ERP Systems in SMEs: Exploring ERP lifecycle cost issues

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ERP in SMEs:

Exploring ERP Lifecycle Cost Issues

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Abstract

This thesis presents a study of Enterprise Resource Planning (ERP) systems lifecycle in small and medium-sized enterprises (SMEs). The majority of businesses and firms around the globe can be considered to be SMEs. Thus, SMEs are seen to be typical companies that are the cornerstone of most economies. Compared with large enterprises (LEs), SMEs have limited budgets and resources, and have a higher sensitivity to costs. Although ERP adoption is one of the most complex, costly, and biggest projects an enterprise can embark on, many factors lead SMEs to take such a decision. When SMEs take the first steps towards adopting an ERP system, they need to think about many things; first and foremost, they need to take into account the cost of adoption. Literature and professional reports show that a prevailing number of ERP adoption projects fail because of inaccurate or optimistic budgets and time schedules. In addition, many organizations have difficulty identifying the potential cost factors that could occur during their adoption projects Moreover, current mainstream cost management and estimation methods are inadequate in ERP adoptions settings.

The purpose of this thesis is to explore and identify the cost factors and other cost estimation related issues that may occur when SMEs adopt ERP systems. Many researchers have argued that expected and potential benefits are influential during the budgeting process and investment evaluation, and should not be ignored. Thus, the investigation of benefits management and realization practices falls within the boundaries of this research. In order to identify cost factors associated with ERP adoption in SMEs, and SMEs practices and behaviours in relation to the estimation of costs and benefits, it is necessary to explore one main research question and its subset of questions.

- What are the challenges to the management and estimation of costs and benefits within on-premise ERP adoption projects in SMEs?

The ERP adoption term used in this thesis refers to the first five phases of the ERP lifecycle framework developed by Esteves and Pastor (2007), which denote the ERP introduction process. This process moves from the “adoption decision” through to go-live and maintenance, and evolution; however, it excludes the retirement phase.

In order to understand and investigate the challenges in their perspective context, a qualitative exploratory research approach is adopted to answer the research question stated above.

This PhD study was carried out through a combination of literature reviews, panels of experts, and case study research. The empirical part of the study encompasses a multiple case study, an experts' panel, and one in-depth case study of ERP adoptions in four SMEs. All four organizations are privately owned Egyptian small and medium -sized enterprises. Besides the target organizations, the data collection process covered two ERP vendors (local and international), two implementation partners, two independent ERP and investment consultants, and eight participants on the experts' panel. Data analysis was carried out in order to identify impending cost factors and challenges that SMEs may encounter when justifying and evaluating their investments and estimating their adoption budgets.

This thesis has mainly adopted a six-phase ERP lifecycle framework. The research results are presented in six articles, which focused on the different lifecycle phases. The articles have been published in international peer-reviewed conference proceedings and journals.

This thesis has implications for both theory and practice, because data was also collected from clients, vendors and implementation partners. In terms of the literature, this study contributes to several research domains as follows:

- It contributes to the research stream on cost estimation in ERP systems, with a particular focus on SMEs. A novel and comprehensive list of ERP adoption cost factors has been identified, ranked, visualized, and validated in four case organizations, along with vendors, implementation partners, and independent consultants. The list also includes frequently overlooked potential indirect cost factors. In total, 10 main cost factors and 32 sub-factors were identified and ranked. In addition, associations between organizational contextual characteristics and their influence on cost factors have been identified. Moreover, this study used an experts' panel thus combining focus groups, nominal group technique, and the Delphi method to elicit knowledge from the various stakeholders involved in ERP adoption projects.
- By exploring the actual ERP adoption projects in target organizations, the study supports the area of ERP implementation evaluation. It also supports the claim made by current research as to the inadequacy and challenges

posed by current cost estimation models used in ERP adoption project settings (Aslam, Coombs, & Doherty, 2012; Daneva, 2007). Despite the fact that adopting organizations consider investments in ERP projects to be substantial, the results of this study show that those organizations still do not attempt to engage in cost management and estimation practices.

- This study contributes to research on benefits management and its realization in ERP systems adopted by SMEs. Benefits realization efforts are assumed to create more value than they cost (Ward & Daniel, 2006). Hence, the maturity of organizations should be increased and their cultures cultivated towards more rational benefits realization practices. The findings of this study on ERP implementations in Egyptian medium-sized organizations challenge the fundamental arguments for formal benefits realization practices. Whilst investments in ERP are regarded as significant, and the projects seen as challenging, formal benefits realization and investment evaluation practices are considered to be largely irrelevant. The reasons include the "self-evident" nature of ERP benefits, the perceived difficulty and costliness of the methods used, and suspicions as to the rationality of these methods. Moreover, according to some organizations, ERP vendors tend to provide a very optimistic cost estimate for their systems in order to win the bid.
- By carrying out a literature review, it became evident that there is a scarcity of studies and cases that are related to ERP retirement. ERP retirement is the term used to describe the replacement of one ERP system with another because of the emergence of new technologies and other factors (Esteves & Pastor, 1999). During this research, I was able to recognize an exceptional early retirement case in one of the target organizations in which the ERP system was replaced, before 'going live.' Thus, it was possible to investigate the case and ERP project circumstances in order to explore the reasons for this early ERP system retirement. It would also be possible to determine whether the retirement decision was related to a faulty budget or benefits estimation. Traditionally, the retirement phase is the last stage in the ERP lifecycle after the systems have gone live and have been used for some time. The findings suggest that the main reasons for making a retirement decision are not solely related to new technology emergence. Rather, they may relate to a deficient ERP selection process, of a situation in which formal ERP selection methods and practices are overlooked. Thus,

incorrect selection and insufficient user involvement could be the only reasons for ERP retirement, as could the desire to introduce new technology or address new unmet business requirements. Of course, the risk of ERP retirement before maturity, or even before go-live, is magnified since it reflects a substantial loss of investment and time.

- This research adds to the literature on ERP evolution and future development. In this study, the history of ERP systems and state-of-the-art technologies have been investigated in order to suggest the potential for the integration of current technologies within ERP research. While keeping the ERP lifecycle in mind, the research suggests that certain technologies (e.g., social networks and enterprise 2.0) could, if adopted, contribute to specific phases of the ERP lifecycle. Moreover, such technologies could potentially decrease the risk of ERP adoption failures, cost overruns and challenges to benefits realization, as well as other risks and barriers to entry.

In this study, data was collected from the different stakeholders involved in ERP adoption projects; this data reflects the different views and issues recognized by different parties. A list of cost factors could support organizations in more accurately estimating their budgets through the visualization of potential direct and indirect ERP costs that could escalate their investments. In addition, the findings of this research could help adopting organizations and vendors to avoid any pitfalls during the several phases of the ERP system adoption process, and have a more realistic view of the potential cost escalations. Moreover, the study demonstrates the potentials of adopting new technologies and their expected benefits during the ERP lifecycle phases.

In general, this research is one of the few studies to be conducted in typical Egyptian companies, i.e., small-to-medium sized enterprises. The findings of this thesis suggest that, although SMEs put into place limited budgets and resources, all our target cases exceeded their roughly estimated budgets. It should be noted that these SMEs do not, in the main, follow any formal budgeting; nor do they follow benefits realization methods and practices. In addition, the findings suggest that there are no differences in the behaviour of SMEs towards formal budgeting and benefits management practices when these SMEs operate in different contexts; for example, industrial sectors. For some organizations, the effectiveness of benefits realization methods appears questionable. These methods are sometimes viewed as a political justification

tool for future investments, which supports findings by Lederer et al. (1990). Although SMEs are often classified as having low levels of IS and IT competences, maturity, simple business processes and operations, this was not supported in some of our case organizations. This study calls for more research into ERP adoption projects in SMEs and more case reports, which show ERP adoption in practice. Research should also focus on enhanced cost estimation and benefit realization models, which are more suitable for ERP settings. In addition, as presented later in this thesis, this study suggests that the enterprise-size classifications in Egypt also pose challenges to researchers.

Table of Contents

1 Introduction 1
1.1 Thesis organization 5

2 Related literature 6
2.1 The SME context and environment 6
2.2 Drivers for ERP adoption 9
2.3 ERP implementations 12
2.4 Cost estimation research 19
2.5 Benefits realization 24

3 Research approach 31
3.1 Research design 32
3.2 Data collection 42
3.3 Data analysis 49
3.4 Research validity and reliability issues 51

4 Publications overview 58
4.1 Publication 1: ERP in SMEs: An Extended Literature Review 59
4.2 Publication 2: The Use of Experts Panels in ERP Cost Estimation Research 60
4.3 Publication 3: Why Benefits Realization from ERP in SMEs Doesn't Seem to Matter? 62
4.4 Publication 4: Exploring ERP Adoption Cost Factors in SMEs 64
4.5 Publication 5: ERP Lifecycle: a retirement case study 65
4.6 Publication 6: The Future of ERP Systems: look backward before moving forward ... 66

5 Contributions 68
5.1 ERP adoption cost factors 68
5.2 Costs and benefits estimation and management practices in SMEs 73
5.3 ERP Retirement 77
5.4 ERP evolution and development 79
5.5 ERP in SME research 82

6 Conclusions and future research opportunities 83
6.1 Research conclusions 83
6.2 Research limitations 89
6.3 Future research opportunities 90

References 93

Appendix A- Interview guide 101

Appendix B- Data use & confidentiality agreement 109

Appendix C- Research publications 110

List of Figures

Figure 2-1. A model for IS research 7
Figure 2-2. The TOE framework 8
Figure 2-3. Technology-Organization-Environment framework of SMEs adoption of Enterprise Systems (TOEES) 9
Figure 2-4. Multi-dimensional ERP benefit framework 25
Figure 2-5. Reasoning for increased benefits management and realization practices in literature 29
Figure 3-1. Overview of research activities 32
Figure 3-2. Research design overview 34
Figure 3-3. ERP Lifecycle framework 38
Figure 3-4. Data collection and analysis overview 51
Figure 4-1. Mapping of publications' main foci with ERP lifecycle phases 59
Figure 5-1. Potential ERP adoption cost factors 70
Figure 5-2. Ranked and validated cost factors example 73
Figure 5-3. Summary of the thesis' findings on benefits realization 75
Figure 5-4. Proposed future research focus 80
Figure 5-5. Proposed research integration 80
Figure 5-6. ERP in SMEs research approaches 82

List of Tables

Table 2–1. Motivations for ERP adoptions 11
Table 2–2. Frequency analysis of CSF in literature 16
Table 2–3. Critical risk factors 18
Table 2–4. 2013 ERP report. 20
Table 3–1. Overview of target cases 38
Table 3–2. Overview of interviews in target cases and other stakeholders 46
Table 3–3. Internal validity assessment 52
Table 4–1. List of publications 58
Table 5–1. Influencing cost factors and their rankings 71

1 Introduction

According to Davenport, "If a company's systems are fragmented, its business is fragmented" (1998, p123). Enterprise Resource Planning (ERP) systems are used to unify organizations through the maintenance of a single large database that stores, shares, and disseminates data from within different business functions. ERP systems focus on the technical integration of different business functions such as accounting and finance, manufacturing and production, human resources, procurement, and distribution. ERP systems are considered "tightly coupled", in contrast with systems that are usually operating within organizations prior to ERP systems adoption (Gattiker & Goodhue, 2004). ERP projects may vary in size and structure, each requiring careful management decisions to be taken during the implementation process (Safavi, Amini, Abdollahzadegan, & Zakaria, 2013).

This PhD thesis focuses on ERP system lifecycle and adoptions in small and medium-sized enterprises (SMEs). The term 'adoption' varies in ERP research literature. In some cases, it refers to a final phase during which the users accept and use the system; in other cases, it is used as a more general term to refer to the decision taken by the organization to acquire an ERP system, passing through the ERP lifecycle phases (Van Everdingen, Van Hillegersberg, & Waarts, 2000). In this study, the latter definition is adopted.

The purpose of this thesis is to explore and identify issues related to cost factors, cost estimation and benefits realization practices, which could occur when SMEs adopt ERP systems. Furthermore, this thesis aims to contribute to a better understanding of these topics under exploration. The motivation for this research project has both scientific and practical roots, as explained in the following sections.

Major ERP vendors focus their attention on SMEs. This is mainly due to the close-to-saturation ERP adoptions within large enterprises, as nearly every major business has adopted at least one ERP system (Deltour, 2012). In addition, many SMEs are now considering ERP systems because of the increasing number of alliances, value-webs, data flows, and complex operations. It is also likely that SMEs will already have several silo computer systems, making it too costly to store and rationalize redundant data (Davenport, 1998). Hence, when SMEs adopt ERP systems, they do so in the belief that it is a step towards process standardization (Shanks, Seddon, & Willcocks, 2003), and cost effectiveness. In short, they see it as a way to survive strong market competition (Ram, Corkindale, & Wu, 2013a). Business complexity is not the sole

preserve of large enterprises. Although some SMEs are not "large" in terms of employee numbers, they still face business complexities, and high coordination and communications demands, all of which require complex technologies (Van Everdingen et al., 2000). In the case of Egypt, around 75% of total employment falls within SMEs that are involved in a broad range of economic activities (El Gamal, El Megharbel, & Inanoglu, 2000). Thus, SMEs in particular are potential candidates for future growth in the Egyptian economy.

SMEs are known for having scarce financial and human resources, limited information systems (IS) knowledge, and a lack of information technology (IT) competence (Deltour, 2012; Schniederjans & Yadav, 2013). These limitations mean that IT investment is a critical endeavour for SMEs. A faulty IT investment decision could have a huge impact on the enterprise's business operations, which could be more difficult for SMEs to overcome than is the case for large enterprises (LEs) (Schniederjans & Yadav, 2013). This applies particularly to ERP systems adoptions, as they are considered one of the biggest projects launched by an organization (Moon, 2007). In addition, ERP system adoption is a critical project that requires commitment, substantial resources, and organizational changes (Aslam et al., 2012). Given the complexity and high cost of ERP systems, when organizations take the first step towards acquiring an ERP system, they need to think about many things, foremost among them is cost of adoption (Ram et al., 2013a). In this study, costs are defined as the required overall budget spending for the attainment of the ERP adoption goal.

There is an obvious gap in ERP cost management and estimation research (Daneva, 2007; Safavi et al., 2013). In addition, the adequacy of current financial and cost estimation models in ERP settings is questionable (Al-Mashari, 2002; Aslam et al., 2012). Hence, with the shortage of proper identification and estimation methods to determine cost factors, organizations face considerable challenges in estimating costs, size, time, effort, productivity and other cost factors when embarking on ERP systems adoption projects (Aloini, Dulmin, & Mininno, 2012b; Daneva, 2004; Shanks et al., 2003). Furthermore, costs could exceed their estimated budgets, as many organizations overlook potential increases in direct costs (Irani & Love, 2000), as well as the projection of indirect costs (Aloini et al., 2012b; Irani & Love, 2002). Such a situation may be critical for an SME with limited resources (Aslam et al., 2012).

In general, costs can be classified as either direct or indirect costs. Direct costs are normally predicted and known costs; however, they may escalate because of an unpredicted need for additional hardware and its installation, human resources, and customization. Indirect costs are usually organizational costs that evolve due to a move

from old to new work practices; for example, business process re-engineering (BPR) and organization restructuring (Love & Irani, 2004). In this thesis, any unpredicted direct and indirect cost factors or cost escalations are regarded as hidden costs.

The size and structure of organizations that implement ERP systems are not the only variables within ERP projects. Specific contextual factors, existing software reuse, and the adoption of a specific vendor ERP implementation methodology are also important factors (Daneva, 2007; Molnár, Szabó, & Benczúr, 2013). Furthermore, context can dramatically influence an ERP project, as the typical Western understanding of conducting business is not valid in every part of the world (Soh, Kien, & Tay-Yap, 2000). In contrast with large enterprises, SMEs do not possess similar amounts of resources; thus, their practices in managing their investments are often challenged by a lack of resources. In addition, limited financial resources could make SMEs more cost-sensitive (Bharathi et al., 2012). Consequently, any rise in costs or project delays could seriously affect an SME's survival in the market (Moon, 2007). Even some large enterprises have filed bankruptcy because of a faulty ERP implementation project.

At first glance, cost estimations for ERP adoption projects in SMEs may appear trivial because of the size of the enterprise; however, our data indicates that cost overruns still occur. Moreover, the literature suggests that smaller firms are less likely to have successful system implementations (Raymond, 1990). Nonetheless, ERP adoption within SMEs is still growing; thus researchers need to scrutinize and identify the basic drivers that influence ERP adoption decisions (Ram et al., 2013a), especially ERP adoption costs.

Maturity of management in organizations (Lin & Pervan, 2003), and information technology competence (Thomas, Seddon, & Fernandez, 2007) could play a role in the adoption of formal benefits management and realization practices. The adoption of formal benefits management practices is sought to maximize the organizations' benefits realization outcomes (Ward & Daniel, 2006; Zeng, Lu, & Skibniewski, 2012). Nevertheless, realizing these benefits from their substantial investments in ERP projects is considered a major challenge by ERP-adopting organizations (Aslam et al., 2012). Several reasons may contribute to the difficulty in managing and realizing benefits from ERP projects. Basically, the process of identifying the potential benefits from ERP adoptions is a complex task (Eckartz, Katsma, & Daneva, 2012). A recent ERP report shows that of 172 organizations surveyed, 14% of the companies did not have a business case, and 60% of the companies have realized 50% or less of their anticipated benefits (P.C.G, 2013). The report, however, does not indicate if the participating organizations had adopted any formal benefits identification or

management practices. In addition, several benefits management and realization frameworks exist in literature, however, they are not tailored to ERP complex environments (Eckartz, Katsma, & Maatman, 2012) and rarely adopted in practice (Aslam et al., 2012). Thus, there is a need to investigate if Egyptian SMEs adopt formal benefits management practices. In addition, it is important to gather insights concerning the target organizations' attitudes toward those formal practices. Moreover, there is a need to explore the applicability, fit, challenges, and the use of such practises in ERP adoption projects in SMEs.

Given the motivations presented above, this thesis aims to explore the issues and practices of costs and benefits related to ERP system adoptions in SMEs. Furthermore, it aims to shed light on the factors that affect these efforts. In particular, this research focuses on identifying common direct and indirect ERP adoption cost factors, which may explain why cost escalations happen in some cases. The budgetary and investment evaluation challenges that Egyptian SMEs face in particular are also examined. Accordingly, the thesis addresses the following issues:

- What are the cost estimation and benefits realization challenges for ERP adoption projects in SMEs?

In order to better understand the challenges associated with costs and benefits management, the following sub-questions are investigated.

- What are the potential costs factors for ERP adoptions in SMEs?
- Do SMEs follow any formal budgeting or cost estimation methods?
- Do SMEs follow any formal benefits realization and management practices?
- Are there any differences in cost and benefit management practices in different SME contexts? (e.g., government policies, industries)?

The ERP lifecycle framework developed by Esteves and Pastor (1999) and presented in figure 3-3, was adopted in this thesis. It was used as a general guide to organize and frame the data collection efforts according to the ERP lifecycle phases. The phases are further described in the section on "ERP implementations". The empirical basis for the thesis is based on an in-depth case study, a panel of experts, and a multiple case study of ERP adoptions in four SMEs in Egypt, representing a total of five cases. Two of the five case studies were conducted in one organization; however, they were regarded as separate cases because of their different research focus (adoption, retirement) and the separate data collection efforts made. The results from this research were presented and discussed in six research publications (see Appendix C). The purpose of this

dissertation summary is to integrate these publications and articulate the research effort and findings in a coherent structure.

1.1 Thesis organization

The remainder of the thesis is structured as follows. Chapter 2 introduces the literature on ERP adoptions, together with theoretical perspectives on the concepts of ERP cost estimation, benefits and risk management. Chapter 3 discusses the research approach, research design, and data collection methods adopted in this thesis. In addition, an overview of the five cases studied and research validity issues are presented. Chapter 4 provides an overview of the six research publications and summarizes the articles and their findings. Chapter 5 demonstrates the main research contributions. Chapter 6 summarizes the research contributions to theory and practice, and discusses the research limitations. It also reflects on potential future research avenues.

2 Related literature

This chapter provides an overview of existing literature related to the research topics presented in this thesis. As outlined in the introduction, of particular interest are cost-related issues in ERP systems adoptions within SMEs. There exists a substantial body of scientific literature in the domain of IS development with regard to cost estimation; however, there is little research into the cost of ERP adoptions, particularly in the context of SMEs. Moreover, the fundamental concepts of IS benefits management and realization have been well covered in the literature, which this study has taken as the basis for its investigations. This review does not intend to be comprehensive, but rather to compliment the relevant topics discussed in this thesis.

Section 2.1 introduces the SME environment and context within the IS domain. The purpose of this section is to define the scope of the context applied in this research, which could possibly have an impact on ERP adoption projects. Based on a review of the relevant research, I also present the 'Technology-Organization-Environment framework of SME adoption of Enterprise Systems' which is used in this thesis. Also presented is a summary of SME characteristics, which represent the SME setting studied in my research. The section is organized as follows. I start with a brief discussion of context in IS and ERP literature, before going on to present a general review of literature on ERP adoption drivers (2.2). In (2.3) I examine the literature on ERP adoption and the implementation process, and briefly discuss the critical success factors for ERP implementations, and risk management issues found in the literature. Section (2.4) presents a discussion of current literature on cost estimation and management issues in IS and ERP adoptions. Finally, a review of benefits management and realization in IS is provided in section (2.5). This review covers general literature that explores the benefits realization concepts and challenges in IS and ERP adoptions.

2.1 The SME context and environment

Context is considered as a scoping tool for researchers. Indeed, the IS literature has accentuated the importance of context in research endeavours (Walsham, 2006). Context is a broad term, however, which may refer to an organization or its environment; it may even cross enterprise borders on a national or international scale (Walsham, 2006).

The prime focus of early research in IS literature was mainly on intra-organizational IT innovation and contextual factors in organizations, (e.g., Ein-Dor & Segev, 1978). However, some early research papers did shed light on the importance of an

organization's external environment (Ives, Hamilton, & Gordon, 1980). Ives et al. (1980) developed an illustrative model of information systems in organizations, showing their internal and external environments. The model intended to suggest and pave the way for a research roadmap, as well as stress the importance of internal and external environments as variables. Ives et al. identified five main information system environments, as illustrated in figure 2-1. The external environment includes social, political, legal, cultural, economic, educational, resource and industry/trade variables, while the organizational environment variables are its goals, structure, tasks, management style, and volatility (Ives et al., 1980).

In the last decade, researchers have considered the pressures of the external environment on large enterprises, and within SMEs contexts. For example, Kuan and Chau (2001) noted that SMEs' external pressures are their competitors, business partners, governments, and markets. In addition, some researchers have crossed the national environment and context to include international dimensions (Avgerou, 2008). The external environment does not only provide pressures; it also offers opportunities. For example, the Egyptian Ministry of Industry Modernization has offered funding to SMEs to help them acquire IT and IS technologies. Two of the target cases have benefited from such aid.

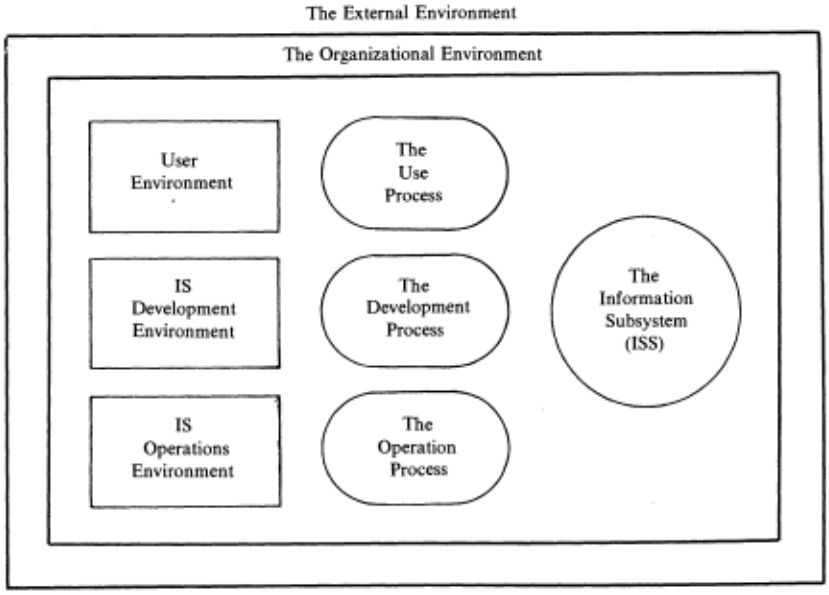

Figure 2-1. A model for IS research. Adopted from (Ives et al., 1980)

As well as taking an internal SME context stance in this thesis, other external organizational factors were considered. The study used the Technology-Organization-Environment framework for SMEs' adoption of enterprise systems (TOEES)

developed by Ramdani et al. (2009) (see figure 2-3). The framework is used as a tool to identify the potential technological, organizational and external environmental factors that need to be investigated. TOEES is based on the Technology-Organization-Environment framework (TOE) developed by Tornatzky et.al. (1990). The TOE framework (fig. 2-2) features three general aspects of a firm's context that influence the adoption and implementation of the technological innovation process: organizational context, technological context, and environmental context. The three dimensions are also consistent with the innovation diffusion theory, which highlights technological characteristics, and both the internal and external characteristics of organizations as drivers for technology dispersion.

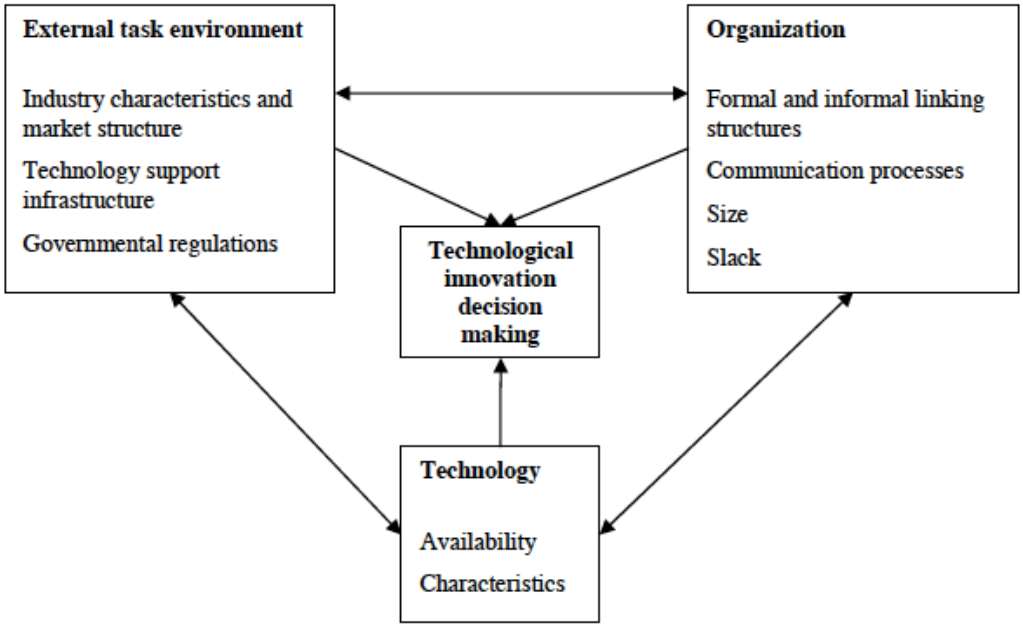

Figure 2-2. The TOE framework. Adopted from (Tornatzky et al., 1990)

The TOE framework was adopted and adapted from several research studies in the IT and IS domains. For example, Kuan and Chau (2001) adopted the TOE framework in order to study the potential for electronic data interchange (EDI) adoption among small-sized firms in Hong Kong. Another researcher employed TOE in order to assess the factors influencing cloud computing adoption in enterprises (Borgman, Bahli, Heier, & Schewski, 2013). Others have used TOE and its variations to investigate companies' readiness for e-business application adoptions (Lin & Lin, 2008) in European countries (Oliveira & Martins, 2010). Researchers in the ERP systems adoption domain have also adopted TOE (e.g., (Kouki, Pellerin, & Poulin, 2010; Pan & Jang, 2008; Schniederjans & Yadav, 2013)). Moreover, within the domains of ERP

adoption and SMEs' contextual factors, several studies have used the framework and reported on its relevance as a tool for studying enterprise systems adoption in SMEs (Poba-Nzaou & Raymond, 2010; Ramdani et al., 2009; Raymond & Uwizeyemungu, 2007).

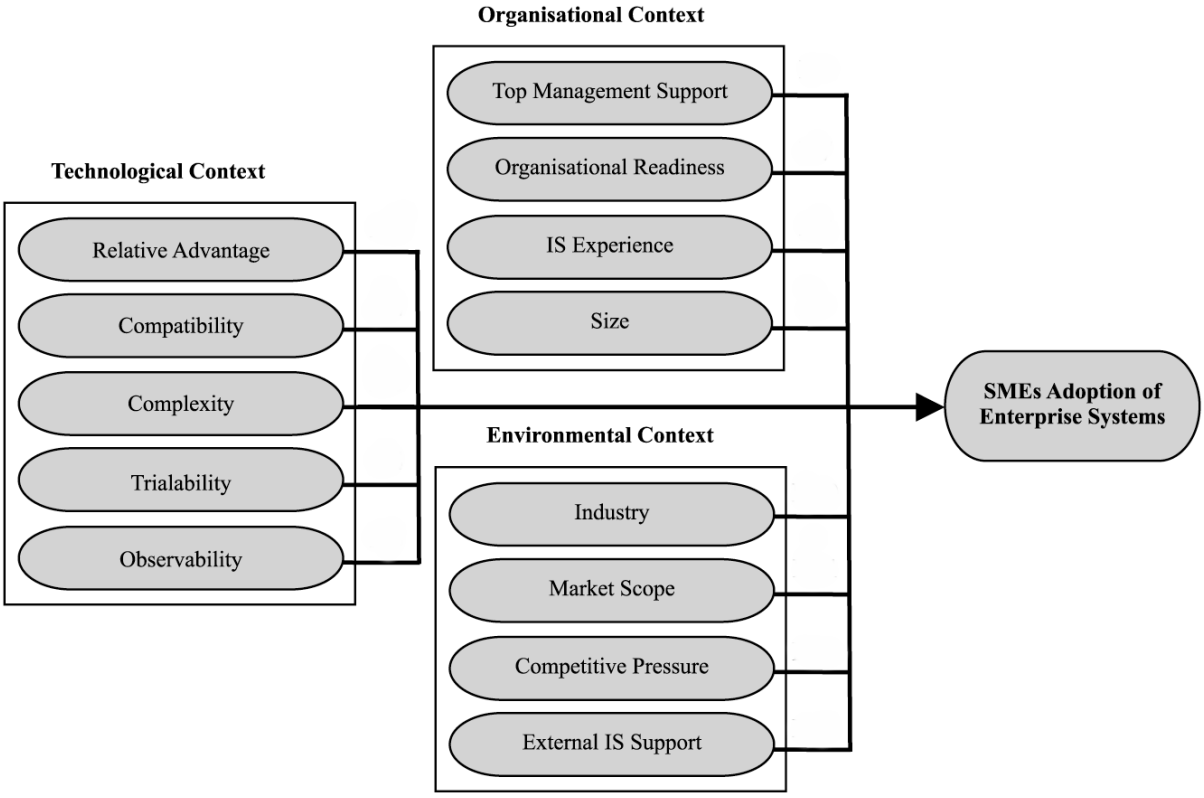

Figure 2-3. Technology-Organization-Environment framework of SMEs adoption of Enterprise Systems (TOEES). Adapted from (Ramdani et al., 2009)

The successful application of the TOE framework and its variations in existing research led to my adoption of the TOEES framework in my research. The TOEES framework was used mainly in scoping the data collection process. The application and use of the TOEES framework will be discussed in the research approach section in this thesis.

2.2 Drivers for ERP adoption

ERP systems are among the most commonly adopted IS solutions in organizations (Al-Mashari, Al-Mudimigh, & Zairi, 2003). The decision as to whether to adopt an ERP system or not is highly critical; it is not a trivial decision to be taken. The change over from a manual system or scattered applications to an ERP requires extensive planning and changes within organizations. Furthermore, ERP adoptions require many resources, not all of which are available to SMEs.

Prior to the year 2000, Y2K compliance was seen as a major concern for many firms. Enterprises looking for expert advice about operating in the new millennium were encouraged by business, IT consultants, and ERP vendors to replace their legacy home-grown scattered systems with a single unified and integrated solution. Besides the potential cost savings, one of the main drivers for ERP adoption was the technical and operation integration of business functions; these would harmonize the information stream with the material flow of goods or services (Beheshti, 2006). ERP adoption would integrate the internal value chain of the firm (Zeng et al., 2012), and provide a seamless and streamlined business processes, which could potentially sustain the firm's market competitiveness and responsiveness (Finney & Corbett, 2007). According to Beheshti (2006), enterprise competitiveness could be achieved through the use of ERP systems, because they can provide reporting capabilities to management; such cost and operational information would aid in strategic decision-making related to the enterprise's competitive position. On the other hand, in order for management and employees to utilize the competitive capabilities of ERP systems, they must have a basic understanding of the principles of ERP, so that it can be used to its maximum potential. Acquisitions, mergers, and joint ventures could also be drivers for organizations to adopt ERP systems, in order to unify, utilize and manage the huge information and work flow among themselves. In addition, one of the major forces for implementing ERP systems is globalization. As the world moves closer to becoming one small village, more and more organizations are being involved in strategic alliances. Thus a large volume of information and communications needs to be managed and utilized amongst these alliances. All of these factors have led to a more heightened need for ERP systems in organizations. For this reason, there has been a trend among SMEs in recent years to adopt ERP systems in order to manage this huge information flow.

Several papers have discussed ERP adoption drivers in SMEs from different angles. A few studies (Ramdani & Kawalek, 2008; Ramdani et al., 2009) have adopted TOE to develop a model that can be applied to predict which SMEs are more likely to become adopters of Enterprise Systems (ES). Although, the model developed was applied to predict the factors that influence the willingness of SMEs to adopt ES, nevertheless it does not differentiate between the factors that affect each type of system (e.g., ERP, SCM). Ramdani and Kawalek (2008) and Ramdani et al. (2009) concluded that SMEs' ES adoptions are influenced more by internal organizational and technological factors, rather than industry and market- related factors. On the contrary, another study has suggested that external factors could be the main reason for ES adoption; indeed, the

higher levels of SME collaboration within a network of organizations, the more likely they are to adopt an ES (Schäfermeyer & Rosenkranz, 2008).

Adoption drivers may vary for each enterprise, because the motivations for ERP are likely to be influenced by the organization's contextual internal and external needs or requirements. Considerable research has been undertaken on ERP adoption drivers, together with many classifications and categorizations. Some studies have classified these drivers and motivations broadly into technological and business performance - related categories (Markus & Tanis, 2000). Others have extended them to include strategy and competitiveness categories (O'Leary, 2004). Whilst there are several classifications in ERP literature for adoption drivers and motivations, they generally fall within technical, operational and strategic dimensions (Holland & Light, 1999). Based on the literature review, the principal reasons for deciding to adopt ERP are summarized in table 2-1.

Table 2–1. Motivations for ERP adoptions

Technical	Operational	Strategic
– Common platform and standardization – Scattered and incompatible systems – Database capacity overload and inconsistency	– Data visibility and transparency – Enhance reporting – Process enhancements/best practices – Improve financial management – Ensure data security and control	– Partnerships and value networks – Facilitate enterprise growth – Enhanced decision making – Globalization – Compliance with government regulations (e.g., Sarbanes-Oxley Act) – Cost reduction – Enhance customer responsiveness

Nowadays, SMEs are engaged in an increasing number of alliances, value-webs, data exchanges, and complex operations. In addition, many enterprises still have several silo computer systems, which might make it too costly to store and rationalize redundant data. Thus, SMEs are now making ERP adoption decisions, because they believe that it is a step towards process standardization (Safavi et al., 2013; Shanks et al., 2003), cost effectiveness, and a way to survive strong market competition (Ram,

Corkindale, & Wu, 2013b). For these reasons, SMEs are now a prospective source of interest for major ERP vendors such as SAP, Oracle, and Baan (Van Everdingen et al., 2000). What's more, while ERP adoption within SMEs is still growing, researchers need to scrutinize the basic drivers that influence ERP adoption decisions (Van Everdingen et al., 2000), particularly ERP adoption costs (Safavi et al., 2013).

2.3 ERP implementations

The main focus of ERP research has largely been on large organizations. However, in recent years, research into ERP adoptions in SMEs has also become more common (Esteves, 2009). ERP adoption projects vary in scale and arrangement; careful and timely management decisions must be made during each lifecycle phase of ERP projects (Markus, Tanis, & Van Fenema, 2000). The term 'implementation' refers to the introduction and installation of the actual system, which corresponds with the implementation phase within the ERP lifecycle. The ERP system implementation process requires dedication, commitment, a significant amount of resources, and organizational changes. Many variables affect implementation complexity and scheduling. For example, variables may be related to the adopting organization's structure, size, and technological status. They may, however, be related to external factors, such as the vendor's implementation methodology and market-specific contextual factors.

A relatively large number of studies have focused on the implementation phase. It should be noted, however, that ERP implementation methodologies and lifecycle phases can vary in name, number of stages, and level of detail in the literature. ERP lifecycle models usually include several analogous phases, e.g., adoption, selection, implementation, go-live, use and maintenance, and evolution. Some researchers have extended these models to include a retirement phase (Esteves & Pastor, 1999). The retirement phase is the point when an ERP system is replaced with another ERP or any other information system (Esteves & Pastor, 1999). In practice, most major ERP vendors have their own implementation methodologies, e.g., SAP follows the ASAP methodology, Oracle ERP follows the AIM methodology, and several other open source ERP systems follow their own methodologies.

Sometimes they are used interchangeably; however, some researchers and practitioners differentiate between an implementation methodology and an implementation strategy. The latter term describes the process of how and when the system will go-live. ERP implementation strategies can include: a) phased rollout, b) pilot study, c) parallel adoption, and d) big bang or direct cutover. Each of these

strategies has its own advantages, disadvantages, and associated costs and risks. Some organizations prefer to combine strategies during the implementation process.

Several of the critical challenges faced by organizations when adopting ERP systems are related to the degree of business process re-engineering (BPR), customization, and change management required to best fit with their adopted ERP system. On the other hand, some organizations adopt a vanilla implementation, which could be the least risky implementation approach (Staehr, Shanks, & Seddon, 2012). A vanilla implementation usually keeps the degree of BPR to a minimum; it follows core ERP functionalities and process models instead of customizing the ERP to accommodate and fit the unique processes of the enterprise (Al-Mashari et al., 2003). The fit typically needs a two-way approach to be taken by combining BPR with system customization in order to accommodate business needs and core unique competencies in some corners, and following standard ERP best practises in others.

Whether they involve a vanilla or a complex implementation, a small or a large organization, ERP implementations require careful project management and a committed team. Moreover, organizations usually pass through a "shakedown" phase, during which they face challenges at the same time as they have to adapt to the newly re-engineered processes (Markus et al., 2000). This might result in business disruptions or reduced productivity for a certain period of time.

Organization-specific characteristics and contexts have been important research aspects throughout, prompting researchers to investigate their implications on the ERP implementation process. One study presented a conceptual model that could help implementers, vendors, and consultants to implement SAP R/3 ERP in order to better understand SME's expectations of the system in certain contexts or regions (e.g., Australia) (Gable & Stewart, 1999). In (Liang & Xue, 2004), an organizational learning dialectic approach was taken, which led the authors to recommend that ERP systems need to be localized according to local management features. Moreover, they advocated systems flexibility, incremental business process re-engineering, and system customization in order to increase the fit between the systems and each organization's specific characteristics. SMEs' characteristics and culture played an important role in the success or failure of ERP implementations in Belgium (Doom, Milis, Poelmans, & Bloemen, 2009), whilst cultural issues did not play a major role in ERP implementations within Chinese SMEs (Xia, Lok, & Yang, 2009). Project activities, coordination, and project sponsors (Muscatello, Small, & Chen, 2003), employee behaviour, individual characteristics of the ERP project management's team, and organizational culture have a great effect on the success of ERP implementations in

SMEs (Chien, Hu, Reimers, & Lin, 2007). Chan (1999) emphasized the importance of knowledge capturing and management during implementations in SMEs. The author's study identified the essential knowledge required for ERP implementations, and proposed a framework to manage it by matching the required knowledge with ERP capabilities and features. Moreover, Zain (2008) proposed the application of the FAST (Framework for Application of Systems Thinking) system development methodology while implementing ERP systems in cigarette-manufacturing SMEs. Here, the author concluded that using such an agile method could assist in reducing and filtering common problems that occur during the implementation of ERP.

Newman et al. (2008) conducted a study on two Chinese SMEs. Through business process modelling, the study compares and analyses the process of ERP implementation in these two companies, and discusses their decisions with regard to business process re-engineering. Likewise, (Quiescenti, Bruccoleri, La Commare, La Diega, & Perrone, 2006) emphasized the importance of business process modelling, management and re-engineering ex-ante implementations. Their study was a simulation based on niche Italian SMEs. They concluded that, in some cases, ERP systems should be customized to fit with niche SMEs and not vice versa, as they might lose their competitive advantage by complying with standard ERP processes.

Moreover, ERP implementation methodologies differ because of variations in organizational size and business complexity; thus, LEs are more reluctant to adopt a big-bang approach than SMEs (Mabert, Soni, & Venkataramanan, 2003). Further, a comparative analysis of ERP implementation rates and success rate between organization of different sizes and in industrial sectors in Taiwan has shown that ERP implementations in SMEs within the electronics and science industry are usually more successful than those in traditional industries (Wu & Wang, 2003). According to Franz and Robey (1986), smaller organizations with small IT departments are more likely to deliver satisfactory system implementations, because they are more closely involved with the target end-users.

Several free and open source (FOS) ERP systems exist and are available for download on the Internet. With their increasing number and availability, free and open source ERP systems could appear as a lucrative option for SMEs (Johansson, 2012). Adopting FOS ERP systems is believed to reduce adoption costs, ease the adoption process, and increase the future potentials of system evolution in SMEs (Olson & Staley, 2011). Nevertheless, FOS ERP adoptions in SMEs are still limited (Ven & Van Nuffel, 2013). The limited adoptions by some SMEs could be explained through the immaturity, lack of functionality and support of several FOS ERP packages (Ven &

Van Nuffel, 2013). In addition, specialized consultants on FOS ERP systems are scarce and expensive. As proprietary and closed source ERP, FOS ERP systems adoptions are complex, they require a qualified and highly communicative implementation team, a thorough requirements analysis, and a high degree of fit between these systems and the organizations (Cereola, Wier, & Norman, 2011). Thus, regardless of their high scalability and openness, Johansson (2012) concludes that there are no evident differences between the adoption process of proprietary and FOS ERP in SMEs. That could explain why adoption failures of FOS ERP in SMEs still occur (Olson & Staley, 2011). Finally, FOS ERP adoptions reduce several costs including license and customization fees, however, their total cost of ownership requires a careful analysis and management.

2.3.1 Critical Success Factors

What's the best measurement for success? Happiness! (Sir Richard Branson)

One of the mainstream definitions of successful ERP implementation is when it is finished on time and within budget (Equey, Kusters, Varone, & Montandon, 2008). However, this definition might be too strict when applied to actual ERP implementations. Many organizations have struggled with their ERP implementation budgets and schedules. As presented later in this thesis, however, some of these organizations still consider their implementations to have been successful. The view, degree, and perception of a successful implementation may even vary from one stakeholder to another within the same organization.

Research and practice have identified several critical success factors (CSF) that could dramatically affect the implementation process. In the following section, I will briefly shed light on some of these CSFs. I will also briefly discuss the factors that might result in potential ERP implementation failure.

Success factors

A large number of studies have explored CSFs for ERP implementations. Most of these studies have compiled a similar list of factors, but with different CSF rankings. Usually, these rankings vary according to the cases being studied, as well as the context, culture and other variables. Several studies have found that top management support and commitment to ERP implementation feature at the top of the list of CSFs,; indeed, it is believed that they directly contribute to the implementation success or failure (Beheshti, 2006).

It is not surprising to find that change management has been also identified as one of the top CSF (Somers & Nelson, 2001), because ERP systems introduce many changes into adopting organizations. The degree of fit between the organization and the ERP systems is highly critical. Thus, BPR, software customization and configuration have been found to be CSFs (Al-Mashari et al., 2003; Aslam et al., 2012). On the other hand, other studies have found that a minimal ERP customization effort through a vanilla implementation could also be considered to be a CSF (Mabert et al., 2003).

Table 2-2 provides a more comprehensive list of CSFs, ranked according to their positions in the literature. The list was developed using a literature review by Finney and Corbett (2007). This review covered all ERP CSF-related papers in major IS journals, up until the date of this thesis. Although very few journal papers have found that ERP selection, and project cost planning and budgeting are CSFs, some studies stated that user involvement in the ERP selection process is highly critical, and that ERP implementations could fail because of faulty or optimistic cost estimations (Jones, 2007). In addition, according to a survey conducted and published by SAP, 30% of implementations fail because of a lack of proper project planning, while only 10% fail because of technology-driven causes. Moreover, organization size, industry, complexity, and structure have all been argued to be influential in ERP implementation success (Mabert et al., 2003).

Table 2–2. Frequency analysis of CSF in literature. Adapted from (Finney & Corbett, 2007)

CSF Category	Number of instances in literature
Top management commitment	25
Change management	25
Training and job redesign	23
Project team	21
Implementation strategy	17
Communication plan	10
IT infrastructure	8
Managing cultural change	7
ERP selection	6
Vanilla ERP	6
Project management	6

2.3.2 Risk management and mitigation

As any sizeable project, there are several risks associated with ERP adoptions in enterprises. These risks are usually present within the entire ERP adoptions lifecycle

phases (Al-Mashari et al., 2003; Aloini, Dulmin, & Mininno, 2012a). The high rate of project failures shows that risk management of ERP projects is a complex and critical endeavour. The poor risk management and mitigation approaches could lead to project cancellations or unplanned cost and time escalations. In addition, risks could impede the organizations from realizing the expected benefits from their ERP adoptions (Aloini et al., 2012a). Formal and structured risk assessment methods exist in literature but are rarely applied to risk management in large IT projects (Aloini et al., 2012b) and ERP adoptions (Dey, Clegg, & Cheffi, 2013). Also, there are few risk management approaches and techniques in literature that are specifically accommodating ERP contexts (Aloini et al., 2012b), which may explain why managers scarcely adopt them in practice (Dey et al., 2013). As illustrated in the previous section, several studies have identified CSFs that are usually considerable factors for ERP adoption success. Also, they are aspects that the management and implementation team should carefully manage and target. Likewise, project risks are the other side of the coin. If the critical success factors are not properly managed, then they could impose risks of failure on ERP adoption projects. Several ERP studies have identified risk factors that enterprises should be able to expect and control during the project lifecycle. For example, a recent survey by Ojiako et al. (2012) has identified several factors that could impose risks on ERP adoptions in Thai enterprises. The study surveyed 267 ERP consultants in twelve SMEs and seventeen large enterprises. The study classified the factors into 13 internal and 5 external factors, as presented in table 2-3. In addition, the findings illustrate the degree of importance and impact on project success for each factor. In risk management terminology, risk factors and risk effects are related but more of a cause and effect relationship. Risk effects are considered the outcomes of poor critical risk factors management. According to Aloini et al., (2012a), risk effects could be classified to ten different outcomes. 1) Budget overruns, 2) time overruns, 3) project stop, 4) poor business performance, 5) inadequate systems reliability and stability, 6) low organization process fit, 7) low user friendliness, 8) low degree of integration and flexibility, 9) low strategic goals fit, and finally, 10) low financial and economic performance. Thus, the poor risk management and mitigation could consequently lead to risk effects that could have a substantial negative impact on the overall organization performance and financial position. This also is considered of paramount importance to SMEs with strict resources (Safavi et al., 2013).

Table 2–3. Critical risk factors. Adopted from (Ojiako et al., 2012).

Factors	Mean	Degree of importance
External factors		
ERP vendor	2.93	High
Vendor teamwork and composition	3.45	High
National culture	2.44	Moderate
Country-related functional requirements	2.71	High
Overall mean value of external factors	2.88	High
Internal factors		
Organisational characteristics and culture	2.87	High
Appropriate business and IT legacy systems	2.80	High
Top management support	3.52	Critical
Project champion	3.11	High
Business plan, strategy and vision	3.32	High
Project management	3.49	High
Knowledge management	2.91	High
Business process re-engineering	3.01	High
Change management programme	2.92	High
Communication	3.46	High
User teamwork and composition	3.28	High
Software development and testing	3.06	High
Overall mean value of internal factors	3.5	High

Several researchers worked on tailoring current or developing new risk assessment and management approaches and techniques that would better suit ERP adoptions in organizations. In their paper, Aloini et al., (2012a) have emphasized the gap of considering the interdependence among risk factors in current literature of risk management in ERP implementations. Thus, they have developed a quantative coloured Petri Nets (CPNs) technique to simulate and model potential project risks and measure the project's vulnerability for each risk factor with the consideration of their inter-relationships. The findings suggest that risk factor inter-dependence appears to be significant and should gain more focus in future research in order to understand the link between risk factors and their effects. Another study focused more on risk management communication and coordination of activities among the project's stakeholders (de Bakker, Boonstra, & Wortmann, 2012). The study suggests that risk factors identification, reporting, and communication among the stakeholders have a direct impact on project success. Through conducting a case study in a British enterprise, a research has introduced a new ERP risk assessment framework (Dey et al., 2013). This framework is believed to help organizations to identify, assess, and mitigate risks during their ERP implementations. However, the authors stress the need for future research focus on post-implementation risks.

Risk management and mitigation activities could also escalate project costs through the allocation of human resources, business engagements, and overheads. However,

risk management practices and proactive failure prevention approaches are believed to surpass benefits in comparison to costs (Dey et al., 2013). Hence, in order to avoid unanticipated cost escalations, the costs related to project management including risk mitigation and control activities should be foreseen by adopting organizations while estimating their project budgets. In this thesis, risk management costs are included within project management costs, however, the notion of risk management activities is not an explicit focus within this research boundaries.

2.4 Cost estimation research

In general, the cost estimation process is perceived by organizations to be an important phase. However, the accuracy of these estimations is challenging (Lederer & Prasad, 1995b, Aslam et al., 2012). The problem with ERP adoption cost estimation is the fact that it is a complex task (Aloini et al., 2012b); it requires attentive analysis in terms of direct and indirect costs. Both underestimates and overestimates can have dramatic consequences on IS projects (Lederer & Prasad, 1995a). According to Scheer & Habermann (2000), Baan, Peoplesoft and SAP have all stated that the purchase of the software license is not the biggest part of the budget. In fact, ERP customers could spend around three to seven times more money on the implementation and complementary services than on buying the initial software license. This substantial escalation of costs often occurs because of unanticipated hidden costs. For example, many organizations overlook an expected rise in human resources costs both during and after ERP implementation. Although ERP systems adoptions are increasing in the market, however, professional reports show that budget and time schedule overruns frequently happen. In their 2013 ERP report (P.C.G, 2013), Panorama Consulting Group has stated that from 172 companies surveyed in 2012, 59% of the projects have already crossed their estimated budgets (See table 2-4). Some of those companies were not yet finished with their ERP implementations. In addition, the report shows that 53%, of projects have exceeded their planned durations, which could have a significant impact on total costs. It is worth noting that these ERP adoptions included on-premise and cloud-based implementations.

Unplanned system customizations and requirements can also significantly increase total implementation costs. Several vendors claim that organizations tend to ask for several changes and “nice to have” features during the implementation. These were not previously agreed upon in the signed contract and were not financially estimated beforehand. Extra customization costs could also occur because of changes in business requirements. Furthermore, poor system requirements analysis and system design

processes could also increase the implementation costs dramatically. This mainly occurs when key employees were not fully engaged during these two phases. Hence, close attention should be paid to ERP cost estimation effort by the beneficiaries (clients), vendors, and third party consultants if any. Indeed, the vendor's cost estimates alone could omit some customer-specific costs, such as search and vendor selection, human resources, business engagement, and other managerial costs. Moreover, in some reported cases, vendors and implementation partners may give excessively low cost estimations in order to win deals (Ghoneim, 2008).

Table 2–4. 2013 ERP report. Adopted from Panorama Consulting Group (P.C.G, 2013)

YEAR	COST	% OF COST OVERRUNS	DURATION	% OF DURATION OVERRUNS
2012	$7.1MM	53%	17.8 months	61%
2011	$10.5MM	56%	16 months	54%
2010	$5.5MM	74%	14.3 months	61%
2009	$6.2MM	51%	18.4 months	36%

In contrast with LEs, SMEs suffer from scarcity of financial resources; however, only a few papers have discussed ERP adoption costs within an SME context. Through a survey analysis, Equey et al. (2008) investigated and evaluated the costs that occurred during ERP implementations in several Swiss SMEs. They concluded that size, consultants' experience, and peoples' characteristics have a great influence on ERP projects costs. While implementations in larger companies generally cost much more than in smaller companies, a survey by Mabert et al. (2003) showed that the cost of ERP software for SMEs is higher as a percentage of overall costs than for large enterprises.

A number of studies have stated that failures occur because of unrealistic project deadlines and budget estimations (Jones, 2007). In addition, Klastorin (2004) argued that unrealistic deliverables could lead to project failure.

Based on the literature review, there is a considerable gap in the area of ERP adoption cost estimation, because the established and widely used software cost estimation models, such as COCOMO II (Boehm, 2000), are not appropriate within an ERP setting (Al-Mashari, 2002; Jorgensen & Shepperd, 2007; Stensrud, 2001).

Several attempts have been made to investigate ERP cost estimations, but these were: (a) driven by IS or generic software development cost estimation (pricing), (e.g., Boehm, 1981, 2000; Boehm & Sullivan, 2000; Jones, 2007; Lederer et al., 1990; Lederer & Prasad, 1995b), or (b) were closely focused on ERP in a specific milieu,

such as ERP cost estimation from a portfolio management perspective (Daneva, 2007), or (c) focused on cross-organizational ERP projects cost estimations (Daneva & Wieringa, 2008), or (d) adopted a Transaction Costs theory perspective to govern ERP costs in a service-oriented architecture (SOA) implementation setting (Brocke, Thomas, & Sonnenberg, 2008).

In the following section, I present two examples of cost estimation methods/models that are mainly used in software cost estimations. In addition, the adequacy of those methods for an ERP setting is briefly discussed.

Horngren et al. (2002) presented four cost estimation approaches:

Industrial engineering (sometimes referred to as the work-measurement method). This method estimates cost functions by analysing the relationship between inputs and outputs in physical terms. For example, to produce 10 square meters of carpet we need 5 kilograms of cotton and 2 litres of dye. Standards are then used to transform those inputs and outputs into costs, resulting in a cost function. The industrial engineering approach was found to be very time-consuming and inefficient in dealing with indirect of overhead costs;

Conference method. This method estimates the cost functions through analysis and opinion about cost and the drivers collected from various departments. A cost driver (referred to as a generator or determinant) is any factor that affects total costs. The conference method allows cost functions and estimates to be developed quickly, but at a low level of accuracy.

Account analysis method. This method estimates cost functions by classifying cost accounts as variable, fixed, or mixed with respect to the identified cost driver. This approach is widely used; however, it is not appropriate in environments with overlooked indirect and hidden costs.

Quantitative analysis of current or past cost relationships. This approach depends on matching linear cost functions with past data observations. Six steps are normally involved in estimating a cost function:

Choose the dependent variable;

Identify the cost driver(s) i.e. independent;

Collect data about both the dependent and independents;

Plot the data;

Estimate the cost function;

Evaluate the estimated cost function, e.g., regression analysis could be used in this step.

This method could suit ERP cost estimations settings. However, a large pool of ERP cost data is required, and it is usually a challenge to attain this kind of data for several

reasons: a) a compiled list of potential cost factors is needed, b) several companies prefer not to share their financial expenditure and IT investment information, c) some firms have no exact holistic view of their total costs or investments, because the financial data and cost factors might be scattered between several departments and teams, and d) according to my informants, it is difficult to identify the total costs of ERP implementations, as some costs are very challenging to trace, evaluate, and quantify in monetary terms.

Perhaps one of the most established cost estimation models is the COCOMO (COnstructive COst MOdel) model. Boehm (1981) introduced the COCOMO model for software estimation. COCOMO is a software cost estimation method that is based on a set of empirically derived equations. This method predicts the effort and schedule required for software product development based on inputs relating to the size of the software and a number of cost drivers that affect productivity. COCOMO is based on a study of about 60 projects at TRW, which is a company that works on many large software projects. Programs used for the study ranged in size from 2,000 to 100,000 lines of code, and programming languages used ranged from assembly to PL/I.

Different phases of COCOMO are based on the classic waterfall model of the software lifecycle (Boehm, 1981):

- Feasibility
- Requirements
- Software Design
- Programming
- Integration and test
- Implementation
- Maintenance

COCOMO calculates Effort (E) and Development time (D) using kilo lines of code (KLOC).

The basic COCOMO equations take the form:

E =ab (KLOC)bb

D=cb db

Where E is the effort applied in person-months, D is the development time in chronological months, KLOC is the estimated number of delivered lines of code for the project expressed in thousands.

Although COCOMO 81 is the model presented here, the main difference between COCOMO 81 and COCOMO II is the addition of other “modern” cost factors to the

latter; nevertheless, both still lie within a software development setting. The main problem with the COCOMO family of models is that they are more focused on software development cost estimation. Their cost factors are based on variables that are not adequate or applicable in an ERP setting, because lines of code and development time are not considered relevant drivers in an ERP adoption project (Abdel-Hamid, Sengupta, & Swett, 1999; Jorgensen & Shepperd, 2007). Thus, as previously mentioned, these factors could be relevant to ERP at a software development (production) stage.

A shortage of proper representation for cost factors and inadequate cost estimation methods, particularly for SMEs, mean that ERP systems adoption projects face challenges in identifying and estimating costs, size, time, effort, productivity and other cost factors (Daneva, 2004; Irani, Sharif, & Love, 2001; Stensrud, 2001). Furthermore, when ERP adopters exceed their estimated budgets, this could be critical if they are an SME with limited resources. Some studies have argued that the rise in costs is sometimes not as high in relative terms when measured against benefits. Although this might be true, the main argument here is not the cost/benefit analysis, it is the projected budget versus the actual money spent on the adoption project. Even if the expected benefits are high (usually in the long term), this would not protect a business from having to cancel a project, or go bankrupt because of unanticipated cost overruns that may exceed their allocated budgets and capacities. In addition, benefits and associated costs should be projected rigorously before the project is embarked upon, because several companies that implement ERP systems end up filing for bankruptcy (Al-Mashari, 2002; Moon, 2007). This situation is mainly the result of a flawed ERP budget and schedule estimations (Holland & Light, 1999; Jones, 2007). Thus, despite the potential benefits on offer, the costs perspective may be critical. It is the case that more benefits can be gained when more money is spent; however, budget constraints and availability of resources still need to be taken into consideration.

SMEs do not have access to similar amount of resources that large enterprises have at their disposal; thus, any cost rises or project delays could seriously affect an SME's survival in the market. Since ERP adoption within SMEs is still immature, researchers need to inspect and identify the basic drivers that influence ERP adoption decisions (Van Everdingen et al., 2000), especially ERP adoption costs (Safavi et al., 2013). In general, IS and ERP implementation costs can be divided into those that are direct and those that are indirect. Direct costs is expenditure that is directly associated with the implementation and acquisition of new technology or systems (Love, Irani, & Edwards, 2004). Clear examples of ERP direct costs include license and IT

infrastructure costs. On the other hand, indirect costs include human and organizational-related costs that usually occur during the implementation process (Irani & Love, 2002), such as business process re-engineering, HR costs, and project schedule delays. Moreover, most of the informants interviewed in this research study viewed any unanticipated costs that lead to an overspend on the estimated plan and budget as an indirect or hidden cost, even if it was a marginal increase on a direct cost. Estimating the direct and indirect costs of ERP adoption is a problematic process. Thus, there is a considerable opening in IS research to focus on cost factor identification and classification (Irani, Ghoneim, & Love, 2006; Safavi et al., 2013).

2.5 Benefits realization

"I can make more generals, but horses cost money." Abraham Lincoln

In general, there is a considerable gap in the literature related to ERP benefits management and realization (Aslam et al., 2012; Schubert & William, 2009). More specifically, there is a lack of literature related to the SME context (Bernroider & Druckenthaner, 2007). Organizations spend a sizeable amount of money on ERP adoptions in an effort to seek future returns. In turn, ERP vendors vow to deliver benefits to these adopting organizations. These benefits are usually realized in the long run and vary from one enterprise to another. On the whole, organizations expect their BPR efforts to improve and enhance the business process, thus controlling and reducing costs (Ward & Daniel, 2006). In addition, through sizeable cutbacks to paperwork, labour costs and working hours (Beheshti, 2006), organizations would enjoy substantial cost savings. On the other hand, realizing total benefits from ERP investments is not necessarily an easy task. In IS literature, many papers have argued that accurate capital budgeting and cost estimation for IS and ERP implementations are difficult procedures, particularly when it comes to projecting indirect costs (Holland, Light, & Gibson, 1998; Irani & Love, 2000). Similarly, the estimation of potential benefits and realization of post implementation benefits are both highly complex tasks, which require organizations to follow formal benefits realization practices (Eckartz et al., 2012; Ward & Daniel, 2006), especially when it comes to non-monetary and strategic benefits (Irani et al., 2001).

Realizing benefits from ERP investments in organizations continues to be an issue (Aslam et al., 2012). The process of identifying the potential benefits from ERP systems is also under-researched and considered a challenging task (Eckartz et al., 2012). Through surveying 193 Greek companies, Kanellou and Spathis (2013)

attempted to identify ERP accounting benefits. The study identified several benefits (e.g. financial cycle time reductions, enhanced financial decision, etc…), however, monetizing most of the identified benefits could be a very complex task. In their research, Eckartz et al., (2012) have developed a framework that links the expected benefits from ERP systems with the business goals they serve, see figure 2-4. The goals could be classified into operational, managerial, and strategic goals (Eckartz et al., 2012). The framework is believed to aid organizations in identifying the potential tangible and intangible benefits from their ERP adoptions.

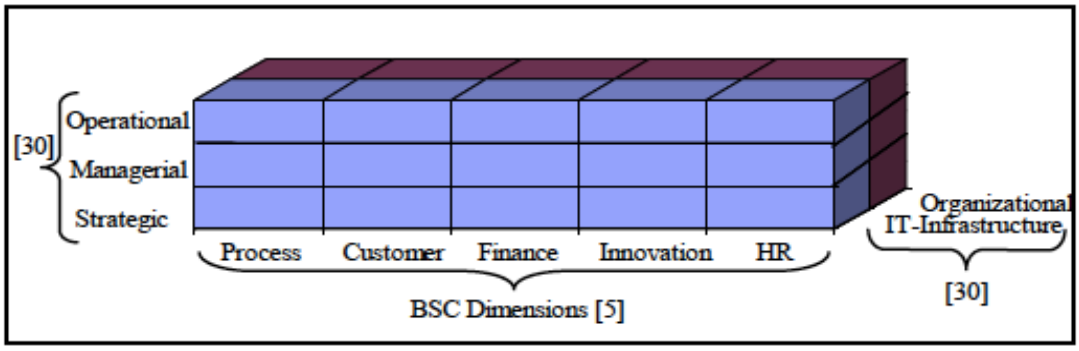

Figure 2-4. Multi-dimensional ERP benefit framework. Adopted from (Eckartz et al., 2012)

The literature on ERP benefits in SMEs has remained largely inconclusive. An early study of Finnish SMEs suggested that, although today's vendors mainly focus on competitive advantage, SMEs actually want ERP as a tool to manage day-to-day operations. SMEs also recognize the importance of local and continuing support for the tools used (Hallikainen, Kivijaervi, Rossi, Sarpola, & Talvinen, 2002). In Austria, SMEs often perceive their ERP projects to be more successful than those implemented in large companies. Indeed, these SMEs report greater benefits (Bernroider & Druckenthaner, 2007). Perceived benefits of ERP systems in Taiwanese SMEs have a significant impact on their adoption decisions (2009). On the other hand, such issues as CEOs' ERP knowledge, cost of ERP implementation, or sophistication of the software do not have significant impacts on the adoption decisions (Esteves, 2009). However, among U.S. construction SMEs, approximately 50% of companies have difficulties implementing ERP systems or refuse to do so in the first place (Negahban, 2008).

In parallel with the development of the ERP field, an increasing number of IS academics have argued for better management processes to govern, evaluate performance (Van Grembergen, 2000), and realize benefits from IT investments in general (Ashurst, Doherty, & Peppard, 2008; Peppard & Daniel, 2007; Remenyi, Sherwood-Smith, & White, 1997; Ward & Bond, 1996; Ward & Daniel, 2006), including ERP. Benefits realization (BR) is seen to go beyond traditional ex-ante

justification and ex-post evaluation of IT investments by denoting the need for management also during the project from the viewpoint of the expected and emergently recognized benefits (Ward & Daniel, 2006). Benefits realization focuses on strategic and managerial IT investments; in addition, it has been suggested that it is a relevant approach with regard to many types of applications and infrastructural IT investments (Ward & Daniel, 2006).

In other application areas, the proponents of the benefits realization approach have highlighted that many SMEs that focus on electronic commerce have started to use formal benefits realization practices (e.g., more than 50% of Taiwanese SMEs) (Lin, Lin, & Tsao, 2005). Cases published in practitioner journals also illustrate success stories; for example, how a customer relationship management system in a medium-sized financial service retailer required the company to move from the problem-based IT investment mind-set towards innovation-based benefits realization (Peppard & Ward, 2005).

The fundamental principles of benefits realization postulate that (Peppard et al., 2007):

- IT has no inherent value in itself;
- the value from IT is realized through the way in which people do their work differently;
- benefits arise through business managers and users, and through the ways (expected and emerging) they benefit from new technology;
- potential negative outcomes from IT need to be recognized and mitigated by management (Peppard et al., 2007);
- thus, benefits realization needs a set of dedicated management practices if the potential benefits are to be optimized (Peppard et al., 2007).

Whereas the evaluation of expected and realized benefits is important, the benefits realization approach also denotes the need for management actions during and outside of the IT project. Such actions lead to the capture of emerging benefits and the mitigation of unwanted emergent impacts (Ward & Daniel, 2006). On the other hand, a few paradoxes and shortcomings in the current literature on IT investment evaluation and benefits realization have been recognized (Thomas et al., 2007):

- Contemporary formal IT investment evaluation and benefits realization practices are inadequate and better methods are needed (Eckartz et al., 2012; Irani & Love, 2002);
- However, a large number of suggested methods and practices already exist, few of which have actually been utilized in practice (Aslam et al., 2012; Thomas et

al., 2007).

- Ashurst et al. (2008) have argued that benefits realization should become an organization-wide capability. They also address a lack of empirical studies on actual benefits realization practices.
- This study reviewed the benefits realization literature that identifies the given reasons both for and against adopting benefits realization and evaluation practices in organizations. The study also included general-level literature on benefits realization and the dearth of literature related to benefits realization from ERP investment. In the following discussion of the literature, the reasons given are divided into four broad categories, which relate to such issues as: maturity, nature of IT benefits, perceived value versus cost from benefits realization, and organization culture and structure.
- Maturity of management (Lin, Pervan, & McDermit, 2005) and IT functions (Lin, Huang, & Cheng, 2007) are thought to have an impact on the adoption of benefits realization practice in two ways. First, it is stated that management may lack an understanding of and competence in IT investment (Thomas et al., 2007) and change management (Truax, 1997) processes in general. Consequently, benefits realization or investment evaluation techniques are not supported by management (Thomas et al., 2007); nor are they adopted (Lin et al., 2005). Immature organizations are characterized by their informal implementation processes, low confidence in the actual outcomes of IT projects, low integration levels of systems, and problems encountered in IT projects (Lin et al., 2007). Based on these observations, Lin et al. (2007) recommended that hitherto immature organizations should pursue higher organizational and IT maturity by adopting more formal benefits realization and investment evaluation practices. The role of IT maturity in a company's business domain may also play an important role. Indeed, Lin et al. (2005) reported high usage rates of investment evaluation and benefits realization techniques among Taiwanese business-to-business electronic commerce companies.
- Several issues related to the nature of expected benefits have an impact on the perceived usefulness of implementing formal benefits realization and investment evaluation practices. If an IT project goes according to plan, it may be assumed that it also produces the desired benefits (Lin & Pervan, 2001). Moreover, organizations may focus on tangible benefits which are self-evident to observe, ignoring deeper analyses of any potential intangible issues (Lin &

Pervan, 2001). A few organizations, such as SMEs that implement ERP for their mundane everyday operations, may focus on short-term tactical and operational benefits, which do not require deeper analysis (Hallikainen et al., 2002; Love, Irani, Standing, Lin, & Burn, 2005). In addition, if the main benefit of IS implementation is perceived to be the technological function of the system itself, there may be less interest in the adoption of benefits realization processes from the viewpoint of the organization (Ward & Murray, 1997). However, the benefits realization literature has highlighted that benefits realization is also needed for infrastructural technology investments (Ward & Bond, 1996). One of the fundamental assumptions made by the proponents of benefits realization is that IT has no value in itself; rather, it requires people to work differently, which would indicate that there is a motor for adopting explicit benefits realization management (Peppard et al., 2007). In fact, the idea that functionality from IS/IT in itself could be a benefit is regarded as a "mindset" which might impede benefits realization (Lin & Pervan, 2001; Ward & Murray, 1997).

- In the benefits realization literature, it was suggested that value gained from benefits realization activities is greater than the costs of carrying out these tasks (Ward & Daniel, 2006, Aslam et al., 2012). Ward and Daniel (2006) suggested that the "benefits of benefits management" include clearer investment planning, improved relationships between IT and business staff, wiser investments and an increase in the realized benefits. However, not all organizations recognize the value of spending time on evaluation or increasing management efforts in order to realize benefits. For example, IT investment evaluation and benefits realization may be seen as a complex and difficult undertaking (Eckartz et al., 2012), which does not warrant the effort (Lin & Pervan, 2001; Thomas et al., 2007; Truax, 1997). Evaluation may also be seen as being too costly (Lin & Pervan, 2001; Thomas et al., 2007), the stakeholders of the benefits may lack the time to carry out the tasks (Thomas et al., 2007), or the scope of an IT project may be too narrow to warrant the effort. However, few attempts have been made to report on studies of actual practices or benefits in practice (Ashurst et al., 2008) beyond single case studies of individual projects (e.g., Peppard & Ward, 2005).
- The fourth category relates to organizational structure and cultural issues, which are suggested to have an impact on the adoption of formal benefits realization practices. Organizational culture may not support the idea of

simultaneously acting as both the "watchdog" and implementer of benefits delivery (Lin & Pervan, 2001). On the other hand, organizational structures may not be optimal for practicing benefits realization as such (Thomas et al., 2007). Thomas et al. (2007) suggested that the adoption of formal practices may appear useful only after an effective decision-making culture has been introduced into an organization; such a culture may focus on accountability, leadership, relationships, strategy, measurement and action. Another culture-related issue is mistrust with regard to benefits realization and evaluation practices. This may arise from the tendency to use them with a bias towards promoting particular political agendas instead of pursuing rational decisions (Thomas et al., 2007).

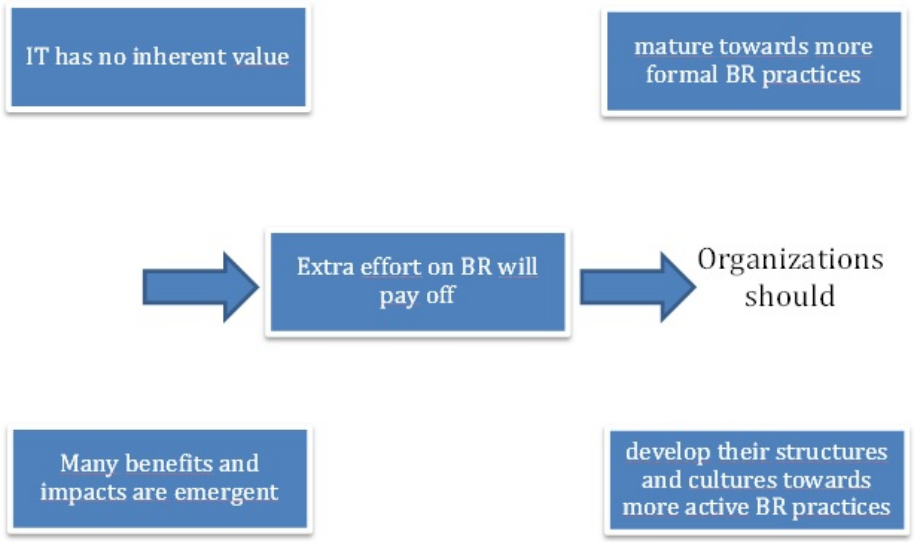

Figure 2-5. Reasoning for increased benefits management and realization practices in literature

To summarize, the benefits realization and IT investment evaluation literature identifies that organizational maturity, structure, and culture are key issues, which can enable or hinder organizations attempting to implement better benefits realization practices. According to the literature, a failure to recognize that IT investments also have no inherent value and that many benefits and impacts are emergent could also hinder an organization during implementing benefits realization. In addition, many organizations may not recognize that extra efforts made to realize benefits and evaluate IT investment will pay off. Recently, however, the literature has begun to argue that a failure to adopt benefits realization and investment evaluation practices is largely due to low maturity and issues of organizational culture and structure. This explains why organizations may not see the fundamental drivers for the

implementation of these practices (Figure 2-5). Finally, although benefits from ERP adoptions are hard to realize and measure (Aslam et al., 2012), some SMEs argue that they are self-evident in many corners of the business, resulting in reduced direct costs, improved interaction within an enterprise, enhanced reporting, and improved order management and cycles (Kanellou & Spathis, 2013, Mabert et al., 2003) .

3 Research approach

Faced with a lack of adequate empirical methods and models to explain why cost escalations occur in ERP settings (Jones, 2007; Zeng et al., 2012), it was decided to apply a qualitative exploratory research approach in this PhD research project. In general, exploratory research is a satisfactory method for investigating and explaining why certain phenomena occur (Yin, 2009). This research was carried out through a combination of a literature review, panel of experts, and case study research. The empirical part of this study comprises a multiple case study carried out in four SMEs, an experts' panel, and an in-depth case study in one SME. The unit of analysis used in the case studies is a completed on-premise ERP adoption project in an SME. According to Yin (2009), a case study research method is recommended when "how" and "why" questions are postured, when the researcher has little control on the events, and when the focus of the investigator is on a current phenomenon that occurs in a real-life context. According to Thomas (2011), case studies can include the analyses of persons, events, decisions, periods, projects, institutions, or any other systems that are investigated and studied holistically through one or more research methods. Although, the five case studies were conducted in four organizations, the fifth study is considered a separate case, because it investigates a separate project that took place during a different time period, and employs comprehensive data collection efforts. In addition, single in-depth case studies are a useful way of representing unique cases when exploring a new phenomenon and when there is a lack of theory (Eisenhardt, 1989). Single case studies' generalizability is limited; however, they can provide an important insight into the direction for any future research.

Case study research is recommended in particular when the borders between the phenomenon and context are not clearly defined (Yin, 2009). The purpose of this research is to identify new insights within the context of ERP system adoptions in SMEs; thus, the use of a panel of experts and case study methods served constitutes a suitable research approach. This study adopted a multiple case study design (Yin, 2009), together with an in-depth single case study (Walsham, 1995). A multiple case design is favoured over a single case study design, because analytic results that arise independently from two (or more) cases might prevail over those that arise from a single case (Yin, 2009). During the course of my research, however, I came across a unique case that needed a more in-depth investigation in order to analyse and document the phenomenon. A multiple case design offers a flexible approach for information systems research (Cavaye, 1996; Eisenhardt, 1989; Yin, 2009), and strengthens the precision and validity of the findings (Miles & Huberman, 1994).

Moreover, several recent ERP publications have adopted the multiple case study approach (e.g., Gallagher, James, & Mason, 2012; Sanchez-Rodriguez & Spraakman, 2012; Sharma, Daniel, & Gray, 2012). The selected research approach moulded the foundation for the research design, case selection, data collection and data analysis. These aspects are further illustrated in the following sections.

3.1 Research design

Research design is a roadmap with a logical sequence that relates the empirical data to the initial questions under investigation, and eventually connects it to the study's conclusions (Yin, 2009). A clear research design minimizes the risk of collecting and analysing irrelevant data that does not satisfy the research questions (Yin, 2009). The research design in this study comprised several activities. An overview of the research activities is depicted in figure 3-1. The letters EP indicate the experts' panel, whilst A,B,C,D and E indicate the data collected in each of the four case organizations. The numbers in the figure represent the research papers, and the estimated timeframe required for the development of each paper. First, a review of literature was carried out using a systematic methodology and following clear procedures for paper searches (for more details refer to publication 1). In total, 77 articles were reviewed. The articles were categorized and classified according to the phase(s) they covered in the ERP life-cycle framework put forward by Esteves and Pastor (1999). In addition, other dimensions were considered in the literature review analysis, such as research methods, topics, and theories adopted in the reviewed papers. The literature review shed light on the current research gaps within the domain of ERP Systems in SMEs, which had implications on all the subsequent publications. Moreover, the literature review offered guidance on future research avenues. In summary, the review effort contributed towards refining the problem definition used in this study.

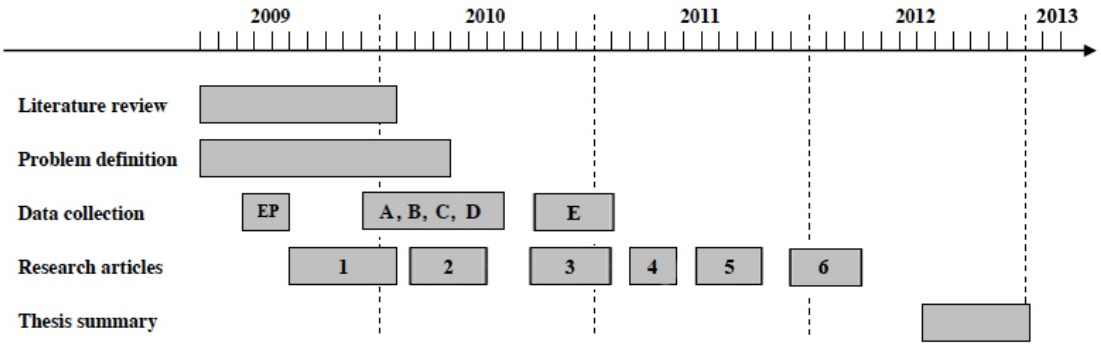

Figure 3-1. Overview of research activities

As previously mentioned, the empirical part of the research encompassed a multiple case study, an experts' panel, and an in-depth case study. First, an exploratory study

was carried out, which used a combination of focus group, nominal group, and Delphi methods and techniques to elicit experts' knowledge in Egypt's ERP industry. This experts' panel served as a starting point for this study. In particular, it gave me insights into the panel's participants, who included various key stakeholders and representatives from client SMEs, implementation partners, independent consultants, and participating vendors in ERP adoption projects. The outcomes of the experts' panel helped me to pinpoint cost-related issues in ERP adoptions, and helped in the visualization of the cost factors that may occur during on-premise ERP adoptions. This research process resulted in paper 2, which documented the relevance of the research focus for practice and research. The study's outcomes also designated a potential spectrum of issues for further investigation. Future research steps could include the collection of additional data within the four organizations, and a focus on the importance of context within the cases. Following this study, a multiple case study was conducted in four SMEs. In this study, the TOEES framework was adopted in order to identify the potential stakeholders involved within ERP adoptions in the target organizations and their external environment. In addition, TOEES suggested that the SME's contextual characteristics could affect their decision-making processes with regard to technology adoptions. Hence, the study considered investigating the motivations for ERP adoptions in the target cases, and the influence of context on their ERP adoption decisions. The internal and external contexts were primarily investigated through TOEES in order to: a) identify whether the ERP adoption decision is due to internal operational, technical, or strategic motivations, or external pressures from partners, competitors, and government regulations; b) investigate whether the Egyptian government's funding for SMEs has influenced the target organizations' decisions to adopt their ERP systems; c) identify the stakeholders and understand why costs escalated and budgets were exceeded in the target cases; and d) identify the size of each enterprise within its respective industry. This multiple case study also assisted in a cross-case analysis aimed at investigating similarities and differences between the four target companies. This multiple case study resulted in the publication of papers 3 and 4. An overview of the research design is illustrated in figure 3-2.

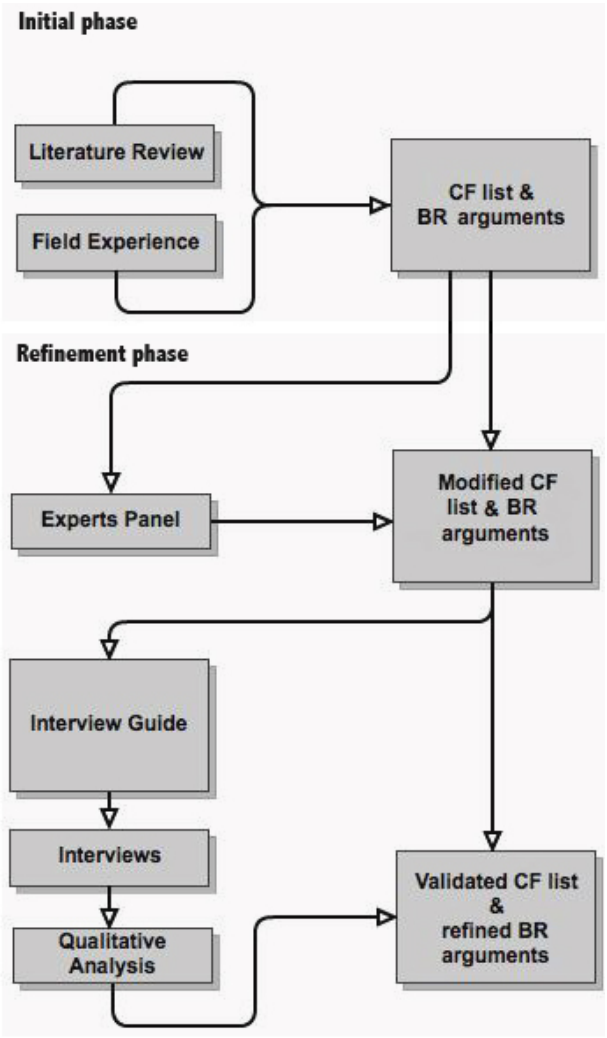

Figure 3-2. Research design overview

One of the main reasons for employing a multiple case study design in this study was to enable cross-case comparisons to be made. Each of the cases was different in industry sector, size, maturity, had adopted different ERP systems, and had received varying levels of government support, if any. Thus, the findings of the cross-case analysis would aid in pinpointing similarities and contrasts for all cases, within their contexts.

3.1.1 Case selection

With regard to the focus of this research, the primary criterion for case selection was that the organization needed to be an SME that has adopted an on-premise ERP system. In particular, I wished to include SMEs that operate in different industry sectors and of different sizes (small and medium), as well as those that had adopted different ERP systems, and had different levels of IT expertise. Such variations could help me to identify their effect on cost estimation, cost management, and benefit

practices in the organizations under study. In addition, the variety of organizations' industries, sizes, and ERP systems used, could give granular and various insights about the cost factors they encounter, and the benefits realization practices they adopt, if any. It was decided to collect data from Egyptian organizations. The selection of Egypt over Norway, the country in which I am currently enrolled on a PhD programme, was made because Egypt is the country of my origin. I have many contacts within Egypt's ERP industry and this would facilitate my access to enterprises. In addition, there would be no language barriers. On the other hand, interviews in Norway would have had to be carried out in English, leading to the risk of failing to capture desired details and data richness from the interviewees. Also, due to my cooperation in the ERP field in Egypt, I know several ERP consultants, which aided me to gain access to the organizations of interest.

My target cases can be seen as typical SMEs; in other words, family-owned enterprises and a private stocks firm. Also taken into consideration was the fact that SMEs are usually private enterprises, whereas typical public sector enterprises are employee-intensive, and are in receipt of substantial governmental budgets. Thus, I gave more attention to privately owned organizations during the case selection phase. Furthermore, in order to fully capture the ERP context, I interviewed ERP implementation partners, vendors, and consultants in four companies in Egypt. The case selection process in this study employed a combination of strategies: selection criterion, opportunistic, critical, stratified purposeful, snowball, and extreme sampling (Patton, 1980).

The selection of all case SMEs took place following the opportunistic sampling strategy. The target organizations were not preselected at the beginning of the research project; nevertheless, they emerged progressively in response to various issues that emerged from the data collected through the experts' panel and literature. In addition, the individual cases were selected according to various strategies, as outlined below. Access to the organization was an important selection criterion (Yin, 2009). With regard to the first studied organization to be recruited, I had a personal contact in the company, which allowed me to gain access. This organization is a medium-sized dairy products manufacturing and importing company. The findings from the first case

suggested that size, industrial sector and IT department skills could be significant factors in ERP cost estimation and benefits management during the implementation process. To enable a comparison to be made between the target cases, the three subsequent cases were selected using a stratified purposeful sampling strategy (Miles & Huberman, 1994). The second case is also a manufacturing organization, although it can be classified as small in size. Its selection also involved the use of a snowball sampling strategy, as it was identified as a potential case based on the interviews carried out in the first company. Since the first two cases are manufacturing companies, the intention was to include a company that represents a different business type and level of IT maturity. Thus, an automotive parts distribution organization was selected as the third case. In contrast to the first two organizations, this third organization has a greater maturity of IT/IS experience, as evidenced by a large, dedicated and highly skilled IT department. This case was seen as an important milestone in the data collection process, as it would show whether maturity and IT experience have an effect or influence on the organization's behaviour towards cost estimation and benefits realization practices. This can be classified as a critical sampling strategy (Patton, 1980). The fourth organization to be selected was a medium- sized retailer. Whilst carrying out the study in one of the case organizations, it came to my attention that this organization also had a unique ERP retirement case. Thus, the fifth case used an extreme case strategy (Patton, 1980) and an in-depth case study approach (Yin, 2009) to understand and explain the unique phenomenon. The main purpose of the case investigation was to see whether or not early ERP retirement was related to budgeting practices or other factors.

According to the European Commission (1996), enterprises can be classified as SMEs class when they have more than 10 employees but less than 250 employees, together with an annual turnover of less than 50 million euro or 43 million euro on the balance sheet. While conducting this study, however, I had difficulty in classifying Egyptian enterprises according to these standard classifications and characteristics. For example, in Egypt, employees‘ salaries and wages are generally not high in typical SMEs. As a result, Egyptian SMEs might employ more employees in comparison with, for example, European companies. Even though some Egyptian organizations are labour

intensive, they are still recognized as small or medium in their markets and industrial sectors. According to Egyptian government reports (Economic-Research-Forum, 2004; Lerchs, 2001; Lerchs, 2002), the classification of SMEs in Egypt is still neither clear nor standardized, especially across industrial sectors (Lerchs, 2002). Thus, the current classification, which takes into account the number of employees and fixed assets, is not adequate (Lerchs, 2001). In this study, therefore, the interviewees were asked to classify their organizations' size according to their annual turnover, number of employees, number of ERP users, and their perceived position in their industry in comparison with their market competitors. As a result, three could be classified as medium-sized, and one as a small enterprise. It should be noted that the Egyptian Ministry of Industrial Modernization has also classified all my target cases as SMEs.

In general, the selection of the cases was also restricted by the time and resources available for my PhD project. The number of case studies was limited to five (in four organizations). According to Eisenhardt (1989), between four and ten case studies is thought to be an adequate number, allowing sufficient empirical grounding for theory generation. Further details about the case studied organizations are provided in the following section.

3.1.2 Cases overview

All four case studied organizations are privately owned Egyptian SMEs. In order to preserve confidentiality and ensure anonymity, the organizations are termed Org1, Org2, Org3 and Org4. Table 3-1 lists the key characteristics and ERP implementation projects for each of the four cases. The case organizations represent different usage time since the go-live date, different implementation methodologies, and different stages within the ERP lifecycle phases, according to Esteves and Pastor's model (1999) (figure 3-3). At the time of the interviews, two organizations (Org1 and Org3) were in the "use and maintenance" phase, while Org2 and Org4 were in the "evolution" phase, as they were extending their ERP systems to include a business intelligence module and separate payroll systems. In addition, the in-depth case study on Org1 was related to the "retirement" phase. Org1 adopted a phased rollout implementation strategy, while all other organizations adopted a big-bang strategy. Moreover, the Industrial Modernization Centre (IMC), which is a division of the Egyptian Ministry of Industrial Modernization, funded two of the case organizations (Org1 and Org2). IMC has directly financed ERP investments in Egyptian SMEs,

without requiring the benefits to be reported or the costs justified. However, their rules are now stricter. During the year 2008/2009 alone, the IMC funded 2,477 SMEs. This external financing was awarded regardless of the SME's attempts to optimize benefits and cost estimations; thus, it was thought to decrease motivation for further management efforts in that regard.

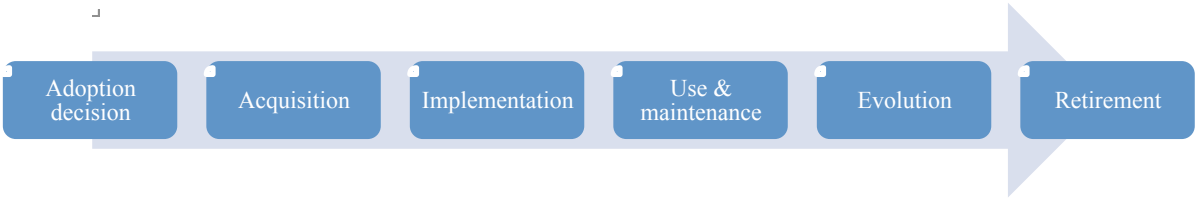

Figure 3-3. ERP Lifecycle framework. Adapted from (Esteves & Pastor, 1999)

The following section provides a brief presentation of the individual target organizations.

Org1, which was founded in 1998, is a manufacturing SME that specializes in the production of dairy products. The company operates in a single location, situated in Alexandria, Egypt. The company manufactures 14 different products, and imports frozen food items. Org1's name has become synonymous with a range of quality fresh and frozen products, both in the domestic and international markets. The organization is a family-owned and family-run business. The company is engaged in the production and marketing of a range of products, e.g., natural pure ghee, natural butter, processed cheese, Cheddar cheese, long-life juices, long-life milk and flavoured milk.

Table 3–1. Overview of target cases

	Org. 1	**Org. 2**	**Org. 3**	**Org. 4**
Industry	Manufacturing	Manufacturing	Retail & distribution	Retail
Type of business	Dairy products manufacturing	Printing and packaging	Automobile parts	Fast-moving and durable goods
Organization size	Small	Medium	Medium	Medium
Ownership type	Family owned	Family owned	Private stocks	Family owned
ERP system	SAP ECC	Oracle E-business Suite	SAP ECC	JD Edwards Enterprise One
Implementation partner	Local vendor (went bankrupt) and then Indian off-shore partner	Local Oracle partner	Internal implementation	Local Oracle partner
Implementation modules	All modules	All modules	All modules	All except manufacturing
Implementation strategy	Phased rollout out by branch	Phased rollout by module	Big-bang	Big-bang
Go-live date	Aug-2009	Sep-2009	Jan-2008	Aug-2007

Legacy systems	Scattered applications built on MS Access/ An early retired local ERP system	Silo systems based on MS Excel	In-house developed applications	Local ERP / POS solution
Project overruns	Time and budget	Time and budget	Time and budget	Time and budget
Use of ERP consultants	Yes	Yes	No	Yes
Upgrade plans (e.g., ERP II)	Yes	In progress	N/A	In progress
IMC funding	Yes	Yes	No	No

Org1 had already undertaken two ERP adoptions. Prior to the recent Oracle ERP system adoption, Org1 had implemented a local ERP system known as "Almotakamel ERP" by OFIS Soft. OFIS is a well-known ERP vendor in the Egyptian market. In 1986, OFIS began helping businesses to improve their IT operations and implement ERP systems. OFIS provides information technology services to the Middle East, and to Egypt's most important sectors, such as commercial, industrial, retail, and construction. Furthermore, OFIS provides large-scale WAN-based solutions, in addition to bespoke applications. Org 1's Almotakamel ERP adoption experience proved to be a failure. The system had to be retired and was replaced with another ERP within the implementation phase. According to our case analysis, the main reason for this case of early retirement case was faulty ERP selection process (see publication 5). The selection of ERP was undertaken solely by the IT manager (no longer employed in the company at the time of the study), and approved by the CEO. In addition, the ERP adoption process was carried out by the company's internal IT team, which again turned out to be an unfortunate decision. The IT team was comprised of two employees: the IT manager and the database manager. Prior to ERP implementations, Org1 had several scattered applications, which lacked integration and scalability. These applications were built on Access databases, which could no longer handle the company's increasing number of business transactions and invoices. In addition, the company suffered from database failures and loss of data. In, 2006 the company decided to invest in an ERP system (first ERP adoption). After early ERP retirement, the company decided to replace the system with a new SAP all-in-one ERP. The company hired an implementation partner to assist in the adoption process,

together with an independent ERP consultant to aid in the new Oracle SAP ERP implementation stage, and in later phases. The majority of the ERP adoption project costs were financed by the IMC. The new ERP implantation was carried out in a phased rollout strategy, which began in 2008. The rollout began with the following ERP modules: financial control, inventory, purchasing, fixed assets, and order management. Later, the company extended the system to include human resources and manufacturing modules. In Org1, the ERP adoption project exceeded its budget and overran its time schedule.

Org2 is a family-owned and family-run manufacturing SME. The company was established in 1921 and mainly specializes in producing paper and cartoon supplies for fast food restaurants in Egypt. The company produces several products, including hot and cold paper cups, ice-cream packages, sandwich wrappings, and boxes. The company is located in an industrial zone, which is around 25 kilometres from Alexandria city centre.

Until June 2006, the company did not have an IT department. Before acquiring an ERP system, it relied on several silo and scattered applications. Most of the processes were carried out manually because they were not integrated with the applications used. The applications were mainly built on Microsoft Excel. The company suffered many business and technical problems because of this lack of integration between the applications. In addition, the existing scattered applications did not meet the business's requirements; for example, they had problems processing orders, and sales planning was not integrated with production planning. The company also found that it was difficult to generate reports and control the business cycle. The main challenges faced by the company were reporting, loss of manual data, and control.

In July 2006, the CEO decided to hire an IT/ERP consultant who would be responsible for recruiting qualified IT staff and establishing a skilled IT department. The consultant was also responsible for carrying out change management plans, business process re-engineering, and integrating the IT department into the company's organizational chart. The company had to build and overhaul several infrastructural components, such as wired and wireless LAN, a RAID backup system, hardware and software firewalls, and security policies. Once the IT infrastructure had been successfully established, the various systems could then be implemented. The IMC partially funded the establishment of Org2's IT infrastructure establishment and its ERP adoption project.

The consultant recommended the company choose the Oracle E-Business Suite ERP, and the system went live in 2007. The implemented modules were financial control, order management, purchasing and warehousing. At the time of the interviews, the company was extending its ERP system by integrating an external customized payroll system. Despite the fact that the company engaged an ERP consultant during all of the ERP adoption phases, it nevertheless exceeded its estimated ERP adoption budget and ran over-schedule.

Org3 was founded in 1975. The company is engaged in distributing and selling automotive spare parts. Originally established as a family business, today it is a privately owned stock organization. The management board is comprised of members of the family, who are the major stockholders. The company's headquarters are based in Alexandria, and it has several distribution channels around Egypt.

The organization had an in-house developed system before moving to an international ERP system (SAP). The company mainly faced technical problems with the existing legacy system, which were affecting its operations. In addition, the system posed other challenges because of the employee turnover, absence of sufficient system documentation, and support. Thus, the company decided to migrate to a standard ERP package, which would be more stable and easier to handle. The company used no external ERP consultants, as they saw themselves as being competent and mature enough to identify the company's requirements, and select and manage the ERP system. According to the IT manager, the company was one of the first IS adopters in the industry; it had three in-house developed systems prior to the latest ERP system adoption.

The project team was composed of internal employees and the implementation partners. The system went live on the 1st of January, 2008. The implemented ERP modules were: finance and control, sales and distribution, material management, customer service, human resources management, and CRM. During the implementation, the project's estimated budget doubled, and it significantly over-ran its schedule.

Org3 did not apply for IMC funding, because they claimed that this would mean that IMC had some control over the project. Rather, the company wanted to be in full control of their own project.

Org4 is a retailer that deals with a diverse number of commodities, which are sold directly to customers through one outlet in Cairo. The commodities range from fresh food and fast-moving goods to non-food commodities, textiles and furniture.

Prior to the JD Edwards ERP acquisition, the company had installed another local Egyptian ERP system, which had come in the form of a complete retail bundle. This consisted of an ERP as a back office, and a point of sale (POS) application as a front office. The company used the system for some time; however, the system had many technical problems, including poor performance, slow transactions, and inexact report calculations. Although it was implemented as both a front-end and back-end solution, there were still many integration problems with the POS network, which dramatically affected day-to-day operations. The point-of-sale network used to go down for no obvious reason, something which is considered a nightmare for any retail business. Hence, Org4 decided to retire the system and adopt a new ERP package, which could be integrated with a POS solution and applications. In this case, it was clear that the adoption drivers were technical.

Although Org4 had a skilled and experienced IT department, they nonetheless decided to hire an ERP consultant, who was involved in all of the project phases. The estimated project budget was approximately 3 to 5% of the yearly sales revenues. Although a 'vanilla' implementation was carried out, the project still exceeded its budget and over-ran its time schedule. The implemented modules were: financial controlling, capital asset management, logistics, procurement, and sales and distribution. The system went live in August 2007. One interesting observation to note is that the consultant managed to reach a deal with the implementation partner to deduct the amount of money spent on the retired ERP from the new SAP ERP implementation and licence costs.

3.2 Data collection

Three qualitative data collection techniques were used in this research: experts' panel, interviews, and document analysis. Each of these techniques is presented in more detail below.

3.2.1 Experts' panel

In order to inductively elicit data from the most relevant context in practice, an experts' panel (EP) of practitioners was convened at an early stage in this PhD study. The EP was used as a mean of eliciting knowledge from ERP experts in Egypt. The EP served as an initial research catalyst and ensured the mapping and alignment of the research issues and problems in practice. The EP method was based on a combination of Delphi, nominal and focus group techniques. It incorporated face-to-face group discussions and interviews supervised by two moderators. In addition, the panel included anonymous electronic surveys and rankings. Mind-mapping tools and

techniques (Willis & Miertschin, 2006) were also used. Face-to-face group techniques could be fruitful when investigating a certain phenomenon in the early exploratory stages of research (Hines, 2000; Krueger & Casey, 2009). A number of researchers have also pointed out that group brainstorming and discussions can generate comments that are more consequential than is the case in one-to-one interviews (Hines, 2000). As recommended by Willis and Miertschin (2006), dynamic mind maps were used as a tool for representing the cost factors of ERP as a graphical list. This stimulated the participants to engage with the content and provide modifications and rankings for the initial mind map (costs list). In addition, mind maps were useful in cases that required problem solving, group understanding and brainstorming, information delivery, and the evaluation of participants' beliefs (Willis & Miertschin, 2006). The illustrative dynamic mind mapping technique is similar to cognitive mapping, which is used to present and record qualitative data in group discussions (Eden & Ackermann, 2004).

The main objective of the panel was to identify the direct and hidden cost factors that could occur in ERP adoption projects in SMEs, in order to be able to create a cost factors list. The list could consequently aid in creating a cost estimation model that predicts potential ERP costs, and can be used by both adopting companies and vendors. The EP's recommendations and insights were invaluable to this research in its early exploratory stage. Indeed, the experts provided rich inputs that helped me to better understand the phenomena and refine the problem under investigation.

The panel was composed of key persons involved in ERP implementations in Egypt. Ten potential participants were contacted by phone and via e-mail; eight experts responded and participated. The participants were ERP consultants, vendors, implementation partners' representatives and implementation project managers in SMEs. The participants' expertise represents a wide knowledge of a broad range of international companies and industrial sectors. The panel included vendor consultants from SAP, Oracle, JD Edwards, Focus ERP, independent ERP consultants, and project champions and managers from different industrial SME beneficiaries. A wide variety of experts were selected in order to ensure that the research captured different views and perspectives on ERP costs. In addition to the identification and ranking of cost factors, the experts identified the potential influence of contextual variables on several cost factors. After two rounds, the EP presented lists, rankings, discussions, and a visual costs list. The panel developed a cost list and a final round was held in order for all eight participants to validate the results. For more details concerning the research method and findings, please refer to publication 2.

3.2.2 Interviews

The interviewing process was split into two separate parts. First, interviews were held in relation to the multiple case study. These involved four SMEs, two ERP vendors, two implementation partners, and two consultants. Second, interviews were conducted with relation to the in-depth case study of one SME.

A. For the multiple case study, 28 qualitative face-to-face interviews were conducted in Egypt. Data collection was carried out during the period from December 2009 to July 2010. The interviews were conducted in eight Egyptian companies. During the interviews, the whole ERP lifecycle phases were discussed. The interview process followed the guidelines recommended by Myers and Newman (2007) for conducting qualitative interviews. The participants included a mixture of various stakeholders who have been involved in ERP system implementations, four SMEs (15 interviews) that have adopted an ERP, major ERP vendors (2 companies), major ERP implementation consultants and vendor partners (2 companies), and senior independent ERP and finance consultants in Egypt (2 interviews).

   In order to break the ice within the case organizations, I sent a signed "data confidentiality and use agreement" to the case organizations before conducting the interviews. In the main, the agreement listed the topics that will be covered during the interviews, and stated that I would preserve the anonymity of the informants, store the data in a secured environment, and would not publish any data analysis and publications without validation by the perspective informants. That was also an important process for me, as I made sure that my analysis and understandings matched the informants' statements. The agreement can be viewed in Appendix B. The case organizations also aided in suggesting the potential interviewees who were directly involved in their ERP adoptions, and have the overview of the project finances. After the initial interviews, I have also employed a snowballing strategy to identify other key informants.

   In total, 15 interviews focused on gathering information from four SMEs, including two manufacturing companies, one in the importing and distribution business, and one retail company. Five interviews focused on vendor representatives, six on implementation consultants, and the other two involved an independent senior ERP consultant and a senior freelance finance and corporate development consultant. The vendors and implementation consultants were chosen according to their popularity and the number of projects they had

been worked on within Egyptian SMEs. In addition, those who were engaged in ERP implementations in the four SMEs were also interviewed. The informants had experience of working with various ERP systems:

- Al Motakamel;
- Focus;
- Infinity (a.k.a Al-Motammem);
- JD Edwards;
- Oracle E-Business Suite;
- SAP;
- and several in-house developed Integrated Enterprise Applications.

The consultant interviewees had a wide range of experiences. They varied from junior consultants, who were among the least experienced and had participated in just three implementations, to two senior consultants, of whom the most experienced had participated in more than 150 implementations. The main context and focus of the interviews was on Egyptian SMEs.

All interviews were of 30 to 120 minutes duration, with an average duration of about one hour. Table 3-2 provides details about the informants, their positions, and length of the interviews. The interviews were semi-structured, using an interview guide with open-ended questions. An initial interview guide was developed based on the data collected from the EP and literature review. Before using the interview guide, I sent it to my supervisors and peers for their reviews and comments. In return, I received some useful insights and feedback. First, the guide was used for data collection in Org1. Minor revisions were then made to the interview guide, based on what was learnt from the first case analysis. This guide was used for data collection in the other three SMEs, as well as, from vendors, consultants, and implementation partners. The predefined themes that are relevant to this study included:

- adoption drivers;
- ERP selection processes;
- ERP lifecycle phases (Esteves & Pastor, 1999);
- feasibility and cost/benefit analysis;
- benefits and investments justification;
- benefits realization;

- ex-post benefits and investment evaluation;
- the context of SMEs.

Some of the themes were not used in some interviews, because some of the informants did not possess such information (e.g., ERP costs and financial information). The interviewees who had financial information regarding the ERP adoption's costs and budgeting process were handed an ERP cost factors list (developed by the EP). They were then asked to state how much they did spend on each cost factor during their project as a percentage of total costs. Moreover, they were also asked to verify and validate the cost factors list, and suggest any enhancements or changes to the list.

Table 3–2. Overview of interviews in target cases and other stakeholders

Case	Organization type	No. of interviews	Informant	Duration in minutes
Org 1	ERP client	3	IT manager	91
			ERP consultant	72
			ERP project steering committee member	65
		43	+ With various positions (in-depth case study)	30-60
Org 2	ERP client	3	IT manager	51
			ERP project steering committee member	63
			ERP consultant	65
Org 3	ERP client	4	Business solutions manager	36
			IT manager	82
			Project leader	57
			ERP project steering Committee member	54
Org 4	ERP client	5	IS manager	111
			Application unit manager	91
			IS deputy manager and business intelligence specialist	60
			ERP consultant	68
			ERP project steering committee member	55
Vendor 1	Local ERP vendor	2	ERP implementation and training manager	94
			General manager	142

Vendor 2	ERP vendor	4	Deputy general manager	84
			Senior ERP implementation team leader/ ERP functional consultant (financials and control)	86
			Junior ERP functional implementation consultant (human resources)	87
			Junior ERP implementer (finance and inventory)	74
Imp. partner 1	Implementation partner	3	Junior ERP functional consultant (manufacturing)	53
			Senior ERP consultant	88
			Operations manager	55
Imp. partner 2	Implementation partner	2	ERP implementation projects manager/ senior consultant	98
			ERP department manager	66
-	-	1	Independent senior ERP consultant	52
-	-	1	Independent senior IT investment and financial consultant	77

The interviews involved employees who occupied diverse positions within the organizations in accordance with the 'triangulation of subjects' strategy (Rubin & Rubin, 2011). In addition, in order to capture the whole context and have different perspectives on the phenomena under study, interviews were also held with the ERP consultants, implementation partners, and vendors involved in the ERP adoption projects within the four target SMEs. This was necessary in order to counterbalance the opinions and data collected related to costs escalations and benefits realization practices.

All interviews were tape-recorded. They were then transcribed and translated into English. To ensure that my understanding, translation, and data analysis were clear, and according to my agreement with the informants, I followed up with many emails and phone calls with several informants. An example of the interview guide, which, provides an overview of the issues discussed and questions posed, is included in Appendix A.

B. The in-depth case study in Org1. With the assistance of a colleague, I conducted 43 qualitative face-to-face and semi-structured interviews in Egypt. The interviews were carried out in one Egyptian manufacturing SME. As previously mentioned, the target organization is notable because it had a unique early ERP retirement case. Thus, all interviews were focused on the reasons for the ERP system's retirement. The interviews ranged in duration from 30 to 90

minutes, and notes were taken during the interviews. The respondents included several stakeholders who have been involved in the ERP system selection and implementation. The interviewees' positions included the CEO, GM, IT manager, IT staff, business function managers and mid-level and front-line employees. The variety of interviewees engendered different perspectives, which enriched both the data collected through data triangulation (Bryman, 2012) and the findings.

The interview questions were directed at capturing the adoption drivers that led the organization to acquire an ERP system, the selection process used in choosing the ERP system, and the reasons for the system's early retirement. Moreover, the interviewees were asked if they have estimated the costs and expected benefits prior to the adoption decision, and if the retirement decision was related to financial challenges. The main interview questions used to collect the data were:

- How did you select the current Al Motakamel ERP?
- Who was involved in the selection process?
- Did the organization follow any formal cost estimation or budgeting methods?
- Did the organization calculate the expected benefits, or adopt any benefits management practices?
- Why did you decide to retire it?
- How did you choose the new SAP ERP?

Data collection spanned a period of five months. The data collected was rich, and enabled us to capture details concerning the phenomenon under investigation. Observation and document analysis were used to supplement interviews as methods of data collection. In particular, we attended several board meetings, IT staff meetings, and had access to project-related documents.

3.2.3 Document analysis

In all target cases, the data collection process was further complemented by document analysis. Gaining access to all financial documents concerning ERP project costs was challenging for two main reasons. First, organizations consider this sort of information to be highly confidential. Second, costs and actual expenditures are usually spread among many documents and departments. The target cases explained the difficulties in

identifying the exact amounts spent, especially when they related to internal and indirect costs.

In general, two main categories of documents have been accessed:

- documents with general information about the case organizations like company web pages, company presentations, and brochures;
- documents related to the adoption projects, such as project documentation, vendors' and implementation partners' websites, internal company reports, project management team reports, and financial documents.

The documents were thoroughly studied and all relevant information was extracted. The purpose was mainly to acquire supplementary information about the target organizations and the ERP adoption projects studied.

3.3 Data analysis

As this study progressed, the analysis process progressed through several steps, reflecting the focus of the particular research publications. A combination of within-case analysis and cross-case analysis was employed in the research publications. Three papers relied on a within-case analysis (Eisenhardt, 1989). The remaining three papers were based on multiple case studies; here, a cross-analysis of the cases was provided. These two steps are described in the following sections.

3.3.1 Within-case analysis

The main purpose of the within-case analysis was to gain a broader and comprehensive understanding of the individual cases. The data analysis was made to reveal and extract information related to the organizations, stakeholders, organization context, and ERP adoption projects. The main sources of data analyzed were the interview recordings, notes, meetings, and several documents.

The analysis presented in the publications was based mainly on the data collected within the organizations, in addition to data collected from other stakeholders (e.g., consultants and vendors), who had been involved in such events as ERP adoption or retirement. The analysis aimed to integrate information from the various respondents which related to the issues covered in the interviews, and emerging issues from the data. Several tables were developed during the analysis in order to have an overview of the topics and data representation from the various informants. In addition, important quotes and direct observations related to each of the issues under investigation were transcribed. Moreover, the analysis was sent to relevant

interviewees before publication in order to increase the credibility of the analysis through respondent validation (Bryman, 2012).

3.3.2 Cross-case Analysis

According to Eisenhardt (1989), cross-case analysis should preferably be used when searching for patterns among cases. These patterns can be mainly identified by using three methods: a) the selection of categories and scanning for within-group similarities coupled with intergroup differences, b) the selection of pairs of cases and listing of the similarities and contrasts between each pair, and c) the classifying of data by data source to extract distinctive understandings from different types of data collection (Eisenhardt, 1989). After the data collection process was completed, the data had to be electronically organized in order to be ready for analysis. Thus, I used coding and tagging techniques, whereby the data gathered in each interview was classified according to the topic of discussion, and according to the ERP lifecycle phase in which it is situated. I also added notes and comments on some data segments. It was then possible to generate matrices, which can be classified by topic, interview, and/or case. This process eased the data analysis, because it enabled me to view the data related to the focus and topic of interest in each publication. I also used a system of color-coding (Knafl, Webster, Benoliel, & Morse, 1988) to show similarities and patterns across the data. This made it easier for me to visualize the data, and speed up data extraction into matrix tables and further analysis.

With regard to the data analysis, several topics emerged. Across all cases, data was usually analyzed on the basis of topic and focus. For example, when I was writing the third paper, I extracted the segments that relate to benefits realization practices in target cases. This strategy was used in all my published papers; it allowed me to separate the topics of interest from the large data pools.

In general, two coding strategies were applied. These can be classified as selective and theoretical coding (Glaser, 2008), in which the categories were predefined and coded, and in other cases they emerged from the data.

The cross-case analysis concentrated on investigating the similarities and differences that existed between the cases, focusing on the following dimensions:

- Contextual characteristics (i.e., industry, business type, ownership type, organization size, organization culture, IMC funding, use of consultants, experience since “going-live”, ERP system type, ERP modules, legacy systems and organization readiness, IT/IS maturity, organization maturity, implementation partner, and implementation team). The contextual characteristics served as the

basis for further analysis, relating the analysis to similarities and contrasts in these dimensions.

- Specific focus of the analysis (e.g., ERP adoption drivers and motivations, ERP adoption benefits management, ERP benefits realization practices, ERP costs identification, ERP cost estimation process, ERP benefits and costs management challenges, and cost escalations). The data and case analysis process echoed the focus of the individual papers. The studied aspects were compared across the target cases.
- Influences of organizational and IT maturity. The potential influences of SME maturity on the use of formal costs and benefits management practices was also discussed and compared across the cases. The findings were further analyzed in relation to findings based on the two previous dimensions.

The results and findings from the cross-case analysis were then compared with findings from the literature. This comparison allowed some findings to be confirmed. However, it also gave rise to some contradictions that challenge the fundamental arguments put forward in the literature, indicating that this study does indeed make a contribution to research. An overview of the data collection and analysis process is demonstrated in figure 3-4.

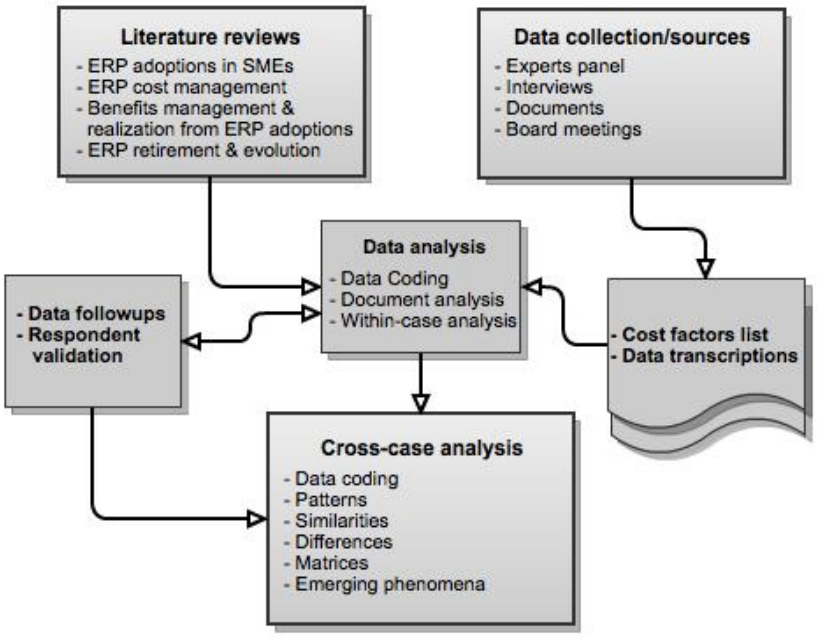

Figure 3-4. Data collection and analysis overview

3.4 Research validity and reliability issues

This section discusses validity and reliability issues in this research. In the following

section, internal validity and reliability will be elaborated, Concerns regarding the external validity and transferability of the findings will then be raised. I also reflect on potential concerns regarding the researcher's bias.

3.4.1 Internal validity and credibility

Throughout this research, I endeavored to document details concerning the research phases in order to assure, as far as possible, the validity and credibility of the research approach, the data analysis and the findings. To ensure the internal validity of this research, I applied the "criteria for rigorous assessment of positivist case research" developed by Dubé and Paré (2003). They focused on three main cornerstones: research design, data collection and data analysis. I have elaborated on some of the issues here and in table 3-3, I provide an overview of the assessment.

There are several techniques that could maintain qualitative research validity and credibility. The two techniques applied in this research are the triangulation of subjects and respondent validation. ***Triangulation*** is a technique that entails the use of more than one method or data source by the researcher (Denzin, 1970). Hence, this research used the TOEES framework as a lens for identifying the internal and external SME context and environment. This aided in identifying several stakeholders in the SMEs' ERP adoption projects, namely the adopting organization, internal/external consultants, implementation partners, and government policies and funding. Thus, the data collection was conducted within the organizations and other attainable sources. These multiple sources of data helped in gaining a better understanding of the ERP adoption projects' process, and the tensions that occurred between the various parties involved. ***Respondent validation*** was also used in this research in order to maintain 'good practice'. Respondent validation is a process whereby the researcher shares an account of the findings with the participants (e.g., organizations and interviewees) upon which the research is based (Bryman, 2012). After the data analysis, I sent the findings to the relevant participants to make sure that my understanding matches their statements and opinions. In addition, the published papers were shared with the participants.

Table 3–3. Internal validity assessment

Criteria (Dubé & Paré, 2003)	**Assessment Comments**
Research Design	
Clear research questions	The study presented clear predefined set of questions and objectives.
A priori specification of	The study used a priori constructs derived from the

constructs and clean theoretical slate (exploratory case studies)	literature and experts' panel to ensure the inclusion of constructs. Nevertheless, the study recognized new issues that emerged from data and which point towards the need for future research and suggest the potential discovery of new constructs.
Theory of interest, predictions from theory, and rival theories (explanatory case studies)	The research adopted several theoretical frameworks, e.g., TOEES (Ramdani et al., 2009), ERP lifecycle framework (Esteves & Pastor, 1999), and predictions following on from the applied theory were stated. The study challenged fundamental arguments for benefits and cost management practices.
Multiple-case design	The study employs a multiple case study of four companies.
Nature of single-case design and replication logic in multiple-case design	The case selection process employed several sampling strategies (Patton, 1980). This study also partially followed theoretical replication logic (Yin, 2009).
Unit of analysis	The unit of analysis was stated as a completed on-premise ERP adoption project in an SME.
Pilot case	A pilot case study strategy was not used; however, the insights and data analysis from the experts' panel and first case organization have aided in the form and structure of the following data collection process.
Context of the study	The study context was described in detail.
Team-based research and different roles for multiple investigators	Two researchers were involved in the data analysis published in five papers. This resulted in higher internal reliability of the data analysis, and decreased bias through following inter-observer consistency concepts (Bryman, 2012). In other cases, I worked alone on the cases' analysis; however, I thoroughly discussed the analysis and findings with my supervisors and co-authors.
Data Collection	
Elucidation of the data collection process	A detailed description of the data collection process and data sources is provided. The study also includes a number of tables and figures that provide information about the data collection process.
Multiple data collection methods and mix of qualitative and quantitative data	This study relied entirely on qualitative data. The primary data sources were face-to-face interviews and a panel of experts. In addition, note taking, company meetings, document analysis, and direct observations were used in

	some cases. Moreover, follow-up meetings, e-mails and telephone communications were used for the clarification of some issues and for data validation. This allowed me to make sure that my data interpretations match with interviewees' statements. Further, implementation partners, ERP & financial consultants, and vendors engaged in the ERP adoptions were also interviewed. This approach aided in capturing various stakeholders' viewpoints, and consequently improves the internal validity of the findings.
Data triangulation	The study employed data triangulation (Bryman, 2012) and the triangulation of subjects (Rubin & Rubin, 2011).
Case study protocol and case study database	An interview guide was developed and reviewed by peers prior to conducting the interviews on site. The guide was used throughout the interviews. It included an overview of the case organization, roles of employees to be interviewed, and interview questions grouped according to the research topics to be covered. In addition, before conducting the interviews, a "data confidentiality and use agreement" was signed and sent to all interviewees and organizations' top management. In addition to covering data use and the anonymity preservation of the subjects, the agreement also contained a briefing about the topics and focus of the interviews. The agreement also ensured the *respondents' validation,* which increases data credibility (Bryman, 2012).
Data Analysis	
Elucidation of the data analysis	An overview of the data analysis process is given in section 3.3

3.4.2 Internal reliability

The research employed internal reliability concepts through the application of the inter-observer consistency technique (Bryman, 2012). As mentioned earlier, two qualitative researchers analyzed the case data independently. After the analysis, we discussed the interpretations and initial findings looking for consensus and differences in our understanding; these were included in the published papers. In other cases, I had to consult with the subjects again in order to clarify some points. In most cases, my interpretations matched those of the interviewees. However, in two cases the interviewees stated that I had misinterpreted specific statements that they had made; I later corrected my analysis accordingly. Finally, inter-observer consistency is believed

to increase data analysis reliability and, consequently, the richness of the study's findings (Eisenhardt, 1989).

3.4.3 Concerns of potential bias

As a researcher interested in a certain phenomenon, my research and data collection were oriented towards investigating the cost issues and cost escalations in ERP adoptions. While developing the interview guide, I tried to exclude or rephrase the questions that might direct the interviewees to certain positive or negative answers. For example, instead of directly asking, "Did your ERP adoption project exceed its estimated budget and time schedules?", which might prompt a negative answer, I rephrased the question to: "It is common that ERP adoption projects exceed their estimated budgets and schedules in some large enterprises and in SMEs. What was the case in your organization?".

In addition, I paid attention to the ordering of the questions, because some questions could pre-set the interview route if they were asked early on during the interview. To reduce the risk of bias as much as possible, I sent the initial interview guide draft to Professor Ann Langley at the École des Hautes Études Commerciales de Montréal (HEC) for review and comments. Her comments were valuable and enhanced the interview draft. I then sent the final draft to my supervisors for another round of comments. Their feedback helped in further developing the interview guide and making it ready for fieldwork. Moreover, as mentioned above, the inter-observer consistency and respondent validation techniques have the potential to reduce researcher's bias through the data analysis process.

While my intention was to keep bias at a minimum, I can't claim that my interpretations and analysis are entirely free of bias. In addition, the data collection process did not cover all subjects within organizations. Thus, this study cannot be said to give the full context; nor does it represent all opinions. In some cases, employees who were directly involved in the ERP adoption project (e.g., IT manager in one case organization), were not interviewed, because they had already left the organization before the interviews took place.

3.4.4 External validity: generalizability and transferability

Here, I discuss issues related to the generalizability and transferability of the research findings. This study is one of the few research attempts to discuss and report experiences of on-premise ERP adoption costs, and benefits management and estimation in SMEs, specifically in Egypt. In addition, it is evident from the literature review (Haddara & Zach, 2012) that this study also presents the very first ERP

retirement cases in SMEs. In total, four case organizations were studied. All target organizations are privately owned or family-owned Egyptian SMEs. Being a developing country in the Middle East and North Africa region, Egypt's context may be different from that of developed countries in Europe and other parts of the world. In addition, generalizability and transferability from qualitative research and the case studies may pose something of a challenge. The relatively small samples available mean that it is difficult to replicate findings in other contexts (Bryman, 2012). Nonetheless, some academics have argued that it is feasible to generalize and develop theories from such case studies (Eisenhardt, 1989; Flyvbjerg, 2006; Seddon & Scheepers, 2011). Guba and Lincoln (1985) argued that 'thick descriptions' of case studies could help other researchers in judging the transferability of their descriptions to their own contexts and lexicons. In this study, I sought to document and describe the context in detail, which may enable researchers to relate the findings to their domains. In addition, based on the fact that several SMEs share many of the contextual and organizational characteristics (e.g. scarcity of resources) around the world. Thus, given the potential similarity between causal drivers in the case organizations and others in different settings, the findings of this study could likely be also applicable to organizations in other countries (Seddon & Scheepers, 2011). As my cases are limited to Egypt, however, any general conclusions must be made with prudence. The experience of on-premise ERP adoption in Egyptian SMEs could be different from that of SMEs in other contexts. One difference is that some Egyptian SMEs are eligible to apply for ERP implementation partial funding from the IMC, which usually covers half of the project's expenses. In some cases, then, this might affect the motivation to carry out proper cost and benefits management. Nevertheless, ERP literature reports that organizations in different parts of the world face similar challenges with regard to ERP cost and benefits management and estimations. As the case organizations in this study adopted standard international ERP packages, the findings of this study could be a good indicator for SMEs in other countries with analogous characteristics.

Currently, there is an increased number of cloud-based ERP adoptions by organizations. While the potential impact of the state-of-the-art technologies and solutions on costs and benefits were partially discussed in this thesis, however, the research particularly focused on on-premise ERP adoptions. The adoption of such cloud ERP systems may reduce costs, increase benefits, and minimize risks of adoptions (Parthasarathy, 2013). On the other hand, according to the ERP vendors and consultants who participated in this research, cloud ERP adoptions were not very

common among the Egyptian SMEs at the time of this study. Hence, the data and results of this thesis might not be applicable in other ERP adoption environments but more to those of on-premise ERP settings.

Finally, although the case studies were limited to four organizations, the interviews with consultants who have wide experience in the Egyptian SME field in general suggested that the results were generalizable within the Egyptian context. However, studies in other countries and cultures are needed in order to confirm whether or not this is a culture-related phenomenon. Not only is my data limited to the Egyptian context, the study focused solely on ERP projects. Hence, the results should not be seen to refute the usefulness of benefits realization practices in connection with other types of information systems.

4 Publications overview

This chapter summarizes the six research publications and their relevance to the research context and theme. I have ordered the papers in sequence, ignoring the publication dates in order to present them in a coherent way. The list of publications is provided in table 4-1, and the full publication text is given in appendix C. The sections that follow provide an introduction to each of the published papers and their main findings. In addition, figure 4-1 presents an overview of the main focus of each publication in accordance with the ERP lifecycle framework.

Table 4–1. List of publications

No.	Publication	Publication outlet
1	Haddara, M. and Zach, O. (2012). ERP in SMEs: An Extended Literature Review.	International Journal of Information Sciences (IJITS), 2, (6) pp. 106-116.
2	Elragal, A. and Haddara, M. (2010). The Use of Experts Panels in ERP Cost Estimation Research.	Communications in Computer and Information Science (Vol. 110, pp. 97-108), Springer.
3	Haddara, M. and Päivarinta, T. (2011). Why Benefits Realization from ERP in SMEs Doesn't Seem to Matter?	Proceedings of the 44th Hawaii International Conference on System Sciences (HICSS), Kauai, Hawaii, USA, IEEE Computer Society Press.
4	Haddara, M. (2012). Exploring ERP Adoption Cost Factors. Journal of Computer Technology & Applications (JCTA) 3(3) (2012), 250-261.	Journal of Computer Technology and Applications (JCTA), Vol. 3, 3, pp. 250-261.
5	Haddara, M. and Elragal, M. (2013). ERP Lifecycle: A Retirement Case Study.	Information Resources Management Journal (IRMJ), Vol. 26, 1, pp. 1-11.
6	Elragal, A. and Haddara, M. (2012). The Future of ERP Systems: look backward before moving forward.	Procedia Technology, Vol.5, pp. 21-30, Elsevier.

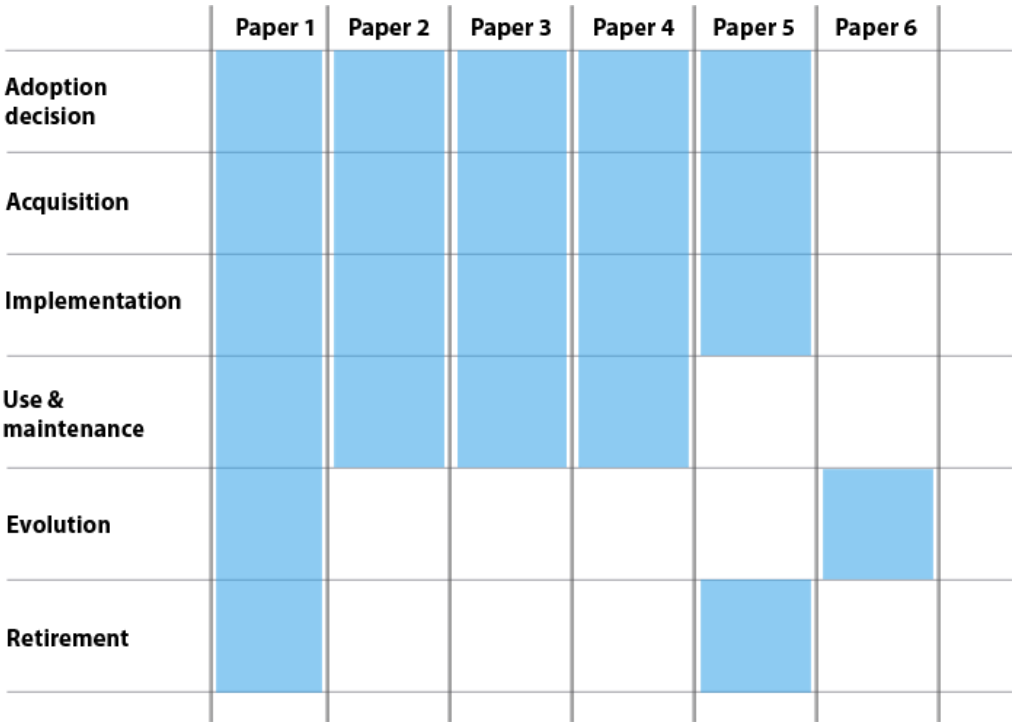

Figure 4-1. Mapping of publications' main foci with ERP lifecycle phases

4.1 Publication 1: ERP in SMEs: An Extended Literature Review

This study served as the basis for my research work. The literature review helped me to identify the current research gaps in ERP adoption in SMEs in general, and become familiar with published studies in my specific domain of interest. In addition, the literature review introduced me to several research approaches and frameworks, some of which I have adopted in my research.

4.1.1 Main research questions and theme

The literature review was carried out to investigate the following main research question: what are the issues that relate to ERP in SMEs being discussed in the current literature?

4.1.2 Synopsis

The literature review covered published papers that address ERP in SMEs and related topics between 1999 and 2009. The literature review employed a comprehensive and systematic method; a clear and detailed paper-searching process was used. In total, 77 articles were identified and reviewed. Of these, 48 were journal publications and 29 were conference proceedings. The papers were published in 44 various outlets, including 26 journals and 18 conference proceedings. They have been categorized according to the ERP adoption phase(s) they address and have been mapped in line with the ERP lifecycle framework put forward by Esteves and Pastor (1999). In

addition, the papers were further classified and grouped according to the topics they discuss in each lifecycle phase. The review also offers a summary of the frameworks, theories, research approaches and research methods used in all of the reviewed papers.

4.1.3 Main findings

Several research gaps were identified during the review. A brief discussion of those that are directly related to my research work will follow.

First, despite the fact that budgets and cost escalations in ERP adoption projects continue to be an issue, only one paper (Equey et al., 2008) directly addressed ERP cost-related aspects in SMEs. In Equey et al. (2008), the authors were mainly investigating the impact of specific costs on the total costs of ERP adoptions. The paper was focused more on business-related cost drivers, such as consulting costs, tending to overlook other types of costs (e.g., technological and human resources). In addition, although the survey data was collected from SMEs, the article did not report on the SME-specific context and its influence on the cost management process and drivers. In general, ex-ante cost estimation, cost factor identification, financial feasibility and investment evaluation studies of ERP projects have not been identified in the current literature.

Second, very few papers (e.g., de Búrca, Fynes, & Marshall, 2005; Metaxiotis, 2009) directly emphasized the evolution, further development and extension of ERP systems in SMEs. In addition, the current literature lacks focus on new technologies and such methods as Software as a Service (SaaS), cloud computing, crowd sourcing and their implications for ERP adoption in SMEs. We were not able to find any published papers that directly address the retirement phase. Consequently, the literature review highlights the need to focus more on the evolution and retirement phases, because they can shed light on what motivates SMEs to extend or replace their ERP systems.

Third, the current literature has tended to adopt a one-sided perspective in their data collection (e.g., from the customer side), overlooking SMEs' external environments in many cases.

Finally, all the above-mentioned issues and gaps in the literature have been a great motivation for me to investigate and form bases for the papers that follow.

4.2 Publication 2: The Use of Experts Panels in ERP Cost Estimation Research

This second paper served as a backbone for my research and paved the way for subsequent research data collection. In this paper, I presented the planned research

design for my PhD. The research design incorporated several data collection methods and qualitative and quantitative multi-method research approaches. However, I later excluded the quantitative methods, as I was not able to acquire a representative sample of people with financial knowledge for me to carry out the casual survey required to construct cost factors. The paper's significance relies on its survey of the cost factors that occur in ERP adoption projects, and the justification and detail given for the method used in the first exploratory and subsequent rounds of data collection. In addition, when I first started investigating ERP adoption costs, it was evident that very little relevant research exists; indeed, few studies have tackled cost factor estimation within the SMEs and ERP contexts. Furthermore, whilst some papers have discussed ERP costs, very few have sought to identify or visualize them.

4.2.1 Main research questions and theme

This paper addresses cost-related issues. In particular, it explores the following main questions: what are the cost factors that occur in ERP adoptions in Egyptian SMEs? What are the indirect costs that usually appear during the adoption process? What is the influence of some cost factors on other factors? What is the ranking of cost factors in comparison with the total costs?

4.2.2 Synopsis

This paper is an early attempt to identify the different cost categories and factors that could occur when SMEs adopt ERP systems. A mixture of focus groups and Delphi techniques were used; thus, the paper contributes both to research into ERP costs, and the domain of research methods. In order to gather a wide range of views regarding this matter, the data collection method targeted diverse stakeholders and experts involved in ERP projects in Egypt. The stakeholders group consisted of eight ERP experts. The panel's participants had an extensive national and international expertise in enterprise systems and ERP adoptions. The inclusion of mind mapping, rankings, group discussions, and group interviewing techniques enabled participants to recommend and identify a list of potential cost factors that may occur in ERP adoptions. The group was provided with a list of ERP cost factors compiled from field experience and the literature (see figure 3 in publication 2). Over the course of two rounds, they made alterations and additions to the list. They also ranked the cost factors according to their influence on total costs.

4.2.3 Main findings

During the group discussions, many important issues were raised. Each participant wanted to share his/her own experiences related to cost issues. These experiences helped me to gain an understanding of ERP projects and the challenges related to the cost management of ERP adoptions. One of the important outcomes of the experts' panel was an updated cost factors list. The list was comprehensive and included the major cost nodes that organizations should think about and expect prior to their ERP adoptions. The experts made many modifications to the initial costs list by combining some costs, and adding new factors and sub factors. The experts' identified factors included: quality management, services, and machinery. In addition, the sub factors included: business engagement under HR costs; hosting and VPN under services and planning; and execution under BPR.

The experts also identified associations between costs and their main influencing drivers. For example, the group stated that business engagement would directly influence quality assurance costs. Likewise, buying or leasing hardware and business requirements would have a direct influence on hardware costs. In addition, many ERP research papers have argued that vendor costs are not the largest part of ERP projects; however, the experts thought differently. They ranked vendor-related costs as the top cost factor in ERP adoptions in Egyptian SMEs. Finally, the experts concluded that the cost factors and their influence on total costs are subject to individual case scenarios.

4.3 Publication 3: Why Benefits Realization from ERP in SMEs Doesn't Seem to Matter?

During my study of cost-related issues in SMEs, I realized the need to investigate the way in which organizations carry out their benefits management and realization practices. The research data originates from interviews that involved: four Egyptian SMEs who had adopted ERP systems; vendor representatives; and independent ERP consultants who, between them, had been involved in hundreds of implementations.

4.3.1 Main research questions and theme

To date, research into ERP implementation benefits in SMEs and related benefits realization practices remains inconclusive. Thus, this paper focuses on the question of whether and why SMEs adopt formal cost management and benefits realization practices in connection with their ERP investments?

4.3.2 Synopsis

The data collected from the four case companies showed that they significantly exceeded their estimated budgets. In addition, the target cases reported that they did not follow any formal benefits realization practices. The purpose of this paper was to investigate the methods used by these companies in order to estimate their ERP costs and benefits, as well as the influence of the SME context and environment on these methods. In addition, this paper aimed to investigate the organizational challenges and beliefs with regard to the use of formal cost and benefits management methods. The data analysis in this paper was organized and presented according to five main themes:

- Maturity;
- Nature of expected benefits;
- Perceived value from benefits realization or investment evaluation activities;
- Organizational, professional, and national culture and context;
- Egyptian national policies that support ERP investments in SMEs.

4.3.3 Main findings

This research aimed to shed more light on the inconclusive fundamentals of normative IT investment evaluation and benefits realization literature. It sought to do so by exploring the explicated reasons for the target organizations' initial neglect of IT investment evaluation and benefits realization practices. Specifically, the cross-case analysis showed that aberrant results challenge the fundamental concepts of cost management and benefits realization practices put forward in the literature. In particular, the role of maturity with regard to the organization's IT and change management, which was recognized in the literature, was nearly absent in the data. In addition, the self-evident nature of expected benefits from ERP was given as the prevailing explanation for a lack of investment evaluation and benefits realization practices in the case organizations. Both the organizations and the experts expressed their view that formal evaluation and benefits realization efforts would not pay off. Whilst ERP investments were expected to reap monetary rewards, relating them to the technology directly through formal analysis was regarded as impractical. Some organizations considered formal evaluation methods and practices as potential political tools for the justification of investment rather than as rational decision-making aids. The analysis also showed that, in some Egyptian organizations, the ERP selection process is not based on rational decisions. In some case organizations, the owners and managers of Egyptian family businesses had mostly built long-term, trust-based relationships with consultants; the adoption of ERP was based on these relationships

and on consultant recommendations. This culture of trust meant that no further system evaluations were considered necessary. Further, the data indicates that the adoption costs often remained unpredictable despite the shared idea of self-evident benefits.

4.4 Publication 4: Exploring ERP Adoption Cost Factors in SMEs

This paper focused on identifying the direct and indirect cost factors that influence total costs in the ERP adoption process. This study aimed to present and test the validity of cost factors that occur within ERP adoption projects in Egyptian SMEs. These cost factors were identified and published in a previous study (see paper 2). The fourth paper offers a continuation of this research by validating the factors list through interviews with ERP-adopting organizations, consultants, implementation partners, and vendors in Egypt.

4.4.1 Main research questions and theme

This study investigated the following main research questions, as follows: Are current formal cost estimation and budgeting methods adequate for ERP adoption settings in Egypt? What are their challenges? How is the budgeting process carried out? Why do costs escalate in ERP projects? Is a cost factors list valid in practice when adopting ERP in SMEs? Is it a comprehensive model?

4.4.2 Synopsis

In IS research, a considerable gap exists in cost factor identification and classification in ERP. Through interviews, this study examined the adequacy and validity of the cost factors model developed in previous research.

4.4.3 Main Findings

During interviews with ERP consultants in Egypt, several interviewees stated that the current cost estimation methods are not adequate for ERP settings. In addition, they stated that the usual European or American cost factors weight distribution (e.g., accountants' rate per hour) is not relevant to the Egyptian context. On the other hand, the data suggests that, in most cases, Egyptian SMEs don't follow any formal budgeting or cost estimation methods; rather, they rely on ERP offers and cost estimates presented by vendors. The study also identified some tensions between ERP clients and vendors. These tensions are mainly related to cost escalations that occur during ERP adoption. For example, some vendors blame SMEs for overlooking potential internal costs, such as infrastructure, frequent changes in requirements, human resources, last minute "nice to have features" and customization costs. On the other hand, SMEs blame vendors for under-estimating organization size and its

relation with the project's scale, and for providing low and unrealistic cost estimates in order to win the bid or deal. The data shows that both vendors and ERP clients face difficulties when trying to estimate and project ERP costs using existing financial and budgeting methods. Moreover, the analysis suggests that the mainstream definition of success, whereby a project has to have been completed within budget and on schedule, is too rigid in practice. Several informants ranked their projects as having been successful, even though they exceeded their allocated budgets and schedules. Furthermore, views on how successful a project had been varied between informants within the same enterprise.

In this study, the informants also validated the cost factors list, together with its comprehensiveness and suitability for their ERP projects.

4.5 Publication 5: ERP Lifecycle: a retirement case study

My initial literature review on ERP in SMEs (see paper one) revealed a clear gap in ERP retirement research. Although ERP retirement cases do exist in practice, we were unable to find any in the literature. During the data collection, I came across a unique early ERP retirement case in one of the target organizations. A decision was made to investigate the case further and report the findings to the research community.

4.5.1 Main research questions and theme

This research used an in-depth case study approach to gain an understanding of the reasons behind the ERP retirement decision taken by the organization. This paper examined the following main questions: how was the selection of the former ERP system carried out, i.e., Al Motakamel? What was the budgeting process? Why did the company decide to retire the system? How did they choose the new ERP, i.e., SAP ERP?

4.5.2 Synopsis

The main focus was on carrying out an investigation of the retirement decision. In particular, this study explored whether this decision was the result of faulty budget estimation or unexpected cost escalations. The findings of the data analysis suggested different reasons and conclusions. In this study, the retirement phase corresponds to that put forward in Esteves and Pastor's (1999) framework.

4.5.3 Main Findings

Traditionally, ERP systems are retired after a period of use, during which time they have acquired maturity, and have added value to an organization. However, in my case study, the retirement of the ERP systems preceded its full go-live date. In other words,

a decision was made to retire the system before waiting for any maturity or gains. The case analysis suggested that cost escalations were not the main factors in the retirement decision; rather, the decision was the result of the selection process itself and reasons related to user engagement. In general, the majority of reasons that led to the retirement decision were related to the system's inability to fit with the organization. During the selection process, the organization overlooked the engagement of the functional managers in the decision-making process; instead, the ERP selection process was mainly carried out by the IT staff. Thus, the functionality of the system did not meet the minimum business requirements, and was not able to augment all of the business units' information. Other reasons were related to the way in which business requirements fit with the technical features of the system itself, such as complex reporting techniques and a lack of web-based interfaces.

The study concluded with several recommendations to organizations on how to avoid such pitfalls in future. One of the main suggestions was to avoid ignoring formal ERP selection methods and user engagement, as this could lead to failure and wrong case evaluation.

4.6 Publication 6: The Future of ERP Systems: look backward before moving forward

This concluding paper addressed ERP evolution through an exploration of ERP development history and current mainstream literature constructs. The paper aimed to elicit knowledge that would shed light on the future of ERP systems research. The paper also explored the reasons for the lag that exists between ERP literature and current technologies available in practice.

4.6.1 Main research questions and theme

The study investigated several cornerstones in existing ERP literature through the following main questions: how did ERP systems evolve? What are the mainstream ERP research constructs? What are the current challenges associated with ERP adoptions? How can state-of-the-art technologies and methods enhance the ERP adoption experience in organizations such as SMEs?

4.6.2 Synopsis

According to the literature review, the majority of ERP research undertaken is mainly focused on implementation, CSFs, project management, and use and maintenance issues. Other important areas have received little in the way of research attention; for example, social networks and enterprise 2.0. Thus, the study tried to analyse and

identify the reasons for the lag that exists between ERP research and the up-to-date technologies provided by vendors. In addition, this paper suggested the incorporation of current state-of-the-art technologies into the ERP lifecycle phases. In so doing, it provided a vision of the effect this infusion could have on overcoming potential adoption challenges, such as cost escalations.

4.6.3 Main findings

The findings of the analysis revealed multiple reasons for the lag that exists between mainstream ERP research and state-of-art technologies: a) organizations that implement ERP systems only want to secure their investment by pushing, or focusing solely on the go-live stage; b) the vendors' chief objective is to expand sales, and so they do whatever is necessary to meet that objective. Thus, from the current situation, it appears as if mainstream research and practice belong to two different worlds.

This paper presented an 'as-is' ERP research model, in contrast with what we believe is 'to-be' the future of ERP research. It suggested that the implementation lifecycle would change with the emergence of social networks and cloud computing. This is due to the fact that social networks are currently outside the lifecycle scope. In addition, cloud computing is expected to shorten and change the activities within the lifecycle. In addition, the CSFs would change to reflect the interaction between people and new media of connectivity (e.g., social networks). This might also influence and reduce the resistance to change, or at least reform the way that communication is managed throughout a project's lifecycle. In addition, the project management team would be smaller in terms of the number of members needed, because when the ERP is hosted in the cloud, organizations need far fewer technical team members. Moreover, when it comes to costs, the adoption of cloud computing would rephrase, and potentially cut the associated costs dramatically. On the other hand, the utilization and integration of ERP and social networks, such as E 2.0, and decision 2.0, could introduce new benefits package, as well as cost and time reductions, to beneficiary organizations that adopt or implement ERP systems. Furthermore, the study suggests that with the integration of new technologies into the ERP lifecycle, the contextual characteristics may lose their influence on ERP adoptions. Thus, the picture of ERP adoption costs could become more visible and clear. Finally, it is believed that all the above factors may add to the development of ERP systems, minimizing the challenges faced during ERP adoptions.

5 Contributions

This thesis has covered several aspects of the ERP projects lifecycle under the umbrella of one main question: -what are the costs estimation and benefits management-related challenges in ERP adoption projects in SMEs? In order to explore these issues, an experts' panel was convened, and a multiple case study and in-depth case study were conducted. The research results and findings have been published in six peer-reviewed articles, as presented in chapter 4. In this chapter, I will highlight the contributions that this study has made to the literature on ERP in SMEs.

This thesis has, in the main, contributed to six research areas. First, this study has contributed to the domain of the influence of contextual characteristics on ERP system adoptions. It does so by investigating the influence of SMEs' internal and external environment on budgeting and investment evaluation methods,. Second, this thesis explores ERP cost estimation practices in SMEs. Third, the study contributes to research into ERP cost management and identification in SMEs. Fourth, the study contributes to the domain of benefits management and realization in ERP adoptions. It does so by studying SMEs' perceptions of, and behaviour towards, formal practices and methods. Fifth, this thesis contributes to the literature on ERP retirement. Sixth, by investigating and analysing ERP development history and state-of-the-art technologies, this study contributes to research on ERP evolution and development. Finally, the study contributes to more general research on ERP systems in SMEs through its comprehensive literature review. The following sections present these main contributions to theory in greater detail.

5.1 ERP adoption cost factors

Cost estimation and budgeting methods used in relation to information system projects have been heavily discussed in the literature. Nevertheless, few studies have focused on ERP settings (Jorgensen & Shepperd, 2007). Several researchers have questioned the applicability of the established cost estimation models and their adequacy for use in ERP system adoption projects (Al-Mashari, 2002; Daneva & Wieringa, 2008; Jorgensen & Shepperd, 2007). In addition, in IS literature, studies on cost factors identification are lacking (Ghoneim, 2008), particularly in the area of ERP systems research. Hence, in order to facilitate the development of cost estimation models for SMEs engaged in ERP adoption, more research on cost factors identification and weighting is needed.

The SME context and environment were core lenses in this thesis. The characteristics of SMEs, and the environment in which they operate, were mainly identified through the literature and the adoption of the 'TOEES' framework, which was developed by Ramdani et al. (2009). In addition, SMEs' characteristics were considered during data collection and subsequently in the data analysis, which resulted in the research publications presented in chapter 4.

5.1.1 Cost factors identification

As mentioned above, in order to better understand cost related issues, an essential phase in the research was to explore the potential cost factors within ERP adoptions in SMEs. Several informants stated that they had had difficulties in predicting the potential cost factors during their own implementations. Through collecting data from various experts and stakeholders in the ERP area in Egypt, the study identified a list of potential direct and indirect cost factors that usually occur within ERP adoptions in Egyptian SMEs. The potential costs list is presented in figure 5-1. The experts were asked to suggest a list of potential cost factors that could occur within ERP adoptions. This list was mapped to the phases of the ERP lifecycle framework developed by Esteves and Pastor (1999). The experts identified ten main cost factors and a total of 32 sub factors that are distributed among these cost factors. One frequently overlooked cost factor is *business engagement*. The participants classified business engagement under HR costs. Business engagement refers to the amount of time and money the business team have invested in the project. For example, when the business team has a half-day training session or, for example, a procurement workshop, the business teams put aside their day-to-day work and devote their time (which is also a cost) to project activities. The experts recommended that companies should take this into consideration when calculating the costs of the project; however, one should note here that, in some cases, it is difficult to quantify the cost of time in monetary terms.

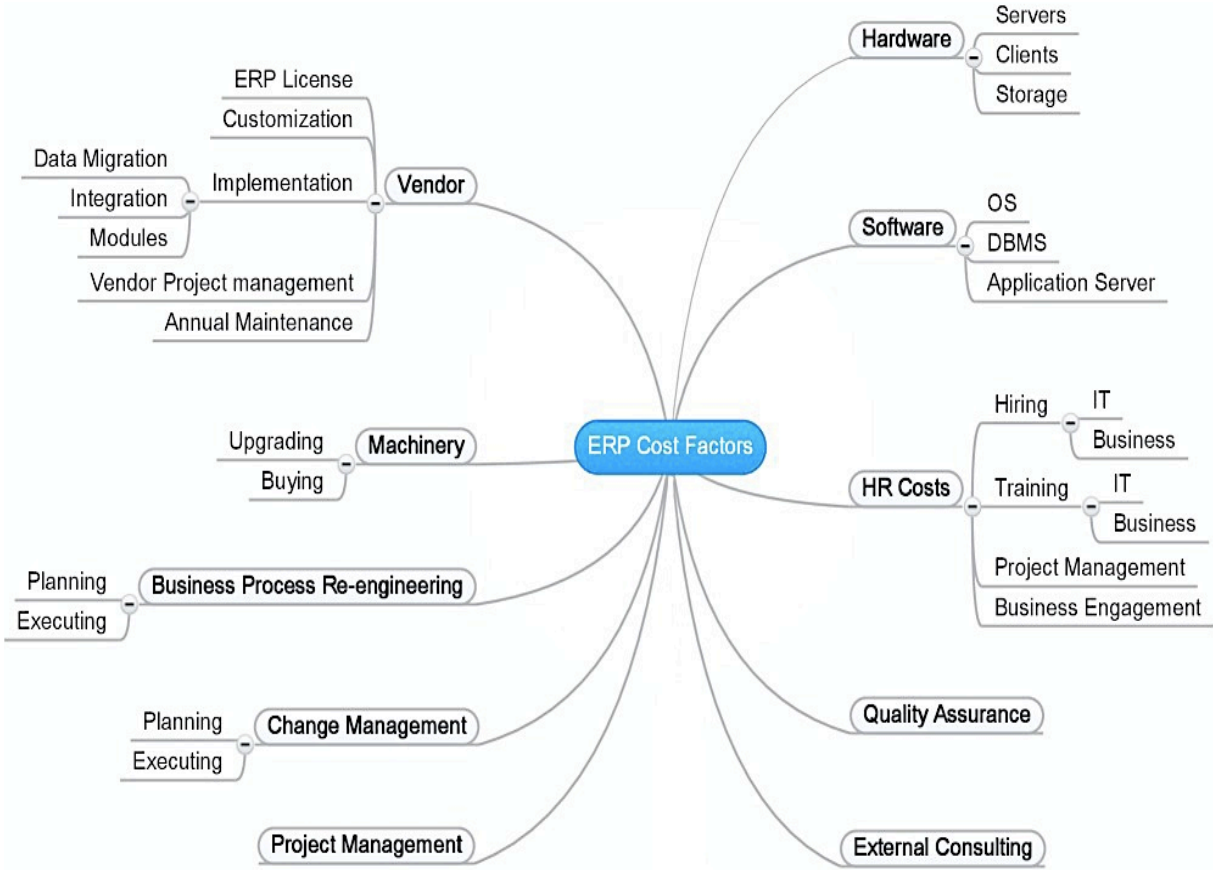

Figure 5-1. Potential ERP adoption cost factors

It is worth noting that the experts went through several cycles of discussions and debates before reaching a consensus on the prime cost factors and their sub factors. Their identification of cost factors could aid organizations that are planning a future adoption process by allowing them to visualize any potential direct and indirect costs.

5.1.2 Cost factors rankings and relationships

After a list of cost factors had been put together, the experts anonymously ranked the impact of each cost factor on the total cost of the adoption project during the lifecycle phases (Esteves & Pastor, 1999). The rankings ranged from very low (cost share) to very high. Table 5-2 provides an average of the cost rankings. Significantly, some of the results disagree with many of the findings presented in the literature. Mainstream ERP literature has argued that vendor-related costs make up a small portion of the total adoption costs (Scheer & Habermann, 2000). According to the participants' rankings, this is not the case in the Egyptian context, as vendor-related costs are considered the highest cost during the project's lifecycle. In addition, BPR-related costs are significant in ERP projects (Safavi et al., 2013). Although many Egyptian SMEs adopt a vanilla implementation, which requires a high rate of BPR, the data show that BPR is

ranked as a low cost. This can be partially explained through arguments in the literature, which state that SMEs usually have less complex business processes than large enterprises (Wong & Aspinwall, 2004). Moreover, external consultancy costs are ranked as 'very low', making up a small portion of total costs, which might not be the case in other contexts and countries.

Table 5–1. Influencing cost factors and their rankings

Cost factor	**Very High (5)**	**High (4)**	**Medium (3)**	**Low (2)**	**Very Low (1)**	**Influencing factor(s)**
Vendor	**X**					Responsibility matrix; implementation method, experience; project size; licensing; product performance
BPR				**X**		Nature of business (multinational, local, public organization); Local/international ERP vendor; International or local implementation; ERP scope/generic
External Consultants					**X**	Scope of acts; business complexity; type of business; experience
Hardware			**X**			Buy or lease; business requirements
Software					**X**	Open source Vs. licensed/proprietary
HR & project management			**X**			Business engagement
Change management			**X**			Company size
Quality assurance					**X**	Business engagement
Logistics					**X**	Business size, distribution and distance of facilities & inlets/outlets
Services (Hosting & VPN)					**X**	
Machinery					**X**	Type of business (e.g., manufacturing); scope

Guided by the TOEES framework and their ERP field experience, the experts also considered the influence of some variables on cost factors, as seen in table 5-1. For each cost factor, they identified the relationships between some SME contextual characteristics, the environment within which SMEs work, and other variables. For example, the experts stated that there is a positive relationship between 'business complexity' and the cost of bringing in 'external consultants', which includes the time they spend on the project. This also applies to the influence of 'company size' on 'change management'-related costs. Moreover, the participants stated that these rankings are debatable. In particular, they are subjective in that they present their own personal experiences, which might not apply to other cases.

The study contributes to cost estimation research by demonstrating the cost factors, relationships, and their impact on total costs. Another important outcome of this study is the confirmation of the suitability and validity of the TOEES framework and Esteves and Pastor's lifecycle framework for use in the context of Egyptian SMEs.

5.1.3 Validation of cost factors

The list of cost factors (fig. 5-1) was later validated through interviews in the four target case organizations and through ERP vendors, implementation consultants, and independent consultants. The interviewees were asked to suggest any modifications, inclusions, and exclusions with regard to the list. In addition, the informants were asked to rank the cost factors according to the impact that they felt they had had on total costs in their company's own implementations. The informants gave percentages for any cost factors that applied to their cases. They also stated that, from their point of view, the list is comprehensive; however, they did mention that not all of these factors occur in all projects and that they are based on individual cases. This is also in-line with the experts' conclusions. For example, some of the informants stated that they did not have any machinery-related costs, whilst others did not hire external consultants, In addition, one informant in Org1 suggested that 'change management' costs could be related to the costs of bringing in 'external consultants', which is applicable in many cases. According to all interviewees, vendor-related costs were the highest costs in their ERP implementations, which also confirm the results put forward by the experts' panel. Moreover, BPR has a low impact on total cost, whilst customization costs are high; this also corresponds to the results of the experts' panel. Another informant in Org. 3 remarked that, during their ERP adoption project, HR costs had unpredictably and significantly escalated after the go-live process. An example of a ranked and

validated cost factors list is presented in figure 5-2.

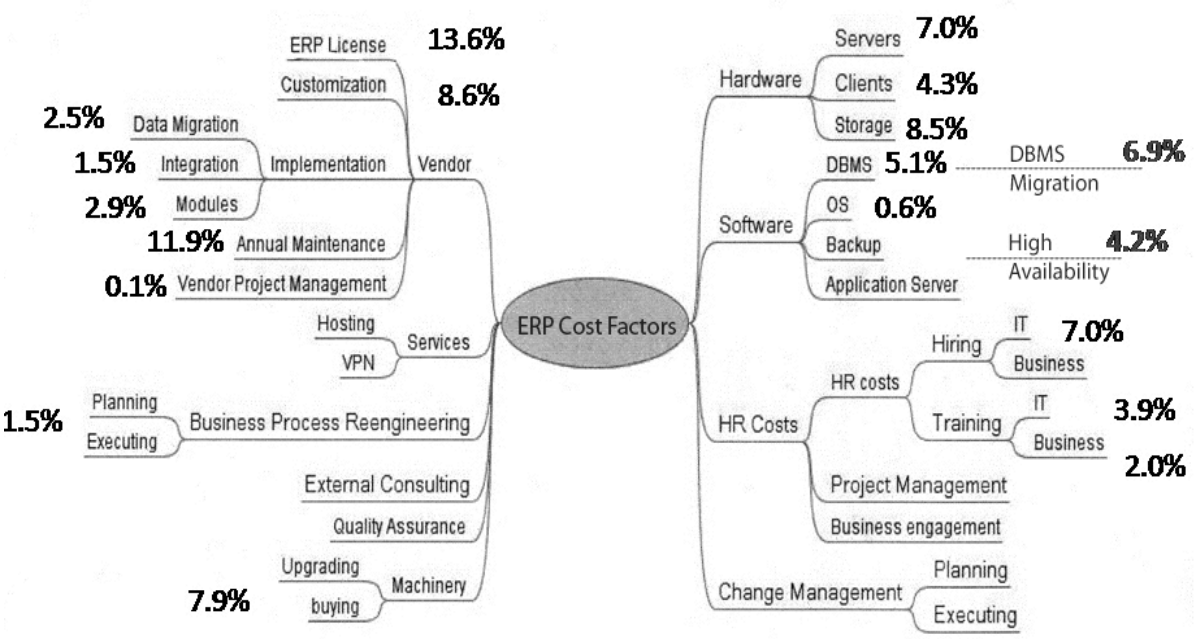

Figure 5-2. Ranked and validated cost factors example

The respondent who ranked the above-presented costs list stated that the organization (Org4) faced major difficulties in calculating the costs related to change management and business engagement during their ERP adoption project. In particular, they had overlooked these costs factors prior to the actual adoption process. Consequently, informants and experts agreed that *search for vendor* and *vendor selection* costs should be included as part of 'business engagement' costs.

5.2 Costs and benefits estimation and management practices in SMEs

The thesis also contributes to the literature on cost and benefits estimation and realization. By analysing the data from target organizations and other stakeholders, the thesis highlights the challenges of adopting formal budgeting practices in SMEs. In the following section, I will elaborate on these contributions.

5.2.1 Influence of SME characteristics and the environment

One of the main contributions of this thesis is the analysis of SMEs' contextual features and their influence on ERP system adoptions and SMEs' attitudes to formal budgeting and investment evaluation practices. As can be observed from chapter 4, the consideration of SME characteristics has been a recurrent topic in all of my published papers. With respect to the overall focus of the thesis, it represents a common theme that links the data to the research findings.

During the past decade, ERP implementations in SMEs have increased, as have studies on benefits realization in the academic literature. Nonetheless, few attempts have been

made to verify expected versus realized ERP benefits in ERP implementations in general (Eckartz et al., 2012; Schubert & William, 2009), and in SMEs in particular (Bernroider & Druckenthaner, 2007; Esteves, 2007) .

This study contributes to the literature through a dissemination of aberrant results in the light of mainstream normative suggestions to adopt management practices for benefits realization that have been made in the literature (Lin & Pervan, 2003; Peppard et al., 2007; Remenyi et al., 1997; Ward & Daniel, 2006; Ward & Bond, 1996). In particular, the results challenge the suggestion that lack of "maturity" could be the root reason for the non-adoption of benefits realization or investment evaluation practices (Lin et al., 2007; Lin et al., 2005). The results also contradict the assumption made in the BR literature that benefits generated by IT can be regarded as fuzzy at the start, only emerging during the implementation of a project; thus, only then, would additional management actions be needed in order to realize them (e.g., Peppard et al., 2007; Ward & Daniel, 2006). The four companies had several years' experience of using IT, including earlier versions of ERP and legacy systems. The target organizations were also confident in their assumption of the usefulness of ERP implementation outcomes, even though they recognized having had cost coordination problems in their projects. In addition, even though the consultants had experience of implementing tens, and in some cases more than hundred, ERP projects each, they did not regard benefits realization as a significant issue. Rather, the problems encountered by the target organizations were related more to cost control than uncertainty about benefits. This observation suggests the need for developing cost-control instruments for ERP implementations in SMEs rather than promoting the formal benefits realization processes themselves.

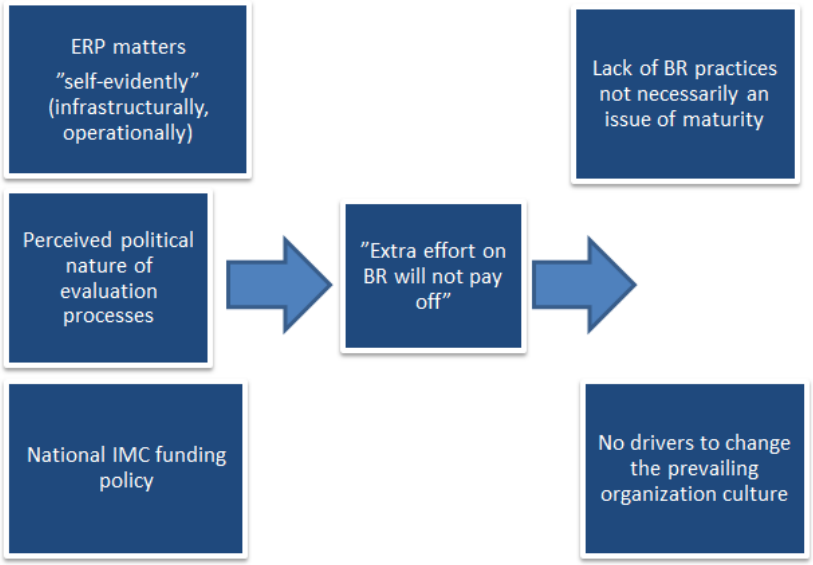

Figure 5-3. Summary of the thesis' findings on benefits realization

In addition to the perceived "self-evident" benefits of ERP in SMEs, which contradict one of the most fundamental assumptions stated in the benefits realization literature, the results of this thesis also suggest two other reasons for reducing the efforts made with regard to benefits realization. Many informants had opinions concerning the potential weaknesses of formal evaluations – in particular, they were uncertain as to whether the evaluation methods would actually be used for rational decision-making or, rather, for promoting personal political agendas. Moreover, it was felt certain that national IMC funding practices had led to decreased management motivation for realizing the benefits of ERP, because these initiatives were funded by external means.

In general, the study responds to the lack of empirical research on benefits realization practices (e.g., Ashurst, et al., 2008; Zeng et al., 2012) – in my case, through a multiple case study into the lack of such practices in ERP implementations by Egyptian SMEs. However, the results should by no means be taken as a basis to refute the focus on benefits realization and IT investment literature in general. This research should not be seen as an example of a case in which "ERP would not matter" at all from the viewpoint of management (cf., (Carr, 2003, 2005)). ERP systems are regarded as bringing significant benefits and significant costs, thus representing a significant area for future investment. Rather, the results highlight that the widely documented academic assumptions about the less self-evident nature of IT benefits and the lack of maturity that could hinder adoption of benefits realization practices are perhaps less universal than suggested in the recent literature. Figure 5-3 summarizes the study's findings.

In the case organizations, the normative idea about the usefulness of benefits realization practices is not shared. While the results support the previous observations, whereby the SMEs are often confident about the benefits of their ERP investments (Bernroider & Druckenthaner, 2007), they do not seem to regard formal evaluation and benefits realization practices as a useful way of reaching these goals. The data implies that a policy of national funding may reduce interest in the adoption of benefits realization practices in the Egyptian context; however, it does not explain the whole phenomenon, even among the target organizations. It should be noted that two target companies received no funding from the national programme. Rather, two more prevailing reasons for a lack of benefits realization might be the clear-cut nature of ERP benefits and the mistrust of human rationality with regard to the justification and evaluation of benefits realization techniques. In addition, the findings indicate that better cost coordination practices might have been useful in many of the cases, in which the costs to reach the desired benefits exceeded the initial budgets. On the other hand, the data proposes that current cost estimation and formal budgeting methods are not suitable for the estimation of ERP costs. Several informants stated that it was difficult to identify and predict the cost factors and their ranges, and the political nature of investment justification and evaluation methods. The majority of informants stated that Egyptian SMEs basically preserve a portion of their annual budgets for ERP/IT adoption projects, which usually make up around 3 to 5% of their annual turnover. In addition, several informants confirmed that ex-post cost/benefit evaluations pose some challenges. Thus, they suggested that a causal relationship between ERP investments, and increases in sales, costs, and revenues is almost impossible to achieve, as any changes could be the result of other internal or external factors. Whereas ERP systems were regarded by some consultants as “commodities” (Carr, 2003, 2005), the data shows that, despite the shared idea of self-evident benefits, adoption costs were often unpredictable.

Unlike the normative literature, which promotes benefits realization practices, management processes and evaluation methods, the findings highlight that benefits from ERP investments in SMEs may be too obvious to warrant the efforts required for their use. At the same time, national investment policies implied that there were no incentives for optimizing the benefits beyond a focus on the straightforward implementation of ERP systems. Together with general-level distrust on the rational use of analysis methods, these issues explain the non-adoption of formal benefits realization and investment evaluation practices. While the maturity of IT management and management, and organizational and regional cultures, might also go some way to

explain lack of adoption, our interpretation of the data does not necessarily suggest these to be the root causes for non-adoption. Rather, our interpretation suggests that the benefits of ERP in SMEs are perceived as "self-evident" and further analysis is, therefore, perceived as non-economical. Thus, the target organizations have no real incentive to direct their "maturity" towards more formal practices or to change organizational cultures. Finally, the data suggests that ERP adoption drivers (e.g., technical) might have an impact on the likelihood of organizations endorsing budgetary and benefits formal management practices.

5.3 ERP Retirement

This thesis reached the same conclusions put forward by Tariq (2009) and Moon (2007): that the ERP literature lacks research that covers the ERP retirement phase, even though such retirements exist in practice. The retirement phase of an ERP system corresponds to the stage at which this system is abandoned and substituted by another information system or ERP system. Through an in-depth case study in Org1, this thesis contributes to the ERP literature by offering insights into a rare retirement case; indeed, one of the first to be reported in ERP research. As a researcher, I felt it was important to explore this phenomenon in order to understand how and why it happened, and also to share my findings with the ERP research community. When I started to collect data, my initial assumption inclined towards the view that the ERP system was retired because of escalating costs. However, the data analysis showed that cost escalation was not the prime reason for the retirement decision.

The preliminary data indicated that the stakeholders reached a consensus that the ERP system does not satisfy their business needs; thus, it was necessary to retire the system and replace it with another, more appropriate, ERP system. During the interviews, the informants explained that the system needed to be retired because of the following reasons:

a) User involvement: they explained that they had not been involved in choosing the system. They had not supported its existence and had never been trained on the system;
b) Poor/void requirements analysis: the system does not have an HR module and this is something they felt was necessary. In addition, the system is not web based;
c) ERP technical features/challenges and fit: the system is not web enabled. The user-interface did not allow them to augment all business units together. In addition, reporting is highly complicated because each year is stored in a

separate database.

According to the informants, the system did not offer any tangible benefits to support its retention; thus, they felt that it should be retired. Traditionally, ERP systems retire after a period of maturity and value-adding to the business. In addition, according to Esteves and Pastor (1999), retirement decisions are usually based on the appearance of new technologies or the perceived inadequacy of the current ERP system and its fit with emerging business needs. Hence, managers decide whether or not to substitute the ERP system with another system, which would better satisfy the organization's needs. However, in this case study, the retirement of the ERP system at Org1 preceded its full go-live date. In other words, the decision was taken to retire the system without waiting for any maturity or gains. Previously, Esteves and Pastor noted that, in the literature, early ERP retirement was regarded as an extreme case. However, in the literature review carried out as part of this thesis, no related research was identified.
Following the case data analysis, it was concluded that the following problems led to early ERP retirement in Org1:

- Functional managers were not engaged in the decision making process;
- Absence of implementation contract i.e., Org1 only bought a license rather than any service;
- Functionality of the system does not meet minimum business requirements;
- Inability to augment all information of business units;
- Complex reporting techniques;
- Lack of web-based interfaces, and;
- IT staff alone made the ERP selection decision.

This study also provided a guide for future adopting SMEs to follow in order to avoid early ERP retirement and investment loss risks. Based on the case analysis the following recommendations can be made. The choice of the ERP system should be taken by both business and IT staff. In addition, their selection criteria should include both current and future demands; by way of example these could relate to web-interface, business intelligence, HR and user-friendly interfaces. In addition, it is extremely important that key users and business teams act as catalysts for implementation consultants and functional users. Moreover, it has been shown that buying an ERP license and putting the implementation entirely in the hands of the

internal IT department leads to failure. Ignoring the official selection methods is also risky, leading to failures and an inability to evaluate the situation.

Finally, based on the case findings, early ERP retirement came as a result of incorrect choices being made, and by overlooking formal ERP selection methods and other user engagement options, instead of merely the appearance of new technologies. Thus, poor ERP selection decisions and a failure to involve users may be the cause of early retirement; so too can a desire to introduce new technology, or a need to meet new business requirements. Of course, the risks associated with retirement before maturity, or even before go-live, are magnified because they reflect a loss of investment. In addition, inadequate system requirements analysis and poor system design processes could dramatically increase implementation costs. This situation mainly occurs when key employees are not fully engaged during these two phases.

5.4 ERP evolution and development

In practise, ERP systems have gone through several development and enhancement cycles. New technologies evolve over time, and their integration and infusion within ERP systems has, in many cases, become a requirement. On the other hand, the ERP literature clearly indicates that there is usually a lag in organizations' ability to cope with emerging technologies in practice. The literature review given in this thesis also showed a clear gap in research on the ERP evolution phase, and on new technologies and their effect on ERP adoptions. The majority of ERP research has tended to focus on such issues as implementation, CSF, project management, use and maintenance. Nevertheless, other rather important areas have been largely neglected in the literature, such as social networks and enterprise 2.0. Based on the literature analysis, multiple reasons could account for the lag between mainstream ERP research and state-of-art topics. First, organizations that adopt ERP systems want to secure their investment by pushing, or solely focusing on, the go-live phase. Second, the vendors' primary objective is to increase their sales, and so they do whatever is necessary to meet that objective. Thus, in the light of the current situation, it appears that research and practice operate in two different worlds. As a consequence, this study has recommended several research topics (see Fig. 5-4) that have the potential to facilitate the implementation of ERP systems in organizations. They may also help to minimize adoption costs and maximize the benefits of ERP adoption. For example, cloud ERP providers argue that organizations could avoid hidden costs, escalating costs, and substantially decrease their total costs of ownership by adopting cloud-based systems.

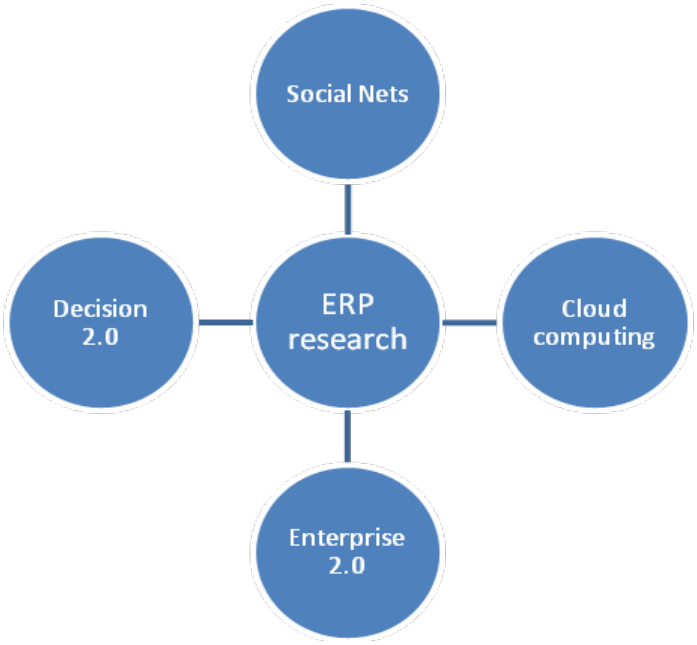

Figure 5-4. Proposed future research focus

Hence, through an analysis of the current literature and state-of-the-art technologies, this thesis proposes the mapping and integration of certain technologies to guide ERP lifecycle phases and research constructs, as seen in figure 5-5. This mapping has the potential to avoid adoption cost escalations, benefits realization challenges, user resistance and implementation complexities.

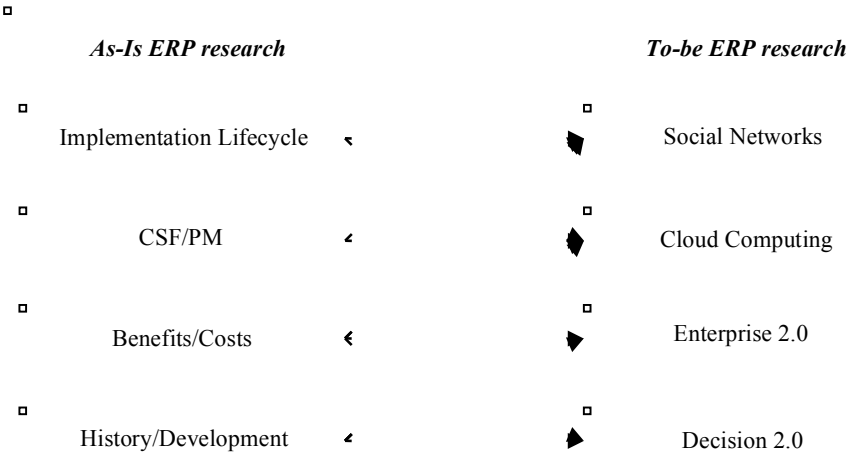

Figure 5-5. Proposed research integration

Current emergent technologies could benefit future ERP adoptions in several ways:

- Social networks: the widespread use and adoption of social networks is supported by people's rapid adaptability to use them. Ideally, ERP systems should be integrated into social networks, leading to shorter implementation

lifecycles, higher ROI, and fewer investments. In addition, the success in CRM achieved by salesforce.com needs to be replicated in ERP systems.

- Cloud computing: this is one of the most important trends in recent years. It has the potential to reshape the way in which IT services are consumed. Cloud computing includes both the applications delivered as services and the hardware and systems software in the data centers that provide these services (Armbrust et al., 2010). Some of these services are referred to as Software as a Service (SaaS), whilst others use the terms IaaS (Infrastructure as a Service) and PaaS (Platform as a Service) to describe their products. More recently, some ERP vendors have moved some of their offerings to the cloud, e.g., SAP By Design. However, much remains to be done if customers are going to be able to see more and more services and suites moving to the cloud. Therefore, a great deal research is still needed in order to increase our knowledge of the marriage of ERP and cloud computing.
- Enterprise 2.0: enterprise 2.0 (E2.0) is defined as the use of Web 2.0 technologies. E2.0 tools and applications have the potential to achieve better collaboration, content creation and overall performance. E2.0 can be seen as social software that enables its stakeholders to connect, meet and collaborate through computer-mediated communication, as well as form online communities. Through offering digital environments, which are known as platforms, E2.0 allows all users' contributions and interactions to be transparent and visible to everyone within the organization, until deleted. Although organizations currently use ERP systems to solve their niche problems, this alone they might not lead to an organization's workforce abilities and knowledge being fully utilized. These systems are cross-functional and, thus, allow for minimal flexibility. However, E2.0 encompasses a different complementary approach. It emphasizes "freeform"; that is to say, it does not predefine workflows and is indifferent to formal hierarchies (Elragal & El-Telbany, 2012). Therefore, more integration is required between ERP systems and E2.0 tools and applications.
- Decision 2.0: Traditionally, ERP systems have focused only on the support of key business processes and functions. To a great extent, this has resulted in businesses being run in a standardized way. However, nowadays, there is a need to focus on how the decision-making process can be supported, because well-informed decisions can have far reaching consequences, affecting almost all aspects of business. There are many decision-making models; most notable

among them is Simon's decision-making model. This model starts with the intelligence phase, and is followed by the design phase, the choice phase and the implementation phase. Decision implementation is only considered successful when it actually solves its intended problem and fulfills the original objectives. However, it is worth mentioning that, on average, 50% or more of the decisions made by individual decision makers were found to be a failure, despite having correctly followed the decision-making process (Elragal & El-Telbany, 2012). Therefore, a new trend in decision-making is to involve the crowd, achieving so-called crowd sourcing. This enhances intelligence and the choice phase of the decision-making process. Integrating the crowd into ERP to facilitate the decision-making process is a long-waited development in terms of ERP enhancement.

5.5 ERP in SME research

This thesis contributes to the body of knowledge on ERP because it is one of the very first reviews to focus solely on SMEs. The literature review included a total of 77 publications, and the organization of this literature into ERP lifecycle phases. Through the review, researchers can identify the topics currently neglected by researchers. In addition, it provides information about the findings of previous literature endeavours. Moreover, adopted research methods (see fig 5-6) and theories in the literature were also presented. Finally, the review provided observations and future research suggestions that can enrich our knowledge in this domain.

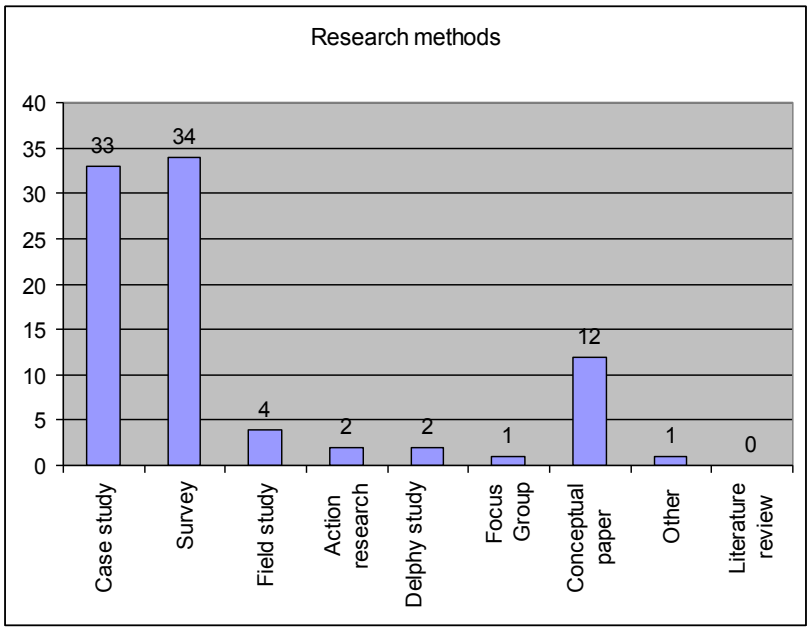

Figure 5-6. ERP in SMEs research approaches

6 Conclusions and future research opportunities

This thesis is one of the few studies to attempt to explore and discuss ERP adoption and lifecycle cost-related issues in SMEs. It is also one of the first attempts to focus on the Egyptian context. In the following section, I will start with mapping the research questions presented in chapter 1 with the summary of the research contributions, which have been discussed in more details under the contributions section in chapter 5. Section 6.1.1 concludes the contributions to existing theory and literature. In section 6.1.2, a concluding summary of the research contributions to practice is also provided, followed by research limitation in section 6.2. Finally, a discussion of possible future research opportunities is presented in section 6.3.

6.1 Research conclusions

The overall scope of this thesis was to answer the following main question:

What are the cost estimation and benefits realization challenges for on-premise ERP adoption projects in SMEs?

In order to answer this broad research question and explore the challenges associated with costs and benefits management, the following four sub-questions were investigated.

A. What are the potential costs factors for ERP adoptions in SMEs?

   This research contributes to the research stream on cost estimation in ERP systems, with a particular focus on SMEs. The study provides a novel list of on-premise ERP adoption cost factors collected from literature and experts. These factors were further ranked, visualized, and validated in four case organizations, along with vendors, implementation partners, and independent consultants. The cost factors list also includes frequently overlooked potential indirect cost factors. In total, ten main cost factors and thirty-two sub-factors were identified as presented in figure 5-1. In addition, the inter-dependences between organizational contextual characteristics and their influence on cost factors have been investigated and identified (see table. 5-1). Moreover, the findings recommend that future ERP adopting organizations should pay more focus on certain commonly overlooked cost factors, in order to avoid any unanticipated budget escalations.

B. Do SMEs follow any formal budgeting or cost estimation methods?

   This study supports the area of ERP implementation evaluation. It also supports the claim in literature as to the inadequacy and challenges posed by mainstream cost

estimation models used in ERP adoption project settings. In spite of the fact that the target cases consider investments in ERP projects to be abounding, the findings of this research show that those organizations still do not attempt to engage in cost management and estimation practices for several reasons. Some of those reasons are related to the adequacy of current budgeting methods in ERP settings, and some other reasons are related to the organizations beliefs, competence, and attitudes toward these methods. Section 5.2 provides a detailed discussion on budgeting and cost estimation issues identified in this study.

C. Do SMEs follow any formal benefits realization and management practices?
   This research aimed to shed more light on the inconclusive fundamentals of normative IT investment evaluation and benefits realization literature. The initial data collection efforts suggested that the target organizations did not embark on adopting any formal benefits management or realization practices. Thus, the study explored the explicated reasons for the target organizations' initial neglect of ERP investment evaluation and benefits realization practices. Specifically, the cross-case analysis concluded aberrant results that challenge the fundamental concepts and theoretical assumptions of cost management and benefits realization practices put forward in the literature. A summary of these findings is presented in figure 5-3.

D. Are there any differences in cost and benefit management practices in different SME contexts? (E.g., government policies, industries)?
   The study was conducted in organizations with different sizes (small and medium), ownership models, maturity and IT competence levels, and work in various industrial sectors. Also, the target cases had various international and local ERP systems. In addition, two of the target cases had partial governmental support for their ERP investments, while the other two organizations did not apply for this funding. The reason behind this variety was to investigate if the contextual differences have an impact on the organizations' attitudes toward cost and benefits management and estimation practices through conducting a cross-case analysis. Across the organizations, significant differences in the attitude towards costs and benefits management practices were not evident. While some organizations have spent minor efforts in estimating some costs and benefits, still they were non-accurate and individual efforts that did not follow any formal methods nor were enterprise-wide activities. The findings also suggest that the applicability and

feasibility of the current formal methods are questionable by the target organizations.

6.1.1 Contributions to theory and research

The findings of this study may provide insights that could potentially change the views on the fundamental assumptions and theories of benefits realization and cost management in ERP for SMEs research. Also, the findings of the study have the potential to extend existing theories and enhance the mainstream costs and benefits concepts and models.

This study has employed several data collection and research methods, which have involved various stakeholders. The experts' panel, which was convened for the purposes of this research, was an attempt to combine Delphi, nominal and focus group techniques, while avoiding their potential weaknesses. These weaknesses are discussed in the mainstream literature on research methods and in publication 2. This method is believed to add to the research methods literature, especially with regard to its aim to explore ERP-related phenomena. In addition, this thesis demonstrated the adequacy and validity of both the Ramdani et al.'s TOEES framework, and the ERP lifecycle framework put forward by Esteves and Pastor within the context of Egyptian SMEs.

By focusing on the ERP lifecycle and the frequently overlooked contextual environments of SMEs, this thesis adds to ERP research through an exploration of ERP cost issues within SMEs. A list of possible potential cost factors was identified, classified, and visualized, and costs were ranked according to their impact on total adoption costs. This study also provided a list of influencing contextual characteristics for SMEs and variables on those cost factors. In addition, the thesis investigated the influence of various stakeholders on the behaviour of cost factors in the Egyptian SME context. In particular, it sought to address the question of why cost escalations occur in some cases. According to the ERP literature, current budgeting and cost estimation models are inadequate for ERP settings; thus, this research sought to investigate the formal budgeting and cost estimation methods used in Egyptian SMEs. The results could aid future development of specialized ERP cost estimation models. To provide a balanced costs view, this research also investigated the benefits of ERP. In particular, it investigated whether SMEs adopt any formal benefits estimation, management, and realization formal practices. In addition, SMEs' behaviour and attitudes towards these practices were investigated. The challenges associated with the adoption of formal budgeting and benefits realization methods were also discussed. The findings illuminated the inconclusive fundamentals of normative IT investment evaluation and

benefits realization in theory and literature. They did so by exploring reasons as to why the target organizations neglect IT investment evaluation and benefits realization practices in the first place. Specifically, the role of maturity with regard to the organization's IT and change management competence, which was recognized in the literature, was nearly absent in the data. In addition, the self-evident nature of expected benefits from ERP systems was given as the prevailing explanation for a lack of investment evaluation and benefits realization practices in the case organizations. Both the organizations and the experts expressed their view that formal evaluation and benefits realization efforts would not pay off. Whilst ERP investments were expected to deliver monetary rewards, relating them to the technology directly through formal analysis was regarded as impractical. Some organizations considered formal evaluation methods and practices as potential political tools for the justification of investment rather than as rational decision-making aids. The analysis also showed that, in some Egyptian organizations, the ERP selection process is not based on rational decisions. In some case organizations, the owners and managers of Egyptian family businesses had mostly built long-term, trust-based relationships with consultants; the adoption of the ERP was based on these relationships and on consultant recommendations. This culture of trust meant that no further system evaluations were considered necessary. Further, the data indicates that the adoption costs often remained unpredictable despite the shared idea of self-evident benefits, and benefits realization may require high expertise and departmental coordination, which might be difficult to achieve in practice. The findings of this study also suggest that the target organizations were neither encouraged nor interested to adopt any benefits realization practises, while being more concerned with costs. Thus, this study calls for more adapted benefits realization practices, cost estimation and budgeting methods, which would be able to better accommodate ERP adoptions in organizations. In addition, the current fundamental assumptions of benefits realization (e.g. extra BR efforts will pay off, lack of maturity affects the adoption of BR practices), which are implicit assumptions in most of the benefits realization literature, might not be shared by adopting organizations nor evident in some cases. This advocates for closer investigations on the reasons behind the neglect of benefits realization practices by many SMEs. Through the adoption of the SME context and TOEES framework, the thesis focused on internal and external environment's stakeholders and pressures. The external pressures were not ascertained as major influencing factors in this study. However, given the similarities between the target cases, the attitudes and rationality towards disregarding formal benefits realization and costs estimation practices in SMEs might

be potentially explained through other theoretical lenses. Specifically, studies that would investigate the coercive, mimetic, and normative isomorphism mechanisms (DiMaggio & Powell, 1983), and their effects on ERP in SMEs' environments. The institutional isomorphism lens would aid us to make a deeper analysis to determine and verify if the target organizations did not adopt the formal practices due to the factors identified in this study, or due to a common *rationality* among the peers and external organizational influences.

By carrying out an in-depth case study, this thesis is able to contribute to ERP retirement research. Retirement is an important phase in ERP lifecycle frameworks; however, it is seldom studied in ERP research. This thesis presented an extreme case of an early ERP retirement and investigated whether cost overrun was the reason for this decision. The findings stressed the importance of user involvement and the use of formal selection methods during the ERP selection process.

The ERP literature has reported on the complexity of ERP adoption projects and their associated risks. In addition, published statistics give a strong indication that ERP adoptions tend to exceed their estimated time schedules and budgets. SMEs have limited resources; thus, time and cost escalations are critical. Hence, this thesis analyzed the existing literature and explored both current and emerging state-of-the-art technologies in order to suggest an integrated future research model. The inclusion of current technologies in practice enables the model to close the gap between "ERP in research" and "ERP in practice" (see fig. 5-4, 5-5). Such integration would potentially reduce many of the risks associated with ERP adoption, including the challenges of cost estimation and management, and benefits realization.

This research also suggests that the mainstream ERP adoption *success* definition may be too strict to be applicable in practice, and "ERP success" as such; could be redefined. In addition, the relationship between the implementation partner and the ERP vendor and its impact on ERP adoption success requires more attention and research (Sarker, Sarker, Sahaym, & Bjørn-Andersen, 2012). Moreover, this study investigated the state-of-the-art technologies and their potential impact on how ERP implementations are delivered in organizations. For example, the adoption of cloud-based ERP is believed to change the ERP implementation process dramatically, and consequently the way risks, benefits, and costs are estimated, managed, and mitigated. Thus, this study advocated for the incorporation of the state-of-the-art technologies within the ERP research topics, in order for research to cope with the fast advancing ERP industry and technologies. Furthermore, the thesis urges for a standardized SME

classification in Egypt, as the current classification based on annual turnover and number of employees is proved to be non applicable in the Egyptian context.
Finally, the literature review provided in this thesis is one of the first reviews with a specific focus on ERP adoptions in SMEs. The review supports researchers who wish to focus on ERP issues in SMEs by providing a list of topics, research gaps, research methods, theories, and findings in the current literature. It also suggests areas for future research.

6.1.2 Contributions to practice

The data collected in this research offers the perspectives of various stakeholders involved in ERP adoption in SMEs. Hence, the findings of this study could support other ERP stakeholders who wish to identify the potential direct and indirect costs in future ERP adoption projects (see fig. 5-1). In addition, SMEs may be better able to predict potential cost escalations, the impact of context and other variables, and the association of these variables with various cost factors, as shown in table 5-1. Moreover, the findings could support those ERP providers and implementation partners who wish to provide more realistic budget estimates to SMEs, based on their contextual characteristics and project scope. Also, ERP providers can use the study findings to refine their existing ERP implementations cost estimation models. This would reduce the tensions between ERP providers and their clients, which usually occur due to unanticipated cost overruns. The thesis findings can also help SMEs to assess and address their weaknesses in relation to the adoption of formal cost and benefits management practices prior to their actual ERP adoptions.
Additionally, the findings can help both ERP vendors and beneficiaries to avoid early ERP retirement situations. As the findings show, the ERP selection (acquisition) phase is not trivial. Indeed, it could lead to a high risk of failure. Thus, SMEs should pay particular attention to this process by involving key users and through adopting formal selection practices. Moreover, this thesis presents the potentials of adopting new state-of-the-art technologies, their expected benefits in terms of facilitating the ERP adoption process, and their implications for the different ERP lifecycle phases. Furthermore, the study sheds light on past and recent issues, challenges, and success stories in the literature, all of which can guide consultants, vendors and clients in their future projects, and aid them in understanding organizational challenges.

6.2 Research limitations

In this section I will discuss the general research limitations. A discussion of those limitations that relate to the generalizability of results and researcher's potential bias can be found in chapter 3 in this thesis.

My original research plan was to adopt a multi-method approach. This approach began with the collection of qualitative data on ERP cost factors and their impact on total costs. This was followed by a quantitative survey. Based on individual projects, a questionnaire was designed, which aimed to gather data from several SMEs regarding their ERP adoption cost factors, estimated budgets and actual expenditures, and cost factor's ranking based on its percentage of total costs. This would potentially have led to the development of a cost estimation model for ERP adoptions in SMEs, thus supporting the rigour of the research findings. In addition, a survey could have increased the generalizability of the findings. However, I was not successful in obtaining a statistically representative number of informants that could offer information on on-site ERP adoption budgeting details in their own organizations. In addition, several informants expressed their concern with regard to the sharing of financial details. Hence, the cost factor rankings presented in this thesis are subject to the opinions and varied personal experiences of the informants who participated in this study. While this research has covered budgeting issues in Egyptian SMEs, however, in-depth focus on risk management and mitigation practices beyond cost overruns was not undertaken. Thus, given its impact on costs and benefits in organizations, risk management oriented research could be a logical complement to this research. Risk management research could provide amore realistic view of expected costs and their risks. Also, would provide mechanisms in order to better mitigate situations where cost escalations impose risks on the ERP adoption process's success. The target organizations were primarily not interested in estimating and identifying benefits, as they shared the idea of the self-evident nature of benefits. This could be due to the fact that these organizations mainly adopted ERP systems to solve technical and operational problems and disruptions. Also several informants within the case organizations elaborated on the political nature of the benefits evaluation process. On the other hand, the participants have expressed their interests in the cost estimation and identification process, as they are more concerned with project budgets than the evaluation of benefits. Thus, this thesis has paid more focus on cost identification and management issues. Opinions and views of the organizations on benefits realization practices have been collected and analysed, however, these topics require more focus in future research.

When considering the contextual characteristics of SMEs in this research, however, several of these characteristics (e.g., maturity) had no proven influence on organizations' behaviour towards formal budgeting and benefits management practices. The study considered contextual environments from a wide perspective; thus, some of the findings might not be context-specific.

6.3 Future research opportunities

The findings and results of this research can be further extended into several areas. First, the thesis identified various gaps in research into ERP in SMEs. For example, the majority of the literature only focused on the first four phases of the ERP lifecycle. Very few studies focused on ERP 'evolution' and 'retirement'. In addition, more variations in research methods are needed, because it is clear that case study and survey research methods dominate the scene today. Moreover, research lacks a focus on ERP adoption costs and benefits management. Also, the EU's definition of SMEs was shown to be inadequate in the Egyptian context. In addition, I was not able to find an alternative, reliable way to classify Egyptian organizations. Thus, it would be particularly helpful if researchers and practitioners could work on standards to classify and categorize Egyptian organizations of various sizes.

The cost factors model presented in this thesis can be further validated in other settings in order to test its comprehensiveness and adequacy in other SME contexts. In addition, questionnaires, which were used to rank cost factors, could indicate the reliability of the rankings presented in this research. The validation and reliability confirmation of these cost factors, and their associations and rankings presented in this research, justify the further development of a suitable cost estimation model for ERP in SMEs. Future research into ERP systems could examine the applicability of the provided cost factors by testing their validity in other organizations of different sizes; for example, in large enterprises. This thesis questions the current formal budgeting and cost estimation methods, and calls for the need for suitable methods to accommodate ERP adoption environments. Future research could include the following suggestions. Firstly, proponents of more formal benefits realization and IT investment evaluation practices may find it useful to study the preconditions for benefits realization in terms of particular types of IT investments. Whilst some IT investments are expensive and mission critical, this may not necessarily mean that in-depth benefits realization or investment evaluation practices are appropriate. In the Egyptian SME context, expected and realized benefits from ERP systems may have been too self-evident to warrant a focus on benefits realization practices. Furthermore,

adherence to less frequently adopted practices may be regarded as harmful in itself if conducted without a wider understanding of the context (leading to political game-playing or misunderstandings about the actual nature of the desired benefits). These two propositions warrant further investigation with regard to different types of information system investments and in other contexts. Secondly, although benefits realization was seen to be less useful in the case studied organizations and in the national context of Egyptian ERP investments in SMEs, this does not mean that such investments are without their own problems. In this case, the benefits seem to be self-evident, even without in-depth evaluation or realization practices. In the target domain, the main problem seems to be the coordination and management of costs, which continue to exceed budgets, sometimes to an alarming degree. Effective and efficient cost control practices for ERP projects are still necessary, even when the benefits are seen to be obvious. Further, research is needed on the way in which ERP adoption drivers and motivations (i.e., technical, strategic, operational) influence organizations' desires to justify their investments. Based on the similarities across the cases, there is a need to investigate the influence of institutional isomorphism (e.g. mimetic) on the behaviour of SMEs towards the non-adoption of formal costs and benefits management practices. Also, the four organizations were originally family owned and managed businesses. Hence, this raises the question whether those types of businesses are different than others when it comes to the need for and adoption of benefits realization and investment justification practices. Moreover, the findings of this study suggest that some vendors/implementation partners could provide unrealistic estimated budgets to their clients. Hence, the well-established Agency Theory may be used in order to explain whether they behave in an opportunistic way, or facing big challenges in estimating projects' scope and budgets. Furthermore, the area of ERP retirement needs further investigation and a more in-depth analysis. Future research is needed to determine why, how and when companies retire their systems. In particular, cross-industry surveys and longitudinal research efforts are highly encouraged.

For decades, ERP mainstream research has focused on such traditional topics as CSF, use and project management. Therefore, future research is needed to explore the potential to link and integrate ERP systems with such new technologies as social networks and enterprise 2.0 tools in general. Specifically, how can ERP systems go beyond integrating processes and functions of organizations to reach such outlying areas as social networking, decision 2.0 and crowd-sourcing. Simultaneously, ERP vendors and partners need to adapt to these changes in order to be able to deliver value to their current and future customers. Finally, the literature review conducted in this

study suggests that free and open source ERP systems are under-researched in current literature. While this thesis does not focus on costs and benefits of FOS ERP, nevertheless, investigating the suitability and applicability of the findings to free open source ERP systems is an interesting avenue for future research efforts.

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Appendix A- Interview guide

As previously mentioned in section 3.2.2, the interview guide used in this thesis has covered several issues related to cost management and estimation practices within SMEs. In addition, it included questions regarding benefits management and realization, and CSFs. As noted earlier, the interview guide has been divided into sections according to the position of the interviewees and their knowledge of the subject.

Interview Guide

This is a list of all the possible questions. Specific interviews were compiled for different interviewee positions or affiliations (e.g., customers, vendors).

Costs Questions

1. What is your position in the company?
2. What is your company size?
3. Which ERP system do you have?
4. Which ERP modules have been implemented?
5. Could you tell me more about what the Implementation means in your case?
6. Have you been involved in any prior ERP implementations?
7. How did you select this specific ERP system/vendor?
8. Did you have any prior ERP/systems before?
    - If YES
        - Which system?
        - And what were the problems/challenges with the old system?
9. What were the drivers for adopting a new ERP system?
10. What was your role/responsibility in the ERP project phases and in which phase(s) did you take part?
11. Since when did the system GO LIVE?
12. Did you have a consultant involved in the implementation?
    - If YES
        - What was the consultant's role / responsibility
        - In which phase(s) did they take part?
13. Could you tell me more about the implementation process?
14. Which implementation methodology has been used? *(e.g., ASAP, Phased. big-bang)*

… was it proposed by the consultant (if any) or vendor?

15. How successful was the implementation from your point view? And then (Scale from 1-5), and what went bad?

- *It is common that project participants perceive success differently among themselves and with management as well. So could you please tell me:*

16. From your point of view, how do you define a successful ERP implementation project?
17. Does the company perceive the implementation as success?
18. How was the budget estimated for this implementation? And who did it?

19. Although it is not an easy task, but did you undertake a Total Cost of Ownership and ROI analysis, in order to predict the costs against the expected benefits?
    - IF yes/no
        - What were the challenges did you face?
20. Where the any Contingency Plans developed or "what-if" scenarios?
21. What was the budget estimated for this project, and how close did it go with the estimated budget? it would be great if they can give me a number or % over or under for both
    - If Crossed

    A. Would you be able to tell me how much?
        - From your point of view, what were the main reasons for crossing the budget?
        - Could you tell me what were the cost factors that influenced the total cost of the implementation? … Could you rank them in relation to total cost?
        - From your opinion, what and who lead for this cost escalation?
        - Who paid the extra cost (for every previously mentioned cost item)?? (beneficiary, vendor, consultant)
        - Were there any hidden costs?
        - When did the majority of costs escalate? (Phase?)
    - If Met
        - From your point of view, what were the main reasons for meeting the budget?
        - Could you tell me what were the cost factors that influenced the total cost of the implementation? … Could you rank them in relation to total cost?
        - Were there any hidden costs?
        - When did the majority of costs escalate? (Which phase?)

- Present a list of common ERP cost factors (Mind map)

22. Do you think that you can add some cost factors to this list? What are their priority(ies)?
23. Who set the time schedule for this project?
24. What was the time schedule for this project, and how close did it go with the estimated time schedule?
    - If Crossed
        - Crossed by how many months?
        - What lead to this delay?
        - Who was responsible for the delay?

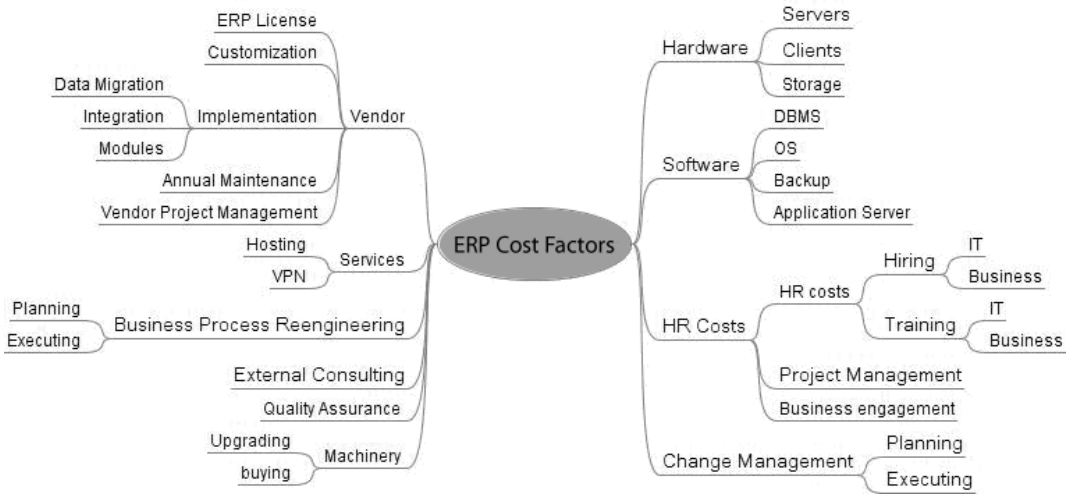
---

25. What was the impact of the ERP system adoption on your company's Business Processes?
26. Did you have enough human resources to commit to the project?
27. If you would advise other companies who will estimate ERP implementation budgets, what would they should think about and take into considerations?

- *In some cases, it is difficult to realize benefits from IT related investments, and some companies don't try to evaluate the investment as long as the system is up and running.*

28. From your point of view, do you think it was worth it invest in this system? And why?
29. One final question, in your point of view, if there is an un-agreed upon escalation of some cost factors that might lead to more expected benefits, would your company would be willing to pay those extra money? Or they will try to stick to as much as possible to the estimated budget?

Cost Factors List



Benefits Realization and Investment Evaluation

1. What is your position in the company?
2. What is your company size?
3. Which ERP system do you have?
4. Which ERP modules have been implemented?
5. How did you select this specific ERP system/vendor?
6. Did you have any prior ERP/systems before?
    - If YES
        - Which system?
        - And what were the problems/challenges with the old system?
7. What were the drivers for adopting a new ERP system?
8. What were the business requirements and their priorities?
9. What were the expected benefits from this ERP system?
10. What are the expected benefits that have not been met by the system?
    - And why they have not been met?
    - Could you give me a number on a scale of 1to 5 on overall expected vs. actual?
11. Did you evaluate the investment so far?
    - IF yes
    - Who have been involved in the evaluation process? *E.g., Key users, top management, external consultants, etc..*
12. What is the impact of the system on the organization?
    - *On business processes*
    - *On user satisfaction*
    - *Organizational change*
    - *Communications within and across the organization*
    - *Company performance*
    - *Costs, could you give me an example?*
13. Have you evaluated the benefits resulted from the system?
    - IF yes
    - How?
14. Did you adopt and benefits management/realization practices?
    - IF yes
        - Which ones?
        - What were the challenges in adopting these practices?
    - IF no
        - Why not?
        - What were the challenges in adopting these practices?

15. Do you conduct a post go-live audit? – How?
16. If you were to advise other companies, what would you advise them to avoid or do?

Selection Questions

1. What is your position in the company?
2. What is your company size?
3. Which ERP system do you have?
4. Which ERP modules have been implemented?
5. How did you select this specific ERP system/vendor?
6. Did you have any prior ERP/systems before?
    - If YES
        - Which system?
        - And what were the problems/challenges with the old system?
7. What were the drivers for adopting a new ERP system?
8. Could you describe the selection process steps? And how many rounds did it take?
9. Did you have a consultant involved in the selection?
    - If YES
        - What was the consultant's role / responsibility
10. What was your responsibility/role in the selection phase?
11. What were your vendor selection criteria dimensions? Could you give me some weights for each one?

--- I will ask here some specific questions related to the selection criteria if I may:

12. What were your business requirements? And what were the priorities?
13. Did you consider a wide range of ERP solutions, or just the well-known ones?
14. Which ERPs you were comparing? And why those in specific?
15. Did you asses your technical status at that time?
    Example:
    - What H/W or S/W upgrades would be needed and its costs?
    - New internal technical skills that may be required to support application going forward.
16. How did you decide on the feasibility of adopting this specific ERP system?
17. Was there a feasibility study for this project? Who prepared it?
18. Did you assess the required organization changes?
19. Did you develop any specific benchmarks?
20. Did you have enough human resources to commit to the project?
21. Were there any Key Users involved in the selection phase?
22. Do you think that your company size had implications on the selection process?

CSF Questions

Questions:

1. How do you use the system? What is your role?
2. Were you involved in the system implementation?
    - If YES
        - What was your role / responsibility
        - In which phase did you take part?
3. What is your opinion about the system? Are you satisfied about it on a scale from 1 to 5?
4. What were your expectations from ERP system?
    - Personal
5. How are your expectations fulfilled?
    - Personal
6. What were the main reasons/motivations for ERP system implementation?

Overall outcomes

7. What are the benefits of the ERP implementation?
8. What are the main business process improvements?
9. What are the limitations of the current ERP?
10. What problems / complications do you face now (IF ANY)?
11. What could be done to overcome these problems

ERP implementation project details

12. What problems / complications did you experience during the ERP systems implementation process?
13. Was the implementation according to the plan?
    - On time
    - Within budget
    - Other resources…

ERP implementation success

14. How do you perceive the implementation project?
15. Do you perceive the project as a success (your personal opinion)?
    - Why YES, why NOT
    - Could you scale it from 1 to 5?
16. How do you define success?
    - What is a success for you in this context?
17. Was the system implementation evaluated by the company?
18. Is the implementation considered as a success by your company?

- Why YES, why NOT
- If YES:
    - How was the success defined / measures / criteria
    - Who was in the evaluation team?
    - Were you involved in this team?

19. To what extent had the system been accepted by the users so far?
20. What are the barriers of acceptance?
21. What kind of user training has been applied?

22. How many hours of user training were provided?
23. Was the training sufficient?

Critical Success Factors

24. Which factors do you consider the most important for the success or failure of the ERP system implementation?
    - Could you rank them according to importance from your point of view?

- NOTE: Present a list of CSFs
    - Do you think that you can add some success factors from this list? What are their (its) priority(ies)?

SMEs characteristics

25. Do you think that your company size had an impact on the implementation process?
26. Which characteristics / features of your company do you consider influential for the ERP system implementation?
    - Which characteristics?
    - How did they affect the implementation?
27. Which characteristics / features of your company do you consider influential for the ERP system utilization / usage?
    - Which characteristics?
    - How do they affect the utilization?

==========

Critical Success Factors' List

- Which factors do you consider the most important for the success of the ERP system implementation?
- NOTE: Prepare a list of CSFs

(Loh & Koh, 2004)

1) Project champion
2) Project management
3) Business plan and vision
4) Top management support
5) Effective communication
6) ERP teamwork and composition
7) Business process reengineering (BPR) and minimum customization
8) Change management program and culture
9) Software development, testing and troubleshooting
10) Monitoring and evaluation of performance

(Snider, 2009)

1) Operational process discipline
2) Small internal team
3) Project management capabilities
4) External end-user training
5) Management support
6) Qualified consultant

Somers & nelson (2001) & Winkelmann et al. 2008

1. Top management support
2. Project team competence

3. Interdepartmental cooperation
4. Clear goals and objectives
5. Project management
6. Interdepartmental communication
7. Management of expectations
8. Project champion
9. Vendor support
10. Careful package selection
11. Data analysis &conversion
12. Dedicated resources
13. Use of steering committee
14. User training on software
15. Education on new business processes
16. Business Process Reengineering
17. Minimal customization
18. Architecture choices
19. Change management
20. Partnership with vendor

SMEs Characteristics

Supyuenyong et al (2009)

1) Ownership and management structure
    - Ownership type
    - Organizational structure
    - Management support
    -
2) Customers and markets
    - Market area
    - Focus on local market
    - Few internationalization markets
    - Close relationship between employees and customers
    -
3) Systems, processes and procedures
    - Level of diversification
    - Simple planning and control systems
    - Less complex operations
    - Processes adaptable to various situations
    - Focus on operational processes
    -
4) Human capital management
    - Lower degree of job specification
    - Employee evaluation is not standardized
    -
5) Culture and behaviour
    - Informal culture

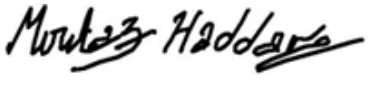
Appendix B- Data use & confidentiality agreement

Data Use and Confidentiality Agreement

The data collection and interviews are commenced in order to publish several high quality research papers in ERP area within the Information Systems domain. These research publications would have implications on research and practice. The research articles will be published as partial fulfilments of my PhD thesis, under the umbrella of the Information Systems Department, and the Enterprise Systems Centre at the Faculty of Economics and Social Sciences, University of Agder (Universitetet I Agder) in Kristiansand, Norway.

I hereby **declare that:**

1. ***All the interviews will be recorded, transcribed, and translated to English.***
2. ***The interview data will be*** *confidential.*
3. ***The interview data will*** *not be shared* ***with anyone within or across organizations.***
4. ***The data will be electronically and*** *anonymously* ***stored, without the interviewees' names or affiliations.***
5. ***The data will be stored*** *encrypted* ***on the computer, to prevent illegal usage in case of theft or intrusions.***
6. ***Names and affiliations*** *will not be published* ***within the research publications (unless the interviewees/companies state otherwise).***
7. ***The interview data will form bases for academic research articles, and there is a possibility of*** *anonymously* ***quoting some statements.***
8. ***Specific parts of interviews' transcriptions might be shared*** *anonymously* ***with other articles' co-authors.***
9. ***The articles will be published in high-class Information Systems/ERP conferences and journals (*****and as part of my PhD articles*****).***
10. ***The data*** *will never be shared* ***with competitors or in any other commercial form.***
11. ***All the articles will be sent to relevant interviewees before publishing, in order to*** *confirm* ***that the researcher(s) interpreted their views correctly.***



Research Fellow in Enterprise Systems

University of Agder, Norway.

07-March-2010

Appendix C- Research publications

No.	Publication	Publication outlet
1	Haddara, M. and Zach, O. (2012). ERP in SMEs: An Extended Literature Review.	International Journal of Information Sciences (IJITS), 2, (6) pp. 106-116.
2	Elragal, A. and Haddara, M. (2010). The Use of Experts Panels in ERP Cost Estimation Research.	Communications in Computer and Information Science (Vol. 110, pp. 97-108), Springer.
3	Haddara, M. and Päivarinta, T. (2011). Why Benefits Realization from ERP in SMEs Doesn't Seem to Matter?	Proceedings of the 44th Hawaii International Conference on System Sciences (HICSS), Kauai, Hawaii, USA, IEEE Computer Society Press.
4	Haddara, M. (2012). Exploring ERP Adoption Cost Factors. Journal of Computer Technology & Applications (JCTA) 3(3) (2012), 250-261.	Journal of Computer Technology and Applications (JCTA), Vol. 3, 3, pp. 250-261.
5	Haddara, M. and Elragal, M. (2013). ERP Lifecycle: A Retirement Case Study.	Information Resources Management Journal (IRMJ), Vol. 26, 1, pp. 1-11.
6	Elragal, A. and Haddara, M. (2012). The Future of ERP Systems: look backward before moving forward.	Procedia Technology, Vol.5, pp. 21-30, Elsevier.

International Journal of Information Science 2012, 2(6): 106-116
DOI: 10.5923/j.ijis.20120206.06

ERP Systems in SMEs: An Extended Literature Review

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Abstract This review summarizes research on enterprise resource planning (ERP) systems within the domain of small and medium-size enterprises (SMEs). Due to the close-to-saturation of ERP adoptions in large enterprises (LEs), ERP vendors now focus more on SMEs. Moreover, because of globalization, partnerships, value networks, and the huge information flow across and within SMEs nowadays, more and more SMEs are adopting ERP systems. Risks of adoption rely on the fact that SMEs have limited resources and specific characteristics that make their case different from LEs. The main purpose of this article is to shed the light on the areas that lack sufficient research within the ERP in SMEs domain, suggest future research avenues, as well as, present the current research findings that could aid practitioners, suppliers, and SMEs when embarking on ERP projects. Moreover, this research highlights the theories, frameworks, and research approaches and methods currently adopted in ERP for SMEs literature.

Keywords ERP, SMEs, Literature Review

1. Introduction

ERP systems have received a substantial attention from both academia and practice. Many research articles dealing with ERP systems have been published, covering various topics and issues. Moreover, a number of ERP literature reviews have been conducted[e.g., 1, 2-4]. These reviews provide overviews of existing ERP literature from a general point of view. Since ERP literature is a broad topic, we focused our review on ERP in SMEs that would provide a more detailed analysis and deeper understanding of this domain.

SMEs have been recognized as fundamentally different environments compared to large enterprises[5]. In relation to ERP implementations, organizational size plays an important role[6, 7]. The literature argues that little attention has been given to research on ERP in SMEs, as the majority of the ERP studies are based on findings from

large enterprises[8, 9]. Up to our knowledge, there are no existing literature reviews covering this particular area.

The objective of this paper is to present a comprehensive review of literature on ERP in SMEs in order to illustrate the status of research in this area, and to assist researchers in pinning down the current research gaps. A total of 77 articles were reviewed and organized into ERP life-cycle phases as described by Esteves et al.[10].

The rest of the paper is organized as follows. Section 2 presents the research methodology. Section 3 provides an overview of the articles reviewed. Section 4 provides our findings. Section 5 discusses our observations and recommendations for future research. Finally section 6, discusses the paper implications on research and practice.

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2. Research Methodology

Literature reviews represent a well-established method for accumulating existing knowledge within a domain of interest. In this article we have applied a systematic review approach [11]. This approach is characterized by adopting explicit procedures and conditions that minimize bias[11].

The review covers articles published between the years 1999-2009. We have narrowed down the search process through a condition, that the articles need to be published in peer reviewed journals or conference proceedings. Moreover, no delimitation has been imposed on the outlets' field, to enable potential research results from various fields. The following search procedures have been applied to provide a comprehensive and systematic methodology.

An initial search was done through Google Scholar. The search option was limited to articles' titles. The keywords: ERP, Enterprise Recourse Planning, SMEs, Small and Medium Enterprises, and their combinations were used.

1. Due to their high relevance for IS research, another search in EBSCOhost and Web of Science was conducted. The search procedure was restricted to the same keywords as in the previous step. In addition to the title area, the abstract and keyword parts of the articles have been included into the search.

2. In order to ensure that no articles were omitted by the search engines used in the previous steps, we went through

tables of contents of selected outlets. These included top IS journals (MISQ, ISR, CACM, JMIS, ISJ, and EJIS) and journals related to the research field (JEIM, EIS, and IJEIS). We searched for the keywords across all issues published during the delimitated period. The same procedure was applied to the proceedings of four top IS conferences (ICIS, ECIS, AMCIS, HICSS).

3. Both authors carefully read the articles' abstracts to check their relevance and adequacy for the review. Only articles directly addressing ERP in SMEs were selected.

4. In addition, we conducted a secondary search through scanning all the selected articles' reference lists, in order to identify further potential literature sources.

In order to better organize the review arrangement, we adopted the ERP life-cycle framework developed by Esteves et al.[10]. It consists of six phases representing different stages an ERP system goes during its life-cycle within an organization. The phases are: adoption decision, acquisition, implementation, use and maintenance, evolution, and retirement. A brief description of each phase is provided in section 4. In addition, the authors independently classified the articles into a concept matrix[12], which included the research themes, approaches, theories, and methodologies. Results were consequently compared and discussed in order to achieve consensus on the articles' classification. It is important to mention that an article could fall in one or more phases and themes.

A number of research articles proposed various ERP life - cycle models[e.g., 10, 13, 14, 15]. There are two important reasons why we adopted Esteves et al.[10] framework. First, it applies more granular approach compared to other models. It provides more detailed understanding of the ERP life-cycle and thus better classification of the articles. In particular, the framework clearly distinguishes between system adoption and acquisition, as these are two diverse phases that are usually merged in other models. Furthermore, the framework separates between system evolution and retirement. Second, it has been previously applied by other researchers reviewing ERP literature[3, 16]. This enables a comparability of our findings with formal literature reviews.

3. Overview of the Articles

In total, we reviewed 77 articles. Of these, 48 are journal articles and 29 conference proceedings. The articles were published in 44 various outlets, involving 26 journals and 18 conferences. As illustrated in tables 1 and 2, journals had the biggest share of publications with JEIM leading by 10 articles, and AMCIS by 5 conference publications.

The review shows a gradual increase in research interest in ERP in SMEs (fig 1.), with a maximum of 20 publications in 2008 followed by a decline to 11 articles in 2009. Figure 2 illustrates the research methods distribution among the articles. Case studies and surveys are clearly the dominant methods, while other methods are comparably less frequently used.

Table 1. Journal outlets and publications

Journal	Number of publications
Benchmarking: An International Journal (BIJ)	1
Business Information Systems (BIS)	1
Business Process Management Journal (BPMJ)	3
Communication of the Association for Computing Machinery (CACM)	1
Communications of the Association for Information Systems (CAIS)	1
Communication of the International Information Management Association (IIMA)	1
European Management Journal (EMJ)	1
Engineering Letters Journal (IAEG)	1
Industrial Management and Data Systems (IMDS)	3
Information Systems Journal (ISJ)	2
Information Systems Management (ISM)	1
International Journal of Enterprise Information Systems (IJEIS)	2
International Journal of Enterprise Network Management (IJENM)	1
International Journal of Integrated Supply Management (IJISM)	1
International Journal of Operations and Production Management (IJOPM)	2
International Journal of Production Economics (IJPE)	4
International Journal of Production Research (IJPR)	3
International Journal of Project Management (IJPM)	1
Journal of Accountancy (JofA)	1
Journal of Enterprise Information Management (JEIM)	10
Journal of Manufacturing Technology Management (JMTM)	2
The Journal of Strategic Information Systems (JSIS)	1
Journal of Information Technology (JIT)	1
International Journal of Procurement Management (IJPM)	1
Media Informatika	1
Omega (The International Journal of Management Science)	1
Total 26	48

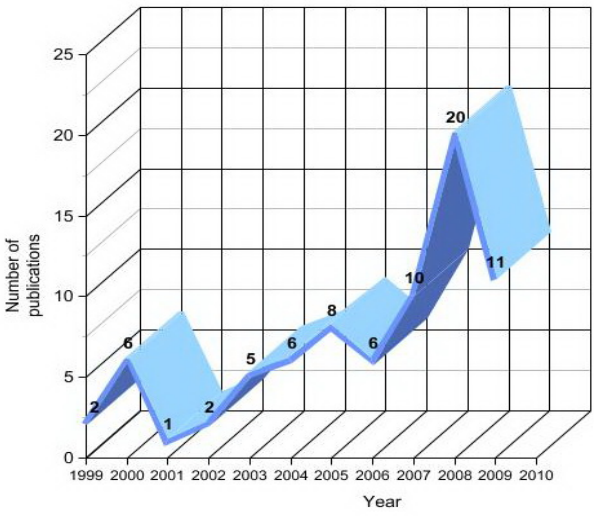

Figure 1. Number of publications per year

Table 2. Conference outlets and publications

Conference	Number of publications
AIM International Conference	1
Americas Conference on Information Systems (AMCIS)	5
Annual SAP Asia Pacific	1
Australasian Conference on Information Systems (ACIS)	2
European and Mediterranean Conference on Information Systems (EMCIS)	2
European Conference on Information Systems (ECIS)	2
Frontier of e-Business Research (FeBR)	1
GMSARN International Conference	1
Hawaii International Conference on System Sciences (HICSS)	3
International Conference on Enterprise Information Systems (ICEIS)	2
International Conference on Information Systems (ICIS)	1
International Engineering Management Conference	1
International MCETECH Conference on eTechnologies	1
International Conference on Management of Innovation and Technology (ICMIT)	1
International Conference on Service Systems and Service Management	1
Pacific Asia Conference on Information Systems (PACIS)	2
Stimulating Manufacturing Excellence in Small and Medium Enterprises Conference (SMESME)	1
World Multi-conference on Systemics, Cybernetics and Informatics (SCI)	1
Total 18	29

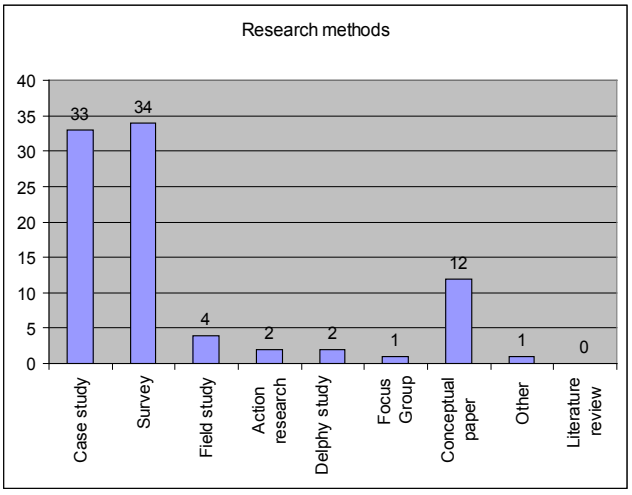

Figure 2. Research methods

As shown in Figure 3, the implementation is the most discussed phase in literature, which is in alignment with several formal literature reviews on ERP systems[3, 16]. Moreover, the figure illustrates the clear difference of research focus among the phases.

Table 4 provides a list of publications that have adopted theories or established frameworks. Some papers have adopted more than one theoretical lens. The richness of theory or framework use varies among articles; however, we list the articles that explicitly mentioned their adoption and use of theories.

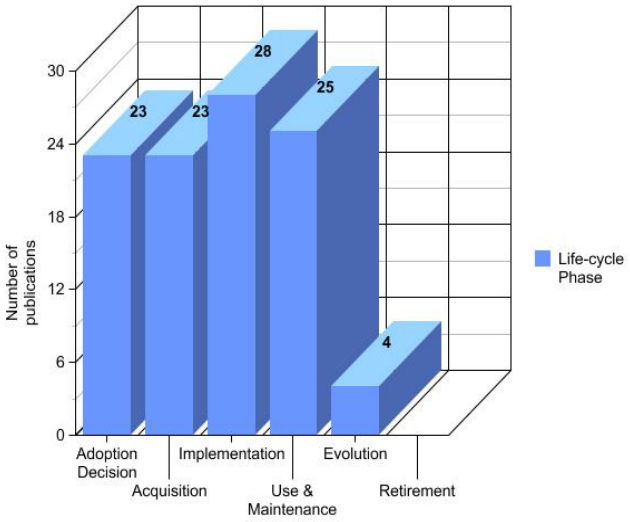

Figure 3. ERP life cycle

4. Findings

In this section, a brief overview of the articles for each phase is presented. It is not intended to provide a detailed discussion of each article, but rather an attempt to briefly present the topics and issues discussed in literature. For the articles reviewed in each phase, refer to Table 3 below.

Table 3. Article categorization

Life-cycle phase	Issues	Reference articles
Adoption decision	Adoption drivers	[6, 7, 17-26]
	Adoption evaluation	[17, 22, 24-31]
	Organizational characteristics	[6, 7, 22, 24, 26, 31, 32]
	Other adoption issues	[8, 14, 28, 33-35]
Acquisition	Factors affecting selection	[18, 19, 36-41]
	Selection criteria	[29, 38, 39, 42-44]
	In-house developed systems	[45-47]
	Other acquisition issues	[8, 14, 33, 42, 47-52]
Implement-ation	CSFs	[9, 40, 41, 49, 53-57]
	SME characteristics	[6, 50, 53, 57-60]
	Impact of consultant	[58, 61, 62]
	Risk management	[33, 48, 63]
	Other implementation issues	[6, 8, 14, 40, 62, 64-69, 81]
Use and maintenance	Benefits	[6, 40, 41, 70-77]
	Use	[6, 14, 48, 50, 63, 77-81, 85]
	ERP impact	[36, 37, 82-84]
Evolution		[14, 86-88]
Retirement	-	-

Table 4. Adopted theories & frameworks

Theory/framework	Reference articles
Dialectic perspective	[60, 81]
Process theory	[9, 14]
Technology-Organization Environment framework	[20, 21]
IT Conversion theory	[88]
Punctuated Equilibrium theory	[66]
Social Process theory	[66]
Grounded Theory	[14, 61, 62]
Innovation Diffusion theory	[33, 51]
Organizational Change theory	[33]
Neo-institutional theory	[33]
Complexity theory	[33]

4.1. Adoption Decision

During this phase, organizations identify their business and technical needs, and question the need for an ERP system. Current ERP literature has tackled several issues related to ERP adoptions in an SME context and environment.

Adoption drivers. Several papers discussed ERP adoption drivers in SMEs from different angles. Few studies[20, 21] have adopted the Technology-Organization - Environment framework (TOE) to develop a model that can be applied to predict which SMEs are more likely to become adopters of Enterprise Systems (ES). Although, the model developed was applied to predict the factors influencing the willingness of SMEs to adopt ES, nevertheless it does not differentiate between factors that affect each type of system solely (e.g. ERP, SCM). In[20, 21] they concluded that SMEs' ES adoptions are more influenced by internal organizational and technological factors, sooner than industry and market related factors. On the contrary, a study[23] suggests that, the higher an SME collaboration within a network of organizations, the more likely to adopt an ES, and more environmental influence it will get.

Adoption evaluation. A study conducted in India argues that business needs, competition, market survival, and customer retention are among the main drivers that force SMEs to adopt ERP system[29]. Ravarini et al.[30] propose a pre-adoption framework for evaluating the suitability of an ERP system in alignment with the degree of business complexity, and the extent of change that a company envisions to achieve. Blackwell et al.[27] developed a decision-support systematic methodology that assists decision makers in regard to adoption decisions and could enhance the overall outcomes from the ERP adoption project. Other studies states that CEO's characteristics and the ERP perceived benefits are correlated with ERP adoptions' outcomes in Taiwanese SMEs[25]. ERP cost *per se* is not a major factor in adoption decisions[25], especially in the adoption or non-adoption of free open source ERP systems in comparison to proprietary ERPs[17].

Organizational characteristics. Other researchersstudied the influence of specific organizations' characteristics on ERP adoption decisions. Research results shows that business complexity is a weak predictor of ERP adoption[7], while organization size is a strong adoption predictor[6, 7, 22, 26]. Moreover, SMEs' willingness and readiness of adopting ERP systems are affected by industry type in manufacturing firms[22, 31]. Other studies argue that the scarcity of financial resources, and the challenges that face SMEs while evaluating and selecting ERP do not have an influence on ERP adoption decisions[24], and that adoption drivers may vary according to SME size[32].

Other adoption issues. Several adoption-related issues were discussed in literature. A study by Muscatello et al.[8] reported that project management activities have a huge influence on the success or failure of ERP adoption projects in US manufacturing SMEs. On the contrary, another research shows that formalized management does not promise implementation risk minimization in small manufacturing companies[33]. In[34, 35] they developed and applied a multi-disciplinary Customer-Centered ERP Implementation (C-CEI) method. They present C-CEI as a tool that could assist SMEs in selecting appropriate ERP Systems, which match their process requirements. They argue that this method would decrease the risk of ERP and organizations misalignment.

One of the few ERP marketing studies has been done by [28]. The research had a vendor-customer perspective. The paper construes that ERP suppliers' marketing abilities and customer reach strategies determine ERP diffusion and adoption success in SMEs, rather than SMEs' low demand or failure in the adoption process.

4.2. Acquisition

This phase includes the process of ERP package and vendor selection that best *fit* the organization requirements.

Factors affecting selection. In order to better understand and evaluate the acquisition and selection process, many studies identified the factors that affect ERP selection in SMEs, and proposed criteria to optimize the selection process. Results show that internal organizational factors like business complexity, change management, and external factors like supply chain partners, and the pressure of value networks affects the ERP selection process in Greek SMEs [36-38]. While other research conducted in Australian SMEs, suggest that cost drivers, functional requirements, flexibility, and scalability of the ERP system[41], and the degree of ERP alignment/fit with the business processes[40] have a great influence on acquisition decisions. Moreover, in[18, 19], they compared Finnish small, medium, and large enterprises. They explored the relationship of enterprise size with the ERP selection process. Their results show that small companies appear to have problems with the ample information for decision-making, and sufficiency of participation from different organizational functions in the ERP system selection phase.

Selection criteria. This part presents research that developed or explored the criteria that SMEs use in order to

select their ERP systems. In[44], they stated that the ERP fit with organization business processes appeared to be the most important selection criterion in Nordic European SMEs, whilst others developed criteria that can aid SMEs in the selection process. The dimensions were local support, affordability, suppliers' business domain knowledge[29], or a methodology for selecting the best-fit ERP system with make-to-order (MTO) SMEs' environments[39].

In-house developed systems. In ERP for SMEs literature, few research papers questioned the feasibility of in-house developed systems over off-the-shelf ERPs as in[45, 46]. These papers argue that standard ERP packages could compel rigid structures and inflexibility on niche SMEs, and in-house developed systems might be more suitable in some cases. Correspondingly, Sledgianowski et al.[47] conducted a case study and reported that in some cases, ERP offshore outsourcing could be more feasible and beneficial for SMEs.

Other acquisition issues. CEOs' technology awareness, employees' IT competence, firm size, ERP compatibility[49, 51], and project management[8], are among the CSF for selecting the right ERP for SMEs. Other researchers furnished recommendations and methods that could be of assistance in managing and minimizing the key risk factors during the ERP selection process[33, 48]. Other studies went further and conducted a comparative analysis of the impact of size on the selection procedures in LEs and SMEs[42, 52], as well as, across industrial sectors in Taiwan[50].

4.3. Implementation

This phase includes the actual ERP installation, customization, business process re-engineering (BPR), and all other activities that align the system with the organization requirements. The ERP implementation phase is very critical, as well as, the most resource consuming phase. Several studies focused on different corners during the implementation process.

Critical success factors. The adequacy of general-ERP implementations CSF in relation to Belgian SMEs-specific characteristics were examined in[53]. The study discovered that most of ERP CSF apply to SMEs with some exceptions. Likewise, a study analyzed implementation success factors in small size firms and concluded that the CSF in literature are adequate when applied on small organizations[49]. Another article presented an analysis of the CSF related to Chinese SMEs' characteristics[57]. While top management support, ERP system quality, and knowledge sharing during implementations, were found key CSF in Thai SMEs[54], however, BPR was found to be a key factor of success[57].

In[56], the authors developed a framework for ERP implementation CSF assessment in small manufacturing firms. Moreover, Loh et al.[9] used the Process Theory in order to identify the implementation critical elements through case studies in the UK. The study concluded that critical success factors, critical people and critical uncertainties contribute to the success or failure of ERP implementations in SMEs. Reuther et al.[41] and Marsh[40] carried out an analysis to determine the key success and failure factors of ERP implementations in Australian SMEs. Further, in Snider et al.[55], they presented a detailed case analysis of successful and unsuccessful implementations in five Canadian SMEs. Finally, a new CSF ranking that would be more adequate to SMEs environments is needed[57].

SME characteristics. As organization-specific characteristics and contexts have been always important research aspects, they attracted researchers to investigate their implications on the ERP implementation process. A study presented a conceptual model that could help implementers, vendors, and consultants implementing SAP R/3 ERP to better understand the system expectations by SMEs in certain contexts or regions (e.g. Australia)[59]. Since organization size and business complexity affect ERP implementations, it was reported that implementations in Irish SMEs are usually easier and shorter in duration than those reported in ERP literature[58]. In[60], through adopting a vendor's perspective, they recommend that ERP systems need to be localized according to the local management features. SMEs' characteristics and culture play an important role in the success or failure of ERP implementations in Belgian SMEs[53], while cultural issues did not play a major role in ERP implementations within Chinese SMEs[57]. Moreover, ERP implementation methodologies differ between different organization sizes and business complexities, as LEs are more reluctant to adopt a Big-Bang approach than SMEs[6]. Further, a comparative analysis on ERP implementation rates and success, between different organization sizes and industrial sectors in Taiwan shows that ERP implementations in electronic and science industry SMEs are usually more successful than those in traditional industry[50]

Impact of consultants. Although experienced consultants can play an important role in correcting their client companies' "unrealistic expectations" of ERP implementations [58]; however, a study in Taiwan shows that consultants could still face resistance from SMEs' managers[58]. On the contrary, through Grounded Theory approach,[62] states that if SMEs implement an SME-specific ERP system, they will not need external consultancy, which will decrease their investments dramatically. Moreover, SMEs will save time and high costs of training, which are usually, associated with standard ERP packages.

Risk management. Few papers discussed risk management during ERP implementations in SMEs. In[63], they portrayed how SMEs should deem and manage the risks in their ERP implementation projects. Poba-Nzaou et al. [33] discuss methods for ERP implementation risk management and minimization in manufacturing SMEs. Iskanius[48] applied and advocated for using the risk analysis method (RAM), to identify and asses the critical risks of the ERP implementations, and to apply the characteristics analysis method (CAM) in order to help SMEs in dividing ERP implementation projects into sub-projects.

Other implementation issues. Project activities, coordination, and project sponsors[8], employee behaviour,

individual characteristics of ERP project management's team, and organization culture have a great effect on the success of ERP implementations in SMEs[64].

Chan[67] emphasized the importance of knowledge capturing and management during implementations in SMEs. The study identified the essential knowledge required for ERP implementations, and proposed a framework to manage it, through matching the required knowledge with the ERP capabilities and features. Moreover, Zain[69] proposed the application of the FAST (Framework for Application of Systems Thinking) system development methodology while implementing ERP systems in cigarette manufacturing SMEs. The study concludes that using such an agile method could assist in reducing and filtering common problems that occur during ERP implementations.

Newman et al.[66] conducted a study on two Chinese small and medium companies. Through business process modeling, the study compares and analyzes the process of ERP implementation in these two companies, and discusses their decisions concerning business process re-engineering. Likewise, in[68], they emphasized the importance of business process modeling, management and re-engineering ex ante implementations. Their study was a simulation on niche Italian SMEs. They conclude that in some cases, ERP systems should be customized to fit with niche SMEs and not vice versa, as they might lose their competitive advantage by complying with standard ERP processes.

In comparison with LEs, SMEs suffer scarcity of financial resources; however, only two papers have discussed ERP costs in an SME context. Through a survey analysis, Equey et al.[65] investigated and evaluated the costs that occurred during ERP implementations in several Swiss SMEs. They found that size, consultants' experience, and people characteristics have a great influence on ERP projects costs. Moreover, implementations at larger companies generally cost much more than at smaller companies, however, a survey by Mabert et al.[6] shows that cost of ERP software at SMEs is higher as a percentage of overall cost than at LEs.

4.4. Use and Maintenance

After the sizeable efforts and investments in ERP implementations, companies start to use the systems. Many issues emerge after the systems' "go-live", like system acceptance, user satisfaction, benefits realization, system utilization, and maintenance.

Benefits. ERP benefits expectations and realization have always been problematic issues for the majority of companies. The difficulty originates to several reasons. Here we present some of the issues discussed in literature.

Although benefits realized could differ in each SME industry[41], or organization size[6], several studies argue that realizing benefits from ERP systems can not be done unless there has been an *ex-ante* efforts to define and audit these expected benefits[41, 70-72, 75]. However, if SMEs make the right choices in the ERP selection phase, some benefits from ERP systems could be self-evident[41, 73, 74] and tangible[40]. Moreover, a study in Swiss SMEs concludes that the benefits realized from ERP systems exceed their costs[76]. Whilst another study reports that benefits realized from ERP systems are higher in LEs than SMEs[77].

Use. Even if the ERP implementation was successful, for many practitioners and researchers, the usage of the systems is considered the *moment of truth* of an ERP system. If the implementation was successful but the system was not used or "accepted" by users, then it is considered a failure. Thus, many studies were focused on use, user motivation and satisfaction related issues.

Adopting ERP's standard best practices is the aim of many SMEs, as they see it as a gateway for standardization and regional or international markets. However, through a dialectic perspective, Nathanael et al.[81] argue that best practices, when imposed on SMEs, might affect the motivation of the users, and lead to the loss of the *know-how* and the competitive edge of these companies. Moreover, if ERP systems were more agile and responsive, this would utilize the system use and offer a competitive edge for MTO and traditional manufacturing SMEs[78-80]. A case study results show that user satisfaction and system acceptance rates in LEs are higher than those of SMEs[77]. Further, Wu et al.[50] argue that user satisfaction in Taiwanese electronic and science industries' SMEs is higher than of LEs in the same industry and SMEs in other industrial sectors. In order to minimize the risk of challenges related to user acceptance and motivation, Huin[85] developed a multi-agent model that can decrease the risks related to system use and user acceptance, through organizing the ERP project management activities. In addition, enhancing user communication, training, and obtaining short-term successes could positively impact the motivation and users' system acceptance rates within SMEs[48]. In[63], they state that risk management is a continuous process. They also recommend that benefits and risks in the use and maintenance phase should be re-assessed once or twice a year, in order to manage the impact of stirring risks, and to govern system usage and avoid slipping into old procedures

ERP impact. Introductions of new information systems in companies are accompanied by changes with their business processes, structure, and communications within those companies. Likewise, ERP systems affect many corners within organizations. A case study in an MTO medium-sized company reports that, the ERP adoption had a positive impact on visibility, quality, and control of information, which in turn enhanced the decision making process[84]. Using the Six Imperatives framework, Argyropoulou et al.[36, 37] evaluated the impact of ERP systems on Greek SMEs' business performance. In[82], they attest that ERPs impact on productivity is moderated by SMEs size. Another study[83] adopted an organizational cross-functional point of view in order to evaluate the impact of ERP implementation on different business functions. The study concludes the smaller the size of the organization, the more it

will benefit from the ERP system's cross-functionality capabilities.

4.5. Evolution

This phase involves the extension of ERP systems through integrating other systems or applications, such as customer relationship managements, supply chain management, and advanced planning and scheduling systems.

In[86], the authors state that SMEs which had successful ERP system implementations, are now investigating means of how to extend it in order to support their external operations. The study concludes that, with the use of Internet, ERPs can be extended to cover SMEs' entire supply chain, which in turn will enhance their external operations and relationships. Another study developed an ontology-based conceptual framework. The study argues that, representing the implementation processes using ontology domains, classes, and relations could enhance the coordination and project management during ERP implementations in SMEs[88]. Further, Metaxiotis[87] carried out a study to investigate the raison d'être for integrating knowledge management (KM) systems and ERP systems in SMEs. The study suggested an ERP extension and KM integration framework.

4.6. Retirement

Retirement phase corresponds to the stage when an ERP system is substituted by another information system. No articles were identified in this phase.

5. Discussion and Future Research Avenues

The reviewed articles are spread across 44 various outlets. Among the outlets, we have recognized only one special journal issue in JEIM focusing on adoption of ICT by SMEs, which included several ERP related research papers. As the research interest on ERP in SMEs is increasing, research outlets should pay more attention to this domain.

In general, 77 articles across 10 years period is relatively a low number of publications. Despite the need for research on ERP in SMEs was recognized in previous literature, still the amount of research conducted on this issue is limited. Thus, more research needs to be carried out in order to gather sufficient knowledge about this phenomenon, as SMEs did not receive appropriate attention in comparison with ERP in LEs.

Based on our ERP in SMEs literature review, in the following part we present some research gaps and suggestions organized according to life-cycle phases:

Adoption. In IS literature in general, and in ERP literature in specific, the term "adoption" is variably perceived by authors. Some authors perceive it as a final stage in which users accept the ERP system, and others define it as the preliminary stage when companies decide on investing in an ERP system.

Although some papers tackled the pressures or motivations imposed by suppliers and partners for ERP adoptions by SMEs, still there is a gap in studying national government policies, rules and laws and their consequences on ERP adoptions in SMEs.

Acquisition. The current literature lacks focus on new technologies (e.g. Software as a Service-SaaS) and their implications on ERP projects. Moreover, ex-ante cost estimation, financial feasibility, and investment evaluation studies of ERP projects have not been identified in our review of literature. Furthermore, literature lacks cases that compare between SMEs'-specific ERP and general ERP systems, as well as, industry-specific ERP packages vs. general ERP ones.

Implementation. Some articles examined ERP projects' success and CSF in SMEs, however, there was no clear definition for *success*. Moreover, the differences of ERP implementation methodologies and their impact on ERP projects had scant attention.

Use and maintenance. Interface language and ERP localization and their effect on user satisfaction are rarely discussed in literature. In addition, post implementation audit strategies and ex-post investment and financial evaluations were not discussed in literature.

Evolution and retirement. Regarding the ERP life-cycle phases, the first four phases were noticeably captured in literature. As recently SMEs started to adopt ERP systems to enhance their operations, value networks, and expansion goals. Thus, it is not surprising to find very few papers discussing ERP evolution, as ERP systems require time to mature enough and recompense in order to convince organizations to extend them further.

We were not able to find any article that directly addresses the retirement phase. Thus, we recommend more focus on the evolution and retirement phases, as they can shed the light on the motivations for extending or replacing ERP systems.

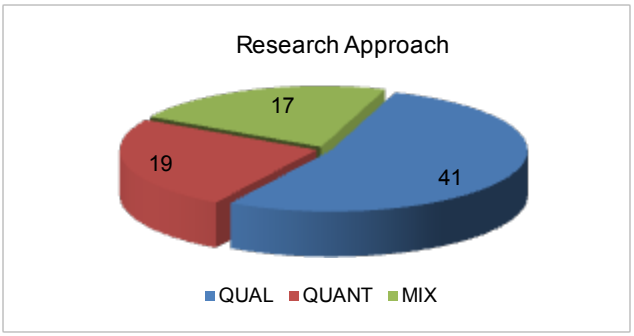

Figure 4. Adopted research approaches

General comments. Although comparisons between SMEs and LEs cases were found in literature, yet the size differences among SMEs were seldom discussed, and they could provide valuable research insights. In relation to type of organizations, the cases studied were often conducted in traditional manufacturing SMEs. Only few articles elaborated on the manufacturing context or type of industry,

however, difference in production strategies or industries could produce different research findings. Besides the SME type and context, another important observation evolved from our review, which is the "SMEs" perception. Some studies delimitate SMEs differently. Some research define an SME in a qualitative manner (e.g.[28]), while the majority of them define SME in terms of number of employees, annual revenue, or their combination. However these numbers differ as well, particularly depending on the geographical location of the study. Adopting the European Union's definition, most studies define SMEs as organizations with less than 250 employees. Interestingly, some researchers have applied a more granular approach distinguishing between subgroups (e.g. small, micro) within SMEs (e.g.[16, 18, 19]). Both, type of investigated organizations and SME definitions are likely to influence the research findings. Therefore, researchers need to be cautious about these issues and elaborate on specificity of each particular environment.

While there were many studies with a national perspective, however, we were not able to find any cross-national studies. This kind of comparison might be fruitful for ERP literature in SMEs. Also, most of the studies were embarked in America, Australia, Europe or Asia. It would be prolific to have some studies on African or Middle Eastern SMEs as well.

Surveys and questionnaires can be quantative or qualitative in nature. Although surveys were highly used, however, figure 4. shows that 53% of the research publications have adopted a qualitative research approach. As many publications have reported that they conducted surveys, still they reported and analyzed them qualitatively, and only 25% of the publications have used a quantitative approach. According to Eisenhardt[89], multiple data collection methods could strengthens theory grounding and theory building through evidence triangulation. Thus, 22% of the studies have adopted mixed research approaches, through combining both qualitative and quantitative approaches and data collection methods. Most often a combination of case studies and surveys was employed. Qualitative studies can provide rich explanations and explorations to emerging phenomena; however, we call for a focus and use of other research approaches, as they can provide different angles of data interpretation. Moreover, use of theories in ERP literature in SMEs is very limited, as only 15% of the papers have adopted a theoretical lens (see fig. 5). This could be attributed to many reasons, among which, the complexity of finding relevant theories that could explain certain technical issues for example. Still, we call for more theory use, theorizing, and reporting on the difficulty of adopting theoretical lenses if any.

As shown in figure 2, only two Action Research (AR) papers were identified, however, we think that AR and similar engaged methods could provide very valuable hands-on experiences for ERP in SMEs literature and practice.

There is also a need for more papers on Open Source (OS) ERP systems, and comparative studies of OS ERP vs. proprietary ERP systems.

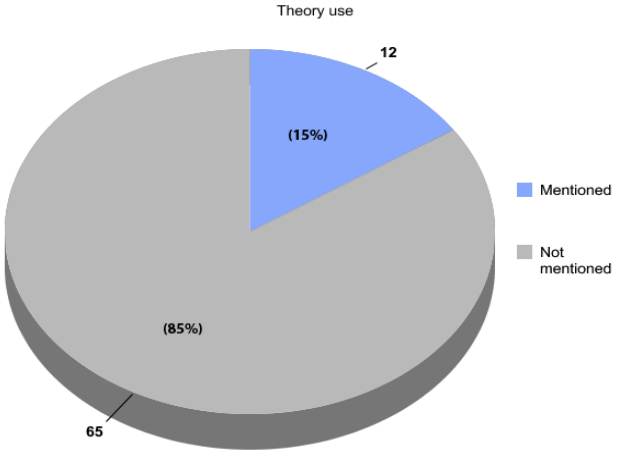

Figure 5. Theory use

While SMEs usually have limited resources, and costs and benefits from ERP implementations continues to be an issue, more research need to address these topics.

Finally, existing literature have usually adopted a one sided perspective in data collection (e.g. customer side), while other perspectives could enhance the understanding of certain phenomena. Finally, it could be beneficial if research provides some reports on ERP failure cases, which might assist stakeholders in avoiding previous pitfalls.

6. Conclusions

This paper contributes to both research and practice through providing a comprehensive literature review of ERP in SMEs. For practice, the paper sheds the light on past and recent issues, challenges, and success stories that can guide consultants, vendors, and clients in their future projects. For research, the organization of literature in ERP-lifecycle phases can aid them in identifying the topics, findings, research methods, theories, and gaps discussed in each phase of interest. Finally, we have provided our observations and future research suggestions that would enrich our knowledge in this domain.

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The Use of Experts Panels in ERP Cost Estimation Research

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Abstract. This paper is an effort towards illustrating the use of expert panel (EP) as a mean of eliciting knowledge from a group of enterprise resource planning (ERP) experts as an exploratory research. The development of a cost estimation model (CEM) for ERP adoptions is very crucial for research and practice, and that was the main reason behind the willingness of experts to participate in this research. The use of EP was very beneficial as it involved various data collection and visualisation techniques, as well as data validation and confirmation. Beside its advantages, one of the main motives for using a group technique is that it is difficult to find a representative sample for a casual survey method, as ERP experts and consultants are rare to find, especially in the scope of SMEs' ERP implementations. It is worth noting that the panel reached consensus regarding the results of the EP. The experts modified and enhanced the initial cost drivers (CD) list largely, as they added, modified, merged and split different costs drivers. In addition, the experts added CF (sub-factors) that could influence or affect each cost driver. Moreover, they ranked the CD according to their weight on total costs. All of this helped the authors to better understand relationships among various CF.

Keywords: ERP; cost estimation; expert panel.

1 Introduction

As they say, *"it's about the journey, not the destination",* research techniques are very crucial for any research endeavour. They can lead researchers to the right path, or deviate them away from the desired destination. Moreover, the significance of any research results is determined by several measures, and the data collection and analysis techniques are on top of them.

In our proposed research phases, different data collection techniques are *used* and proposed. Some of those techniques are qualitative in nature, some are quantative, and some are mixed approaches. The variety of methods chosen should help in identifying the different costs and factors that influence costs in the Enterprise Resource Planning (ERP) systems adoption processes, in order to establish a cost estimation model (CEM). In addition, these techniques should provide a multi-perspective on costs through involving various key stakeholders from beneficiaries, independent consultants, and vendors that participate in ERP adoption projects.

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In particular, this paper discusses the Experts Panel (EP) approach that was used as a part of our "initial model development phase" *(see fig. 2).* The paper is an effort on arguing why *group discussions and interviewing* techniques are proposed in our initial exploratory research phase, and why we preferred the term "Experts Panels" over Delphi and Focus Groups (FG).

The remainder of the paper is organized as follows: the next section presents the research overview, researchers' perspective of costs, followed by a description of the EP conducted. Moreover, a brief comparison between the EP and other related techniques followed by a conclusion.

2 Research Overview

In the next sections, scope, perspectives, and data collection are discussed.

2.1 Research Scope

As previously mentioned, this research focuses on identifying costs and the factors that influence costs within the adoption process in SME's in order to develop a CEM. *Adoption* in this research starts prior to phase 1, and ends at phase 5 *(see fig. 1).* In other words, the focus starts with the cost drivers (CD) occurring during the feasibility study, consultant selection, vendor selection, contracting, etc till the Go-live phase. Post installation costs are often recurring within the ERP system lifetime. These costs are hard to take account of within this research. Thus, costs that occur after ERP installations are off boundaries of this research effort and maybe left for future research, yet the standard agreed-upon maintenance costs in contracts fall within this research's boundaries.

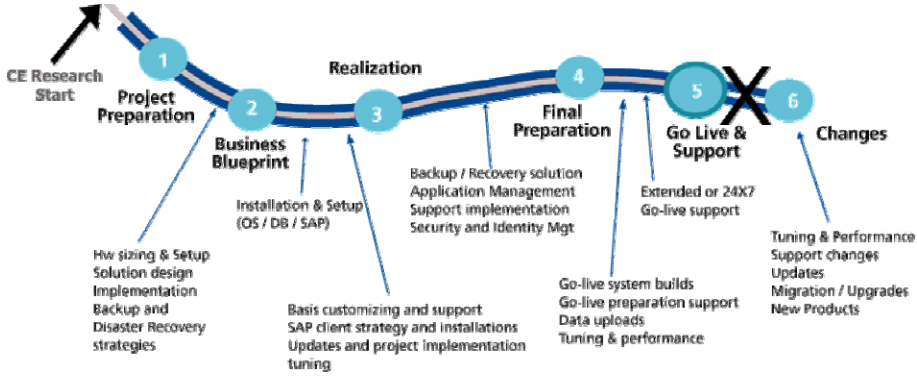

Fig. 1. SAP's accelerated methodology (ASAP) – Adapted from www.sap.com

2.2 Researchers' Perspective *(The Cost Lens)*

This research is not concerned with cost/benefit analysis; it is more focused on the relation (or difference) between estimated ERP adoption costs with actual adoption costs of completed projects. The cost lens proposed in this research is because

sometimes benefits in relation to costs are not important or unattainable. For example, when an SME's budget is crossed, it does not matter how much benefits it will gain through dedicating more money to the project, as it might be out of the required resources already. In addition, benefits and their associated costs should be projected correctly from the beginning, as many companies implementing ERP systems filed for bankruptcy e.g. FoxMeyer Drug [1], [18], [21], and this was mainly due to a faulty ERP budget and schedule estimations [12], [13], [17]. Thus, in the previous example, the costs view is more crucial despite the potential benefits, as you can always gain more benefits when you pay more money, but it is all about your budget and your resources' availability. Moreover, the CEM should be used in order to project more realistic cost estimates, while benefits should be the motive for implementing an ERP in first place. Usually the expected benefits are the system requirements based on the requirements analysis included within the *request for proposal* (RFP) invitation.

2.3 Research Methods and Design

It is hard to predict the future without studying the past. Hence, this research will be based on data collected from EPs along with actual data from organisations that already completed their ERP adoption process. And this will be done through a multiple case study design, as it has more investigative recompense compared to single case study, as well as it provides a flexible approach for Information Systems research [3], [8], [32]. This research will apply a multi-method research technique, encompassing multiple case studies, empirical literature findings, EPs, documents analysis, interviews, as well as surveys. Furthermore, in order to build strong substantiation of constructs, data triangulation as a mixture of qualitative and quantitative data collection methods will be used [8].

To reach the goal of developing a CEM, this research project will tackle different research questions and aspects within the very domain of ERP cost estimation within SMEs. These aspects will require different perspectives, methods, and tools within its development cycle. After identifying relevant perspectives through inductive methods that can assist in identifying factors that influence costs and cost driver to be included in a priori CEM within phase one. Then phase two will start, and in this phase, an empirical test of the cost model will be conducted in order to identify the relative contribution of the different cost concepts in understanding the resulting costs of ERP adoption in SMEs. While phase one will be qualitative and inductive in nature, phase two will be deductive and quantitative.

This research will conduct multiple case studies. Fig 2 presents an initial map of the proposed research design. Within the initial model development, theory, literature review of empirical research and the researchers' experience will be used in order to develop an *a priori* CEM. In addition to that, several EPs with vendors, consultants, and beneficiaries are going to be held in order to direct the a priori CEM development into the right direction.

The theory to be used in this phase is the stakeholder theory (ST), which plays a role in identifying the stakeholders and cost associated with them in these ERP adoption process using its stakeholder identification instruments. Besides ST, the empirical findings and data collected will compliment ST in CD' identification. The a priori CEM will be used in the second stage as an initial guide for pilot interviews. Then an interview guide will be developed, and interviews will be conducted to the cases selected.

In the following stage, a mixture of qualitative and quantitative analysis will be undertaken. As the ST has a very good technique to identify stakeholders and respondents, still it lacks relevance to information and technological aspects. Thus, a complementary theory(ies) will be considered after this initial research step. The findings from the analysis are crucial, because they will be used in mapping candidate theories to these findings, in other words, an iterative theory relevance check will be conducted.

In case of not finding a relevant theory, a grounded approach will be an alternative for theory building from case study data as advised by [8]. After theory mapping or building, the research design will be modified to accommodate the chosen theory. Then a survey will be conducted followed by quantative analysis.

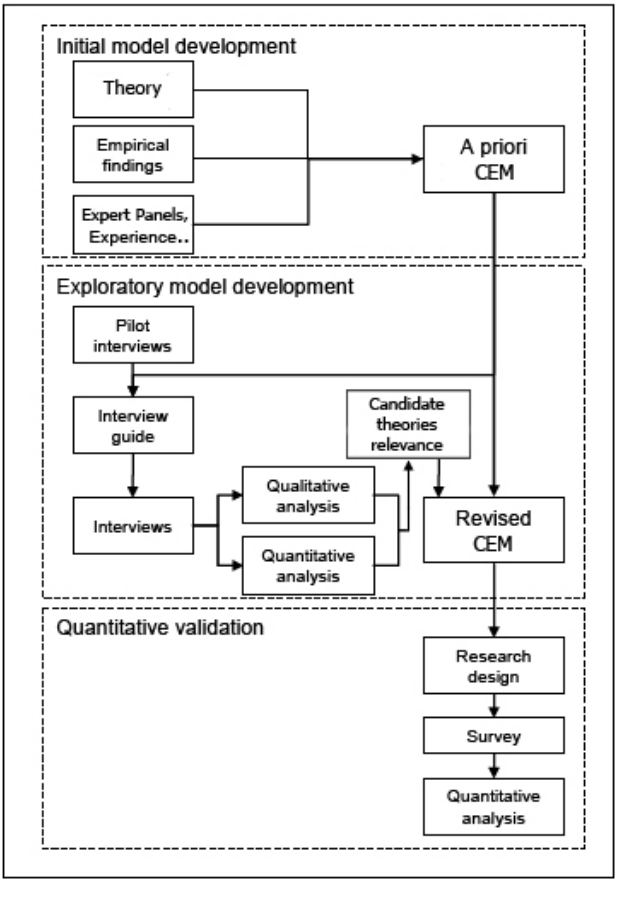

Fig. 2. Proposed research design: Adapted from [7]

2.4 Sources of Data and Data Collection Methods

In order to develop an effectual CEM, this research will collect actual data from the industry. The data required is as follows:

1. ***Data*** is based on finished projects.
2. ***Data Sources:*** Beneficiaries, consultants, vendors, and any stakeholder identified through the stakeholders analysis.
3. ***Type of data:*** Company size, industry type, cost factors (CF) and drivers (e.g. Business process reengineering, vendor selection costs, new hires, contracts, etc).

A further description of each data collection technique is as follows:

a) **EP:** incorporates different techniques and data collection methods. The panels includes various key experts in the ERP adoption field, including consultants, vendors, and key project representatives from beneficiaries.
b) **Interviews:** s*emi-structured* interviews will be conducted with beneficiaries, consultants, and vendors, and guided by [19] 'recommendations for qualitative interviewing'. The interviews will be carried out with diverse employee positions within the organisations in accordance to 'triangulation of subjects' strategy proposed by [26], and based on the initial interviewee's sample plan identified by the stakeholder analysis.
c) **Document Analysis:** analysis of project documentations including feasibility studies, project plan, project schedule, cost estimations, actual project expenses, as well as any documents recommended by the people involved in the project.
d) **Surveys:** some are conducted as a part of EP in order to collect preliminary data about CF and CD within SMEs. Other proposed surveys will be conducted in order to get feedback on the adequacy of the *a priori* CEM developed.

3 The Experts Panel

Due to the implications of this research into practice, an EP has been conducted. The EP recommendations and insights would be very valuable to this research within its exploratory stage, as experts would provide more inputs that would help the researchers to understand the phenomena or the problem they are studying.

The EP serves as an initial research kick off, that will ensure the mapping of the researcher's ideas and research problems with practice. Moreover, the EP is used as a mean of eliciting knowledge from ERP experts.

The panel included key persons involved in ERP implementations in Egypt. The participants were from the elite ERP consultants, vendors' representatives and implementation project managers. The expertise of the participants represents "state-of-the-art" knowledge in a broad range of international companies and industrial sectors. Eight potential participants were contacted by phone and via e-mail, and eight experts responded and participated. The panel included vendor consultants from SAP, JD Edwards, Focus ERP, independent ERP consultants, and project champions and managers from different industrial beneficiaries. The variety of experts was to ensure that the researcher captures different views and perspectives on costs.

- *The Briefing*

Prior to the actual panel discussion, a research briefing was sent by email to participating experts. It contained information about the research, the panel setting, the research objectives, as well as the expected implications for practice.

- *The EP Discussion*

On the first panel meeting, an explanation (reminder) about the research objectives was provided. A set of presentations took place to explain the CEM, and what is needed from them in order to develop a model for estimating costs within the ERP adoption phase. Additionally, we illustrated the importance and need for such a model by beneficiaries, consultants, and vendors. Moreover, a less formal discussion was held at the beginning of the panel regarding their experiences with ERP projects in SMEs. Participants were asked predefined questions centred on the features of ERP adoption cost estimations within SMEs in Egypt, and its success rate of finishing projects at hand within budgets. Moreover, they were asked about the challenges facing implementers and costs' impact on ERP adoptions in SMEs. Some participants from major ERP vendors mentioned that they use CEMs to estimate budgets needed from beneficiaries to cover their part of costs, but they said that these models are not accurate, nor give a realistic view for beneficiaries about all the dimensions of costs needed for the whole ERP adoption project. One major note from several experts was that organisations regularly do not face cost problems in selection nor post-adoption phases, the majority of ERP problems and costs pop-up during the adoption phase, and that the research should focus and start with these costs.

- *The First Round*

In the first panel round, the participants were provided with an initial CD conceptual model (mind map). The initial mind map (fig. 3) was a visualisation of CF gathered through literature and researchers' own experience with previous ERP adoption projects. The visualising of CD and factors in a mind map (tree-like) format is believed to enhance the participants' insights and interpretations.

While the mind map was presented to the participants, group discussions took place and were managed by two moderators. One moderator's role was to ensure that the session advances smoothly, and the other's role was to ensure that all the topics are covered. Both of them were taking notes. The moderator had predefined list of questions for group interviewing, and these questions evoked the discussion and brainstorming among participants. The discussions were about which CD and factors should be merged or split, change their naming, CF' approximate weight on total costs, and their priority pertaining to SMEs, etc.

Although some debates on some specific CD' importance took place, the moderator reminded the group about the focus of discussion, and that they should adopt a *costs view* within an SME setting, and this minimised the level of debates between them. From our point of view, the discussion between participants was very fruitful, as it initially consolidated their views, and made the participants brainstorm together and start to provide valuable suggestions and remarks.

Further, each participant was provided with a questionnaire in a table (list) format that contained the compiled ERP costs. Their task was to verify if the listed CD were appropriate to build a CEM, and to ensure whether there are missing CD or existing ones that should be apart or combined, according to their relevance to the adoption process in SMEs. The questionnaire contained four main parts:

1) A list of CD;
2) A column to associate them with other CD that can influence these factors;
3) A column to CF according to impact on SMEs' ERP adoption projects;

4) A space to comment or add additional CD or factors that can influence these costs, which should be considered and were over looked.

The CD list was gathered through literature and the author's personal experience in the field. This was to ensure the relevance of the data collected through research and experience in the field with practice. The questionnaire was a combination of open and closed ended questions. The open-ended questions were to help the experts provide their insights, recommendations or suggestions about which additional CF to include, exclude, combine, or split. The costs factors column contained cost items compiled from literature and researchers' previous experience with ERP adoption projects. The cost items scale was from very high to very low in relevance to overall costs in an SME setting. The main initial CD were vendors, change management, business process reengineering, project management, hardware, software, human resources costs.

The participants' feedback helped in further developing CD, adding new factors, merging some factors, decomposing some factors to include important sub-factors, and identifying CD that can influence other CF. This brought us to a better understanding of CD that should affect an ERP adoption process.

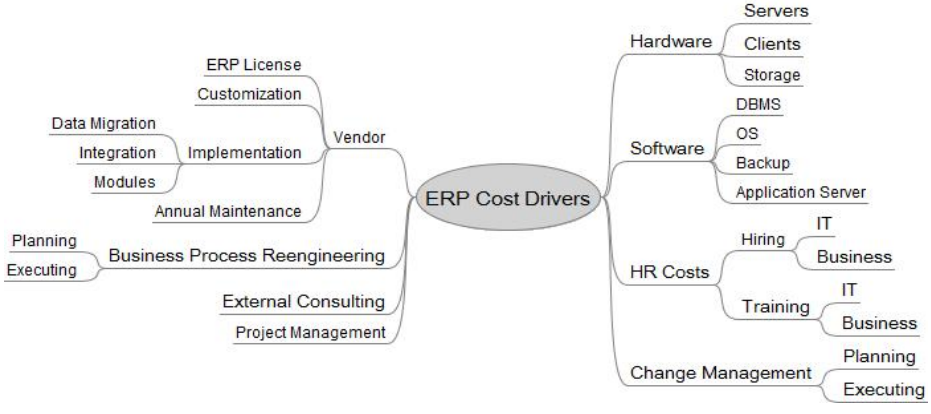

Fig. 3. Initial CD mind map

- *The Second Round*

In the second round, an updated list of CD was provided for participants. The list contained the new updated CF and drivers captured during the first round's questionnaire, interviews, and discussions. The updated list was presented in a table format as well as a mind map. The moderator initiated a discussion about the comprehensiveness of this list, and this stimulated group discussions and interactions. During this round, the participants have agreed upon some slight modifications to the CF' list, and the list was directly updated accordingly. At the end of this round, the participants were provided with the reviewed CF list and were asked to rank them *independently*. Their task was to re-rank the costs and to make sure that all the presented CF and our interpretations are complying with their suggestions and recommendations. The provided rankings of CD were: very high, high, medium, low, and very low. The participants

were alerted that CD should be ranked to their importance to the adoption phase within SMEs and from a cost perspective.

The data was analysed and showed that the experts has reached consensus. Moreover, the updated and consolidated mind map was sent electronically to the participants in order to confirm the validity of the CD presented. The updated mind map is in fig 4.

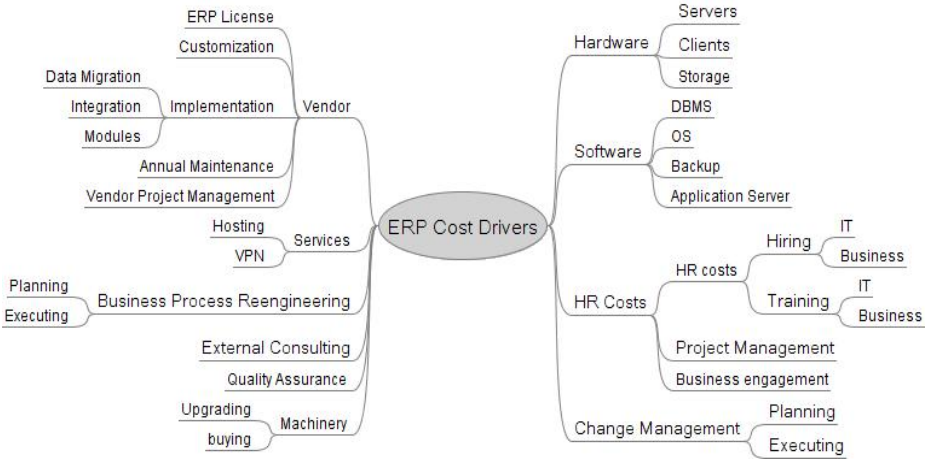

Fig. 4. Updated mind map

4 EP in Contrast with Delphi and FG Techniques

As researchers should choose the best method *they think* satisfies their research objectives, the method used and proposed in this research is a combination of several techniques. Although it is difficult to establish clear boundaries between the EP conducted in this research, and Delphi and FG, but WE will try in the following section to illustrate the main common similarities and differences between them. Part of this difficulty or confusion comes from literature itself, as the Delphi and FG studies have various variations which sometimes conflict with their own main principals, like incorporating fact-to-face group discussions in Delphi studies for example [5]. Moreover, while writing this paper, we have discussed it and consulted several colleagues in order to obtain their opinions about categorising the method used in this research. Some of them viewed it as a Delphi style research technique, and others viewed it more of FG research. These different views made me affirmative that the research technique used here is none of them; it is actually a combination of them whilst incorporating other techniques from other research methods as well.

As mentioned above, the next part will discuss the technical and conceptual differences between the EP in comparison with other "similar" techniques. In addition, we will provide arguments about why the technique used is more adequate than these techniques.

- **Similarities and Differences**

The EP technique used in this research shares similarities with Delphi, FG and NGT research methods. Although Delphi and FG techniques are considered data collection techniques through group interviewing or surveying, still they have basic differences.

- EP and Delphi
  - *Similarities*

In literature, the Delphi method has been used to acquire knowledge from single or multiple experts [25. The Delphi technique serves as a systematic method to collect ideas, opinions, and judgments on a particular topic at stake through the use of sequential questionnaires combined with feedback and summaries derived from previous responses [4]. The Delphi method is primarily used when the problem at stake does not suit itself with precise analytical techniques but can benefit from collective subjective judgments and opinions [16]. Moreover, one of the main goals of the Delphi technique is to reach consensus position from experts [4], [20]. Some Delphi studies use sound ranking measurement techniques (e.g. Kendall's W) through its iterations in order to measure the degree of consensus [2], [27].

  - *Differences*

Although the above-mentioned characteristics and goals match with those of EP, yet there are basic differences between both techniques. The typical Delphi method is asynchronous and does not incorporate face-to-face interactions between participants or experts [28], as the anonymity of respondents is believed to give the method positive recompenses over face-to-face interactions [16].

In order to reach consensus, there have been rounds in the EP that are similar to those of Delphi; on the other hand, these rounds incorporated surveys, rankings, *plus* group discussions and interviews. Furthermore, the EP incorporated ideas and suggestions from the experts' group discussions, as group interaction and brainstorming would enhance the amount and quality of responses, and would initiate new ideas in contrast with individual brainstorming [22], [23] in [28]. Moreover, group interactions can be used to examine not only what individuals think, but also how they think and why they think that in a particular way [14]. In our point of view, face-to-face interactions are better when there is a group of experts that represents clients' side and vendors' side in order to decrease bias through objective discussions. In addition, group discussion would enable participants to exchange ideas and point-of-views, which would help in narrowing down and reaching consensus. Furthermore, Delphi presents data, key issues, and items in a *list* format to participants [2], [29]. On the other hand, during the EP rounds, lists and mind maps were used. Instead of presenting CF in lists only, mind maps were used to visualise information and to help participants grasp the full picture of the factors and the relationships among them. A mind map is an information construction tool represented as a graphical illustration of connections between concepts and ideas that are related to one core subject, and the process of constructing mind maps engages the participants with the content [31]. Mind maps are useful in situations where developing understanding, problem solving, brainstorming, delivering information, and evaluation of participants understanding are needed [31]. Moreover, mind maps are very similar to the notion of *cognitive maps,* which are used to record and graphically present qualitative data [6]. The mind map used was

dynamic; as we modified the map instantaneously according to their recommendations and suggestions to enable the experts to view the changes and re-evaluate them.

- EP and FG
  - *Similarities*

FG is a qualitative data collection technique through conducting organised group discussions and interactions, moderated by one or more moderators. In addition, FG is a form of group interview that relies on communication between group participants in order to generate data [14]. The participants in this group are selected and assembled by researchers in order to discuss and reflect on, from their personal experiences, the topic of researchers' interest [24]. FG can be used at the initial or exploratory stages of a research [11], [15]. The chief purpose of FG research is to draw upon respondents' beliefs, experiences, and responses in a way in which would not be suitable using other techniques like one-to-one interviewing or questionnaires [10]. Moreover, several researchers have also indicated that group discussions can generate more significant comments than usual interviews [11], [30].

  - *Differences*

FG are usually conducted in one rounds and do not capture comprehensive reflections from participants [9], on the other hand the EP was conducted in two rounds in order to reach consensus. In FG, data collection relies on the group interaction, interviews, and discussions solely, while in EP, those techniques were incorporated with surveys, mind maps, and rankings in order to ensure data validity and reliability. One of the core differences between the EP and FG is that, FG research is not considered a consensus oriented technique, and it is typically conducted in social research in order to observe the behaviour, reactions, and interactions among the group [11], [14]. On the contrary, the primary goal of the EP, was to reach *consensus* about the ERP CF and CD within SMEs.

5 Conclusion

This paper is primarily an effort towards illustrating the use of EP technique as a mean of eliciting knowledge from a group of ERP experts as an exploratory research. The developing of a CEM for ERP adoptions is very crucial for research and practice, and that was the main reason behind the willingness of experts to participate in this research. In our point of view, the use of EP was very beneficial, as it involved various data collection and visualisation techniques, as well as data validation and confirmation. Beside its advantages, one of the main motives for using a group technique is that it is difficult to find a representative sample for a casual survey method, as ERP experts and consultants are rare to find, especially in the scope of SMEs' ERP implementations.

It is worth noting that the panel reached consensus regarding the results of the EP. The experts modified and enhanced the initial CD list largely, as they added, modified, merged and split different costs drivers. In addition, the experts added CF (subfactors) that could influence or affect each cost driver. Moreover, they ranked the CD according to their weight on total costs. All of this helped the authors to better understand relationships among various CF.

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Why Benefits Realization from ERP in SMEs doesn't Seem to Matter?

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Abstract

It is often argued that IT investments require active management practices for benefits realization. This applies also to enterprise resource planning (ERP) systems. As well, benefits realization efforts are assumed to create more value than they cost. Hence, the maturity of organizations should be increased and their cultures cultivated towards more rational benefits realization practices. Our study on ERP implementations in Egyptian medium-sized organizations, however, provides aberrant results that challenge the fundamental arguments for formal benefits realization practices. While investments in ERP are regarded as significant, and the projects challenging, formal benefits realization and investment evaluation practices are considered largely irrelevant. The reasons include the "self-evident" nature of ERP benefits, perceived difficulty and costliness of method use and suspicions on rationality of methods. A government policy to support ERP investments may also decrease incentives for further benefits optimization. Cost coordination of the implementation efforts, however, continues to be an issue.

1. Introduction

Enterprise resource planning systems continue to be a topic of interest in the field of information systems [1]. Since the 1990s, the academic literature on ERP has focused mainly on large corporations. The literature has highlighted management control of ERP development and implementation, instead of regarding it only as a technological challenge [2]. ERP can bring up profound business implications or even undermine the strategic capabilities of the implementing organizations [2]. On the other hand, in the beginning of the first decade of this millennium, a majority of Australian ERP projects in large organizations reported mainly operational (73%) and IT infrastructure (83%) benefits, while 55-56% reported some managerial and strategic benefits [3]. Only 14% reported to have gained organizational benefits from their ERP investments [3]. Later on, Carr [4, 5] even predicted "the end of corporate computing", arguing that IT, including ERP, will become a ubiquitous commodity without greater strategic importance.

Aside the main focus of ERP research on large organizations, ERP implementations, however, have become more common also in small- and medium-sized enterprises (SMEs) towards the end of the decade [6, 7]. The literature on ERP benefits in SMEs has remained largely inconclusive. An early study on Finnish SMEs suggested, in contrast to vendors' contemporary main focus on competitive advantage, that SMEs want ERP as a tool to manage day-to-day operations, and that it is important to have local and continuing support for the tools used [8]. In Austria, SMEs perceive their ERP projects more often successful than large companies and report to gain more benefits out from them [9]. Perceived benefits of ERP systems in Taiwanese SMEs have a significant impact on their adoption decisions [7]. (On the other hand, such issues as CEO's ERP knowledge, cost of ERP implementation, or sophistication of the software do not have significant impacts on the adoption decisions [6].) However, among the U.S. construction SMEs ca. 50% of companies have difficulties or refuse to use ERP systems in the first place [10].

In parallel with the development of the ERP field, an increasing number of IS scholars have argued for better management processes to govern, evaluate performance [11], and realize benefits from IT investments in general [12-17], including ERP. Benefits realization (BR) is regarded to go beyond traditional ex ante justification and ex post evaluation of IT investments by denoting the need for management also during the project from the viewpoint

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of the expected and emergently recognized benefits [16]. In addition to the focus on strategic and managerial IT investments, benefits realization has been suggested as a relevant approach also with regard to many types of applications and infrastructural IT investments [16].

However, while both ERP implementations in SMEs and the academic literature on benefits realization have increased during the last decade, expected versus realized ERP benefits are seldom checked in SMEs [9, 18] as well as in ERP implementations in general [19]. In other application areas, the proponents of the benefits realization approach have highlighted how e.g. more than 50% of Taiwanese SMEs with focus on electronic commerce have started to use formal benefits realization practices [20]. Cases published in practitioner journals also illustrate success stories, for example, how a customer relationship management system in a middle-sized financial service retailer required the company to move from the problem-based IT investment mindset towards innovation-based benefits realization [21].

While literatures on both ERP implementation benefits in SMEs and related benefits realization practices remain inconclusive, our focus resides in the question of whether and why SMEs would adopt benefits realization practices in connection to their ERP investments. Our data originates in 22 interviews involving four Egyptian medium-sized companies who have implemented ERP, vendor representatives, and independent ERP consultants with experience altogether from hundreds of implementations. As presented later in this paper, the informants almost uniformly and deliberately expressed their neglect of formal benefits realization or evaluation practices on their (often rather comprehensive) ERP investments. Although the benefits realization literature has mostly focused on the adopters of benefits realization practices, we believe that research on those professionals representing a counterpoint would make a valuable addition to the body of knowledge, in this case with regard to ERP investments in SMEs. The aim of this study is to explain why usefulness of benefits realization practices concerning ERP investments in Egyptian SMEs is challenged.

The rest of the paper is organized as follows. Section 2 summarizes the existing literature on benefits realization and IT investment evaluation practices and issues of ERP implementation projects in SMEs. Section 3 clarifies the research process and introduces the four target organizations in more detail. Section 4 presents the main results of the study after which section 5 discusses about their contribution to the previous literature. Section 6 concludes with suggestions for future research.

2. Literature review

The fundamental principles of *benefits realization* postulate that [14]:

- IT has no inherent value in itself;
- the value from IT is realized through people doing their work differently;
- benefits arise through business managers and users through expected and emerging ways how they benefit from new technology;
- also potential negative outcomes from IT need to be recognized and mitigated by management, and
- thus, benefits realization needs a set of dedicated management practices to optimize the possible benefits. [14]

Whereas evaluation of the expected and realized benefits is important, the benefits realization approach denotes the need for management actions also during and aside the IT project to capture emerging benefits and to mitigate the unwanted emergent impacts [16]. In general, our research is grounded upon the observations by Thomas et al. [22] and Ashurst et al. [12]. A few paradoxes and shortcomings in the current IT investment evaluation and benefits realization literature have been recognized [22]:

- Contemporary formal IT investment evaluation and benefits realization practices are inadequate and better methods would be needed;
- However, a large number of suggested methods and practices already exists,
- of which few have been actually utilized in practice. [22]

Ashurst et al. [12], while arguing that benefits realization should become an organization-wide capability, simultaneously address a lack of empirical studies on actual benefits realization practices.

Our research aims to shed more light on these inconclusive fundamentals of the normative IT investment evaluation and benefits realization literature by exploring explicated reasons why our target organizations neglect IT investment evaluation and benefits realization practices in the first place. We reviewed the benefits realization literature identifying the given reasons both for and against of adopting benefits realization and evaluation practices in organizations. We included general-level literature on benefits realization as well as the scarce literature on benefits realization from ERP investments. In the following, we discuss the literature and the reasons given divided into four broad categories of such issues:

maturity, nature of IT benefits, perceived value versus cost from benefits realization, and organization culture and structure.

Maturity of management [23] and IT functions [24] is suggested to have impact on adoption of the benefits realization practice in a couple of ways. Firstly, it is stated that management may lack understanding of and competence on the IT investment [22] and change management [25] processes in general. Consequently, benefits realization or investment evaluation techniques are neither supported by management [22] nor adopted [23]. The immature organizations are characterized by their informal implementation processes, low confidence on actual outcomes from IT projects, low integration level of systems, and problems encountered in IT projects [24]. Based on these observations, Lin et al. [24] recommend that hitherto immature organizations should pursue higher organizational and IT maturity by adopting more formal benefits realization and investment evaluation practices. The role and maturity of IT in the company's business domain may have something to say, as Lin et al. [20] report high usage rate of investment evaluation and benefits realization techniques among Taiwanese business-to-business electronic commerce companies.

Several issues related to the ***nature of expected benefits*** have impact on the perceived usefulness of implementing formal benefits realization and investment evaluation practices. If an IT project goes according to what was planned, it may be assumed that it also produces the desired benefits [26]. Moreover, organizations may focus on tangible benefits which are self-evident to observe, ignoring deeper analyses of potential intangible issues [26]. A few organizations, e.g. many SMEs implementing ERP for mundane everyday operations, may have focus on short-term tactical and operational benefits, which do not require deeper analysis [8, 27]. As well, if the main benefit from the IS implementation is perceived the technological function of the system itself, it may decrease interest in adoption of benefits realization processes from the viewpoint of the organization [28]. However, the benefits realization literature highlights that benefits realization would also be needed for infrastructural technology investments [17]. One of the fundamental assumptions of the benefits realization proponents is that IT would have no value in itself, without making people to work differently, which would indicate a motor for adopting explicit benefits realization management [14]. In fact, the idea that functionality from IS/IT in itself could be a benefit is regarded as a "mindset" which hinders benefits realization [26, 28].

Benefits realization literature suggests fundamentally that ***value gained from benefits realization activities is greater than the costs from these tasks*** [16]. Ward & Daniel [16] suggest that the "benefits of benefits management" include clearer planning for the investment, improved relationships between IT and business staff, wiser investments and increase in the realized benefits. However, not all organizations may recognize such value from using time for evaluation or increased management efforts for benefits realization. For example, IT investment evaluation and benefits realization may be seen as a complex and difficult undertaking, which does not warrant the effort [22, 25, 26]. Evaluation may also be seen as too costly [22, 26], the stakeholders of the benefits may lack time to do the tasks [22], or the scope of an IT project may be too narrow to warrant the effort. However, few research efforts studying actual practices or benefits from the benefits realization efforts itself have been reported [12] beyond single case studies of individual projects (e.g. [21]).

The fourth category relates to ***organizational structure and cultural issues***, which are suggested to have impact on the adoption of formal benefits realization practices. Firstly, organization culture may not support the idea of being both the "watchdog" and implementer of benefits delivery simultaneously [26]. On the other hand, organizational structures may not be optimal for practicing benefits realization as such [22]. Thomas et al. [22] suggest that adoption of formal practices may appear useful only after an effective decision-making culture is introduced in the organization, which includes such foci as accountability, leadership, relationships, strategy, measurement and action. Another culture-related issue is mistrust on benefits realization and evaluation practices due to the tendency to use them with a bias for promoting particular political agendas instead of pursuing rational decisions [22].

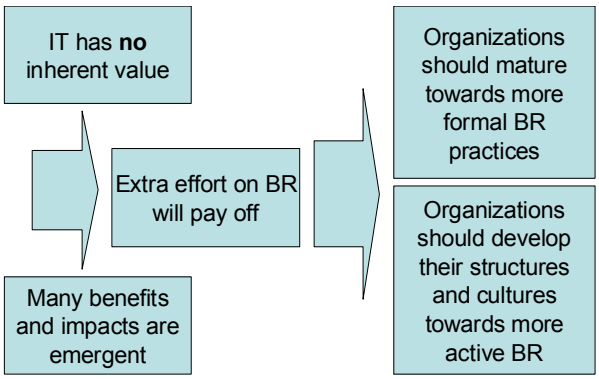

Figure 1 Reasoning for increased benefits management and realization practices in the literature

To summarize, the benefits realization and IT investment evaluation literature identifies that organizational maturity, structure, and culture are key issues, which hinder the organizations from implementing better benefits realization practices. The literature also argues that IT investments have no inherent value and many benefits and impacts are emergent – and a failure to see that would be another reason hindering the organization from implementing benefits realization. As well, the literature assumes that an extra effort on benefits realization and IT investment evaluation will pay off, although some organizations may not see that. However, the literature has lately argued that the failure to adopt benefits realization and investment evaluation practices is largely due to low maturity and issues of organizational culture and structure, which explains why the organizations would not see the fundamental drivers to implement those practices. (Figure 1).

3. Research methodology and cases

The first author conducted twenty-two qualitative face-to-face interviews in Egypt. The interviews were conducted in eight Egyptian companies and discussed about the whole ERP lifecycle, from the pre-selection phase until the post-implementation phase. The participants included a mixture of stakeholders who have been involved in ERP system implementations, four SMEs (12 interviews) which had implemented ERP, major ERP vendors (2 companies), major ERP implementation consultants and vendor partners (2 companies), and senior independent ERP and finance consultants in Egypt (2 interviews).

Egyptian government reports [29-31] give no standardized classification or definition of SMEs in Egypt. Especially, the current classification by the number of employees and fixed assets is not adequate across industrial sectors [30, 31]. Thus, the interviewees were asked to classify their organizations according to their annual turnover, number of employees, number of ERP users, and their perceived size in their industry market in comparison to their same industry competitors. Three were classified as medium-sized, and one as a small enterprise.

Altogether twelve interviews gathered information from the four SMEs including two manufacturing companies, one in the importing and distribution business, and one retail company. Five interviews focused on vendor representatives, five on implementation consultants, and the other two involved an independent senior ERP consultant and a senior freelance finance and corporate development consultant. The vendors and implementation consultants were chosen according to their popularity and number of projects within the Egyptian SMEs. The informants had experience on various ERP systems:

- Al Motakamel;
- Focus;
- Infinity (a.k.a Al-Motammem);
- JD Edwards;
- Oracle E-Business Suite;
- SAP;
- and several in-house developed Integrated Enterprise Applications.

The experience of the consultant interviewees varied from junior consultants, among whom the least experienced had participated in three implementations, to senior consultants, of whom the most experienced had participated in more than 150 implementations. The main context and focus of the interviews were on Egyptian SMEs.

The interviews were semi-structured and face-to-face. The predefined themes relevant for this study covered:

- adoption drivers;
- ERP selection processes;
- feasibility and cost/benefit analysis
- benefits and investments justification;
- benefits realization;
- ex-post benefits and investment evaluation.

Moreover, all interviews were tape recorded, and carried out with diverse employee positions within the organizations in accordance to the 'triangulation of subjects' strategy [32]. In the following, the four target companies, "Nefertiti", "Horus", "Cleopatra", and "Khufu", who had implemented ERP systems, are introduced in more detail. The company names are fictitious to preserve anonymity (table 1).

Nefertiti had an in-house developed system before moving to an international ERP system. The company was mainly facing technical problems with the existing legacy system that were affecting its operations. Moreover, they had other challenges with the system that *"were due to the employee turnover, absence of sufficient system documentation, and support."* (IT manager). Thus, the company decided to migrate to a standard ERP package, which would be *"more stable and easier to handle,"* (IT manager).

The company used no external ERP consultants, as they see themselves competent enough to identify needed requirements, select, and manage the ERP system. *"We are mature enough to decide […], we are from the first IS adopters in the industry, we had three systems before this ERP system, but they were not standard packages, they were in-house developed systems,"* (IT manager).

Table 1. Overview of the four target cases

Company (size)	Informants	Ownership	Industry
Nefertiti (Medium)	Project leader, IT Manager, Business Solutions Manager	Private stocks	Automotive parts distributor
Horus (Medium)	ERP project steering committee member IS Manager, IS Deputy Manager/Business Intelligence Manager, Application Unit Manager.	Family owned	Retail
Cleopatra (Small)	IT Manager, IT Consultant, ERP project steering committee member	Family owned	Printing & packaging
Khufu (Medium)	IT Manager ERP project steering committee member	Family owned	Dairy products

The project team was composed of internal employees and the implementation partners. The system went live in January 1, 2008.

The ERP modules implemented were Finance and Controlling (FC), Sales and Distribution (SD), Material Management (MM), Customer Service, Human Resources Management (HRM), Customer Relationship Management (CRM).

Horus deals with a diverse number of commodities that are sold directly to customers through one outlet. The commodities vary from fresh food, fast moving goods, non-food commodities, textiles, and furniture.

Prior to the ERP acquisition, they had a local Egyptian ERP system that was a complete retail bundle. It was consisted of an ERP as a back office, and a point of sale (POS) application as a front office. This system had many technical problems including poor performance, slow transactions, and inexact report calculations. Although it was both a front-end and back-end solution, still it had many integration problems with the POS, which dramatically affected the day-to-day operations. *"The point-of-sale network used to go down without any obvious reasons, and that is a nightmare for a retail business."* (IS deputy manager). Therefore, Horus decided to move to an ERP package that can be integrated with a POS solution and application. In this case, it was clear that the adoption drivers were technical. *"If the ERP we had was working well, we wouldn't think of buying a new one, but in our case the existing ERP was problematic, so, that was the major driver for buying a new ERP."* (Application unit manager).

The company had an IT consultant involved in the whole project, and he conducted a SMART analysis during the selection process.

The project budget was circa *"3 to 5% of the yearly sales revenues,"* a steering committee member mentioned. The implemented modules were FC, Capital Asset Management, Logistics, Procurement, and SD. The system went live in August 2007.

Cleopatra mainly produces paper and cartoon supplies for fast food restaurants in Egypt. The company's produces several products, like hot and cold paper cups, ice-cream packages, sandwiches wrappings, and boxes.

The company had several scattered applications before acquiring an international ERP system. Most of the processes were not integrated within the applications used, and were manually done. The applications were mainly built on Microsoft Excel.

The company suffered many business and technical problems due to the lack of integration between the applications. *"The existing scattered applications did not meet the business requirements and they ware not integrated, for example we had problems processing orders, sales' planning was not integrated with production planning,"* a steering committee member mentioned. Moreover, it was challenging to generate reports and control the business cycle. As the problems were *"mainly reporting and loss of manual data, and controlling."* (IT manager).

The ERP was implemented in 2007, and the modules were FC, order management, purchasing, warehousing, plus an external customized payroll system. The company has an IT consultant, which was engaged in all the ERP adoption phases at that time.

As we will discuss later, in this case adoption drivers were not only technical. There was an urgent need for IT infrastructure improvements for strategic decisions.

Prior to the ERP adoption, **Khufu** had several scattered applications, which lacked integration and scalability. *"We had scattered systems, so we needed integration […], the systems we had were working with an Access database, which could not handle the business transactions anymore."* (IT manager).

Not only this, the company suffered a database failure and loss of data. *"The system could not handle the number of invoices, then we faced failure in the database, and we lost some data, so we decided to buy a new system."* (IT manager).

The company did not have a consultant during the selection process. They hired one later on during the

implementation. The ERP modules implemented in Khufu were FC, warehousing, purchasing, fixed assets, order management. The company now is thinking of extending the system to include the HR and Manufacturing modules.

4. Results

In general, none of our four target organizations had followed formal practices for IT investment evaluation or benefits realization. Moreover, according to the consultants, benefits management from IT investments is very rare in the context of Egyptian ERP implementations in general. However, the informants still claimed that ERP requires significant financial resources. Moreover, the consultants and most of the informants from the target organizations reported that the ERP projects had often significantly exceeded their initial budgets; some even doubled the initial budget. Anyhow, ERP was seen as a necessary and important part of doing the business.

"… [about evaluating ERP investments] *in very rare cases, but it was not a formal evaluation, they just sense what has improved and so on."* (Independent financial consultant)

"*Not formally, we just get some feedback from employees involved in some process cycles, which say that they sense improvements. But this doesn't happen as a formal evaluation."* (Implementation partner)

"We never evaluated the benefits resulted from the system, although there is a positive impact on the business, but never been measured." (Steering committee member, Cleopatra)

"There are many benefits from the ERP system, like more control, improved processes […] and it has a huge impact on our inventory and stock levels. We had a very big stock buffer, and now we realized that we don't need it." (Steering committee member, Khufu)

We thus continued the case study by gathering data on why benefits realization and IT investment evaluation practices were ignored. In the following, the results are organized under five categories of observations:

1. Maturity;
2. Nature of expected benefits;
3. Perceived value from benefits realization or investment evaluation activities;
4. Organizational, professional, and national culture;
5. National policy in Egypt to support ERP investments in SMEs.

Unlike in the literature review, recognition of the role of **maturity** with regard to the organization's IT and change management was nearly absent in our data. One independent financial consultant touched the issue, implying that if one would like to conduct even a cost-benefit analysis, it would require more competent and educated persons to do it:

"Cost/Benefit is doable, companies do not do it because they do not know-how, because it is calculated based on parameters that they cannot touch […]. Cost/Benefit when done properly will take the investment decision in a technology platform 50% of the way."

An independent ERP consultant noted that if benefits realization would be based only on financial measures, as the culture might become in the current situation where owners of SMEs lack formal education on the topic, it would risk investments in IT:

"When company owners or decision makers are not well IT educated, or if they don't have a consultant, they will care about how much money they will pay and how much would they gain from a system. However, when they understand, they will start to realize that technology is not easily financially justified; it would fail, if your approach is only financial, you will fail, and you will never ever be able to convince anybody to invest. Thus the business value should be clear."

However, the main proportion of the other interviews suggested mainly other reasons than competence or maturity for the lack of benefits realization. Simultaneously, those interviews indicated that the issue had been pondered; contradicting to the idea that lack of formal benefits realization would result in plain lack of maturity or ignorance of the organizational stakeholders. In addition, one of the companies explicitly perceives itself as a mature organization; still it does not carry out benefits measurement or realization related processes.

A prevailing explanation for lack of investment evaluation and benefits realization practices was the **self-evident nature of expected benefits** from ERP. ERP systems were regarded as a "commodity" and the technological functionality was expected as such to lead towards rather operational and infrastructural benefits. Imitation of the peers also has a big role in implementation decisions.

"I always tell the companies that I consult, that IT has become a commodity. It already crossed over the financial evaluation stage, so it is like that I will tell someone, come on, lets assess why we should buy computers, why we should apply for a telephone line, electricity or water. They are all commodities, and IT is a commodity as well." (Independent consultant)

"Yes, costs and time, and mistakes. These are immediate costs reductions. Like HR costs, cash management, and inventory costs. However, companies always focus on daily operations, that's their mentality; they don't focus on long term planning and the overview of the business. It does not matter

how much information they have on the systems that can help them to make strategic decision, they just care about day-to-day operations, based on their claims that the market is very dynamic and changing." (Implementation-partner manager)

"One of the most important selection decision drivers is our references. When a company asks another company, which is in the same field of business about how successful is our ERP there, and they get a positive feedback, they approach us with a buying decision already. That is the fastest sales process," (Implementation partner consultant)

In general, the informants widely shared a view that benefits from ERP investments (beyond the self-evident ones) are difficult to evaluate formally and thus the **evaluation and benefits realization process in itself is too costly or resource-consuming to warrant the effort**. That is, formal evaluation and benefits realization efforts would not pay off. Whereas monetary benefits were expected from ERP investments, they were regarded as impractical to relate to the technology directly through formal analysis.

"… it is very difficult to do a post implementation evaluation, or benefits quantification while running and supporting the system, and coping with changing requirements. This requires a lot of time and effort that we can not afford." (Business support manager, Nefertiti)

"It is difficult to put numbers to intangible benefits, which everyone actually know or sense that they are actual […] It is even difficult to evaluate the generally agreed-on intangible benefits, in a way that can be scientifically correct, and practically understandable and applicable." (Independent financial consultant)

"Establishing a causal relationship between IT investments, sales, costs, and revenues is very hard to achieve, as the change could be due to other internal or external factors." (Independent ERP consultant)

Moreover, one of our target organizations (Horus) had tried to conduct more formal evaluations, but abandoned the practice later on focusing mostly on implementing the technical performance and benchmarking their ERP through such measures.

"*We tried to do it but it is not an easy job*." (IS manager, Horus)

"The realized benefits of IT investments are very hard to measure in terms of a financial or monetary value […] for example, customer satisfaction, how much is this worth? It is hard to calculate it." (Steering committee member, Horus)

A side-story of the perceived difficulty and uselessness of formal evaluation and benefits realization practices, was the **mistrust on rational decision-making if based on formal evaluation** practices. Formal evaluation methods and practices were regarded as potential political tools rather than rational decision-making aids.

"We didn't convert the benefits into money, because everyone can calculate them as he wants, I can show you that our ROI is 200% or 300% if I want, we calculate in another way, like we have a finance function that had problems with our legacy system, but now its performance has been improved, now we can report quarterly financial statements within three working days, and that's an example of what we call ROI, still I can not tell you that it used to take us one month, and now it takes three days and this worth one million, because if you ask someone he could tell you 500 thousands, someone else would say two million, we just see that the ROI is that we do it in three days maximum instead of one month." (ERP project leader, Nefertiti)

The data indicated also **cultural issues related to particular organizations, the profession of IT and management, and the regional culture** in Egypt. In the case organizations, the owners and managers of Egyptian family businesses had mostly built long-term trust-based relationships to consultants and adoption of ERP as such was based on those relationships and consultant recommendations. Due to the trust culture, no further evaluations were considered necessary.

"No we did not have any kind of feasibility study, and I would like you tell you something about the Egyptian owner, because you are doing a study about Egypt. The Egyptian owner has some people that he blindly trusts, and if they recommend a certain system, the owner will go for it, and that is what happened in our case." (IT manager, Khufu)

In a couple of cases, the evaluation methods development for the conditions in Europe and the US were mentioned to be inadequate for Egyptian conditions.

"Even if we agree to choose one method to calculate costs and benefits, we will disagree on the parameters… Moreover, even if we agree on everything… still there is a financial challenge that the projects internal rate of return should exceed the company's weighed average cost of capital (WACC), and regionally we have the challenge that the WACC is relatively very high, which is not the case in most of Europe, for example." (Independent financial consultant).

"I suggest a cost/benefit analysis that is tailored for the region in terms of weight of parameters included." (Independent financial consultant).

Finally, we found **national politics interfering to ERP investments in SMEs** as a likely issue having impact on lack of benefits realization practices. In Egypt, the Industrial Modernization Center (IMC) [33]

was mentioned to have a big impact on ERP investments in SMEs. IMC has directly financed ERP investments in SMEs, without requiring reporting of the benefits. During the year 2008/2009 alone, the IMC has funded 2,477 SMEs. This external financing was mentioned to decrease motivation for further management efforts to optimize the benefits, as the initiatives were funded anyhow. Two of our target organizations had been supported by the IMC money. On the other hand, Nefertiti's IT manager mentioned, that their company did not apply for the fund, as the IMC would have some control over the project, and they wanted to be in full control of their own project.

"Some companies did not have even an IT department; they just bought the ERP because of the IMC fund." (Implementation partner)

"Usually the ERP adoption decisions that I have seen were driven by one of two things, that they got funds from the IMC in order to follow the ISO standards for example, or that they have technical problems that they want to solve." (Implementation partner).

"The IMC recommends us to customers." (An implementation-partner team leader)

"Honestly, in Egypt, besides the need for control and integration, the IMC is one of the main motivators for companies to buy an ERP, as it provides them with a free fund, so companies who want to develop themselves will do it, why not? The money is coming for free." (Implementation-partner project manager)

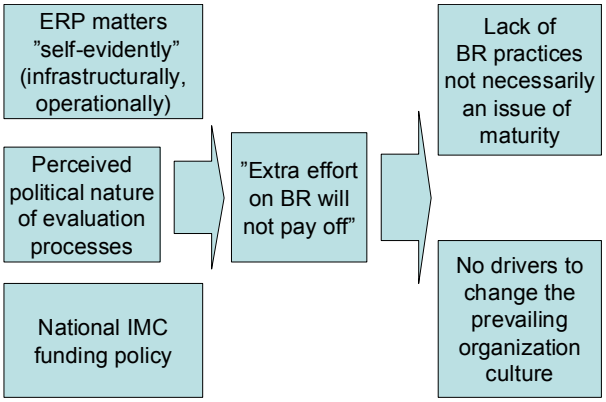

Figure 2 Summary of results

5. Discussion

Figure 2 summarizes our results. All in all, we regard the results as aberrant in light of the mainstream normative suggestions in the literature to adopt management practices for benefits realization [13-17]. Especially, our results challenge the suggestion that lack of "maturity" as such would be the root reason for non-adoption of the benefits realization or investment evaluation practices [23, 24] in our domain of interest. The results also contradict to the assumption in the BR literature, according to which benefits from IT would be regarded as fuzzy from start, emerging during the implementation projects, and therefore some additional management actions to realize them would be needed (e.g., [14, 16]). The four organizations had several years of experience from utilizing IT, including earlier versions of ERP and legacy systems. The target organizations were also confident concerning the usefulness of ERP implementation outcomes, while they admittedly recognized to have cost coordination problems in their projects. As well, the consultant informants had experience from tens, some more than hundred, of ERP implementation cases each, while they did not regard benefits realization as a significant issue. Ratuer, the problems encountered by the target organizations related to the cost control side than uncertainty on benefits. This observation suggests the need for developing cost-controlling instruments for ERP implementations in SMEs rather than promoting more efforts on formal benefits realization processes.

In addition to the perceived "self-evident" benefits from ERP in SMEs, which idea contradicts to one of the most fundamental assumptions stated by the benefits realization literature, our results suggest also two other reasons which decrease the perceived usefulness to put extra effort on benefits realization. Many informants had opinions concerning potential weaknesses of formal evaluations – especially their mistrust on whether the evaluation methods would be used for rational decision-making rather than promoting personal political agendas. Moreover, the national IMC funding practice surely had decreased motivation for extra management effort to realize benefits from ERP – as those initiatives were funded anyhow by external means.

In general, our study responds to the lack of empirical research on benefits realization practices (e.g., [12]) – in our case, an in-depth study on lack of such practices in Egyptian SMEs with regard to their ERP implementations. However, our results should by no means be taken as a basis to refute the focus on benefits realization and IT investment literature in general. Our study should neither regarded as an example of a case in which "ERP would not matter" at all from the viewpoint of management (cf., [4, 5]). ERP systems are regarded to bring significant benefits and significant costs thus representing significant area of investments also in the future.

Rather, the results highlight that the widely-documented academic assumptions of the less self-evident nature of IT benefits and lack of maturity that would hinder adoption of benefits realization practices

are just perhaps less universal than suggested in the recent literature. Although our in-depth case study has been limited to four organizations, the interviews with consultants with wide experience from the Egyptian SME field in general suggest our results to be rather generalizable within the Egyptian context. However, studies in other countries and cultures are needed to confirm, whether this would be a culture-related phenomenon or not. In addition to the limitation of our data to the Egyptian context, the study has focused solely on ERP investments. Hence, our results should not be regarded to refute meaningfulness of benefits realization practices in connection to other types of information systems.

In our case organizations, the normative idea about usefulness of benefits realization practices is not shared. While the results support the previous observations that SMEs are often confident to benefit from their ERP investments [9], they simply seem not to regard formal evaluation and benefits realization practices as useful means for reaching those goals. Whereas our data implies that the national funding policy may decrease interest in adoption of benefits realization practices in the Egyptian context, it does not explain the whole phenomenon even among our target organizations; two target companies received no funding from the national program at all. Rather, two more prevailing reasons for lack of benefits realization might still be the clear-cut nature of benefits from ERP and the mistrust on human rationality with regard to the justification, evaluation and benefits realization techniques. These factors could be studied further with regard their generalizability beyond the Egyptian context.

In addition, our results indicate that better cost coordination practices might have been useful in many of the cases, in which the costs to reach the desired benefits exceeded the initial budgets. Whereas ERP systems were regarded by some consultants as "commodities" [4, 5], our data shows that the implementation costs remained often unpredictable despite of the shared idea of the self-evident benefits.

6. Conclusion and future research avenues

Our study has focused on reasons and explanations given for non-adoption of benefits realization and IT investment evaluation methods concerning ERP implementations in Egyptian SMEs. Unlike the normative literature promoting benefits realization practices, management processes, and evaluation methods, our findings highlight that benefits from ERP investments in SMEs may be too obvious to warrant efforts required for their use. Simultaneously the national investment policies had implied no incentives for optimizing the benefits beyond the plain implementation focus of ERP systems. Added with general-level distrust on rational use of analysis methods, these issues explain non-adoption of formal benefits realization and investment evaluation practices. While maturity of IT management and management, together with organizational and regional cultures, might also explain some lack of adoption, our interpretation of the data does not necessarily suggest these to be the root causes for the non-adoption. Rather, our interpretation suggests that because benefits from ERP in SMEs *are* perceived as "self-evident" and further analysis is perceived as non-economical with regard to its expected fruits, the target organizations have no real incentives to increase their "maturity" towards more formal practices or to change the organizational cultures.

Our study implies at least two suggestions for future research. Firstly, proponents of more formal benefits realization and IT investment evaluation practices may find it useful to study the preconditions for using benefits realization concerning particular types of IT investments. Not all IT investments, despite being expensive and mission-critical, may necessarily require in-depth benefits realization or investment evaluation practices. In the Egyptian SME context, expected and realized benefits from ERP systems could have been too self-evident to warrant deeper benefits realization practices. Furthermore, adherence to some lightly adopted practices in itself may be regarded as harmful if conducted without larger understanding of the context (leading to political games or misunderstandings of the actual nature of desired benefits). These two propositions deserve further research with regard to different types of information system investments and in other contexts.

Secondly, despite that the benefits realization in our case organizations or the national context of Egyptian ERP investments in SMEs was regarded less useful, it does not mean that such investments are problem-free. While the benefits in this case seem to be self-evident even without in-depth evaluation or realization practices, the main problem in our target domain of interest seems to be the coordination and management of costs, which continue to exceed the budgets, sometimes alarmingly. Effective and efficient cost control practices for ERP projects seem still to be needed, even when the benefits are regarded as obvious.

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Exploring ERP Adoption Cost Factors

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Abstract: Due to their limited resources, budgets and their high sensitivity to costs, when Small and Medium Enterprises (SMEs) take the first step into implementing an Enterprise Resource Planning (ERP) system, they need to think about many things, foremost the cost of adoption. Literature suggests that most ERP implementations fail due to inaccurate and optimistic budget and schedule estimations, as well as, anticipating indirect costs beforehand is problematic. With the deficiency of a clear model of cost factors for ERP adoptions, ERP adoptions face high risks of failure. Failures could be caused by several factors, but the scope of this research is focused on identifying, exploring, and validating a comprehensive list of ERP adoption cost factors. This could aid SMEs in visualizing the different expected costs, and would consequently assist in better future cost management and estimations. There has been plenty of research in ERP; however, a clear gap in ERP cost identification, management, and estimation exists. This paper focuses on identifying direct and indirect cost factors that influence total costs in the ERP adoption process. The paper presents a cost list that has been developed through literature and an ERP expert panel. Furthermore, this study validates the costs list through interviews with different stakeholders within ERP adoption projects in Egypt.

Key words: ERP (enterprise resource planning), cost estimation, cost factors, SMEs (small and medium enterprises).

1. Introduction

Enterprise resource planning (ERP) systems are enterprise wide application packages that unify, store, integrate, and disseminate all the information flowing through an organization. ERP systems integrate accounting and financial information, human resource information, supply chain information, and customer information [1].

An ERP system implementation is one of the most complex and largest projects an enterprise could embark on. Although ERP systems mainly target large enterprises, many factors lead small and medium sized enterprises (SMEs) to an ERP adoption decision. ERP implementation projects may vary in size and structure, each requires careful management decisions during the implementation process [2]. Moreover, an ERP implementation is a critical project that requires commitment, substantial amount of resources, and organisational changes [3]. Size and structure of organisations implementing ERP systems are not the only variables within the ERP project. Its specific context factors [4], existing software reuse, and the adoption of a specific vendor's implementation methodology are also important factors [5].

Given the complexity and high costs of ERP systems, organizations need to think about many things, foremost among which is the cost of adoption [6]. With the shortage of proper representation of ERP adoption cost factors and cost estimation methods, especially for SMEs, ERP systems adoption projects are facing challenges in identifying and estimating costs, size, time, effort, productivity and other cost factors [7-8]. Furthermore, when ERP adopters cross their estimated budgets, this could be very critical for an SME with limited resources. Some studies argue that the rise in costs is sometimes not relatively high when measured against benefits. Although this argument might be true, still the main argument here is not the cost/ benefit analysis, it is the projected budget vs. the actual money spent on the adoption project. Even if the expected

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benefits are high (usually long term), this would not protect companies from cancelling an ERP adoption project, or going bankrupt due to unanticipated cost overruns, which could exceed their allocated budgets and capacities. In addition, benefits and their associated costs should be projected correctly prior to the project, as many companies implementing ERP systems filed for bankruptcy [3, 9-10], and this was mainly due to a flawed ERP budget and schedule estimations [11-13]. Thus, the costs perspective could be more crucial despite the potential benefits, as you supposedly gain more benefits when you spend more money, but it is all about your budget constraints and availability of resources [14].

SMEs are more cost sensitive than large enterprises. Any cost rise or project delays would seriously affect SMEs' survival in the market. Since ERP adoption within SMEs is still immature, researchers need to inspect and identify the basic drivers that influence ERP adoption decisions [6], especially ERP adoption costs. In general, information systems (IS) and ERP implementations' costs are mainly divided into direct and indirect. Direct costs are the expenditures that are directly associated with the implementation and acquisition of new technology or system [15]. Clear examples of ERP direct costs could be the license and information technology (IT) infrastructure costs. Alternatively, indirect costs would include human and organizational related costs that usually occur during the implementation process [16]. Like business process re-engineering, human resources (HR) costs, project schedule delays, etc. Moreover, most of the informants interviewed in this research view any unanticipated cost that crosses the estimated plan and budget as an indirect or hidden cost, even if it was a marginal increase in a direct cost. Estimating ERP adoption direct and indirect costs is a problematic process and not clearly presented in ERP literature. The next section will highlight some of the problems that face organizations in general and SMEs through their investment justification and budget estimation phases.

This study aims at presenting and testing the validity of cost factors that occur within ERP adoption projects in Egyptian SMEs. These cost factors have been identified and published in a previous research, and this research is a continuation by validating the factors list through interviews with ERP-adopting organizations, consultants, implementation partners, and vendors in Egypt. There is a considerable gap in IS research regarding cost factor identification and classification [17]. The presented list could lead the way towards a more solid and valid costs' list percentages and weights, which consequently could be used as a cost factor indicator or estimation guide for potential adopting organizations. The Egyptian context was chosen as a research kick-off, as it was convenient to the author due to the availability and access to data. Moreover, based on initial pilot interviews with ERP consultants, many of them stated that the current cost estimation methods are not adequate for ERP settings. In addition, they stated that the usual European or American cost factors weight distribution (e.g., accountants' rate/hour) is not relevant to the Egyptian context. The results presented in this study could enrich ERP literature and practice if further validated, extended, and compared with other research in other countries or contexts.

The rest of the paper is organized as follows: Section 2 summarizes the existing literature on ERP adoption cost management, estimation, and issues of ERP implementation projects in SMEs. Section 3 presents the research methodology and target cases. Section 4 presents the results and discusses the contribution to previous literature. Section 5 discusses the limitations of the study and after which, section 6 concludes and presents potential future research avenues.

2. Literature Review

In most cases, ERP systems are the solution to manage business and coordination complexities effectively [18]. ERP in large enterprises market is close-to-saturation, as nearly every major business has adopted one or more ERP systems [19]. Nowadays,

with the increasing number of alliances, value-webs, data flows, and number of complex operations, SMEs start to consider adopting ERP systems. Moreover, many SMEs have several Silo computer systems within their businesses, which make it too costly in order to store and rationalize redundant data [1]. Thus, an increasing number of SMEs is taking ERP adoption decisions, as they believe that it is a step towards process standardization [20], cost effectiveness, and a way to survive the severe market competition [21]. That also explains why SMEs are a prospective target for major ERP vendors like SAP, Oracle, and Baan [6].

According to Scheer & Habermann [22], Baan, Peoplesoft, as well as SAP state that the software license purchase is not the big bulk, as customers could spend around three to seven times more money on the implementation and its complementing services than the initial software license costs. That could be a clear cause for the increasing number of law suit cases related to ERP's erroneous adoption cost estimations [12]. Hence, ERP cost estimation effort should be embarked closely by beneficiaries (clients), vendors, and third party consultants if any, because the vendor's cost estimates alone could omit some customer specific costs; like hiring, search and vendor selection costs, and business process reengineering.

Markus, et al. [2] divided and classified the ERP implementation project into three phases: (a) project, (b) shake down, and (c) onward and upward phases. Particularly, the ERP system is introduced in the company within the project phase, and the success of this phase is measured according to cost and time completion within schedule and budget. Equey, et al. [23] found that size, consultants' experience, and people characteristics have a great influence on ERP projects costs.

According to Holland & Light [11] and Martin [13], around 90% of ERP implementations are behind schedules, over their budgets, or entirely cancelled due to rigorous underestimations during the requirements phase [12] in which unwarranted optimism and overlooking in cost and schedule estimations, could be the cause, rather than project management pitfalls [11-12]. A recent survey published by Panorama Consulting Group (ERP Report 2011) indicates that in the year of 2010, 61.1% of ERP implementations crossed their deadlines, and 74.1% crossed their estimated budgets.

In literature, many studies discuss the difficulty of estimating costs of IT and ERP adoption projects. Love, et al. [15] has stated that in most IT adoption cases, both direct IT and indirect costs cross their estimated value. The convolution in IT and ERP adoption cost identification and estimation relies on the fact that it is a complex task [18, 24]; it requires vigilant analysis for both direct and indirect costs. The noticeable gap in IT and ERP adoption cost management and estimation areas is partially because the formal conventional budget estimation methods fail to reflect, quantify and accommodate indirect adoption costs [8, 25-26]. Similarly, the IT established and widely used software cost estimation models, e.g., COCOMO II [27] are not appropriate within an ERP setting [9, 12, 24]. The problem with the COCOMO family and similar models is that they are more focused into software development cost estimation. Their cost drivers are based on factors that are not adequate or applicable in an ERP setting, as lines of code (KLOC) and development time (D) are not considered relevant drivers in an ERP adoption project [24, 28-29]. Moreover, the cost factors in software development might be easier to project and identify, than those of complex implementations. Though, these models could be relevant to ERP software development and pricing.

There have been few efforts made towards ERP cost exploration and estimations. However, these efforts were either (a) driven into generic software development cost estimation (pricing), like Refs. [12, 27, 30-31], or (b) were closely focused on ERP in a specific context, like ERP cost identification and estimation from a portfolio management lens [5], or (c) for cross-organizational ERP projects cost estimations

[24], or (d) adopting a Transaction Costs theory lens to govern ERP costs in a service oriented architecture (SOA) implementation setting [32].

The costs list presented in this research could be used in order to project more realistic cost estimates and factors through identifying potential cost factors, while benefits should be the motivation for implementing an ERP system in first place. Usually the expected benefits are the system requirements which are based on the requirements analysis included within the request for proposal (RFP), and the cases presented in this research show that some Egyptian SMEs do not follow any formal benefits realization practices. Furthermore, there is an apparent gap in ERP research, that there are very few studies that focus on ERP cost estimation, ex-ante evaluation or costs identification in SMEs context.

3. Research Method and Design

This research is a continuation to validate cost factors based on existing literature, and data collected from an Experts Panel along with actual data from vendors, implementation partners, investment and ERP consultants, and 4 SMEs that already completed their ERP adoption process (See Fig. 1). This research applied a multiple case study design, as it has more investigative recompense compared to single case study, as well as it provides a flexible approach for Information Systems research [33-34]. Furthermore, in order to build strong substantiation of constructs, data triangulation as a mixture of qualitative and quantitative data collection methods were used [33]. The following section provides more details concerning the data collection process.

3.1 The Experts Panel

Due to the implications of this research in practice, an Experts Panel has been conducted. The Experts Panel recommendations and insights were very valuable to this research within its early stages, as experts provided valuable inputs that helped the researchers to better understand the phenomena or the problem they are investigating. The Experts Panel serves as an initial research onset that aids the mapping of the researcher's ideas and research problems with practice. Moreover, the panel was used as a mean of eliciting knowledge from ERP experts. The Experts Panel approach included a combination of Delphi, Focus Groups, and mind mapping techniques. This group method was chosen by researcher in order to discuss and reflect on the participants' personal experiences with relation to the researcher's research topics [35]. In addition, face-to-face group techniques could be fruitful while investigating a certain phenomenon at the early exploratory stages of a research [36-37]. Also, the Experts Panel could represent respondents' beliefs, experiences, and responses in a way in which would not be suitable using other techniques like one-to-one interviewing or questionnaires [38]. Additionally, a number of researchers have also pointed out that group brainstorming and discussions can generate more momentous comments than usual interviews [37]. As recommended by Ref. [39], dynamic mind maps were used as tools for representing the ERP cost factors list graphically, which stimulated the participants to engage with content and provide modifications and rankings for the initial mind map. Moreover, mind maps

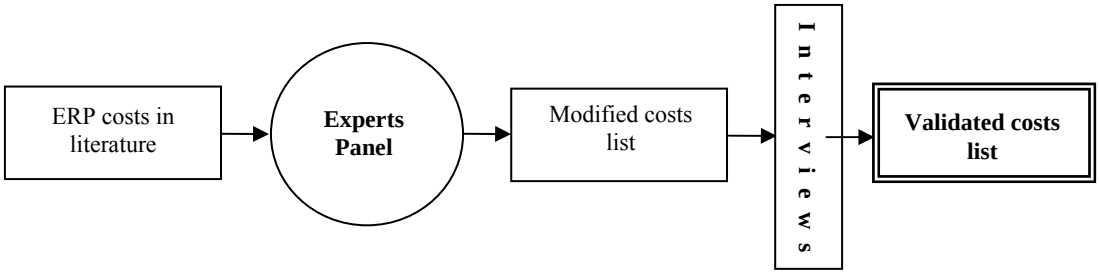

Fig. 1 Overall research design.

could be useful to use in cases where problem solving, group understanding and brainstorming, delivering information, and evaluation of participants' beliefs are needed [39]. The illustrative dynamic mind mapping technique is similar to cognitive maps, which are used to present and record qualitative data in group discussions [40]. Please refer to Ref. [14] for more details about the benefits, limitations, and comparisons of the Experts Panel conducted within this research, in contrast with other research methods.

The panel included key experts involved in ERP implementations in Egypt. The participants were from selected ERP consultants, vendors' representatives and implementation project managers. The expertise of the participants represents diverse knowledge in a broad range of international corporations and industrial sectors. The potential participants were chosen according to their popularity, number of clients and market share in the Egyptian ERP market. Twelve potential participants were contacted by phone and via e-mail, and eight experts responded and participated. The panel included vendor consultants from SAP, JD Edwards, Focus ERP, independent ERP consultants, project champions, and managers from different industrial SMEs. The variety of experts was to ensure that the researcher captures different views and perspectives on costs. The Experts Panel's main purpose was to develop a list of costs that occur during ERP implementations in SMEs and rank them according to their influence on total costs (See Fig. 2). The Experts Panel took two rounds which included lists, rankings, discussions, and visual costs list presentation. At the end of the panel, a cost list was developed and then confirmed with all 8 experts.

3.2 Interviews and Cases

The author conducted a total of twenty-two qualitative face-to-face interviews. Ten of the interviews were carried out with informants that have been involved in the ERP budgeting and cost control process. The interviews were conducted in eight companies in Egypt, and discussed the whole ERP lifecycle, from the pre-selection phase until the post-implementation phase. The participants included a mixture of stakeholders who have been involved in ERP system implementations, four SMEs (6 interviews) which had implemented ERP, a major local ERP vendor, major ERP implementation consultants and vendor partners (two companies), and a senior independent ERP consultant in Egypt.

According to Egyptian government official reports [41-43], the SME classification and definition in Egypt is not yet clear nor standardized, especially across industrial sectors [42], as the current classification through number of employees and fixed assets is not adequate [43]. Thus, the interviewees where asked to

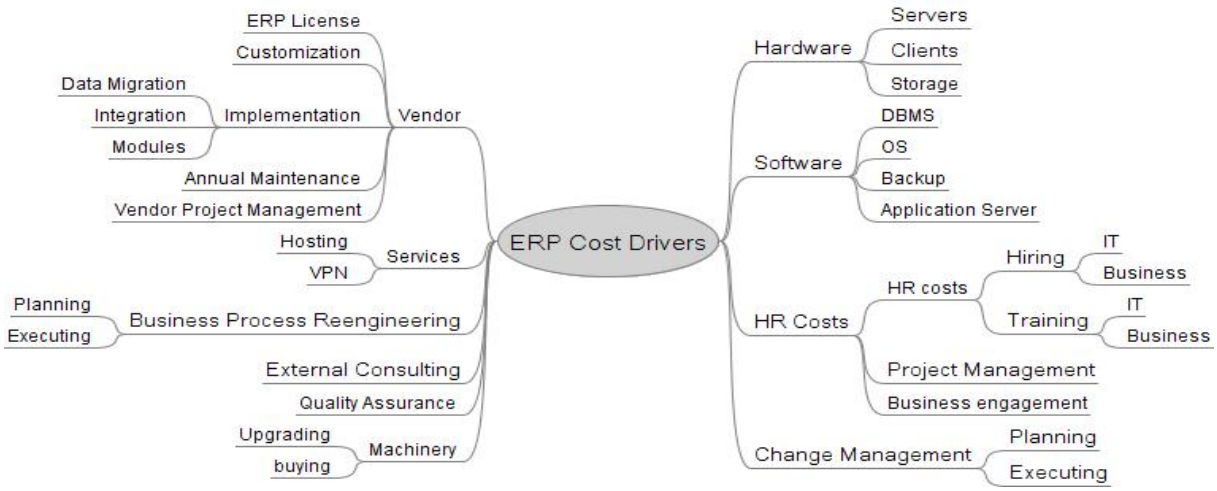

Fig. 2 Expert panel-developed costs list (Adopted from Ref. [14]).

classify their organizations' size according to their annual turnover, number of employees, number of ERP users, and their perceived size in their industry market in comparison to their same industry competitors. Three were classified as medium-sized, and one as a small enterprise.

Altogether six interviews gathered information from the four SMEs including two manufacturing companies, one in the importing and distribution business, and one retail company. One interview focused on a vendor representative, two on implementation consultants, and an independent senior ERP consultant. The vendor and implementation consultants were chosen according to their recognition and number of projects within the Egyptian SMEs. The informants had experience on various ERP systems including:

- Al Motakamel (local ERP);
- Focus;
- Infinity (local ERP);
- JD Edwards;
- Oracle E-Business Suite;
- SAP;
- And various in-house developed Integrated Enterprise Applications.

As the interviews needed informants with a background of the financials involved in the ERP adoptions, all the interviewees were in a senior or managerial position. The interviews topics covered the ERP selection processes, feasibility studies, investments justification, budget estimation process, and ex-post investment evaluation. All the informants were given the cost list developed by the panel of experts (Fig. 2) in order to validate it and modify it if needed. They were also asked to give percentages on the cost factors according to their actual expenditure in their projects. That would aid in ranking cost factors in relation to total costs, and would aid other SMEs to identify their potential costs and budgets. The interviewees were briefed about each cost factor and its sub-factors, so they can easily identify and map their costs under the corresponding umbrella.

All interviews were digitally recorded. In the following, four target companies: "Sakkara", "Khafre", "Senusret", and "Kamose", who had implemented ERP systems, are introduced in more detail. The company names are fictitious to preserve anonymity (Table 1).

Sakkara had an in-house developed system for many years before moving to an international ERP system. The company was mainly facing scalability and technical problems with the existing legacy system that were affecting its day-to-day operations. Moreover, they had other challenges with the system that "were due to the employee turnover, absence of sufficient system documentation, and support" (IT manager). Thus, the company decided to acquire a standard ERP package, which would be "more stable and easier to handle" (IT manager).

The company used no external ERP consultants, as they see themselves competent enough to identify needed requirements, select, and manage the ERP system. The company estimated its own budget for the project, without the use of external investment consultations.

Table 1 Overview of informants and target cases.

Company (size)	Informants	Ownership	Industry/Business
Sakkara (Medium)	IT manager, business solutions manager	Private stocks	Automotive parts distributor
Khafre (Medium)	ERP project steering committee member, IS manager	Family owned	Retail
Senusret (Small)	ERP project steering committee member	Family owned	Printing & packaging
Kamose (Medium)	Steering committee member	Family owned	Dairy products
Abu Simbel	Branch manager	-----	Local ERP vendor
Pyramids ERP	implementation operational manager	-----	ERP implementation partner
Giza	ERP solutions department manager	-----	ERP implementation partner
-----	ERP senior independent consultant -----		ERP/BI consultant

The project team was composed of internal employees and the implementation partners. The system went live in January 1, 2008.

The ERP modules implemented were finance and controlling, sales and distribution, material management, customer service, human resources management, customer relationship management (CRM).

Khafre deals with a diverse number of commodities that are sold directly to customers through one outlet. The commodities vary from fresh food, fast moving goods, non-food commodities, textiles, and furniture.

Prior to the ERP adoption, they had a local Egyptian ERP system that had a complete retail-specific package. It was consisted of an ERP as a back office, and a point of sale (POS) application as a front office. This system had many technical problems including poor performance, slow transactions, and imprecise report calculations. Although it was both a front-end and back-end solution, still it had many integration problems with the POS, which dramatically affected the company's operations. Thus, Khafre decided to move to an ERP package that can provide integration with a POS solution. The company had an IT consultant involved in the whole project, and he developed the main budget estimation for the adoption project.

The project budget was circa "3 to 5% of the yearly sales revenues", a steering committee member mentioned. The implemented modules were finance and controlling, capital asset management, logistics, procurement, and sales and distribution. The system went live in August 2007.

Senusret is specialized in producing paper and carton supplies for fast food restaurants in Egypt. The company's manufactures several paper, carton, and wrapping products. The company had several dispersed applications before migrating to an international ERP system. Most of the processes were not integrated within the applications used, and were manually done. The applications were mainly built on Microsoft Excel.

The company suffered many business and technical problems due to the lack of integration between the applications. "The existing scattered applications did not meet the business requirements and they were not integrated, for example we had problems processing orders, sales' planning was not integrated with production planning," a steering committee member mentioned.

The ERP system was implemented in 2007, and the modules were finance and controlling, order management, purchasing, warehousing, plus an external customized payroll system. Senusret hired a senior ERP consultant, which helped in estimating the costs and budget needed for the ERP implementation.

Prior to the ERP adoption, Kamose had several scattered applications, which lacked integration and scalability. "We had scattered systems, so we needed integration […], the systems we had were working with an Access database, which could not handle the business transactions anymore." (IT manager). Moreover, the company suffered loss of data incidents, as the existing system couldn't handle the increasing number of records. "The system could not handle the number of invoices, then we faced failure in the database, and we lost some data, so we decided to buy a new system." (IT manager).

Kamose produces dairy products like milk, cheese, and butter. The company also imports and distributes different kinds of fish.

The company did not have a consultant during the selection process. The company did a rough cost estimation based on the vendor's estimates. They later hired a consultant during the implementation process. The ERP modules implemented in Kamose were finance and controlling, warehousing, purchasing, fixed assets, order management. The company now is considering implementing the HR and Manufacturing modules to extend their ERP.

4. Results and Discussion

In order to increase the researcher's understanding and the reliability of this research, the interviews conducted have included open ended questions about the evaluation, estimation, and budgeting methods which the companies used. Moreover, the informants were asked about the difficulties they faced during the application of formal budget estimation and ex-ante evaluation methods. In general, none of our four target organizations had followed formal practices for IT investment evaluation or cost estimation. "We did a rough budget estimation and total cost of ownership, which included the licenses cost, implementation costs and so on. We only calculated the external costs, which we will pay to third parties in cash, we didn't calculate internal costs. We had also put 20% extra as a reserve, as some costs usually pop up during implementations, without prior expectations." (IT Manager, Sakkara). In addition, according to the consultants and target cases interviewees, proper formal cost estimation and feasibility studies are very rare in the context of Egyptian ERP implementations in general. However, the informants still claimed that ERP requires significant financial resources. Moreover, the consultants and most of the informants from the target organizations reported that the ERP projects had often drastically exceeded their initial budgets and schedule estimations; some even doubled the initial budget. "…The actual expenditure was double our estimated budget, but we had to go on." (IT manager, Sakkara). When Sakkara's IT manager was asked about why the costs have doubled, he said "because of external and internal factors. The external factors are related to the implementation partner, they under estimated the costs for this implementation scale, although we asked them to take enough time in their evaluation, but the implementation partner wanted to get the deal by any means. The internal factors were related to change management; we did not pay attention to this cost while setting-up the budget". Implementation schedule estimations were crossed in all target companies. "We crossed our budget because of the delay in the schedule estimation, which is a cost, as well as, change management costs were not properly calculated, because of improper implementation scope estimation in first place." (IS manager, Khafre). Vendors and consultants agreed that most of SMEs follow informal budgeting procedures. "SMEs are affected by the ERP offer prices; they usually do not properly include the infrastructure costs within the budget for example. They usually do not follow any formal budgeting procedures at all. But this differs when there is a consultant, usually he would roughly do a better budget estimation." (Branch manager, Abu Simbel). Likewise, other interviewee from an implementation partner stated that their clients usually do not follow formal budget estimation processes. "Probably two or three companies have followed semi formal budget estimation methods, but in general, customers just check our offers and check if they have the required budget for it or not, without following any formal methods." ERP implementation operational manager, Pyramids. On the other hand, some interviewees from client companies had doubts regarding the reliability of vendors' project cost estimations, "relying on vendors' cost estimates only is not wise, as sometimes they have problems in estimating costs that matches your organization's size, or they just present a low and unrealistic cost estimate in order to win the implementation bid" (IT manager, Sakkara). Moreover, some expressed the difficulty of conducting ERP cost estimations, "estimating ERP adoption costs is very difficult and almost impossible when using the existing financial and budgeting models, because there any many hidden costs that you cannot expect or know before the actual implementation" (IT manager, Sakkara). Several informants have provided reasons for unexpected cost escalations, and some implementation partners referred it to the "Frequent change in requirements, or new customization requests related to new needed reports". (ERP solutions department manager, Giza), or that "customers usually

do not know what exactly they need out from the system, so their requirements frequently change, and that increase delays and costs." ERP implementation operational manager, Pyramids.

In order to validate the costs list in Fig. 2, all the informants were asked to check if there are any costs that need to be added, modified, or deleted from the list. Moreover, they were asked add percentages of the total cost on every cost factor they spent money on. The purpose of adding the expenditures' percentage is to try to map common cost factors between SMEs, which could aid in better estimations for new adopters. All informants agreed that the list is very comprehensive and it contains all the cost factors that usually occur during the adoption process. However, some of these cost factors apply to some cases, like machinery. "This list is carefully done, I will gladly put the percentages on the cost factors, as it could aid me in future projects as well, and it is important for me to have all the costs calculated as a reference anyway. I wish I had it beforehand, as it is a good visualization of cost factors." (IS manager, Khafre).

Fig. 3 presents a sample of a filled-in costs list by an informant. The informant put actual expenditure percentages for each cost factor related to their case.

The results are palpable that the cost identification and estimation process is problematic for both implementers and SMEs, which corresponds to IS and ERP cost estimation literature. All target cases have crossed their budgets due to unpredicted costs and schedule delays. Consultants and vendors stated that this happens in most cases and rarely an ERP adoption project stays within the estimated budget because of unforeseen costs and delays. Clients usually relate the rise in costs to unplanned and pre-unidentified costs. Some of these hidden costs are unplanned human resources costs or related to neither realistic nor comprehensive estimated budgets provided by the implementation partners and vendors. On the other hand, informants from vendors and implementation partners mostly claim that the rise in costs is usually because of the poor requirements analysis, frequent changes in client requirements, and last minute customization requests.

As cost factors are often unclear and many are hidden and overseen, the presented costs list could initially aid SMEs to identify all potential cost factors related to their case and scope, as well as, get a glimpse of actual weights of each factor to prepare a more rational budget estimates. Moreover, vendors, implementation partners, and consultant could benefit from the further extension of this research, as it would

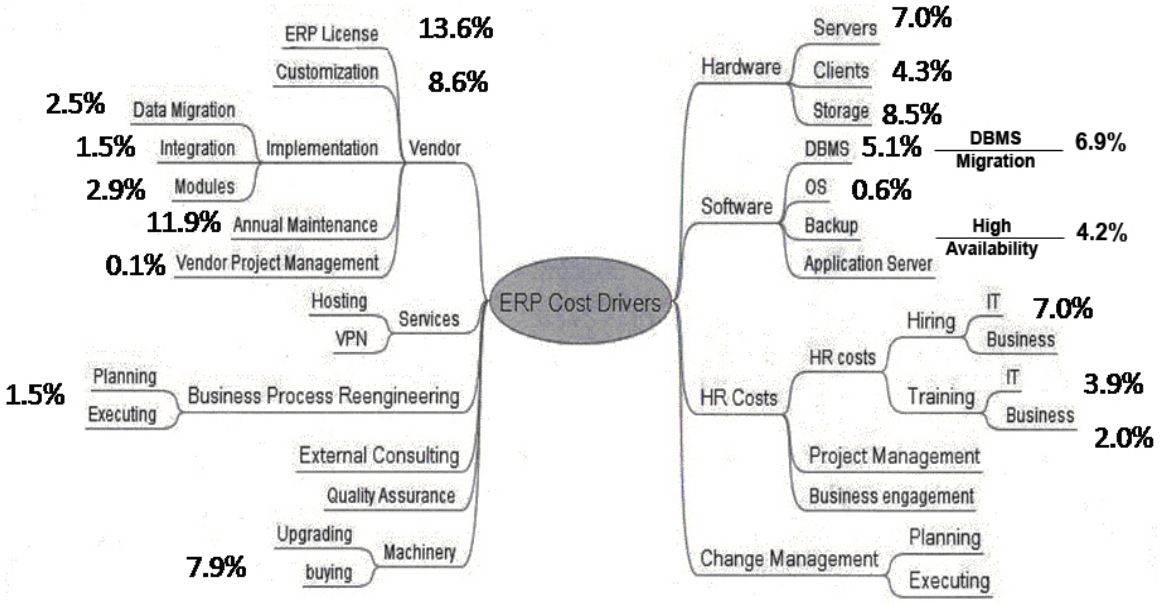

Fig. 3 List of actual cost percentages.

aid them to give their clients more realistic overview and estimations while considering all cost factors presented. Further, the list could help in developing a cost estimation model based on ERP-relevant cost factors and weights.

5. Study Limitations

This study is the first attempt to discuss and validate experiences of ERP adoption cost management and estimation in Egyptian SMEs. The findings and results are more practical than theoretical because the participants of the Experts Panel and interviewees are actual ERP users and consultants. In spite of this strength, the study has weaknesses. Some limitations originated from the approach of our research. Firstly, we had to rely on the retrospective experiences of the respondents. It may be argued that respondent views might be biased, however, we have asked the informants to give realistic percentages and estimations as possible. Secondly, 10 interviews only were carried out, as finding willing informants with the ERP-project financing details is not an easy task, however, some of the interviewees had experiences with more than 100 implementations. Thirdly, our samples are limited to Egypt. Thus, general conclusions must be made with prudence. Moreover, the implementation of ERP in Egyptian SMEs could have some differences than other contexts, as in some cases, SMEs can apply for an ERP implementation partial funding from the Ministry of Trade and Industry, which usually covers half of the project expenses (this applies to 2 of our 4 target cases). This might affect the motivation for a proper cost management or control in some cases. Nevertheless, ERP is no longer restricted within countries, because of globalization. Therefore, the findings of this study can be more than an indicator for other countries as well.

6. Conclusion and Future Research Venues

Through an expert panel and interviews, 10 main cost factor nodes were identified, which subsequently have sub-factors. The importance of identifying these factors relies on the fact that many SMEs (and enterprises in general) which did not have a prior ERP implementation, might lack the experience to identify costs that could occur during the adoption process. Specially that some of these costs are not direct or visible, and interviews show that actual expenditures are usually higher than the estimated ones. SMEs can use the presented costs list in this paper in order to better predict the cost factors they might face, or need to include within their budget estimations, as well as, would help in the cost management process. For research, the costs list could help other researchers to better investigate ERP adoption cases, or participate in action research during implementations. For practice, the costs list could decrease the tensions between vendors and clients through providing more accurate view of occurring costs and needed budgets. In addition, this paper identifies some of the current gaps in ERP cost estimation literature.

This research has the potential to be extended in many corners. Validating and comparing results of this cost list with other SMEs in different countries or contexts would increase the validity and generalizability of the cost factors. In addition, this research can be extended to compare results between different enterprise sizes and/or industries. Moreover, using the cost list to study the difference between projected budgets and actual expenditures would help other companies to better estimate costs and have an idea about their weights before the actual adoption. Finally, the extension of this research would lead to a more realistic cost estimation model when based on real data, collected from actual ERP adoption projects. In its current stage, the cost factors list presented might not be used as a cost estimation model as such, however, it would guide potential SMEs in anticipating potential cost factors that occur during ERP adoption projects.

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ERP Lifecycle:
A Retirement Case Study

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ABSTRACT

A lot of research has been undertaken focusing on ERP systems lifecycles, but very little paid attention to retirement. ERP retirement means the replacement of an ERP with another. The aim of this research paper is to investigate why and when should organizations retire their ERP systems. A convenience case study of a SME has been selected from Egypt. The case study under investigation has retired their local ERP system and replaced it with SAP ERP. Results of the analysis indicate that reasons of retirement were: wrong selection, users were not involved in the selection process, and lack of an official implementation methodology. This is considered a new finding since main stream literature was mainly focused on retirement after maturity.

Keywords: *Case Study, ERP, Lifecycle, Retirement, SME*

1. INTRODUCTION

Enterprise resource planning (ERP) systems are comprehensive systems designed and engineered to integrate main business processes and functions (Ifinedo & Nahar, 2006). ERP systems are information systems (IS) that integrate several business functions together. An ERP system combines inventory data with financial, sales, and human resources data. They evolved from basic inventory software systems into material requirements planning (MRP) and manufacturing resource planning. Nowadays, the organizational and technical complexity associated with the implementation of ERP systems requires more attention in making implementation-related decisions. ERP projects involve difficult technical and managerial choices and challenges. It is one reason why organizations buy their ERP systems off-the-shelve instead of developing them in-house (Wu & Wang, 2006).

Towards the fulfillment of the implementation of ERP systems, organizations usually contract with an ERP vendor having specific ERP knowledge, to provide a turnkey project that meets their needs without having to learn the complexities of the ERP implementation process. Having said that, the result of implementing ERP, however, is not always successful. Many large organizations have installed an ERP system but had to cancel their implementation. This is mainly because ERP implementations are often complex, and require too expensive

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expertise. Therefore, top managers are likely to require an evaluation of the success of the resulting system. Although it may be more desirable to measure system success in terms of monetary costs and benefits, such measures are often not possible due to the difficulty of quantifying intangible system impacts and isolating the IS effect from numerous intervening environmental variables that may influence organizational performance. It is expected that improved performance will automatically follow if the system meets information needs. This does not imply that satisfaction causes performance. Performance and user satisfaction are both caused by the extent to which requirements are satisfied (Wu & Wang, 2006).

ERP systems are commercial software packages that enable the integration of transaction-oriented data and business processes organization-wide. As increasing numbers of organizations have chosen to build their IT infrastructure around this class of applications, there has been a greater appreciation for the challenges involved in implementing these complex technologies. Although ERP systems can bring competitive advantage to organizations, the high failure rate in implementing such systems is a major concern (Kim, Lee, & Gosain, 2005).

An ERP system is a packaged business software system that enables a company to manage the efficient and effective use of resources (materials, human resources, finance, etc.) by providing a total, integrated solution for the organization's information-processing needs. It supports a process-oriented view of the business as well as business processes standardized across the enterprise. Among the most important attributes of ERP are its abilities to: automate and integrate an organization's business processes; share common data and practices across the entire enterprise; and produce and access information in a real-time environment. ERP implementations are costly. Although ERP software is expensive, an even more substantial amount of business cost is typically spent on consulting to overcome difficult software implementation. ERP is a packaged solution with long complicated interrelated code containing a set process (Nah, Lau, & Kuang, 2001).

ERP systems are usually implemented as projects. ERP implementation projects usually involve selecting the ERP vendor, establishing business process reengineering, implementation, and evaluation of the adopted system. ERP implementation projects normally involve internal IT & business personnel from the adopting firm as well as external consultants from implementation partners in order to be successful. This shows how human resources intensive ERP projects are. It is also worth mentioning that a good implementation partner is considered one of the most important factors for the success of ERP projects, and is another addition to the complexity of ERP implementation projects (Elragal & Al-Serafi, 2011).

Besides globalization, there are many other forces e.g., competition, rise of the information economy, etc that drive an organization to an ERP adoption decision. Mostly, organizations adopt ERP systems to manage the everyday large volume of operations and information which are created from within the organization. Not only this, more and more organizations are involved in strategic business alliances, and a substantial volume of information needs to be controlled and utilized amongst these partnerships. All of this has led to the punctual need for ERP systems, which is why nowadays small and medium enterprises are adopting ERP systems in order to manage this vast information flow.

Due to the substantial needed efforts, organizational changes, time and resources, an ERP adoption is considered one of the biggest and most critical projects a company could carry out (Moon, 2007). ERP adoption projects may vary in size, methodology, and structure. The implementation process requires a systematic and careful management monitoring and decision making (Markus, Tanis, & van Fenema, 2000). There are many variables and factors that can affect an ERP adoption process. Contextual factors (e.g., government policies, culture), legacy software reuse, and embracing a specific vendor's ERP implementation methodology are among those factors (Daneva, 2007).

ERP adoptions in SMEs differ than those of large enterprises, as organization size serves as an important variable (Buonanno, Faverio, Pigni, Ravarini, Sciuto, & Tagliavini, 2005). In general, SMEs have been recognized as vitally different environments compared to large enterprises (Welsh & White, 1981). The literature calls for more attention and focus on SMEs, as a little attention has been given to research on ERP in SMEs, in relation to ERP studies which are often based on findings from large enterprises (Haddara & Zach, 2011).

The ERP adoption process happens in phases, those phases are usually referred to as ERP lifecycles. A number of studies have developed ERP life-cycle models and frameworks (Al-Mudimigh et al., 2002; Chang, Yen, Huang, & Hung, 2008; Esteves & Pastor, 1999; Markus & Tanis, 2000; Tariq, 2009).

In ERP literature, lifecycle phases vary in name, number, and level of details from model to model, however, those models usually include several phases, like adoption, selection, implementation, use and maintenance, and evolution. Esteves and Pastor (1999) have extended the common ERP models' phases to include a retirement phase. Retirement phase is the stage when a certain ERP system is replaced by another ERP system or any other information system (Esteves & Pastor, 1999; Moon, 2007). According to ERP literature reviews, there is no current studies on ERP retirement phase in a general context (Moon, 2007), nor in SMEs context (Haddara & Zach, 2011).

The rest of the paper is organized as follows: first we present the background of the study, followed by methodology, case study, then analysis and conclusion, and finally future research.

2. BACKGROUND

ERP is a standard system that provides integrated transaction processing and access to information that spans multiple organizational units and multiple business functions. These functions include financial and accounting, human resources, supply chain, and customer services. An ERP system is based on a single central database. This database collects data from, and feeds data into, modular applications supporting virtually all of a company's business activities – across functions, across business units and across the world. Most companies expect ERP to reduce their operating costs, increase process efficiency, improve customer responsiveness and provide integrated decision information. They also want to standardize processes and learn the best practices embedded in ERP systems to ensure quality and predictability in their global business interests by reducing cycle times from order to delivery (Wu & Wang, 2006).

Studies of ERP implementations, combined with findings from earlier work on change management, point to some of the areas in which critical barriers to success are likely to occur. Those barriers are: human resources and capabilities management, cross-functional coordination, ERP software configuration and features, systems development and project management, change management, and organizational leadership are significant factors (Kim, Lee, & Gosain, 2005).

In their research (Nah, Lau, & Kuang, 2001), eleven factors were identified as critical success factors. Those are: ERP teamwork and composition, top management support, business plan and vision, effective communication, project management, project champion, appropriate business and legacy systems, change management program and culture, Business process reengineering (BPR) and minimum customization, Software development, testing and troubleshooting, and Monitoring and evaluation of performance.

In their research (Ifinedo & Nahar, 2006), six factors were identified as critical. Those factors are: Systems quality, information quality, vendor/consultant quality, individual impact, workgroup impact, and organizational impact.

According to Elragal and Al-Serafi (2011), there might be an effect caused by the industry status and shocks that might occur in the market

when measuring business performance. This might lead to incorrect measurements and therefore misconceptions. Business performance might be affected by the industry of the business. Proper management of IS implementations like the ones involved in ERP can also be reported as an important contributing factor that affects performance gains from the system. Management should also set objectives from ERP implementations. On the other hand, things like "ERP size" can be a contributing factor of its effect on business. The alignment between strategic business goals and ERP objectives is an important factor for generating business benefit from the ERP system. While it was believed that ERP implementations based on business goals are more successful. Business oriented ERP implementations do not necessarily result into better financial performance; however technical driven implementations were found better performing in terms of return on investments.

According to Everdingen, Hillegersberg, and Waarts (2000), European midsize companies tend to focus on product characteristics rather than on characteristics of the ERP supplier of the product. It makes little difference whether the vendor is a market leader, an international oriented company, or a company with a superior corporate image. Companies predominantly look at the functionality and quality of the products and services for evaluating ERP suppliers, which has been found across all lines of business and all countries. To a somewhat lesser extent, the speed of implementation, the possibilities of the product for interfacing with other applications, and the price of products and services also is important supplier selection criteria. According to Beatty and Williams (2006), one of the most important IT-enabled business innovations during the past decade has been the emergence of ERP systems. Many organizations that have committed significant organizational and financial resources to their ERP initiatives have encountered unexpected system implementation challenges. One survey of ERP project managers found that 40% of respondents failed to achieve their original business case even after being live for a year or more; meanwhile, more than 20% of managers stated that they actually shutdown their projects before completion. According to Scheer and Habermann (2000), ERP systems are easy to install, yet users must also determine which goals they wish to reach with the system, how the functionality of the system can achieve this, and how to customize, configure, and technically implement the package.

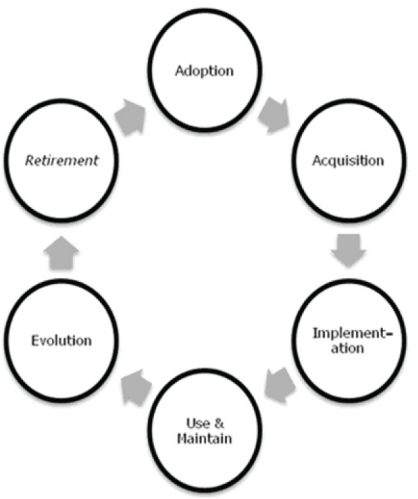
For example, SAP ERP comprises more than 5,000 various parameters to define. The complexity of the implementation process will then be evident. Further, customization and implementation of ERP systems became an industry on its own. But particularly small- and medium-sized enterprises are not able to pay consultants millions of dollars for ERP implementation. Hence, modeling methods, architectures, and tools have become increasingly popular because they can help to reduce the cost of software implementation and at the same time increase user acceptance of ERP software solutions. Several modeling approaches are possible: reduce the effort necessary for creating the target concept by leveraging "best practice case" knowledge available in reference models; create a requirements definition by leveraging modeling techniques to detail the description; document the system requirements definition by means of conceptual modeling methods, making the business logic more understandable; and leverage conceptual models as a starting point for maximum automation of system and configuration customizing.

There are many ERP systems lifecycle models developed. Indeed, the infamous enterprise systems implementation process lifecycle model developed by Markus and Tanis (2000) is one of the most adopted models in ERP literature; however, in this section we are going to present the model developed by Esteves and Pastor (1999). The model is comprehensive and consists of six phases that represent different stages through which an ERP system goes through during its lifecycle in organizations. Although it has been adopted by previous studies (Esteves & Bohorquez, 2007; Esteves & Pastor, 2001; Haddara & Zach, 2011), however, the

main reason behind selecting this model is that it includes the retirement phase which this study addresses. The model's phases are (Figure 1): adoption decision, acquisition, implementation, use and maintenance, evolution, and retirement. Next follows a brief sketch of each phase.

1. *Adoption decision phase.* In this phase, in order to satisfy their business and technical needs, companies start to question the need for an ERP system. Current ERP literature has tackled several corners related to the ERP adoption in SMEs context and environment (e.g., Buonanno et al., 2005).
2. *Acquisition phase.* This phase refers to the actual buying of the ERP system and vendor selection. This happens after evaluating the organization's business needs, ERP packages, and vendors. As the selection is critical, the acquisition phase has been a focus of many studies (e.g., Poba-Nzaou, Raymond, & Fabi, 2008; Sledgianowski, Tafti, & Kierstead, 2008).
3. *Implementation phase.* This phase deals with the actual ERP system installation. This phase includes many activities, like customizing the system to comply with the business needs, business process reengineering, data migration, end-user training, etc. As the implementation phase is the most critical, costly, and time consuming phase, it is not surprising that it has the highest attention from ERP researchers (Haddara & Zach, 2011; Moon, 2007). Some examples of research papers tackled the implementation phase are (Wu & Wang, 2003; Xia et al., 2009).
4. *Use and maintenance phase.* After the ERP system implementation and the *go-live* take place, users start using the system on daily basis. Many topics were subject for research in this phase, like system use and user acceptance (Koh & Simpson, 2007; Wu & Wang, 2003), benefits management and realization (Esteves, 2009; Federici, 2009), ERP impact on organization (Seethamraju, 2008), and maintenance processes (Law, Chen, & Wu, 2010).
5. *Evolution phase.* This phase involves the extension and integration of the ERP system with other systems such as customer relationship managements, supply chain management, or advanced planning and scheduling systems. The ERP system evolution is a non trivial process, and requires a stable and mature ERP system. This phase has not been a center of attention in ERP literature (Haddara & Zach,

Figure 1. ERP lifecycle



2011; Moon, 2007), and requires more focus from researchers in correspondence with its criticality. Examples of studies that covered the evolution phase are (Chang et al., 2008; Sledgianowski et al., 2008).

6. *Retirement phase.* Retirement phase corresponds to the stage when an ERP system is abandoned and substituted by another information system or ERP system. While there are cases in practice, our literature review reached the same conclusion as Haddara and Zach (2011), Tariq (2009), and Moon (2007), that ERP literature lacks research that covers this phase. As a matter of fact, this has been the motivation for us to conduct our case study research.

3. RESEARCH METHODOLOGY AND CASE

According to our literature survey, we believe that there is a research gap in ERP retirement. This is supported by the fact that we have not come across any case study research investigating why companies retire their ERP systems. Needless to say that this is not only a motivation for research, but also a call for more and more research efforts to unfold the retirement decision and process. Accordingly, lifecycle models should focus more on retirement as a phase.

Single case studies are useful to represent unique cases when exploring a new phenomenon and when there is a lack of theory (Yin, 2008). Although single case studies' generalizability is limited, however, it can provide important insights and direction for future research. We have therefore chosen an exploratory case study methodology. This would allow us to collect rich descriptive data on an ERP retirement phase in a manufacturing SME in its natural setting. The purpose of this study is thus to increase our knowledge of the factors which leads for an ERP retirement decision.

This research was carried out as single in-depth case study (Walsham, 1995). The authors conducted more than forty qualitative face-to-face and semi-structured interviews in Egypt. The interviews were conducted in one Egyptian SME and all interviews were focused on the reasons behind the ERP system's retirement. The interviews ranged from 30 to 90 minutes, and notes were taken during the interviews. The participants included a mixture of stakeholders who have been involved in the ERP system selection and implementation. The interviewees positions included the CEO, GM, IT Manager, IT Staff, business function managers, mid-level, and front-line employees. The interviewees variety engendered different perspectives which enriched the data collected through data triangulation (Bryman, 2008), and the findings consequently. Beside interviews, observation and document analysis were also used as data collection means, as we attended board meetings, IT staff meetings, and had access to project related documents.

3.1. Case Study: Food Co – An Egyptian SME

The case study under investigation by this research was chosen based on convenience. The company works in the food manufacturing and distribution in Egypt, to preserve identity we will refer to it as "Food Co," a disguised name. Food Co is considered an SME.

According to reports prepared by the Egyptian government (Economic-Research-Forum, 2004; Lerchs, 2001, 2002), the SMEs classification and definition in Egypt is not yet standardized nor clear, especially across industry types and sectors (Lerchs, 2002), as the current classification through employees number and fixed assets is not adequate (Lerchs, 2001). Hence, the interviewees where asked to classify their organization's size according to its annual turnover, number of employees, number of ERP users, and their perceived size in their market in comparison to competitors in same industry. The interviewees classified their company as a medium size enterprise.

3.1.1. Company Brief

Food Co is an Egyptian company that operates in different fields of business. Their name has

become synonymous with a range of quality fresh and frozen products in domestic as well as international markets. The company started business in 1932 as a family-owned and run business. The group is active in the production and marketing of a range of products e.g., natural pure ghee, natural butter, processed cheese, cheddar cheese long life juices and long life milk and flavored milk. The Food Co consists of four legal entities:

1. Investment: This is a food importer and was established in 1985. It has the following products: frozen fish, frozen chicken, frozen liver, and butter;
2. Industries: it was established in 1998 and it has the following products: juice, table butter, milk, ghee;
3. Products: it has been established in 2004 as a major producer of cheese;
4. In 2011, Food Co. has successfully established a forth company for distribution of its products.

3.1.2. ERP at Food Co

In year 2006, Food Co has decided to implement a local Egyptian ERP called Al MOTAKAMEL by OFIS Soft. OFIS is a well-known ERP in the Egyptian market. Since 1986, OFIS started to help businesses to improve their IT operations and implementing ERP systems. OFIS is providing its information technology services to the Middle East, and to Egypt's most important sectors such as commercial, industrial, retail, and construction. Further, OFIS is also providing large-scale WAN-based solutions, in addition to bespoke applications.

3.2. Data Collection

Semi-Structured interviews were used as the main data collection method, in addition to observation and documents review. The reason for the choice goes back to the nature of the company and the lack of decision making channels and organization structure. For example, no single document was found in the company to explain how they acquired the current ERP. Further, the decision making process and/or procedure is neither documented nor known to them. During a period of nearly two months, interviews were made with various Food Co officials and stakeholders. The main purpose of the data collection is to find out:

1. How did you select the current ERP i.e., Al MOTAKAMEL?
2. Why did you decide to retire it?
3. How did you choose the new ERP i.e., SAP ERP?

The following section details the data analysis of the previous three questions.

3.3. Data Analysis

In this section, we are going to answer the research questions based on the data collected from Food Co.

3.3.1. ERP Selection 1st Phase

During the interviews, all interviewees confirmed that their opinion has never been considered when Food Co decided to implement Al MOTAKAMEL ERP. When asked about whether the decision was financial or managerial, they all explained that they have never been aware of the decision nor its motives.

Further investigation explained that the decision to acquire and implement Al MOTAKAMEL ERP was mainly the former IT manager decision. Here it is worth mention that, the decision solely was made by technical people, with just approval from CEO.

Food Co started Al MOTAKAMEL ERP implementation in 2006. A further astonishing finding is that the implementation was made by the internal IT team; at that time only two people were involved in the implementation: the IT manager and the DBA. Of course this has resulted in a slow-down implementation and a lot of frustration in all branches and functions.

In 2008, the situation becomes very dangerous as the master mind of the implementa-

tion i.e., the IT Manager has resigned leaving the company and the project in the middle of nowhere! Food Co then recruited another IT manager with Al MOTAKAMEL knowledge and experience. Afterwards, Food Co also hired an external ERP Consultant to help in the situation.

3.3.2. ERP Retirement

By 2008, it was clear to all stakeholders that the current ERP, Al MOTAKAMEL, is no longer beneficial to them and it needs to retire, and the seek for a new system must begin. According to the interviews, officials explained that the system needs to retire because: (1) they explained that they did not choose the system to defend its existence; (2) the system does not have an HR module and this is something they needed; (3) they have never been trained on the system; (4) interface did not enable them to augment all business units together; (5) it is not web based; and (6) reporting is so complicated where each year is stored in a separate DB.

According to the interviews, the system did not provide them with any tangible benefits to retain it. And that is why, it must retire.

3.3.3. ERP Selection 2nd Phase

In the second time, Food Co prepared a requirements list and invited 4 vendors; SAP, Oracle, Focus RT (an Indian product), and for the sake of objectivity, Al MOTAKAMEL ERP vendor was again invited. After product demos and offers, SAP All-in-One ERP which is usually used in SMEs was selected. It was a mixed approach of financial as well as managerial criteria.

4. RESULTS

Traditionally, ERP systems retire after a period of maturity and value-adding to the business. However, in our case study the retirement of Al MOTAKAMEL ERP at Food Co preceded even its full go-live date! That is, a decision was made to retire the system before waiting for any maturity or gains. We do believe this is a new finding. When the following happened, expect early retirement:

- Functional managers are not engaged in the decision making process,
- No implementation contract i.e., Food Co only bought a license rather than any service,
- Functionality of the system does not meet minimum business requirements,
- Inability to augment all information of business units,
- Complex reporting techniques,
- Lack of web-based interfaces, and
- ERP decision was mainly made by IT people.

Unfortunately all of those reasons were found to be true at Food Co and therefore they have retired the system.

5. CONCLUSION: ESTEVES & PASTOR MODEL REVISITED

Results of our case study analysis have helped to deduce the following:

- Choice of the ERP system should be taken by both business and IT staff;
- Criteria of choice should include current as well as future demands e.g., web-interface, business intelligence, HR, user-friendly interface, etc.;
- It is very important to have key users and functions owners supporting the system as acting as a bridge between implementation consultants and functional users;
- Buying an ERP license and putting the implementation in the hands of the internal IT department only has proven failures;
- Ignoring the official selection methods is risky and would lead to failures and inability to evaluate the situation.

Esteves and Pastor (1999) described the retirement phase (p. 5) as "this phase corresponds to the stage when with the appearance of new technologies or the inadequacy of the ERP system or approach to the business needs, managers decide if they will substitute the ERP software with other information system approach more adequate to the organizational needs of the moment." However, based on the analysis of the case study under investigation, the retirement came as a result of wrong choice and other user engagement options, instead of merely new technology. So, we believe that the risk of wrong selection and insufficient user involvement could solely lead to retirement, same as seeking new technology or new unmet business requirements. Of course the risk of retirement before maturity, or even go-live, is magnified since it reflects loss of investment.

6. FUTURE RESEARCH

The area of ERP retirement needs further investigation and deeper analysis. Future research is needed and encouraged to explore the reason(s) why companies retire their systems, how and when. Cross-industry surveys and longitudinal research efforts are highly recommended.

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The Future of ERP Systems: look backward before moving forward

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Abstract

This paper explores the enterprise resource planning (ERP) systems literature in an attempt to elucidate knowledge to help us see the future of ERP systems' research. The main purpose of this research is to study the development of ERP systems and other related areas in order to reach the constructs of mainstream literature. The analysis of literature has helped us to reach the key constructs of an as-is scenario, those are: history and development of ERP systems, the implementation life cycle, critical success factors and project management, and benefits and costs. However, the to-be scenario calls for more up-to-date research constructs of ERP systems integrating the following constructs: social networks, cloud computing, enterprise 2.0, and decision 2.0. In the end, the conclusion section will establish the link between the as-is and to-be scenarios opening the door for more novel ERP research areas.

Keywords: ERP; development of ERP systems; future of ERP systems.

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1. Introduction

Enterprise resource planning (ERP) systems attempt to integrate data and processes in organizations. The data is centrally stored in a single database. This database functions as a hub that stores, shares, and circulates data from within the different departments and business functions. ERP systems are one of the most adopted information technology (IT) solutions in organizations [1]. Besides the potential cost savings, one of the main drivers for an ERP adoption would be the technical and operation integration of business functions to harmonize the information stream with the material flow of goods or services [2]. This will happen through integrating the internal value chain of the firm [3], and providing a seamless business processes streamlining, which could potentially sustain the firm's market competitiveness and responsiveness [4]. According to Beheshti [2], enterprise competitiveness could be achieved through the use of ERP systems, as they can provide reporting capabilities to management with cost and operational information needed to aid in strategic decisions related to the enterprise's competitive position. On the other hand, in order for the management and employees to utilize the use of the competitive capabilities of ERP systems, they must have a basic understanding of the principles of ERP, so that it can be used to the maximum potential. In addition, acquisitions, mergers, and joint ventures could be drivers of organizations to adopt ERP systems, in order to unify, utilize and manage the huge information and work flow among them.

Because of their scale and substantial resources consumption, it is not surprising that ERP systems have been a center of focus by both researchers and practitioners. Moreover, ERP systems require many organizational changes which could impose high risks if the implementations are not thoroughly planned, executed, and managed, as statistics from literature and practice show high rates of implementation failures [5]. Through the years, many communication technologies and infrastructural changes have evolved and been introduced to ERP systems, like web enablement, service oriented architecture (SOA), cloud computing, etc.

In this paper, we will provide a suggested future research roadmap for ERP research and practice. ERP systems and their corresponding implementations must change to cope with the new trends in technology e.g. SOA, cloud, in-memory analytics, social networks, and crowd sourcing. We could not project the future of those systems without taking a close look at how ERP systems emerged and matured over the years. This paper is organized as follows, sections 2-6 focus on the mainstream literature of ERP research, section 7 introduces the research problem, sections 8-10 discuss the as-is and the to-be situations, and finally section 11 introduces potential future work.

2. Related Work

While many enterprises are still adapting to their newly reengineered business processes as a result of their initial ERP implementations, other organizations are already seeking to upgrade and extend their current ERP systems [6]. In 2000, Gartner Research has published a report [7] announcing the "death" of the current generation of ERP systems, and stating that ERP II is the future and standard for next generation of ERP systems. In principal ERP II is basically an extension of the traditional ERP systems to incorporate and include e-commerce and supply chain operations [3, 7]. Moreover, companies adopting ERP II would cross the business-to-business (B2B) and business-to-customer (B2C) e-commerce boundaries and would be engaged in collaborative-commerce (c-commerce) processes with their value chain partners [8]. The quality of the information that organizations can publish for consumption by collaborating partners, could gain a competitive edge for these organizations [8]. Physically this will happen through the vertical and horizontal integration of e-business, customer relationship management (CRM) systems and supply chain management (SCM) systems with the local ERP systems within enterprises [3, 8]. This extension would allow firms to share accurate and up-to-date data with their customers, vendors, and partners in the value chain

independently of location and language, which has raised the calls for creating standard data formats for cross communications [8]. Some ERP vendors have already provided systems with partial integrations, like the open source Dolibarr ERP. Dolibarr includes its own CRM system, but it doesn't provide an e-commerce application, but still it provides a built-in integration interface to OSCommerce (an open source web store management application). On the other hand, other vendors have provided a more of complete solutions, which include traditional ERP capabilities, SCM, CRM, material resource planning, e-business and web-store interfaces. The open source software Adempiere would be a good example for a comprehensive ERP system.

ERP is considered to be at the top list of IT-enabled business innovations [6]. It was selected as the second most important key category for investment by IT executives. ERP systems implementation and upgrades are identified as one of the top five IT priorities among global CIOs according to independent surveys conducted by Morgan Stanley and Deloitte & Touche/IDG Research Services Group [6].

Currently, cloud computing, software as a service (SaaS), and open architectures are gaining a considerable attention in IS literature. The emergence of cloud computing has enabled many companies with a handy and on-demand network access to share a bundle of resources. The resources could include networks, servers, data storage devices, applications (e.g. ERP), etc. This bundle of resources could be provided and "implemented" with minimal management effort from the customer side [9].

Although cloud computing providers are facing several architecture and design challenges, however, security concerns, interoperability, data lock-in are on top of those challenges [10]. Most of the clouds are vendor-locked, as several cloud providers offer APIs (application programming interfaces) that are well-documented, but are mainly proprietary and exclusive to their implementation and thus not interoperable [10]. Thus, cloud customers will face challenges extracting and moving their data and applications from a cloud to another. Moreover, interoperability problems have motivated many organizations and government institutions (e.g. NIST) to work on cloud standardization and compliance projects, and were the motives behind establishing the Cloud Computing Interoperability Forum - CCIF (cloudforum.org). OpenStack is an example of the interoperability-solution projects, which provides free open source software. Using open standards, OpenStack is mainly an open platform controller and middleware that can facilitate the communications between clouds [11]. SaaS and cloud providers claim that ERP total costs of ownership would be dramatically reduced through the use of their service delivery models. In ERP literature, there is an apparent gap in cloud computing for ERP applications research, as it has been discussed in IS literature, but was rarely discussed in an ERP context.

3. Development of ERP systems

Through the years, ERP systems have evolved and advanced since the emergence of material requirements planning (MRP) and manufacturing resource planning (MRPII) systems. The primary difference between an ERP system and its predecessors is that ERP spans the whole organization and business function processes, not only the production related operations.

ERP systems can be traced back to the early accounting and inventory systems in the 1960s. The latter systems have evolved during the 1970s to material requirements planning (MRP) systems. MRP systems have been heavily used within manufacturing companies in order to handle production and inventory planning operations.

During the 1980s, manufacture resource planning systems (MRPII) came into the frontlines. MRPII is an extended and more comprehensive version of MRP, which covered other operations and business processes in manufacturing companies [12]. Besides manufacturing planning, the extension handled financial, order handling, inventory management, distribution and procurement processes. MRPII can also handle business processes within, and between several entities within large companies, like plants, warehouses, and

distribution centers. Although MRP implementations were non trivial, however, MRPII were more time and resource consuming, as they were broader in scope and have a larger impact on business processes and people.

In the 1990s, ERP systems were introduced as an extension to its predecessors MRPs. ERP systems span the whole organization but focus on key business function processes, not only the production related operations. Moreover, ERP systems provide a central data storage and integration hub between the several departments within organizations.

4. ERP implementations

ERP implementation projects vary in scale and arrangement, each project obliges careful and timely management decisions during its lifecycle phases [13]. ERP system implementations require dedication, commitment, significant amount of resources, and organizational changes. Many variables affect implementation complexity and scheduling. For example, these variables could be related to the adopting organization's structure, size, and technological status, or related to external factors like vendor's implementation methodology and market-specific contextual factors.

In ERP literature, ERP implementation methodologies and life-cycle phases may vary in name, number of stages, and level of detail. In research, ERP implementation models usually include several analogous phases e.g., adoption, selection, implementation, go-live, use and maintenance, and evolution. Some researchers extended these models to include a retirement phase [14]. The retirement phase is the point when an ERP system is replaced with another ERP or any other information system [14]. In practice, most major ERP vendors have their own implementation methodologies e.g., SAP follows the ASAP methodology, Oracle ERP follows the AIM methodology, as well as several other open source ERP systems follow their own methodologies.

Although sometimes they are used interchangeably, however, some researchers and practitioners differentiate between an implementation methodology and implementation strategy, the latter term would describe the process of how and when the system will go-live. The ERP implementation strategies would include a) Phased rollout, b) Pilot study, c) Parallel adoption, and d) Big bang or direct cutover. Each of these strategies has its own pros, cons, associated costs and risks. Some organizations prefer to combine strategies during the implementation process.

Some of the critical challenges organizations face when adopting ERP systems are the degree of business process re-engineering (BPR), customization, and change management required to best fit with their adopted ERP system. On the other hand, some organizations adopt a vanilla implementation, which could be the least risky implementation approach [6]. A vanilla implementation usually keeps the BPR to the minimum, and follows the core ERP functionalities and process models, instead of customizing the ERP to accommodate and fit the unique processes of the enterprise [1]. The fit typically needs a two way approach by combining BPR along with system customization in order to accommodate business needs and core unique competencies in some corners with standard process in others.

Whether it is a vanilla or a complex implementation, in a small or a large organization, ERP implementations require careful project management (PM) and a committed team. Moreover, organizations usually pass through a "shakedown" phase which they face challenges while adapting to the newly reengineered processes [13]. This might result in business disruptions or a reduced productivity for a certain period of time.

5. CSF

One of the mainstream definitions of a successful implementation is when an ERP implementation is finished on time and within budget [15]. This definition might be too strict when applied to actual ERP implementations. Many organizations have struggled with their ERP implementation budgets and schedules; however, based on field-experience and literature, some organizations still consider their implementations successful. Nevertheless the view, degree, and perception of a successful implementation may vary among stakeholders within the same organization.

Research and practice have identified several critical success factors (CSF) that would dramatically affect the implementation process. In the following section, we will briefly shed the light on some of these CSFs. Moreover, we will briefly discuss the factors that might result in potential ERP implementation failure.

5.1. Success factors

A large number of studies have explored the CSFs for ERP implementations. Most of these studies have compiled a similar list of factors, but with different CSFs rankings. Usually the rankings differ according to the cases studied, context, culture and many other variables. Several studies have found that top management support and commitment to the ERP implementation are on the top of CSFs, and they directly contribute to the implementation success or failure [2].

As ERP systems introduce a lot of changes to adopting organizations, and then it is not surprising to find that change management has been also identified as one of the top CSF [16]. The degree of fit between the organization and the ERP systems is very critical. That is why BPR, software customization and configuration have been found as CSFs [1]. On the other hand, other studies found that a minimal ERP customization effort through a vanilla implementation could be considered as a CSF [17].

Table 1 provides a more comprehensive list of CSFs ranked according to their citations as top CSFs in literature. The list was developed through a literature review by Finney & Corbett [4]. This review covered all ERP CSF related articles in major IS journals to the date of article. Although very few articles have found that ERP selection, and project cost planning and budgeting are CSFs, however, some studies state that user involvement in the ERP selection process is highly critical [18], and that ERP implementations could fail due to faulty or optimistic cost estimations [5, 19]. Moreover, organization size, industry, complexity, and structure have been argued to be influential in ERP implementation success [17].

Table 1. Frequency analysis of CSF in literature. Adapted from (Finney & Corbett, 2007)

CSF Category	Number of instances in literature
Top management commitment	25
Change management	25
Training and job redesign	23
Project team	21
Implementation strategy	17
Communication plan	10
IT infrastructure	8
Managing cultural change	7
ERP selection	6
Vanilla ERP	6
Project management	6

5.2. Failure factors

Some researchers have focused on implementation success factors, and others have focused on failure factors. Several studies have stated that ERP implementation failures are considerably high, which in some cases have led companies to bankruptcy [19]. A number of studies state that failures happen because of the unrealistic project deadlines and budget estimations [5]. In addition, F.D.Ted [8] argues that unrealistic deliverables could lead to project failures. Moreover, other studies have stated that implementation failures and early ERP retirements could happen because of a misfit between the ERP system and the organization, which mainly happens due to a wrong ERP selection in first place [18]. According to a survey conducted and published by SAP, 30% of implementations fail due to the lack of proper project planning, while 10% only fail because of technology driven causes.

5.3. The benefits realization

Organizations spend a large amount of money on ERP adoptions while seeking future returns. ERP vendors have promised to deliver benefits to adopting organizations. These benefits are usually realized in the long run and vary from one firm to another. In general, organizations expect that their BPR efforts should improve and enhance business process, which should control and reduce costs [20]. Moreover, organizations would have a substantial cost savings through cutting the large amount of paperwork, labor costs, and the sizeable hours of work [2]. On the other hand, realizing total benefits from ERP investments is not a trivial task. In IS literature, many articles argue that accurate capital budgeting and cost estimating for IS and ERP implementations are very difficult procedures, especially in projecting indirect costs [21, 22]. Similarly, estimating potential benefits and realizing post implementation benefits are very complex tasks that require organizations to follow formal benefits realization practices [2, 20].

Major ERP vendors e.g., SAP, claim that customers could spend around three to seven times more money on the implementation process and its supplementing services than the initial ERP license costs [22]. This substantial costs escalation is often because of unanticipated hidden costs. Many organizations overlook their expected human resources costs during and after the ERP implementation. Moreover, unplanned system

customizations and requirements can significantly increase implementation total costs. Several vendors claim that organizations tend to ask for many changes and *"nice to have"* features during the implementation, which were not previously agreed upon in the signed contract nor financially estimated. Moreover, extra customization costs could occur because of changes in business requirements. Furthermore, poor system requirements analysis and system design processes could also increase the implementation costs dramatically. This mainly happens if the key employees were not fully engaged during those two phases [18].

Recently, several cloud ERP providers argue that organizations would avoid hidden costs and substantially decrease their total costs of ownership (TOC), if they use their products. For example, Consona claims that organization could save up to 80% of their TOC when they adopt their open source cloud-based Compiere ERP system. Moreover, Lawson Software states that their cloud ERP will cut direct infrastructure, implementation and maintenance costs.

6. Problem statement

The literature discussed in the previous sections clearly indicate that the majority of research undertaken in the ERP domain mainly focused on implementations, CSF, PM, costs, benefits, upgrades, etc. Nevertheless, other rather important areas were little researched e.g., social networks, enterprise 2.0, etc. From our analysis perspective, multiple reasons are behind that lag between mainstream ERP research and the state-of-art topics: 1. Organizations which implement ERP systems want to secure their investment by pushing, or solely focusing on, the go-live; 2. Vendors' number-one objective is to grow their sales, and so they do whatever needed to meet that objective. In the light of that, we do think that the current situation looks as if we are racing in two different grounds. So the research question that we seek to explore its answer is *"what is the future of ERP systems? How does it compare to today's mainstream literature?"*

7. As-Is scenario

Indeed one cannot foresee or predict the future without looking backward and analyze the past. From our analysis, and based on the literature introduced in the previous sections, we could visualize past research on ERP systems as in the following diagram, figure 1.

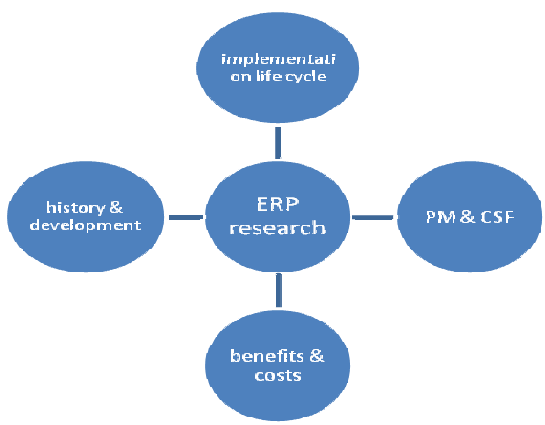

Fig. 1.Mainstream ERP as-is research

It is clear from the figure that the focus has been too much on the implementation areas. This is why, there has been a parallel, looks like unseen, research related to enterprise 2.0, social networks, etc which did not draw enough ERP research attention. In the next section, we suggest a rather forward thinking ERP research agenda.

8. To-Be scenario: The future of ERP systems

In this section, we introduce the to-be scenario of the future of ERP research. The following figure 2, explains the major potential constructs of this scenario. The potentials of integrating ERP systems into those constructs, in explained as:

- Social networks: with the widespread use and adoption of social networks, supported by the very fast adaptability of people to use them. The dream is to see ERP systems integrated into social networks. This will simply indicate shorter implementation lifecycles, higher ROI, and fewer investments. The success which salesforce.com has achieved in CRM needs replication in ERP systems as well.
- Cloud computing: one of the most important trends in the recent years is cloud computing. It has the potentials to reshape the way IT services are consumed. Cloud computing is defined as both the applications delivered as services and the hardware and systems software in the data centers that provide those services [10]. Those services referred to as Software as a Service (SaaS). Others use the term IaaS (Infrastructure as a Service) and PaaS (Platform as a Service) to describe their products. More recently, some ERP vendors have moved some of their offerings to the cloud e.g., SAP By Design. However, there is still a lot to be done in order for the customers to see more and more services and suites moving to the cloud. Therefore, more research efforts are still needed in order to elucidate knowledge on the marriage of the two.
- Enterprise 2.0: enterprise 2.0 (E2.0) is defined as the use of Web 2.0 technologies. E2.0 tools and applications have the potentials for achieving better collaboration, content creation and overall performance. E2.0 can be seen as social software that enables its stakeholders to connect, meet and collaborate through computer-mediated communication as well as form online communities. Offering digital environments, known as platforms, E2.0 allows all contributions and interactions by the users to be transparent and visible to everyone within the organization until deleted. Although organizations are using ERP systems to solve their niche problems, yet alone they might not fully utilize an organization's workforce abilities and knowledge. While these systems are cross-functional, they allow for minimal flexibility. However, E2.0, encompasses a different complementary approach. E2.0 emphasizes "freeform", that is, it does not predefine workflows and it is indifferent to formal hierarchies [23]. Therefore, we believe that more integration is required between ERP systems and E 2.0 tools and applications.
- Decision 2.0: Traditionally ERP systems have merely focused on the support of key business processes and functions resulting in a standardized way of running the business. To a great extent, they have succeeded in doing that. However, nowadays, they need to focus on how to support the decision making process, as well-informed decisions can have far reaching consequences, affecting almost all business aspects. There are many decision making models, notable among them is Simon's decision making model. Starting with the intelligence phase, the design phase, the choice phase followed by the implementation phase. A decision implementation is only considered successful when it actually solves its intended problem and fulfills the objectives that were initially set for it. However, it is worth mentioning that on average, 50% or more of the decisions made by individual decision makers were found to be a failure, despite effectively following the decision making process [23]. Therefore, a new trend in decision making is to involve the crowd achieving the so called crowd sourcing. This will enhance the intelligence as well as the choice

phases of the decision making process. Integrating the crowd into ERP to facilitate the decision making process is a long-waited for ERP enhancement.

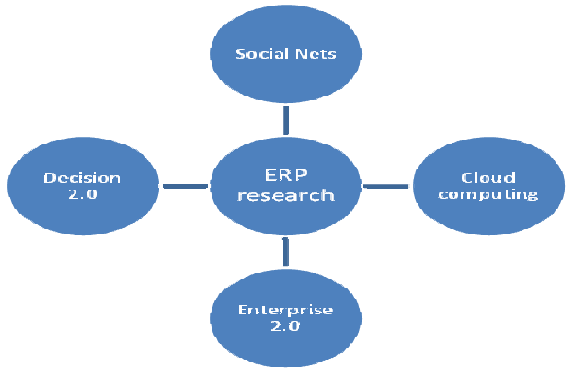

Fig. 2. The future of ERP to-be research

9. Conclusion

In this paper we presented an as-is ERP research model, in contract to what we believe is the future of ERP research. In the below figure, we relate and map the constructs of both figures 1 and 2. That is:

- The implementation lifecycle will definitely change with the emergence of social networks and cloud computing. This is due to the fact that social networks have been outside the lifecycle scope and also cloud computing will shorten and change the activities of the lifecycle.
- CSF/PM: the CSF will change to reflect the interaction between people and their new sort of connectivity i.e., social networks. This might reduce resistance to change, or at least reshape the way communication is managed throughout the project. Also, the PM team formulation will surely be less in terms of members needed, as when the ERP is hosted in the cloud; organizations need by far less (technical) team members.
- Benefits/costs: when it comes to costs, the adoption of cloud computing would rephrase, and potentially cut, the associated costs. On the other hand, the utilization and integration of ERP and social networks, E 2.0, and decision 2.0 will introduce new benefits package to beneficiary organization adopting or implementing ERP systems.
- All the above, adds to the development of ERP systems and it is related to all the to-be constructs.

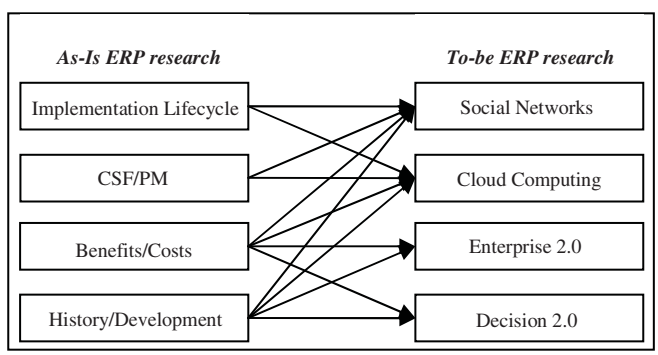

Fig. 3. The ERP research mapping

10. Future work

For decades, ERP mainstream research focused on implementation CSF, upgrades, PM, etc. Future research is needed to explore the potentials of ERP systems to be linked to social networks and enterprise 2.0 tools in general. Specifically, how could ERP systems expand beyond integrating processes and functions of organizations to reach the so far out of scope areas e.g., social networking, decision 2.0, crowdsourcing, and others. Last, ERP vendors and partners need to adapt to those changes in order to be able to deliver value to their current and potential customers.

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