

2013

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### Recommended Citation

Haddara, Moutaz and Elragal, Ahmed (2013) "ERP adoption cost factors identification and classification: a study in SMEs," *International Journal of Information Systems and Project Management*. Vol. 1 : No. 2 , Article 2.

Available at: <https://aisel.aisnet.org/ijispm/vol1/iss2/2>

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## ERP adoption cost factors identification and classification: a study in SMEs

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### **Abstract:**

Enterprise resource planning (ERP) systems adoptions require substantial resources and investments. The majority of businesses around the globe can be considered to be small and medium sized enterprises (SMEs). Thus, SMEs are seen to be typical companies that are the cornerstone of most economies. Compared with large enterprises, an SME-context contains several characteristics, and scarcity of resources is among the top of them. For SMEs, unplanned costs escalation could pose a serious threat to their stability and survival in the market. Frequently, ERP projects have crossed their estimated budgets and schedules. Researchers and practitioners state that a prevailing number of ERP adoption projects fail due to inaccurate or to too optimistic budgets/schedules. In addition, many organizations face difficulties in identifying the potential cost factors that could occur during their ERP adoption lifecycle. While focusing on the SME-context, this research attempts to identify potential costs that could occur in ERP adoptions. The research method employed in this study targeted diverse stakeholders and experts involved in ERP projects in Egypt. This research provides a list of cost factors and their classifications that could aid adopting organizations to better estimate their needed ERP project budgets. In particular, this research explores the direct and indirect cost factors that occur in ERP adoptions in Egyptian SMEs. Also, this study investigates the influence of some SME-specific contextual factors on costs. Moreover, the paper provides a ranking of cost factors according to their impact on total adoption costs.

### **Keywords:**

ERP; cost identification; SME; expert panel.

**DOI:** 10.12821/ijispm010201

**Manuscript received:** 22 April 2013

**Manuscript accepted:** 3 June 2013

## 1. Introduction

Enterprise resource planning (ERP) systems are used to unify organizations through the maintenance of a large database that stores, shares, and disseminates data in 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 modular integrated systems, in contrast with legacy systems that are usually operating within organizations prior to ERP systems adoption. ERP projects may vary in size and structure, each requiring careful management decisions to be taken during the whole adoption process and stages [1].

This research addresses cost-related issues. In particular, it explores the following main question: what are the cost factors that occur in ERP adoptions in Egyptian small and medium-sized enterprises (SMEs)? Subsequently, this research investigates the unpredicted indirect costs that usually appear or escalate during the adoption process. In addition, the influence of some contextual factors on other cost factors is also explored. Moreover, the ranking of cost factors in comparison to the total ERP adoption costs is surveyed. This would eventually lead to the development of a list of potential cost factors and to the identification of their impacts on total ERP adoption costs. This list would aid organizations to benefit from previous experiences and be able to have a more realistic estimation of the costs that would occur in their ERP adoption projects. The term 'adoption' varies in ERP 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 [2]. In this research, the latter definition is adopted.

The motivation for this research has both scientific and practical roots, as explained in the following sections.

SMEs are considering ERP systems because of the increasing number of alliances, value-webs, data flows, and complex operations. Most SMEs have several silo information systems prior to their ERP adoptions, which makes very complex and costly to use, store, and consolidate data from the various business functions. Hence, when SMEs adopt ERP systems, they do so in the belief that it is a step towards process standardization and cost effectiveness [3]. In short, they see it as a way to improve the organization's performance and to survive strong market competition [4]. Business complexity is not exclusive to 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 [2]. In the case of Egypt, around 75% of total employment falls within SMEs that are involved in a broad range of economic activities [5]. 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 [6, 7]. These limitations mean that IT investment is a critical endeavor 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 [7, 8]. This applies particularly to ERP systems adoptions, as they are considered one of the biggest projects launched by an organization [9]. 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 [7, 10]. 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 [11, 12]. In addition, the adequacy of current financial and cost estimation models in ERP settings is questionable [10, 11]. 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 [3, 12, 13]. Furthermore, costs could exceed their estimated budgets, as many organizations overlook potential increases in direct costs, as well as the projection of indirect costs [14]. Such a situation may be critical for an SME with limited resources.

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 [15]. In this research, 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. Organizations' contextual factors, legacy software reuse, and the adoption of a specific ERP implementation methodology could also be important determinants [16]. In contrast with large enterprises, SMEs do not possess similar amounts of resources; thus, their practices in managing their investments are often challenged by this lack of resources. In addition, limited financial resources could make SMEs more cost-sensitive [17]. Consequently, any rise in costs or project delays could seriously affect an SME's survival in the market [9]. Even some large enterprises have filed bankruptcy because of a faulty ERP adoption project [10].

At first glance, cost estimations for ERP adoption projects in SMEs may appear trivial because of the size of the enterprises; however, our review of literature and published reports indicate that cost overruns still frequently occur. Moreover, the literature suggests that smaller firms are less likely to have successful system implementations. Nonetheless, ERP adoption within SMEs is still growing; thus researchers need to scrutinize and identify the basic drivers that influence ERP adoption decisions, especially ERP adoption costs [10].

In order to be able to identify the different cost categories and factors that could occur when SMEs adopt ERP systems, the authors conducted an expert panel in order to collect relevant views on cost factors from different stakeholders. The experts' panel employed a mixture of focus groups, nominal group technique (NGT), and Delphi techniques; thus, the paper contributes both to research into ERP costs, and the domain of research methods. The data collection targeted diverse stakeholders and experts involved in ERP projects in Egypt. 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. Over the course of two rounds, the participants also ranked the cost factors according to their influence on total costs, and identified relationships among several contextual and cost factors.

Finally, according to the European Commission [18], 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, we 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 labor intensive, they are still recognized as small or medium in their markets and industrial sectors. According to Egyptian government reports [19, 20], the classification of SMEs in Egypt is still neither clear nor standardized, especially across industrial sectors. Thus, the current classification, which takes into account the number of employees and fixed assets, is not adequate [20]. This led the researchers to ask the informants to classify their organizations or clients according to how they are perceived in their respective markets.

The remainder of the paper is organized as follows: Section 2 presents the related literature, followed by the research background and scope in section 3. Section 4 illustrates the research methodology and elaborates on the experts' panel conducted in this research. In section 5, a presentation and discussion of the research findings are provided. Finally, conclusion and future research insights are presented in section 6.

## 2. Related literature

### 2.1 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 [12, 21]. ERP adoption projects vary in scale and arrangement; careful and timely management decisions must be made during each lifecycle phase of ERP projects [1]. 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 could 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 [22]. The retirement phase is the point when an ERP system is replaced with another ERP or any other information system [22], presented in Fig. 1. 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 [23]. 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. The fit typically needs a two-way approach to be achieved through combining BPR with system customization in order to accommodate business needs and core unique competencies in some corners, and following standard ERP best practices 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. In addition, organizations usually pass through a “shakedown” phase, during which they face challenges at the same time as they have to adapt to the newly reengineered processes [1]. This might result in business disruptions or reduced productivity for a certain period of time. Moreover, organization-specific characteristics and contexts have been important research aspects throughout, prompting researchers to investigate their implications on the ERP implementation process [12].

### 2.2 Cost factors identification and estimation

In general, the cost estimation process is perceived by organizations to be an important phase. However, the accuracy of these estimations is challenging. ERP adoption cost estimation is a complex task that requires attentive analysis in terms of direct and indirect costs. Both underestimates and overestimates can have dramatic consequences on IS projects [24]. According to Scheer and Habermann [25], Baan, Peoplesoft and SAP have all stated that the purchase of the software

license is not the biggest portion 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 [10]. For example, many organizations overlook an expected rise in human resources costs both during and after ERP implementation. In addition, unplanned system customizations and requirements can significantly increase total adoption costs. 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 [26], Panorama Consulting Group has stated that from 172 companies surveyed, 53% of the projects have already crossed their estimated budgets (see Table 1). Some of those companies are not yet finished with their ERP implementations. Also, the report show that 61% of the companies have crossed their estimated project schedules, which is also has a significant impact on project costs. Several vendors claim that organizations tend to ask for several changes and “nice to have” features during the implementation phase [10]. These features were not previously agreed upon in the signed contract, and consequently were not financially estimated beforehand. On the other hand, extra customization costs could also occur because of changes in business requirements [27]. Furthermore, poor system requirements analysis and system design processes could also increase the adoption costs dramatically. This mainly occurs when key employees are not fully engaged during these two phases [8]. Hence, close attention should be paid to ERP cost estimation effort by the beneficiaries (clients), vendors, and third party consultants if any. Indeed, the vendors’ 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 [10, 27]. A number of studies have stated that failures could also occur because of unrealistic project deadlines, deliverables, and budget estimations [28].

Table 1. Investments in ERP Systems. Adapted from Panorama Consulting Group [26]

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%

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 [29], are not appropriate within an ERP setting [10, 11].

A shortage of proper representation for cost factors, and inadequate cost estimation methods, particularly for SMEs, means that ERP systems adoption projects face challenges in identifying and estimating costs, size, human resources, effort, productivity and other cost factors [13]. Furthermore, when ERP adopters exceed their estimated budgets, this could be critical if they are an SME with limited resources. Thus, despite the future potential benefits an ERP could offer, the current rise in costs may be critical.

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 [30]. 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 adoption process [14], such as business process re-engineering, Human Resources (HR) costs, and project schedule delays. Moreover, most of the informants interviewed in this research study, viewed unanticipated costs that lead to 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 [14].

### 3. Research background and scope

#### 3.1 The ERP adoption process

The ERP lifecycle framework developed by Esteves and Pastor [22] and presented in Fig. 1, was adopted in this research. It was used as a general guide to organize and frame the data collection efforts according to the ERP lifecycle phases. Specifically, the ERP adoption term used in this research refers to the first five phases of the ERP lifecycle framework, 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. This framework has aided the panel’s participants to logically organize the cost factors according to each phase during the lifecycle of their projects.

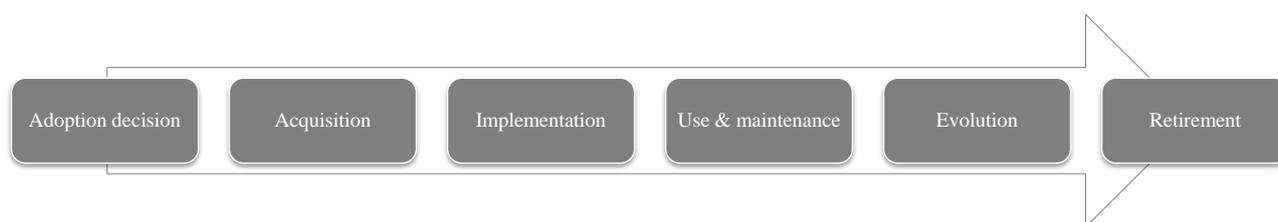


Fig. 1. ERP Lifecycle framework. Adapted from [22]

#### 3.2 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 endeavors [31]. 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 [31]. The prime focus of early research in IS literature was mainly on intra-organizational IT innovation and contextual factors in organizations, (e.g., [32]). However, some early research papers did shed light on the importance of an organization’s external environment [33]. Ives et al. [33] 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 Fig. 2. 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 [33].

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 [34] 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 [35]. The external environment does not only provide pressures; it also offers opportunities. For example, the Egyptian Ministry of Industry Modernization has offered 50% funding to SMEs to help them acquire IT and IS technologies.

As well as taking an internal SME context stance in this study, other external factors were considered. The study used the Technology-Organization-Environment framework for SMEs’ adoption of enterprise systems (TOEES) developed by Ramdani et al. [36] (see Fig. 3).

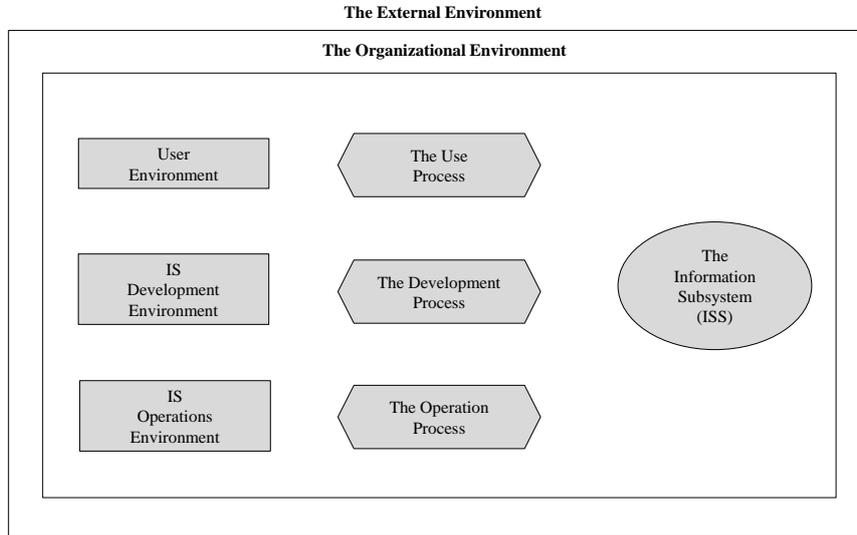


Fig. 2. A model for IS research. Adopted from [33]

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. [37]. The framework 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.

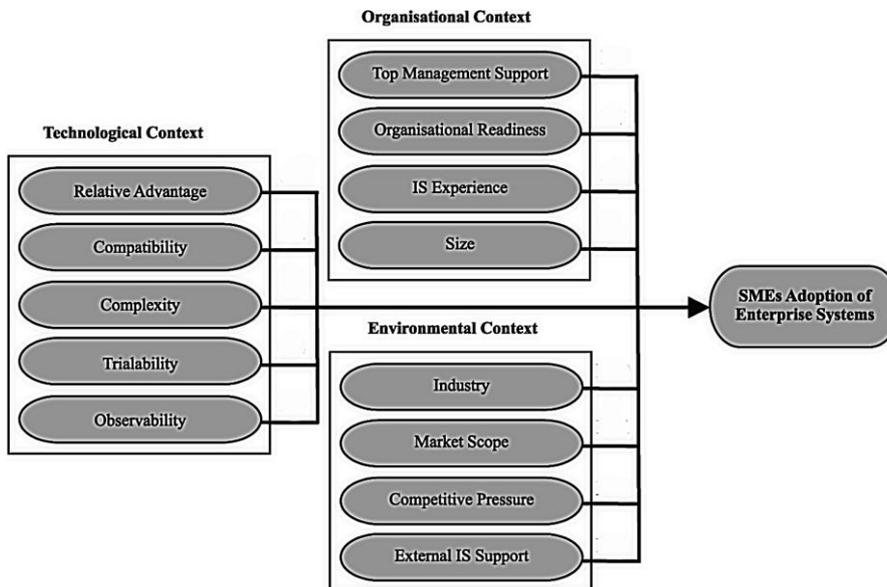


Fig. 3. Technology-Organization-Environment framework of SMEs adoption of Enterprise Systems (TOEES). Adapted from [36]

The TOE framework was adopted and adapted from several research studies in the IT and IS domains. For example, Kuan and Chau [34] adopted the TOE framework in order to study the potential for electronic data interchange (EDI) adoption among small-sized firms in Hong Kong. Others have used TOE and its variations to investigate the impact of trust in the vendor, ERP system, and consultants have on ERP implementation success [7]. In addition, within both 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 [36].

The successful application of the TOE framework and its variations in existing research led to the adoption of the TOEES framework in this research.

#### 4. Research design and methodology

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 [38]. A clear research design minimizes the risk of collecting and analyzing irrelevant data that does not satisfy the research questions [38]. Thus, the data collection efforts were shaped by the adoption of the TOEES and the ERP lifecycle frameworks. The collected data was based on the participants' knowledge and experience from completed ERP projects in SMEs. Fig. 4 presents the research design, which was employed in this research.

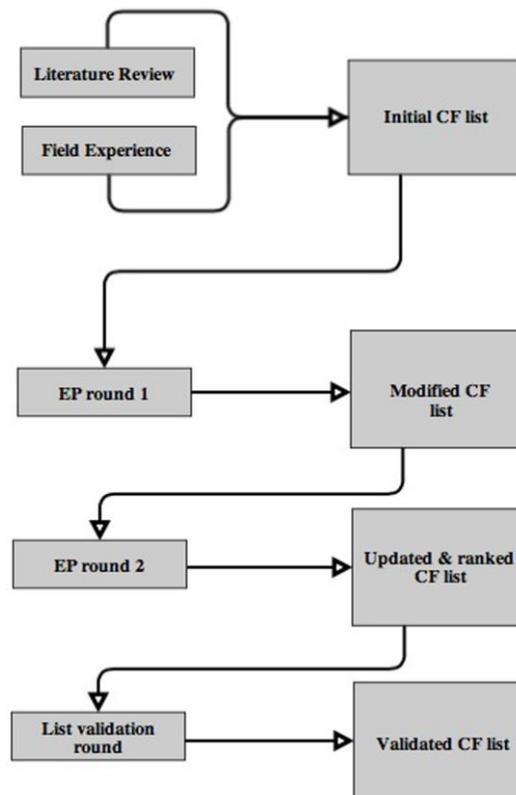


Fig. 4. Overall research design

In order to inductively elicit data from the most relevant context in practice, an experts' panel (EP) of practitioners was convened in this 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 [39] were also used. Face-to-face group techniques could be fruitful when investigating a certain phenomenon in the early exploratory stages of research [40]. 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 [40]. As recommended by Willis and Miertschin [39], dynamic mind maps were used as a tool for representing the cost factors of ERP as a graphical list. In addition, mind maps were useful in cases that require problem solving, group understanding and brainstorming, information delivery, and the evaluation of participants' beliefs [39]. This stimulated the participants to engage with the content and provide modifications and rankings for the initial mind map of cost factors.

One of the main objectives of the panel was to identify and rank the direct and indirect 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. Indeed, the experts provided rich inputs that helped the authors to better understand the phenomena and refine the problem under investigation.

The panel was composed of key persons involved in ERP adoptions 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 captures 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, a list of potential cost factors, costs rankings, variables influencing costs, and discussions were collected. Subsequently, a final round was held in order for all eight participants to validate the results and make sure that they represent their interpretations. A detailed description of the panel is provided in the following section.

#### *4.1 The briefing and pre-panel discussion*

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

On the first meeting, a reminder concerning the specific research objectives was provided. A set of presentations took place to elaborate on the research objectives, and what is needed from them in order to develop a model or list that could aid in estimating costs within the ERP adoption phases. 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 centered on the features of ERP adoption cost identification and 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 their own cost estimation models 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 to beneficiaries about all the dimensions of costs needed for the whole ERP adoption project. One major note from several experts was that organizations regularly do not face cost problems in selection nor post-adoption phases, the majority of ERP problems and costs pop-up during the implementation phase, and that the research should focus on these costs.

4.2 EP - first round

In the first panel round, the participants were provided with an initial cost factors list (mind map). The initial mind map (fig. 5) was a visualization of CF gathered through literature and researchers' own experience with previous ERP adoption projects. The visualizing of cost 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 cost categories and factors should be merged or split, alter their naming, approximate weight on total costs, and their priority pertaining to SMEs, etc.

Although some debates on some specific factors' importance took place, the moderator reminded the group about the focus of discussion, and that they should adopt an ERP adoption costs within an SME setting, and this minimized 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 format that contained the compiled ERP costs. The questionnaire was a combination of open and closed ended questions. The open-ended questions were sought to aid the experts to provide their insights, recommendations or suggestions about which additional cost factors to include, exclude, combine, or split. The main initial cost factors were vendors, change management, business process reengineering, project management, hardware, software, and human resources costs.

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

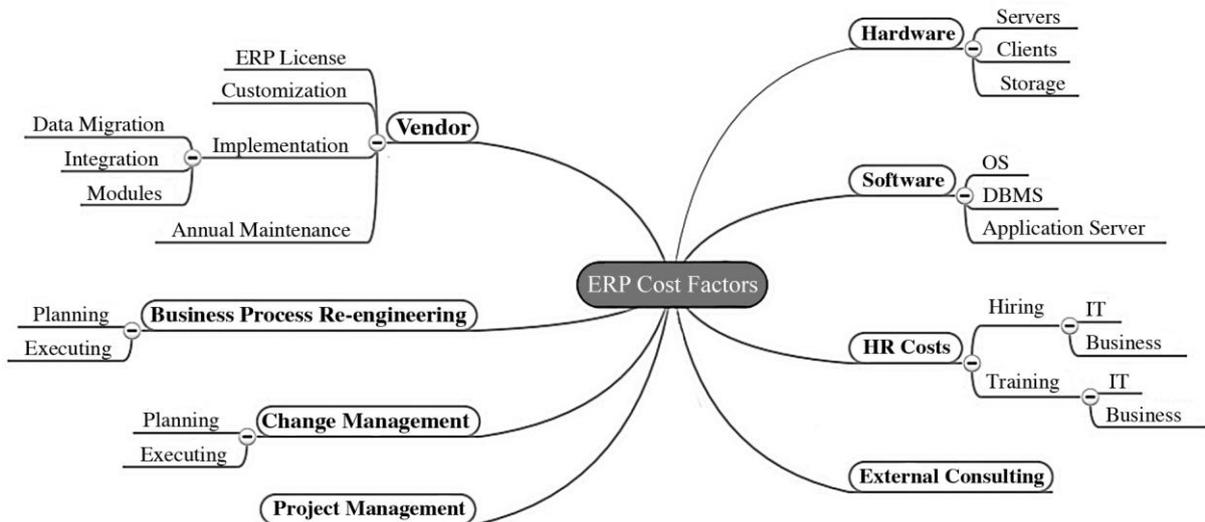


Fig. 5. Initial cost factors list

### 4.3 EP - second round

In the second round, an updated list of cost factors was presented to participants. The list contained the new updated cost factors identified 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 simulated group discussions and interactions. During this round, the participants made some modifications to the cost factors, and the list was directly updated accordingly.

At the end of this round, the participants were provided with a questionnaire. The questionnaire included three main sections: 1) A list of updated cost factors; 2) A column space to independently state any contextual variables that could influence these cost factors; 3) A column to independently rank cost factors according to impact on SMEs' ERP adoption projects total costs. Their task was to independently rank the costs and to make sure that all the presented costs and our interpretations are complying with their suggestions and recommendations. The provided rankings of cost factors were: very high, high, medium, low, and very low. The participants were alerted that cost factors should be ranked according to their impact on total project costs during the adoption process within SMEs (see table 2).

The data was analyzed and the updated and consolidated cost factors list and rankings were sent electronically to the participants in order to confirm the validity of the results.

## 5. Research 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 the authors 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.

### 5.1 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 participants from adopting organizations 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 cost list is presented in Fig. 6. Guided by the ERP lifecycle and TOEES frameworks, the experts were asked to suggest a list of potential cost factors that could occur within ERP adoptions in an SME context. The panel identified 10 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 has 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.

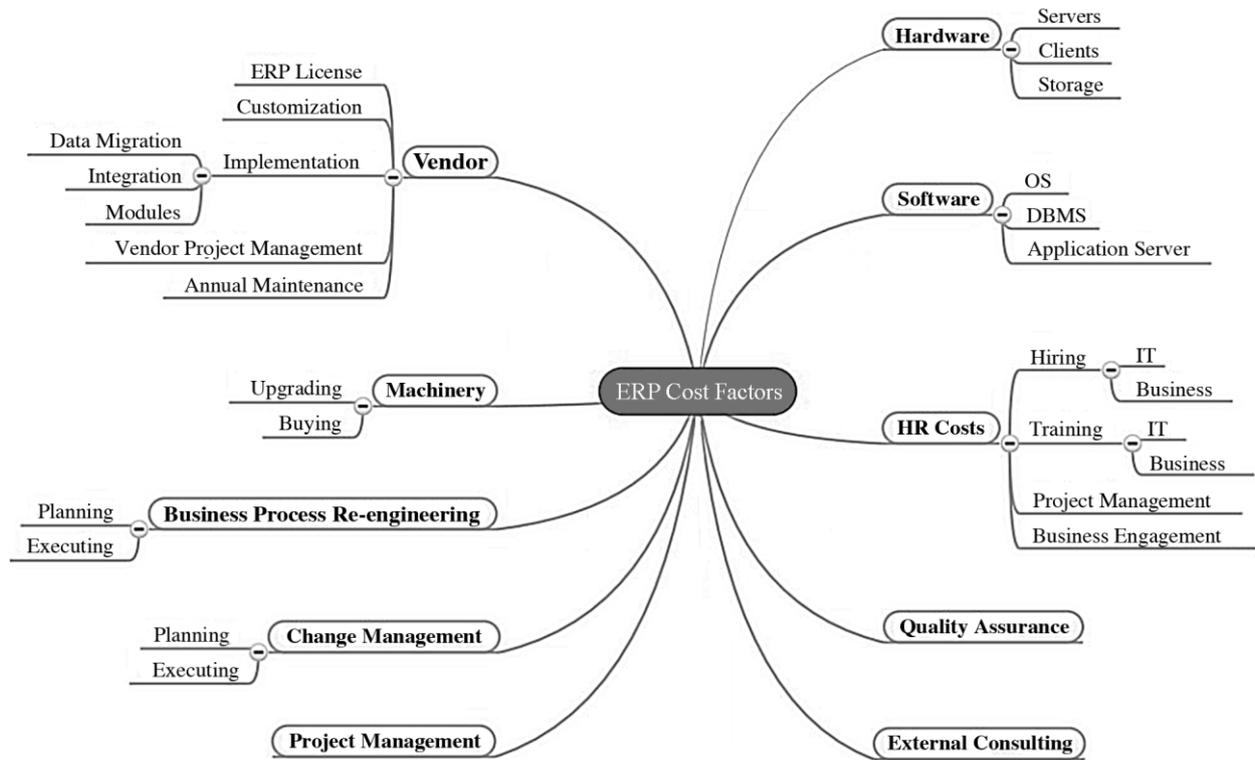


Fig. 6. Updated cost factors list

It is worth noting that the participants 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.

5.2 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. The rankings ranged from very low (cost share) to very high. Table 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 [25]. 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 [41]. 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 which state that SMEs usually have less complex business processes than large enterprises [42]. 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 2. Influencing factors and cost factors 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 2. 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.

## 6. Conclusions

This paper is an attempt to identify the various cost categories and factors that could occur when Egyptian SMEs adopt ERP systems. A mixture of focus groups, NGT, and Delphi techniques were used; thus, the paper contributes both to research into ERP costs in SMEs, and the domain of research methods. In order to gather different perspectives regarding this matter, the data collection method has included 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. Over the course of two rounds, the experts provided a list of potential cost

factors. In addition, they ranked the cost factors according to their influence on total costs. The list also included frequently overlooked potential indirect cost factors. In total, 10 main cost factors and 32 sub-factors were identified and ranked. Moreover, associations between organizational contextual characteristics and their influence on cost factors have been also identified. The outcomes of the panel helped us to pinpoint cost-related issues in ERP adoptions, and helped in the identification and visualization of the cost factors that may occur during ERP adoptions. The results of this research are relevant for practice and research. The study's outcomes also designated a potential spectrum of issues for further investigation.

The study also contributes to cost estimation research by demonstrating the cost factors, relationships, and their impact on total costs. In addition, another important outcome of this study is the confirmation of the suitability and validity of the TOEES and Esteves and Pastor's lifecycle frameworks for application in the context of Egyptian SMEs. Moreover, the 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. Finally, 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.

The results presented in this study have the potential to be extended in future research. The presented cost factors model can be further validated in other settings in order to test its comprehensiveness and adequacy in other SME contexts. The validation 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. Finally, this research questions the current formal budgeting and cost estimation methods, and calls for the need for suitable methods to accommodate ERP adoption environments.

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