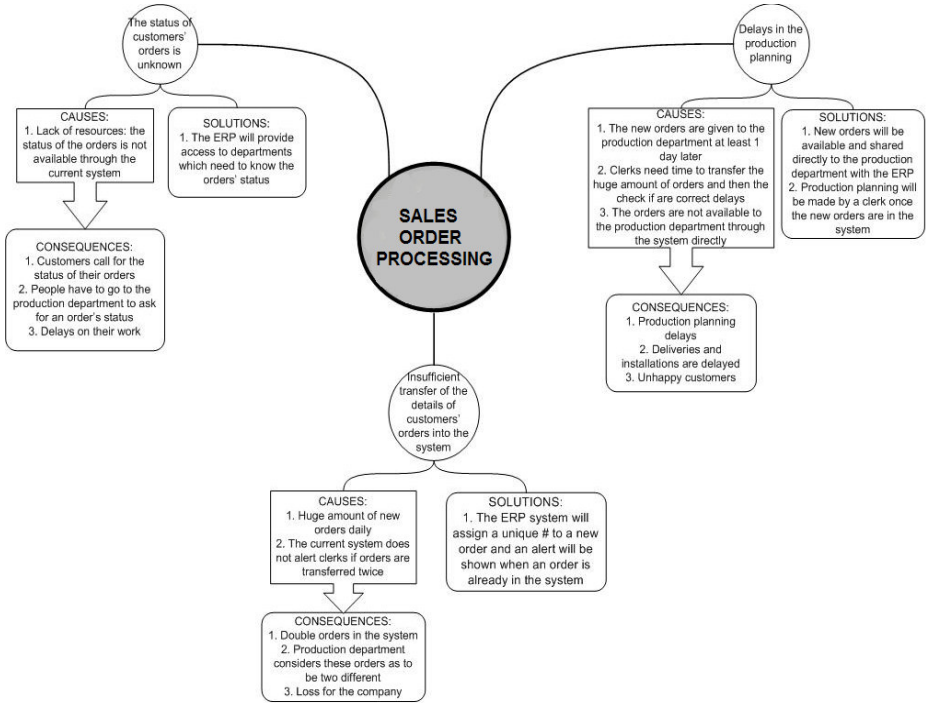

Figure 1. Concept map of sales order processing

In fact, what seems to be problematic in the case company is that, mistakes occur frequently when entering orders into the sales system. Specifically, details of customer orders were not always transferred correctly, accurately and speedily into the system by sales clerks. Moreover, the same order might often be inputted twice, and thus resulting in the system to contain duplicated sales orders. The interviewees stated that incorrect or duplicated customer orders could often lead to confusion to the production department, and thus affect production planning and distort normal

production. These mistakes can also lead to critical impacts in the ERP environment, as discussed below.

Potential impact on ERP adoption/usage

By using a centralised database, ERP systems enable the integration of data within and across all functional areas of user companies (Kumar and Hillegersberg, 2000). This integration feature of ERP however determines that all inputted data will flow "so quickly through the system that there was little opportunity to track down mistakes before they showed up on everybody's screens" (Scapens and Jazayeri, 2003). In other words, if a sales staff input incorrect or duplicated data into the ERP system, it will raise immediate impacts to not just the production department but all other related functional divisions (e.g. finance, warehouse and purchasing) in the firm. Therefore, the occurrence of such human mistakes must be prevented in order to ensure both the ERP system and the company to operate effectively and efficiently.

Potential solutions

The interviewees claimed that their current data problems should be attributed to the deficient legacy system, which lacked alert functions for invalid data. They thus expected that the new ERP system could help them to cease these problems.

Nevertheless, the analysis of the data identified that in the case company, data entry mistakes often occurred because of inappropriate work behaviour, job overload, or just negligence of users, rather than due to technical reasons. Moreover, it is apparent that not all ERP systems will be efficient enough in automatically detecting invalid, incorrect and duplicated data. Due to this reason, user companies often need to integrate third-party software programmes into their ERP packages to enhance data detection and monitoring capability of the system (Sieniawski and Trawiński, 2007). However, purchasing such additional software components may not always be feasible for SMEs due to limited resources available. Overall, it seems unrealistic to expect that user mistakes can be prevented after the adoption of ERPs.

In truth, in order to prevent users from inputting invalid data into the ERP system, there seems to be a need for EUROBLINDS to develop in advance some rigorous system usage rules and policies to restrict and regularise user activities. These ERP policies should specify all working procedures in detail, as well as highlight how users may be punished for irregular and inadequate system usage. Such provisions are useful in formalising business procedures, which are vital in forming "the core of efficiency for an ERP system" (Deep et al., 2008).

4.2 Stock Control

Current issues

As a manufacturing company, EUROBLINDS holds a number of different types of stock, i.e. stock of raw materials, components and finished products. Dransfield and Needham (2004:661) state that effective control of stock is essential for manufacturing firms to run efficiently. However, it emerged from the findings that stock control in EUROBLINDS was very inefficient at the moment. In particular, the company always faces problems of stock overage or shortage (Figure 2). Further analysis of the data identified that these issues were mainly attributed to the failure in setting proper stock levels (i.e. maximum and minimum stock to be kept) in the firm.

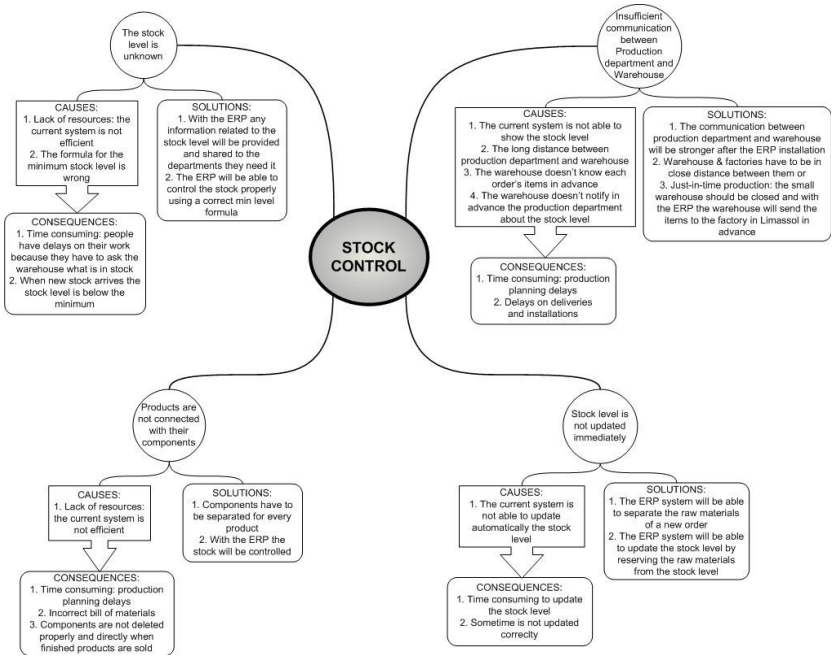

Figure 2. Concept map of stock control

In truth, in order to identify how much stock to keep, companies with the best practice will normally take into account a comprehensive set of factors, such as the nature of the business, type of stock concerned, supplier lead-time, sales demand, inventory capacity, and seasonal reasons, etc (Steele and Plunkett, 1994). However, the findings showed that the case company often failed to consider and evaluate all these factors when deciding stock levels, probably due to a lack of knowledge on advanced business practice.

In addition, as stated by Steele and Plunkett (1994), different departments within the firm always have controversies about what the "best" stock levels are, e.g. the sales department wants to have additional stock to prevent sales losses, but the financial department's mission is to minimise inventory cost by reducing stock level. Therefore, the established stock levels must balance the aims of different business divisions (Steele and Plunkett, 1994). However, this was not currently the case in EUROBLINDS, due to poor cross-functional collaboration and communication within the firm.

In sum, the findings showed that insufficient business knowledge and inefficient organisational communication were the main reasons for the case company to establish inappropriate stock levels, which in turn impacted efficiency of stock control. These issues can certainly also affect ERP adoption and usage in the case company, as discussed below.

Potential impact on ERP adoption/usage

It is widely acknowledged that ERPs do not just consist of the latest technologies of information systems, but more importantly also contain many advanced business concepts and practices. System users must possess sufficient understanding and knowledge about these advanced business concepts. Otherwise, they may not be able to use the system properly and may also fail to exploit the full power of ERP. Moreover, due to a lack of knowledge and understand, system users may often be reluctant to accept and use the ERP system (Peng and Nunes, 2008a; Wright and Donaldson, 2002). Such user resistance is certainly a barrier to successful ERP adoption and usage.

On the other hand, successful implementation and exploitation of ERPs rely on involvement, collaboration and communication of staff from all functional departments. Therefore, poor cross-functional collaboration and communication is frequently mentioned as a crucial barrier to successful introduction of ERPs (Peng and Nunes, 2008a; Fletcher and Wright, 1995).

Potential solutions

All ERP packages contain specific modules and functions addressing stock control and management. Moreover, a well-designed ERP will also involve mathematic tools to assist companies to forecast sales demands and stock requirements, as well as to answer "what if" questions (Agarwal et al., 2000). The managers interviewed thus perceived ERP as the solution towards current problems related to stock control.

However, this is actually an overestimation of the power of ERPs, considering two reasons. Firstly, stock levels generated by using statistical techniques are not always appropriate and reliable, because unexpected changes and problems can often arise in real practice (Steele and Plunkett, 1994). Secondly, and more importantly, Robinson (2003) states that "an ERP system is only the tool you need to [improve the problematic situation, but] it is not a solution [to the problem] in its own right".

Consequently, in order to improve efficiency of stock control, EUROBLINDS cannot merely rely on the use of ERP. Instead, substantial training should be provided to current staff, in order to enhance their business knowledge and improve organisation-wide communication. This is vital for enhancing both the operational efficiency of the case company and the chance of ERP success.

5.0 Overall Discussion of Lessons Learned

Following the investigation of the case study at EUROBLINDS, the researchers identified a list of key lessons that are valuable for helping SMEs to better prepare themselves for ERP implementation. These key lessons learned are summarised and further discussed below.

Firstly, the findings identified that deficiencies and problems existed in SMEs can be found across diverse business processes and functional areas. Therefore, when identifying and exploring deficient business processes during ERP preparation, an exhaustive and in-depth investigation involved all key functional divisions and actors should be carried out. It is worth to note that, in comparison to large enterprises, this task will be easier to achieve in SMEs which have relatively simple organisational structure.

Secondly, it was established in this study that a deficient business process (e.g. sales order processing in EUROBLINDS) could often be attributed to a variety of reasons related to diverse organisational (e.g. irregular working climate), technical (e.g. deficient design of legacy system), and human (e.g. user negligence) aspects. Therefore, in order to improve deficient business processes, it requires changes in not just the process itself but more importantly in people, technology and organisational policies, as shown in exemplifications given above. Additionally, through such internal improvement, SMEs may also be able to identify and address a set of existing barriers (e.g. inefficient cross-functional collaboration) and potential risks (e.g. user inputs incorrect data into the ERP system) that can affect ERP success.

Finally, when asked how existing business problems may be overcome, interviewees of EUROBLINDS commonly proposed ERP as the solution towards these deficiencies. In fact, this was to be expected, since SMEs often perceive ERP as a panacea to achieve competitive advantage (Deep et al., 2008). However, it clearly emerged from this study that this is indeed an over optimistic view. In particular, although ERPs may potentially lead to a set of substantial business improvements in the case company (e.g. improve data processing and stock control efficiency, etc), it is unrealistic to expect the adoption of ERP can resolve all business problems, especially those that are related to human aspects (e.g. inappropriate working behaviour and attitudes of employees). Indeed, managers' perception of ERPs as an omnipotent solution may blind them to the impacts and threats of existing organisational issues (e.g. inappropriate staff working behaviour in EUROBLINDS), which can lead to potential ERP failure.

6.0 Conclusions and Implications

This paper reports on an in-depth case study, which provided valuable insights and exemplifications for improving business processes in SMEs to prepare them for ERP implementation. In conclusion, the study confirmed that a wide range of deficient business processes and internal problems can be inherent in SMEs. Disregarding these business problems in the ERP preparation stage will not just directly impact success of ERP implementation, but can also substantially affect the use of the system after it goes lived. It is therefore vital for SMEs to address these drawbacks as early as possible in order to increase the possibility of ERP success. This is deemed to be particularly critical to SMEs, which often have limited resources and are thus less likely to afford losses and impacts caused by ERP failure.

The results of this study have important practical and research implications. In practical terms, although the problems identified and recommendations drawn are specific to the case company, they are likely to be meaningful and valuable for other SMEs, especially for those that are engaged in similar business sector and context as the one studied. Moreover, the overall lessons learned and discussed provide useful insights for SMEs that are preparing to adopt ERP systems. In research terms, this study added to the knowledge of ERP in general, and contributed to the research gaps of ERP preparation and business process improvement in SMEs in particular. However, since the study examined only one case, further empirical research of the same type is certainly required.

References

Achanga, P., Shehab, E., Roy, R. and Nelder, G. (2006). *Critical success factors for lean implementation within SMEs*, Journal of Manufacturing Technology Management, 17 (4), 460-471.

Agarwal, R., Raha, A.R. and Ghosh, B. (2000). *Our experience and learning in ERP implementation*, Software Engineering Notes, 25 (2), 31-34.

Avison, D. and Fitzgerald, G. (2006). Information Systems Development: methodologies, techniques & tools, 4th ed. McGraw-Hill Companies, New York.

Bernroider, E. and Koch, S. (2001). *ERP selection process in midsize and large organizations*, Business Process Management Journal, 7 (3), 251-257.

Braun V. and Clarke, V. (2006). *Using thematic analysis in psychology*, *Qualitative Research in Psychology*, 3, 77-101.

Daly, J., Kellehear, A. and Gliksman, M. (1997). The public health researcher: A methodological approach. Oxford University Press, Melbourne.

Deep, A., Guttridge, P., Dani, S. and Burns, N. (2008). *Investigating factors affecting ERP selection in made-to-|ZAorder SME sector*, Journal of Manufacturing Technology Management, 19 (4), 430-446.

Doomun, R. and Jungum, N.V. (2008). *Business process modelling, simulation and reengineering: call centres*, Business Process Management Journal, 14 (6), 838-848.

Dransfield, R. and Needham, D. (2004). Business for foundation degrees and higher awards. Heinemann, Oxford.

Everdingen, Y.V., Hillegersberg, J.V. and Waarts, E.V. (2000). *ERP adoption by European midsize companies*, Communications of the ACM, 43 (4), 27-31.

Fletcher, K. and Wright, G. (1995). *Organisational, strategic and technical barriers to successful implementation of database marketing*, International Journal of Information Management, 15 (2), 115-126.

Gable, G. and Stewart, G. (1999). *SAP R/3 implementation issues for small to medium enterprises*, In Proceedings of the 5th Americas Conference on Information Systems (AMCIS), Milwaukee, WI.

GBRW (2004). *Study on asset-backed securities: impact and use of ABS on SME finance*. Available at: http://www.gbrw.eu/assets/Asset_backed_report_en.pdf [Accessed 09/12/08]

Harindranath, G., Dyerson, R. and Barnes, D. (2008). *ICT adoption and use in UK SMEs: a failure of initiatives*, The Electronic Journal Information Systems Evaluation, 11 (2), 91-96.

Harkness, W.L., Kettinger, W.J. and Segars, A.H. (1996). *Sustaining process improvement and innovation in the information services function: lessons learned at the Bose Corporation*, MIS Quarterly, 20 (4), 349-368.

Jarrar, Y.F., Al-Mudimigh, A. and Zairi, M. (2000). *ERP implementation critical success factors – the role and impact of business process management*, In Proceedings of IEEE International Conference on Management of Innovation and Technology (ICMIT), Singapore, 12-15 November 2000.

Koh, S. C. L, Jones, M. H., Saad, S. M., Arunachalam, A and Gunasekaran, A. (2000). *Measuring uncertainties in MRP environments*, Journal of Logistics Information Management, 13 (3), 177-183.

Koh, S.C.L. and Simpson, M. (2005). *Change and uncertainty in SME manufacturing environments using ERP*, Journal of Manufacturing Technology Management, 16 (6), 629-653.

Kumar, K. and Hillegersberg, J. (2000). *ERP experiences and evolution*, Communications of the ACM, 43 (4), 23-26.

Lee, J., Siau, K. and Hong, S. (2003). *Enterprise integration with ERP and EAI: comparing internal and external approaches to enterprise business integration*, Communication of the ACM, 46 (2), 54-60.

Loh. T.C. and Koh, S.C.L. (2004). *Critical elements for a successful enterprise resource planning implementation in small-and medium-sized enterprises*, International Journal of Production Research, 42 (17), 3433-3455.

Markus, M.L. and Tanis, D. (2000). *The enterprise systems experience – from adoption to success*, In Framing the domains of IT research: glimpsing the future through the past (Eds, Zmud, R.W.), Pinnaflex Educational Resources, Cincinnati, pp. 173–207.

Martin, I. and Cheung, Y. (2000). *SAP and business process re-engineering*, Business Process Management Journal, 6 (2), 113-121.

Martin, M.H. (1998). *An ERP Strategy*, Fortune, 2, 95-97.

Nah, F.F., Lau, J.L. and Kuang, J. (2001). *Critical factors for successful implementation of enterprise systems*, Business Process Management Journal, 7 (3), 285-296.

National Bureau of Statistics of China (2007). China statistical yearbook 2007. China Statistic Press, Beijing.

Newell, S., Swan, J. and Galliers, R. (2000). *A knowledge-focused perspective on the diffusion and adoption of complex information technologies: The BPR example*, Information Systems Journal, 10, 239–259.

Newman, M. and Zhao, Y. (2008). *The process of enterprise resource planning implementation and business process re-engineering - tales from two Chinese small and medium-sized enterprises*, Information Systems Journal, 18, 405-426.

Novak, J. D. and Cañas, A. J. (2006). *The theory underlying concept maps and how to construct them*, available at: http://cmap.ihmc.us/Publications/ResearchPapers/TheoryUnderlyingConceptMaps.pdf [accessed May 2007].

Nunes, M.B., Annansingh, F., Eaglestone, B. and Wakefield, R. (2004). *Knowledge management issues in knowledge-intensive SMEs*, Journal of Documentation, 62 (1), 101-119.

O'Neill, P. and Sohal, A.S. (1999). *Business process reengineering: a review of recent literature*, Technovation, 19, 571–581.

Palaniswamy, R. and Frank, T. (2001). *Enhancing manufacturing performance with ERP systems*, Information Systems Management, 17 (3), 43-55.

Peng, G.C. and Nunes, J.M. (2007). *A risk ontology for ERP post-implementation*, In Proceedings of the 2nd Annual South East European Doctoral Student Conference (SEERC), Thessaloniki, Greece, 22-23 June 2007.

Peng, G.C. and Baptista Nunes, J.M. (2008a). *A discussion of barriers to successful exploitation of ERP systems in China*, In Proceedings of the IADIS International Conference in Information Systems, Algarve, Portugal, 15-17 April 2008.

Peng, G.C. and Baptista Nunes, J.M. (2008b). *Identification and assessment of risks to successful exploitation of ERP systems in China*, In Proceedings of the 5th European and Mediterranean Conference on Information Systems (EMCIS), Dubai, UAE, 25-26 May 2008.

Poba-Nzaou, P., Raymond, L. and Fabi, B. (2008). *Adoption and risk of ERP systems in manufacturing SMEs - a positivist case study*, Business Process Management Journal, 14 (4), 530-550.

Premkumar, G. (2003). *A meta-analysis of research on information technology implementation in small business*, Journal of Organizational Computing and Electronic Commerce, 13 (2), 91-121.

Rice, P. and Ezzy, D. (1999). Qualitative research methods: A health focus. Oxford University Press, Melbourne.

Robinson, P. (2003). ERP (Enterprise Resources Planning) Survival Guide. BPIC, Hove, UK.

Robson, C. (2002). Real world research: a resource for social scientists and practitioner-researchers, 2nd ed. Blackwell, Oxford.

Saunders, M., Lewis, P. and Thornhill, A. (2000). Research methods for business students. Pearson Education Limited, Harlow.

Scapens, R.W. and Jazayeri, M. (2003). *ERP systems and management accounting change: opportunities or impacts? A research note*, European Accounting Review, 12 (1), 201-233.

Sieniawski, P. and Trawiński, B. (2007). *An open platform of data quality monitoring for ERP information systems*, In Software engineering techniques: design for quality (Eds, Sacha, K.), Springer, New York, pp. 289-299.

Slack, N., Chambers, S. and Johnston, R. (2004). Operations Management, 4th edition. Pearson Education Limited, Essex.

Steele, W. and Plunkett, K. (1994). *Finished stock: the piggy in the middle*, Logistics Information Management, 7 (6), 16-22.

Stonebraker, P.W. (1996). *Restructuring the bill of material for productivity: a strategic evaluation of product configuration*, International Journal of Production Economics, 45 (1-3), 251-260.

Tashakkori, A. and Teddlie, C. (1998). Mixed methodology: combining qualitative and quantitative approaches. SAGE Publications, California.

Willcocks, L. P. and Sykes, R. (2000). *Enterprise resource planning: the role of the CIO and it function in ERP*, Communication of the ACM, 43 (4), 32-38.

Wong, A., Scarbrough, H., Chau, P.Y.K. and Davison, R. (2005). *Critical failure factors in ERP implementation*, In Proceedings of the 9th Pacific-Asia Conference on Information Systems (PACIS), Bangkok, Thailand, 7 - 10 July 2005.

Wright, G. and Donaldson, B. (2002). *Sales information systems in the UK financial services industry: an analysis of sophistication of use and perceived barriers to adoption*, International Journal of Information Management, 22, 405-419.

Xue, Y., Liang, H., Boulton, W.R. and Snyder, C.A. (2005). *ERP implementation failures in China: case studies with implications for ERP vendors*, International Journal of Production Economic, 97 (3), 279-295.

Yin, R. K. (2003). Case study research: design and methods, 3rd ed. SAGE Publications, California.

Yu, B. and Wright, D.T. (1997). *Software tools supporting business process analysis and modelling*, Business Process Management Journal, 3 (2), 133–150.

Yusuf, Y., Gunasekaranb, A. and Abthorpe, M.S. (2004). *Enterprise information systems project implementation: A case study of ERP in Rolls-Royce*, International Journal of Production Economics, 87, 251-266.

Zhang, L., Lee, M.K.O, Zhang, Z. and Banerjee, P. (2002). *Critical success factors of enterprise resource planning systems implementation success in China*, In Proceedings of the 36th Hawaii International Conference on System Sciences (HICSS), 2002 Hawaii, USA.

Zhang, Z., Lee, M. K. O., Huang P., Zhang, L. and Huang, X. (2005). *A framework of ERP systems implementation success in China: An empirical study*, International Journal of Production Economic, 98 (1), 56-80.

Zhou, Y., Liu, B. and Zhou, Q. (2005). ERP and enterprise management: theories, methods and systems. Tsinghua University Press, Beijing, (in Chinese).