

ERP Systems in SMEs: A Literature Review

Moutaz Haddara
Department of Information Systems
University of Agder
Serviceboks 422
4604 Kristiansand, Norway
Moutaz.Haddara@uia.no

Ondrej Zach
Department of Information Systems
University of Agder
Serviceboks 422
4604 Kristiansand, Norway
Ondrej.Zach@uia.no

Abstract

This review summarizes research on enterprise resource planning (ERP) systems in 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 focus 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.

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 which 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.

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 which 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.

1. An initial search was done through Google Scholar. The search option was limited to articles' titles. The keywords: ERP, Enterprise Resource Planning, SMEs, Small and Medium Enterprises, and their combinations were used.
2. 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.

3. In order to ensure that no articles were missed 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 delimited period. The same procedure was applied to the proceedings of four top IS conferences (ICIS, ECIS, AMCIS, HICSS).
4. The articles' abstracts were carefully read by both authors to check their relevance for the review. Only articles directly addressing ERP in SMEs were selected.
5. 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 which are usually merged in other models. Furthermore, the framework separates between system evolution and retirement. Second, it has been already 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 43 various outlets, involving 25 journals and 18 conferences.

The review shows a gradual increase in research interest in ERP in SMEs, with a maximum of 20 publications in 2008. Figure 1 illustrates the research methods distribution among the articles. Case studies and surveys are clearly the most used methods, while other methods are comparable less frequent.

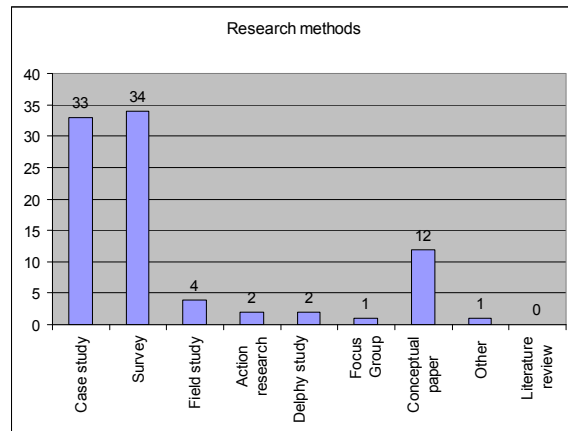


Figure 1. Research methods

As shown in Figure 2, 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.

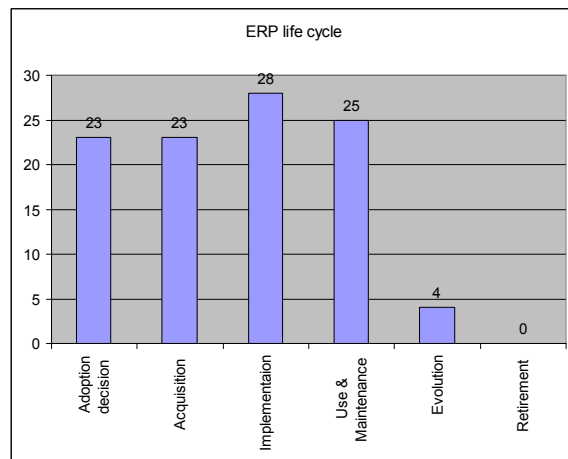


Figure 2. ERP life cycle

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 1 below.

Table 1. 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]
Implementation	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	-	-

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) in general. 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 researchers studied 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 off-shore 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 assess 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 are 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 cross-functionality it will benefit from the ERP system.

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 43 various outlets. Among the outlets, we have recognized only one special journal issue 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 issue.

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.

General comments. Although comparisons between SMEs and LEs cases were found in literature, yet the size differences among SMEs were seldomly 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.

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.

In general, existing literature have 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. Conclusion

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, 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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