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Exploring the rationales for ERP and knowledge management integration in SMEs

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Abstract

Purpose – To survive in the global economy, SMEs have to improve their products, services and processes, exploiting their intellectual capital in a dynamic network of knowledge-intensive relations inside and outside their borders. This paper aims to explore the rationales for the integration of knowledge management (KM) and ERP in SMEs and to present a conceptual model for their integration.

Design/methodology/approach – A wide range of academic and practitioner literature related to ICT and KM adoption from SMEs is reviewed. On the basis of this review and analysis, a conceptual model is designed.

Findings – The proposed model is regarded as an adaptable solution, where an SME with a traditional business structure uses existing IT applications and builds on them. Before applying the proposed model, SMEs should ensure that their KM initiatives fit into their organisational culture, or otherwise they should be prepared to change it.

Research limitations/implications – The applicability of this model in an SME seeking to gain a competitive advantage needs to be explored. Practitioners should use the model in order to develop new platforms and extended ERP modules.

Practical implications – The model can be used in any area of information and knowledge management.

Originality/value – Using the model, SMEs can achieve the integration of ERP and KM, which is proven to be a necessity for them in the knowledge economy.

Keywords Manufacturing resource planning, Knowledge management, Small to medium-sized enterprises, Intellectual capital

Paper type Conceptual paper

Introduction

During the last decade, the global economy has entered a new era where the future of enterprises will essentially be determined by their ability to use knowledge wisely. Knowledge is a precious global resource that is the embodiment of human intellectual capital and technology. The knowledge-based economy places great importance on the diffusion and use of information and knowledge, as well as its creation. In this new global economy, SMEs, being a vital part of any national economy, are obliged to focus on maintaining and enhancing their knowledge capital in order to innovate, and their ability to learn, adapt and change becomes a core competency for survival (Perry, 1999).

In today's business environment, the success of a small business or a SME can be linked to how well they manage their knowledge (Organization for Economic Co-operation and Development, 2000; Desouza and Evaristo, 2003); knowledge to represent know-how, expertise, skills, ideas, intuitions and insights. SMEs compete on their know-how and hence have to use knowledge to their advantage, even more than traditional resources.

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SMEs normally do not have deep pockets to spend on resources such as land, labour and capital; they must do more with less. The knowledge kept in a SME must be leveraged so that goals can be achieved in an effective and efficient manner. Research (Nonaka, 1991; Rollo and Clarke, 2001; Bhatt, 2001) has shown that a knowledge-based company possesses information and knowledge that confer a special advantage, allowing it to manoeuvre with intelligence, creativity, and occasionally cunning.

On the other hand, new information and communication technologies (ICT), expeditious data processing models, configurable platforms, networking and the internet have facilitated enterprises to gain access to external sources of knowledge and have provided them with the opportunity to foster intra/inter-organizational integration with the aim at achieving higher efficiency, effectiveness, better quality of services and minimisation of costs. In this context, enterprise resource planning (ERP) systems have been shown to be powerful ingredients in the success of enterprises (Davenport, 1998; Alsene, 2007). ERP is a strategic IT tool that helps a company to gain competitive advantage by integrating business processes and optimizing the resources available. Although ERP has been initially directed for use from large-scale enterprises, recent research has shown that SMEs have started adopting ERP solutions in order to gain competitive advantage and improve their position in the market (Maguire *et al.*, 2007).

In this framework, this paper examines these two important concepts – KM and ERP – in terms of their evolution and current development in SMEs, explores the rationales for their integration in SMEs by analysing key issues and problems, and presents a conceptual model for their integration.

The paper is articulated into five further sections. The following two sections present a state of the art literature review on ICT and KM in SMEs, respectively. Section four discusses the rationales for their integration in SMEs by analysing key issues and problems and presents a conceptual model for their integration, while in section five conclusions and suggestions for further research undertakings are provided.

SMEs and ICT

An overview

Emerging literature regarding ICT application in SMEs shows that the application of new ICT tools in SMEs is still lagging behind (Levy and Powell, 2003). As a matter of fact, their small size is interpreted as being synonymous with the inability to commit financial and human resources, to assign ICT tools to something different from short-ranged operating issues, and to understand ICT benefits. Many SMEs still consider ICT as a set of tools used to a large degree for solving short-term operating problems rather than long-term strategic plans (Martin and Matlay, 2001) because of the unpredictability of SMEs' strategic future: strategic planning is described as an "emerging vision" or "strategic awareness", neither of which lend themselves easily to the explicit definitions required for systematic investment in ICT.

On the other hand, research shows that although UK SMEs are rapidly adopting the internet, they are slow to adopt e-business as the basis for business communication and transaction (Department of Trade and Industry, 2003). Despite the fact that 1.9 million small businesses in the UK are connected to the internet, surpassing the government's original goal of 1.5 million, the UK's Federation of Small Businesses (Federation of Small Businesses, 2002) research indicates that the use of the internet by SMEs is still relatively undeveloped. SMEs still tend to use the internet only to send e-mails, transfer

files or documents or gather information. There is no evidence that SMEs adopt and invest in ICT in order to improve services, processes, business automation, and internal processing of business information and knowledge. This claim is also confirmed by the "Sectoral e-Business Watch" study of the European Commission (2007); according to this study:

> e-Business activities of large companies are rapidly maturing. These companies have powerful ICT systems for linking business processes, understand their benefits and possess the necessary know-how to steadily improve these systems to their advantage. Many smaller companies, by contrast, still struggle with the requirements of getting digitally connected with their suppliers and customers. If they can not cope with the requirements of the digital economy, they risk being eliminated from the value systems that tend to be orchestrated by large firms.

In addition, the same study presents the lack of ICT strategy and skills as a key reason for SMEs not being able to adopt and invest in ICT. According to the e-business survey, only about 15 per cent of small firms and 30 per cent of medium-sized firms employ ICT practitioners (i.e. have their own ICT department). Thus, ICT strategy and implementation critically depend on the respective skills of management. Lawson *et al.* (2003) have presented a set of factors affecting the adoption of electronic commerce technologies by SMEs in Australia.

Although studies so far have shown that SMEs are more flexible, more adaptable to change and more receptive to new ideas and techniques, they do however face limitations in purchasing and implementing new systems due to a lack of human and financial resources. The empirical research of Corso *et al.* (2003) analysed the factors influencing 47 Italian SMEs in the adoption and use of modern ICT tools. Recently, Eikebrokk and Olsen (2007) have made an empirical investigation of the competency factors affecting e-business success in European SMEs. In addition, Maguire *et al.* (2007) tried to investigate how SMEs use ICT to gain a competitive advantage. The key findings of this research were the following:

- SMEs viewed ICT as playing a useful role in cost reduction;
- ICT could improve product development and service quality in a high percentage of SMEs;
- the most popular ICT planning horizon was 2-3 years; and
- SMEs viewed sales forecasting, customer analysis, and pricing as the most potent ways of using ICT for competitive advantage.

ERP in SMEs

ERP is an outcome of 40 years of trial and error. It has evolved as a strategic tool because of the continuous improvement in the techniques available to manage business and the fast growth of information technology. The evolution of ERP systems is a reflection of added layers of functionality to the germ-cells of materials requirements planning (MRP) of the 1970s and manufacturing resource planning (MRP II) of the 1980s.

ERP systems are defined as configurable information systems packages that integrate information and information-based processes within and across functional areas in an enterprise (Metaxiotis *et al.*, 2005); in this sense, ERP systems are designed to integrate business functions and allow data to be shared across many boundaries and divisions within the company. For instance, the customer service department of a

company can have access to information being used by its finance and accounting divisions. This ability to share information gives businesses increased flexibility and allows them to operate more efficiently than before. ERP systems consist of series of integrated modules from accounting, distribution, sales and manufacturing to human resources management. Because these systems are complex and expensive, the decision to install an ERP system necessitates a choice of mechanisms to determine both whether an ERP system is needed and, once implemented, whether it will be successful.

Although ERP is now considered to be the price of entry for running a business successfully (Jacobs and Bendoly, 2003), little literature deals with the use of ERPs by SMEs (Moon, 2007). Most literature is focused on ERP implementation stories (Mabert *et al.*, 2003; Okrent and Vokurka, 2004; Alsene, 2007), critical success factors (Motwani and Subramanian, 2005), extended ERP modules (Metaxiotis *et al.*, 2003), measurement of ERP success (Wu and Wang, 2006) and ERP II (Mohamed and Fadlalla, 2005).

The study of Van Everdingen *et al.* (2000) dealt with ERP adoption by midsize European companies. In addition, the survey of Moller (2004) on ERP adoption in midsize Danish enterprises concluded that:

- ERP has become a pervasive technology;
- ERP has become a contemporary technology;
- the ERP market has matured; and
- the dominant ERP strategy is still the single vendor strategy.

Recently, Maguire *et al.* (2007) tried to investigate how SMEs use ERPs to gain a competitive advantage. Some of the key findings of this research were the following:

- a significant majority of SMEs purchased commercial ERP systems as opposed to developing in-house systems;
- a wide range of commercial ERPs is being purchased by both small and medium-sized enterprises; and
- Sage Tetra CS3 and Calliach MRP are the favoured systems purchased by small firms, while SAP R/3 is the most popular commercial ERP system used by medium-sized companies.

SMEs and KM

An overview

KM today is the subject of much literature, discussion, research and action (Nonaka, 1991; Wiig, 1993; Davenport and Prusak, 1998; Liebowitz, 2000; Metaxiotis, 2005; Ergazakis *et al.*, 2007). Knowledge management is based on applying the fullness of an organisation's knowledge to its decisions, and this requires working hard to represent it, transfer it, make it accessible and encourage its use. According to Davenport and Prusak (1998), KM is defined as follows:

> Knowledge management is concerned with the exploitation and development of the knowledge assets of an organization with a view to furthering the organisation's objectives. The knowledge to be managed includes both explicit, documented knowledge, and tacit, subjective knowledge.

Basically, a company has to manage the change and allow the culture to move towards a structure that enables the organisation to transform tacit knowledge into explicit

knowledge; to develop the knowledge cycle (Figure 1) and make knowledge available and accessible company-wide (Burk, 1999).

KM is driven by the need to enhance:

- intellectual asset management;
- operational efficiency;
- customer and competitor intelligence;
- continuous improvement;
- organisational learning;
- innovation in products and services; and
- time to market.

In general, one of the most important issues in KM is the organisation, distribution and refinement of knowledge. Knowledge can be generated by data mining tools, can be acquired from third parties, or can be refined and refreshed. The collected knowledge can then be organised by indexing the knowledge elements, filtering based on content and establishing linkages and relationships among the elements. Then this knowledge is integrated into a knowledge base and distributed to the decision support applications. The insights resulted from the decision support applications are used to refine the existing knowledge and feed back into knowledge organisation.

Another important issue is knowledge presentation. This refers to the ways knowledge is displayed to the organisation's members. In general, an organisation may devise different procedures to format its knowledge base. Because of the different presentation styles, organisation members often find it difficult to reconfigure, recombine and integrate knowledge from distinct and disparate sources. A third key point is knowledge distribution and sharing. We should always keep in mind that when knowledge within the organisation is shared, it becomes cumulative. Information technology and the internet have enabled and increased this sharing of knowledge and new, emerging technologies can further advance it.

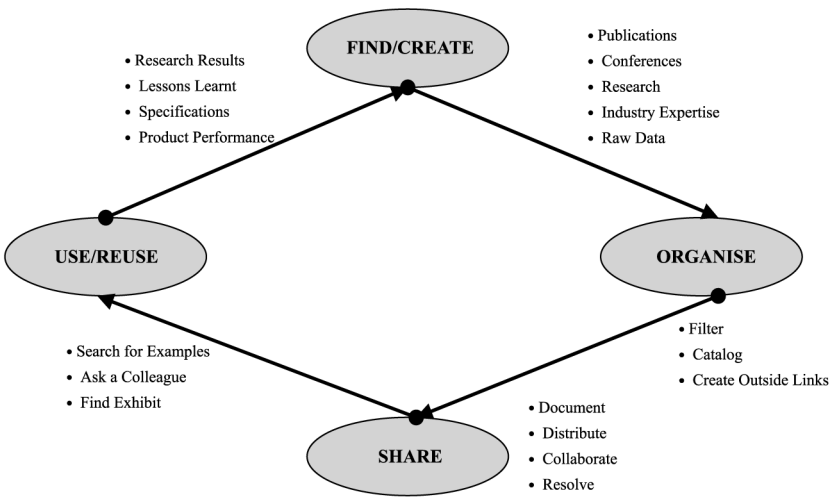

Figure 1.
The cycle of knowledge

KM in SMEs

Knowledge has become one of the most important driving forces for business success. Enterprises are becoming more knowledge-intensive; they are hiring "minds" more than "hands", and the need to leverage the value of knowledge is increasing. Okunoye and Karsten (2002) stated that KM has indeed become the underlying source for successful enterprises regardless of their size and geographical locations.

A central KM issue in SMEs is the occurrence of knowledge loss through key employees leaving companies (Wickert and Herschel, 2001). SMEs traditionally rely heavily on particular individuals and lack the recruiting capacity of large organisations; the potential loss of key personnel can lead to the fear that the enterprise could lose its competitive edge, which is dependent on the knowledge acquired and developed by these employees. SMEs cannot afford to lose customers by having gaps or breaks in knowledge application and the conduct of work. Realistically, this was the main reason behind the development and growth of KM concepts, models and systems. Besides, using the knowledge directly, the owners of SMEs must also transfer knowledge to their employees. Seldom do SMEs have the capabilities of recruiting the best minds in the business (Desouza and Awazu, 2006); hence, they must settle for less qualified but motivated individuals. These individuals must be trained and taught how to be successful employees.

Given this need to manage knowledge in SMEs, and while KM seems to be successfully applied in large companies, it is still disregarded by SMEs. Despite the strength of the arguments presented above, the lack of uptake of KM within SMEs suggests that SMEs are currently not convinced of the advantages of adopting a KM strategy for business growth. The study of Nunes *et al.* (2006) on how knowledge is used, perceived, represented and managed within knowledge-intensive SMEs has shown two key KM barriers. The first is associated with the already discussed syndrome that long-term investments are always lower priority than short-term investments. The second reason is related to the difficulties in obtaining a "believable return on investment case".

Wong (2005) proposed a comprehensive model of 11 factors for adopting and implementing KM in SMEs, as follows:

(1) management leadership and support;
(2) culture;
(3) IT;
(4) strategy and purpose;
(5) measurement;
(6) organisational infrastructure;
(7) processes and activities;
(8) motivational aids;
(9) resources;
(10) training and education; and
(11) HRM.

Lee and Chang (2007) presented a model for linking knowledge management and innovation management in e-business for SMEs, while Cegarra-Navarro and

Martinez-Conesa (2007) discussed how e-business can be developed through knowledge management in Spanish telecommunications companies.

Bozbura (2007) proposed a model to measure the perceived effect of the dimensions of KM on the performance of Turkish SMEs in manufacturing industry. The major finding of this study is that senior managers of Turkish SMEs do not like to share knowledge. The main reason behind this is their conservative approach to keeping important knowledge within the firm or inside themselves. Since most of the SMEs are family businesses, the senior managers (also the owners) of these companies are afraid of going out of business if they lose control of even basic knowledge about the business. Finally, the study of Maguire *et al.* (2007) on the adoption of KM in SMEs has shown the following:

- less than 10 per cent of SMEs profess to use KM;
- these SMEs do not create knowledge from existing information and business processes, and hence if the expert is not available and the same problem arises, no alternatives can be used to resolve the problem effectively;
- SMEs are prone to using tacit and cultural knowledge due to the low level of complexity in acquiring, creating and managing such knowledge; and
- KM activities take place in these enterprises but few SME managers call them "knowledge management".

Finally, the study of Akhavan and Jafari (2008) found that, considering SMEs as a micro-element of a society or macro economy, knowledge management is crucial to drive them towards becoming learning organisations and to achieving sustainable competitiveness.

ERP and KM integration in SMEs

The rationale

Based on the previous examination it becomes clear that, in the current knowledge-based economy, SMEs need to:

- integrate and optimise internal business processes in order to minimise costs, improve the quality of products and services, and increase customer satisfaction;
- exploit and use appropriate and up-to-date knowledge in order to compete and gain competitive advantage; and
- avoid knowledge loss in order to retain competitiveness in the business environment.

Consequently, the integration of ERP and KM is proven to be a necessity for SMEs in the near future. ERP can improve the internal organizational efficiency by integrating different parts in the enterprise so that employees use less time to perform tasks, while KM can provide the enterprise with the required competitive advantage in order to compete. In the following subsection, a conceptual model for the integration of ERP and KM in SMEs is presented.

The proposed conceptual model

A conceptual model was developed for the integration of ERP and KM in the framework of a research project (2006-2007) funded by the General Secretariat for Research &

Technology in Greece. The design of this model was based on a knowledge-based view of the SME which suggests that knowledge is the firm's key resource for creating and sustaining economic rent. What distinguishes knowledge (the basis of a KM system) from information (the basis of an ERP system) is the validation context of knowledge; knowledge is information that has being tested and validated by record or experience, which was provided by working practices as the validation process.

The proposed model for the integration of ERP and KM is illustrated in Figure 2. It should be stressed that this conceptual model has a sound basis in the comprehensive literature review and is regarded as an adaptable solution, where a SME with a traditional business structure uses existing IT applications and builds upon them.

As presented in Figure 2, ERP provides integrated transaction processing and access to information that spans multiple business functions; these functions include financial and accounting, human resources, supply chain and customer services. At the heart of the ERP system is a single central database. By integrating ERP and KM, a central database and knowledge base is built which collects information and knowledge from, and feeds information and knowledge into, modular applications supporting all of a company's business activities. When new information and knowledge is entered in one place, related information and knowledge is then automatically updated.

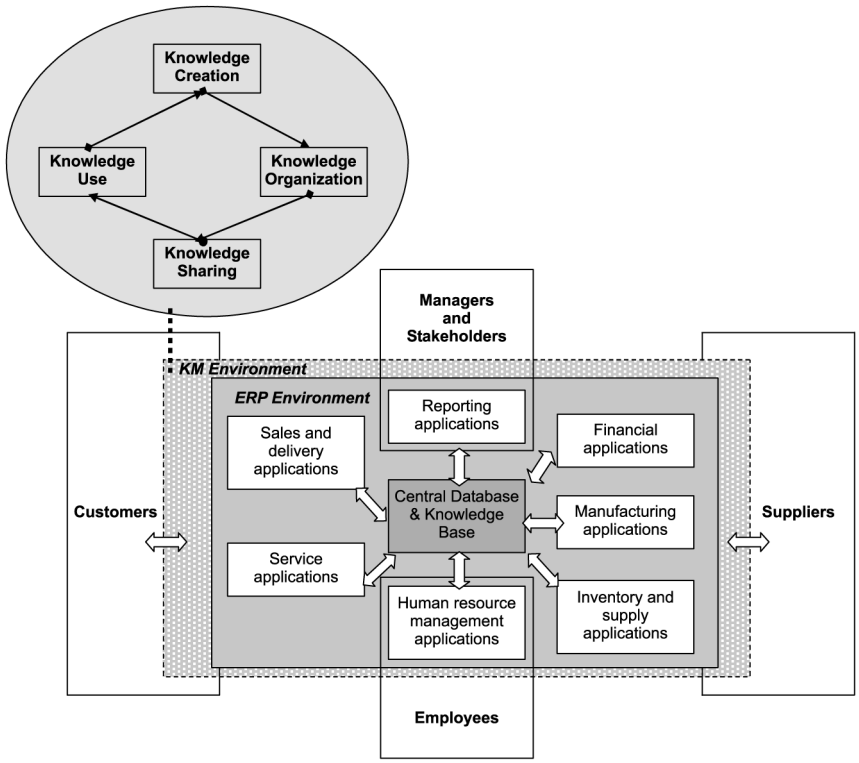

Figure 2.
The proposed conceptual model

Figure 2 clearly shows that all the software components of the ERP are integrated and that the information flows from one software component to another. The advantage of an ERP system is that this information is entered only once; this minimises the risk of human error.

One way to identify the critical knowledge that should be captured and determine the employees in the SME who have the knowledge on a specific issue (e.g. specific product development) is to conduct a knowledge audit. A knowledge audit helps to identify the types of knowledge needed and the appropriate sources. On the other hand, also taking into account that people in general are not likely to share their knowledge unless they think it is valuable and important, it becomes clear why SME managers are not willing to share and transfer their knowledge. Effective knowledge management requires a "knowledge sharing" culture to be successful. Lessons-learned systems can be an effective knowledge-sharing approach to be used in SMEs. Moreover, technological networking tools should be supplemented with face-to-face discussion and meetings because the latter can provide a richer medium for transferring knowledge within the firm.

Knowledge creation may take the form of new products or services, increased innovation, or improved customer relationships. Two examples of knowledge creation technologies to be integrated with ERP, which can be used in SMEs, include:

(1) *data mining* – tools that analyse data in very large databases and look for trends and patterns that can be used to improve organisational processes; and

(2) *information visualization* – computer-supported interactive visual representations of abstract data to help improve understanding.

Finally, we should stress that before the application of this model and the development of the ERP-KM platform in the firm, the SME's business processes must be modelled, and if necessary re-engineered, to allow smooth integration. An effective change management strategy as well as a business process re-engineering strategy (if required) will improve the enterprise's change analysis capabilities and provide more fluid and efficient change implementation/migration processes.

Conclusions and further research

It is widely acknowledged in the academic milieu that all enterprises, both large and small, require efficient KM in order to maximise their competitiveness and survival chances in the current knowledge-based economy. The success of a small business or a SME can be linked to how well they manage their intellectual capital and knowledge; knowledge to represent know-how, expertise, skills, ideas, intuitions and insights. On the other hand, research and studies have shown that modern ICT tools like ERP systems can support SMEs in minimising costs, improving the quality of products and services, and increasing customer satisfaction. The integration of ERP and KM is proven to be a necessity for SMEs in the near future.

The conceptual model that this paper proposes should be regarded as a basis for future research. The proposed model has to be tested, refined and improved. The main emphasis of the model is that SMEs should use the advances of geographically open boundaries and the power of knowledge management to gain a competitive advantage in those areas that once belonged to large firms with significantly greater financial resources. In this context, the applicability of this model in a SME seeking to gain a

competitive advantage needs to be explored. Practitioners should use this model in order to develop new platforms and extended ERP modules. The present author would recommend a case study project, based on a SME attempting to utilise this conceptual model as a "prototype". This will achieve a better understanding of SMEs and their heterogeneous nature and complexity, including owners/managers and their employees' attitudes towards knowledge management.

On the other hand, what we should not forget is that in order to apply an appropriate KM environment in a SME, cultural and behavioural issues need to be tackled before even considering technical issues. Apart from models and systems, organisational culture is an imperative factor for successful KM. Before applying the proposed model, SMEs should ensure that their KM initiatives fit into their organisational culture, or else they should be prepared to change it. Further studies in this field should focus on the former issues in order to close the gap between theoretical propositions and the reality of practice.

Concluding, we should stress that the new market demands a distributed knowledge network, which necessitates the participation of the entire value chain from customer to supplier, and in some cases, even that of competitors. This requires synergetic relationships between ERP and KM within one system, the basis of which is the proposed model.

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