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An Empirical Study of Critical Success Factors for ERP Software Systems Implementations in Saudi Arabia

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Abstract. Enterprise resource planning (ERP) systems have been applied to overcome business issues; however, because of a number and a sort of organizational and technical obstacles, companies run into expensive and consequently subsequent catastrophic difficulties with the implementation process. The main goal of this paper is to investigate the critical success factors (CSFs) of ERP implementation in Saudi Arabian companies. In this context, 18 CSFs were identified to analyze the impact of such identified CSFs on the performance of ERP projects implementation in Saudi Arabian companies. We further present a factor analysis of the correlated CSFs.

Keywords: Index terms-ERP, CSF, Factor analysis.

1. Introduction

An ERP system is a totally integrated with organization industry management system including functional departments of an organization like logistic operations, production, finance, accounting and human resources [4]. By implementing such a system, enterprise organization can make best use of resources such as personnel, product, and financial. Hence, to succeed in today's business, organizations must improve their own internal procedures and business management techniques by transforming their IT software systems into ERP software systems. Implementing enterprise resource planning ERP to control all sections of an organization is hard and risky, especially when an organization maintains a legacy system. Introducing enterprise resource planning ERP into enterprise organizations without careful pre-analysis and comprehension of what is yet to come is a major risk factor to the enterprise resource planning ERP implementation project [4].

Researchers have found that there is 67%-90% enterprise resource planning ERP system failure rate and 35% of enterprise resource planning ERP implementations are cancel [2], also, the successful implementation depends on many critical factors, which have been addressed in the literature [3]. According to this, the main goals of this study are to: (1) identify CSFs and quantify their impact on their implementation in Saudi Arabian companies, and (2) explore the implicit dimensions of such CSFs.

In this context, a comprehensive literature review was reviewed to collect CSFs of ERP implementation in different governmental and private sectors. Such factors were revised and revisited to present a set of

CSFs that are applicable to Saudi Arabian organizations. in accordance with these CSFs, a questionnaire survey was designed and submitted to ERP experienced practitioners in Saudi Arabian companies. The data being collected were analyzed to characterize the practices. Factor analysis was utilized to group the CSFs that contribute to the success of the ERP implementation projects.

The rest of this paper is organized as follows; Section II, presents a background in the CSFs literature, Section III presents the research methodology used in this research, Section IV describes the ERP implementation in Saudi Arabian organizations, Section V presents the results summary and their related discussion, while section VI concludes this paper.

2. Background

ERP systems are Information Systems that provide the integration of business processes this "enables the decision making process to be timely, consistent and reliable across organizational units and geographical locations" [17]. The implementation of ERP system has various significant benefits throughout the organization: cleansing of redundant information, better understanding of the changing customer requirements, reduction of production cost, decreased production cycle, improved response time, efficient management, and increased productivity [1][2][5][8][21] [33]. Considering these benefits, ERP systems are being considered as a major businesses solution development environment in the last fifteen years [32] and consequently have been accepted as a standard software in the world's of business [14] [15].

However, the success rate of such ERP implementation projects is observed to be truly frustrating [18][19][21] since ERP implementation project requires considerable financial resources as well as it considered lengthy, challenging, and complex [13][15]. More specifically, the ERP success rate is, only, around 50%, while 90% of ERP implementation projects terminated with over allocated budget or postpone.

Financial constraints play a major role in the rejection of ERP systems. ERP research over 60% of them exceeded schedule, over 50% of the projects exceeded costs, and fully 60% of them received half or less than the expectations [13, 15]. A similar study by Umble and Umble [1] sesulted with failure rates in the range of 50% and 75%. Therefore, a thorough and further empirical studies are mandatory to be addressed to help companies in lowering the failure rates of the implementation of ERP projects as well as enhancing and increasing their related success rates. A work by Saeed et al., [40] proposes a thorough examination to reduce the failure of the implementation of the ERP systems.

The concept of CSFs have been introduced in the 1960s and gained a wide attention in the context of ERP systems [16]. CSFs have been presented as a concept that would provide managers and companies with the necessary assistant to directly affect a specific result in order to achieve their goals and to boost their performance and competitiveness [32][37][38] significantly by taking necessary actions in certain areas proactively [23][24][25][26]. CSFs specify a methodology of identifying key business areas that need constant and continuous follow-up and attention by the management [22].

Numerous high failure theoretical and empirical studies have been published during the last 15 years [24][34], most of them failed to figure out the phenomenon [22] as their analysis have incorporated a limited number of critical factors, while a limited studies have adopted the case-study methodology [26]. Due to a lack of a framework for the identification of CSFs,

many organizations have experience a numerous difficulties and failures in implementing ERP systems [19][23], thus, further studies and researches would be required.

Saini, Nigam, and Misra [20] explored the CSFs in Indian companies. In their study that included 164 companies, Support was observed for all hypotheses, discussing that people factors (e.g. the implementation team), technological factors (e.g. testing, IT infrastructure), and organizational factors (e.g. communication) have a positive impact on ERP implementation success [20][37][38]. A similar study by Prodromos et al. [36] argued that the appropriateness of resources and expertise factors have a significant impact of ERP implementation success. CSFs addressed in the conceptual framework presented by Garg and Chauhan [20] explained 62.7% of the success of the ERP implementation projects. A similar study by Garg and Garg [17] and Chatzoglou et al., [38] argued that technology issues, people, strategic, and project management factors have a direct impact on the success of ERP implementation.

Another similar work by A work by Chien, Lin, and Shih [19] included 305 Taiwanese companies in their study, they studied the influence of centrifugal and centripetal forces on team confidence and cohesion. They argued that centripetal forces have a positive influence on the implementation, whereas the centrifugal forces were not verified [19]. An analysis by Zabjek, Kovacic, and Indihar Stemberger [18] addressed 152 questionnaires submitted to Slovenian companies, Their analysis showed that business process management is an important factor. They concluded that change management, top management support, and business process management have a positive impact on successful ERP implementation. Identical results were obtained by the same authors in their similar work [21].

A work by Garg and Agarwal [22] and Ziemba and Kolasa [35] concluded the importance of business process reengineering, top management commitment, project management, user involvement, and implementation team on the success of ERP implementation. The authors argued that implementing companies are required to address and adopt the essentials of the project management methodologies and employ the best business practices simultaneously.

Total Quality Management is a necessary prerequisite of ERP implementation as argued by Li, Markowski, Xu, and Markowski [29] study, according to analyzed data from USA manufacturing companies concluded that. Similar visions were supported by related studies that argued the importance of formulating an overall ERP architecture prior the deployment of an ERP system [29].

Chou, Hung, and Chang [30] study focused on the knowledge transfer. Their analysis revealed that ERP implementation success is affected either directly or indirectly by ERP knowledge factors and ERP communication factors. Ngai, Law, and Wat [9] and Fahim [39] addressed the necessity of country-related characteristics and national cultural issues faces when implementing an ERP system.

On a different methodology, instead of CSFs, other studies addressed the Critical Failure Factors. The authors identified 47 failure factors on a developing country. These CFFs are classified into seven groups (human resources, project management, vendor and consultant, managerial, organizational, processes, and technical) [30]. Although the spread of the investigation of CSFs related to ERP implementation, there is a long way before the empirical contribution can be considered to be substantial and failed to

provide a framework of the phenomenon due to the incorporation of a limited number of CSFs [32].

Precisely, the literature addresses the gaps as follows:

(a) Although numerous CSFs required to predict ERP implementation success, studies are incapable to identify the most important. Consequently, there is a high demand for additional research;

(b) Limited researches have applied specific criteria for identifying factors, as well as excluding others;

(c) Limited empirical published studies were executed in Arabic countries in general and specifically in Saudi Arabia. Our proposed study endeavors to address that gap in the related literature that was crystallized by a literature review analysis as well as by the consultation with experienced practitioners in Saudi Arabian companies.

3. Research Methodology

In this research, a questionnaire was designed to measure the impact of identified CSFs in ensuring the success of ERP implementation in Saudi Arabian companies. The survey was submitted to the professionals and experienced practitioners of the major government and private organizations located in different regions of Saudi Arabia, that would provide significant information on the experiences in the context of the implementation of the ERP systems whether they have succeeded or not. Questionnaires were submitted to:

- 14 members of the Aviation/Automotive organizations,
- 9 to members of the central government,
- 11 to members of the information technology organizations,
- 2 to members of construction industries,
- 1 to member of consulting services,
- 19 to education organizations,
- 4 to manufacturing organizations,
- 11 to military organizations, and
- 15 to transportation organizations.

Participants' roles includes general project leaders, consultants, IT specialists, project managers, department managers, account managers or any other job that is involved in the implementation process. 86 applicable questionnaires answers were received out of 94 sent out, resulting in a 91.4% response rate. There were (51) responses from government organizations and the rest (43) were from private organizations. The survey consists of four main parts:

1. General information about the organization,
2. The implemented ERP system,
3. The current status of the working environment,
4. The CSFs of ERP implementation projects.

The respondents were requested to provide the feedback about their impression and evaluation of the significance of the listed CSFs using a 1–5 point Likert scale (1, strongly disagree; 2, disagree; 3, neutral; 4, agree; and 5, strongly agree).

4. ERP Implementations in Saudi Arabian Organizations

Among the respondents,

- 15% are aviation/automotive organizations,
- 9% are central government,
- 11% are information technology,

- 2% are construction firms,
- 1% are consultation firms,
- 20% are education organizations,
- 4% are manufacturing,
- 11% are military organizations, and
- 16% are transportation companies.

Table 1 below shows descriptive statistics of the CSFs according to the 94 responses. The feedback suggest that IT infrastructure, training, goals, vendor support, BPR, top management, maturity are the most significant drivers of the implementation success of ERP projects, while cost, project management, consultant, data accuracy are less significant.

Table 1. Critical success factors for erp implementations in saudi arabia arranged in ascending order from most critical to least critical.

Rank	CSF	Mean	Std. Deviation
1	Cost	2.45	0.899
2	Project management	3.22	0.906
3	Consultant	3.28	0.999
4	Data accuracy	3.47	0.876
5	Implementation team	3.52	0.750
6	Change management	3.56	0.850
7	Project champion	3.57	0.849
8	Package selection	3.62	0.650
9	Testing	3.65	0.839
10	Communication	3.66	0.681
11	Number of customization	3.68	0.675
12	Maturity	3.74	0.671
13	Top management	3.75	0.557
14	BPR	3.96	0.802
15	Vendor support	3.97	0.809
16	Goals	4.01	0.679
17	Training	4.07	0.765
18	IT infrastructure	4.14	0.784

From the correlation test results, we introduce new ERP implementation CSFs dimensions specific for Saudi Arabian environment based on the correlation test values and logic. The first dimension includes five CSFs, which are concerned with the company, the second dimension encompasses three CSF items that are concerned with the package, the third dimension is composed of four CSFs that are concerned with business re-engineering of ERP implementation, the fourth dimension consists of four CSFs that are concerned with the management of ERP implementation, and Finally, the goals dimension correlates with one or more CSFs from each group. Goals dimension is the one of the most important parameter (mean value, 4.01). Figure 1 shows the proposed dimensions based on the correlation test results and experience.

4.1 Organization Dimension

The first dimension is composed of five CSFs that are concerned with the company implementing an ERP system. Among these, IT infrastructure CSF was most significant parameter (mean value, 4.13). It is crucial to assess the IT organization's infrastructure readiness for the ERP system execution. The ERP software vendor addresses the relevant hardware and its related customizations and configurations that must be set to execute the ERP system. Adequate IT infrastructure are essential for the ERP system's success. Infrastructure might need to be changed or even upgraded if necessary considering the ERP system requirements [10, 11].

Maturity is the ranked the second most important parameter (mean value, 3.79) of this Dimension. Organization Maturity Level (OML) has a positive impact on the implementation of an ERP system. As the maturity level of the organization increases, the opportunity to ERP implementation success increases as well. Together with other CSFs, OML can boost the implementation process. The capability maturity model (CMMI) has been described in 6 phases [10, 11]. These phases clearly demonstrate that an organization with level (4) of CMMI has a better chance to success in ERP implementation than an organization having level (3) of CMMI [10].

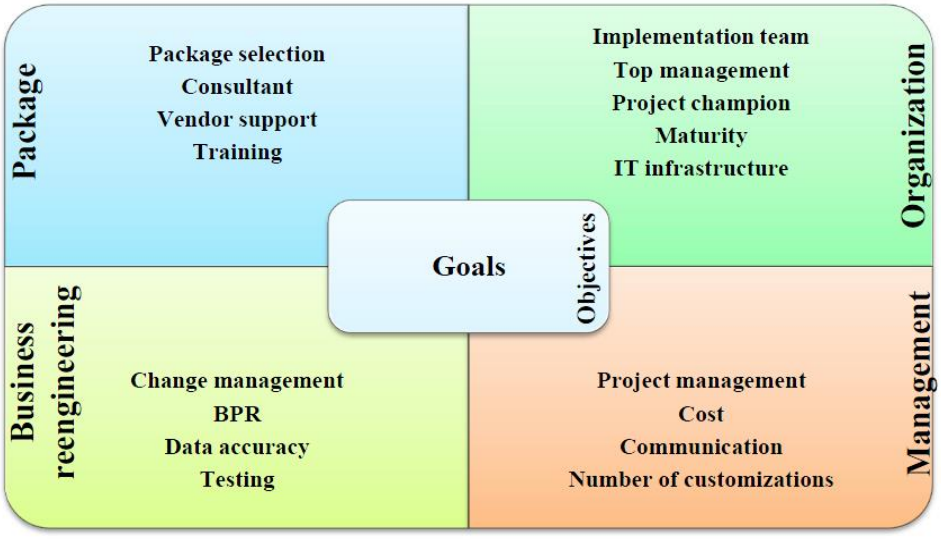

Fig. 1. New Critical Success Factors Dimensions of ERP Implementation in Saudi Arabia.

Business process re-engineering is one of the most important aspects of ERP system implementation to deploy and enroll the processes that cause significant changes in the company. It is ranked the third CSF (mean value, 3.75). The mission of project champion in an ERP projects is crucial. The project champion serves as a mediator and requires the organizational overall commitment and balance necessary to ensure the project advance within the enterprise as well as to enable faster agreements within the project with an accurate manner. Therefore, resistances and conflicts can be solved instantly with slighter way by the support of the top management. He is intended to announce and to spread throughout the organization the importance and significance of the project. This important position requires skills of powerful and highly capable person and have a supreme position in the company in order to drive to a more successful implementation, and may not be occupied or represented by the leader or the senior management of the ERP project.

Implementation team plays a critical role in correcting possible errors in the implementation process [1, 14]; it is ranked as the fourth CSF (mean value, 3.52). Many authors have identified that the implementation team should consist of people selected according their education, knowledge, experiences, and skill is required to deal with possible errors that may occur during the implementation process. The cooperation between team members as well as building confidence between them is necessary to avoid conflict during the implementation phase [6].

We studied the correlations between the above CSF items of the Dimension 1. Table 2 below, illustrates these correlation results.

4.2 Package Dimension

Dimension 2 is composed of three CSF items that are mainly associated with ERP solution choice. Among these, training CSF is one of the important factors (mean value, 4.10). Training plays an important role in terms of motivating end-user to involve and participate positively in the implementation of the ERP system project. Top management should put the training in the consideration and allocate their required funds. The goal of training is to provide the end-user with a solid

and an adequate understanding of the business processes of the ERP packages and modules. An adequate training for making use of the ERP functionalities functionality is necessary. Since ERP will affect the entire organization's business solution [13]. Insufficient user training and lack of understanding of ERP logic and concepts and how it transfers and makes changes to the existing organization's business solution processes are obstacles to implement the ERP successfully. Often, Failure of the implementation of ERP system may be caused by missing or lacking end-user training [1]. Therefore, it is necessary and highly recommended to set up a suitable training plan to provide end-user with a deep understanding of business processes [8]. Employees should be noticed with any content amendments during training caused by the implementation process [13]. In addition, Stedman (1991) suggested reporting function raised by the employees should be put into consideration during the training phase [3]. In our study, training have a higher impact in reducing the degree of user resistance from ERP.

Table 2. Organization dimension results.

Questions	CSFs	Q-Mean	F-mean	Std. Dev	Results
6	Project Management	3.61	3.14	0.907	Agree
7		2.67		0.988	Neutral
8	Cost	2.45	2.45	0.899	Strongly disagree
9	Communication	3.66	3.66	0.681	Agree
21	Number of customization	4.32	3.55	0.793	Strongly agree
Management dimension results		3.39	-----	0.537	Neutral

Vendor support is another significant (mean value, 3.96) technology-related factor. Selecting the right system is equivalent to selecting the right vendor and build a strategic relationship in nature required for a successful ERP implementation project in the long run as well as to enhance the competitiveness and efficiency of the organization. The organization should base their vendor selection decision on several considerations; i.e., the vendor's characteristics, technical assistance, emergency maintenance, fixes and updates, and the continuous support that the vendor can offer to guarantee its success [5][6][14].

Selecting the ERP software package is considered critical as well (mean value, 3.64) for ERP implementation. The companies should select the adequate ERP package that would address and meet their requirements; this may require least effort during the transition process to the ERP system [5].

Use of consultants is an important component of this dimension (mean value, 3.22). To enhance the level of the ERP implementation success, Finney and Corbett (2007) cited the necessity of ERP consultants with skills include technical knowledge, interpersonal skills, functional knowledge, and specific ERP modules accepted a wide support by many researchers [13]. Consultants stood a stronger position in the ERP implementation projects than the other two CSFs; namely, top management support and business vision. ERP consultants play a major role and contribute effectively in case of, poor organization's vision or insufficient support from the top management in addition to a lack of internal experts. Consultants participate in analyzing requirements and providing advices related to the selection of ERP vendors and the selection of the appropriate ERP packages and modules, leading the configurations, and managing the implementation. They participate in the skills and knowledge transfer to the organization

personnel according to their defined roles and tasks defined by the organization [8]. The consultant CSF in Saudi Arabia is suffering from poor participation of the consultant. In our research, we studied the correlations between the above CSF items of the Dimension3. Table 3, illustrates these correlation results.

4.3 Business Re-engineering Dimension

This dimension includes four CSFs that are concerned with business re-engineering of an ERP implementation; namely, change management, BPR, data accuracy, and testing. During the implementation, re-engineering the company's business process to align the ERP is considered to be critical [3]. The dependence and the focus on modifying the ERP system to meet the company's business requirements and to be aligned with the existing business processes and practices always received a failure result [3].

Table 3. Package dimension results.

Questions	CSFs	Q-Mean	F-Mean	Std. Dev	Results
35	Package Selection	3.21	3.62	1.208	Neutral
28		3.68		0.997	Agree
39		3.97		0.809	Agree
35	Consultant	3.21	3.22	1.208	Neutral
36		3.15		1.173	Neutral
37		3.16		1.176	Neutral
38		3.36		0.878	Neutral
39	Vendor Support	3.97	3.97	0.751	Agree
16	Training	4.2	4.20	0.77	Strongly agree
17		4.01		0.823	Agree
Package Dimension results		3.46	----------	0.807	Agree

In our research, the most important CSFs belong to this Dimension. Among these, BPR was the most significant CSF (mean value, 3.96). Business process re-engineering can achieve significant improvement for organizational business processes [12]. The customization of the ERP system should be limited as possible [1]. "Redesign business process to align to the processes in the organization". The companies should be prepared to change their business processes to fit to the processes [6]. Heavy modifications to program could lead to high cost overruns [31] and could put the project at risk of failure [3]. For those essential customizations, it is necessary to establish an agreement stating clearly with the ERP vendor. Those parts are going to be customized in the early stages of the project [3]. It sounds obvious that a project will not succeed if it does not follow practices of the project management, as well as that a major project such as an ERP requires business process re-engineering to improve the software functionality that satisfies the company's requirements.

Testing is ranked the second most important parameter of this Dimension (mean value, 3.65). It is necessary to motivate end-users to detect and recognize errors and problems. The Ignorance of the that phase could produce failure of ERP implementation [1][13][14]. The test phase should never be neglected or ignored.

Change management is ranked the third most important parameter of this Dimension (mean value, 3.56). Change management is required to change the dynamics of such organization by ensuring the readiness to the business demands. It is not simple task, since it changes the organizational culture. Such organization should be embracing new and alternative methods that would help the organization implementing a new ERP. Change management is required since ERP implementation enforces BPR of key processes within organizations [1]. Hong [7] gives a slight

importance mentioned under the ERP adaptation process as well as process adaptation, he implies that change management is important especially for client acceptance of the project. Change management is an effective balance between forces in change over forces of resistance [9]. It is important to employ the change management, throughout the all development phases [6]. The enterprise have to be managed including human, organization, and cultural change [5][6]. The current organizational hierarchy in addition to the business processes found in most organizations are not compatible with those provided by the ERP systems [1]. The end-users might resist changing to the new system. Organizations can deal positively with end-user resistance by the involvement of the change management team and procedures for feedback and monitoring the accomplishment. It is necessary to put into consideration the end-users' opinions, this makes the implementation process is more likely to be successful.

Data accuracy is ranked the fourth CSF of this Dimension (mean value, 3.47). It is an important factor for the success and the effectiveness of ERP systems. Problems of data problems can give rise to serious delays [14]. It should stand a top priority [3]. It is an important challenge and its related management represents a critical factor for the organization throughout the project [2] required to identify and get the right data to be loaded and convert it into uniform data structure, putting into consideration that data may be distributed in different servers in different locations [8][14]. The conversion process is often underestimated. End-users should work thoroughly within the system [1]; ignoring or excluding them is bad effect for the system implementation [1]. Umble (2003) states that data quality has to be established for accuracy [1] and Hong (2002) mentions it not very significantly under the factor organizational fit [7]. Similarly, There is a need for the organization to create a data analysis plan, quality control, migration and data cleansing as well as data accuracy. Finney considers this factor as tactical under the data conversion and integrity [9, 13, 14]. However, Somers [14] states that it is necessary to give an importance to data accuracy. The whole success of the ERP system depends on the ability of the ERP implementation project team to ensure the validity and the accuracy of data when migrating it into the new system [1] [14]. In this study, the correlation test on the change management CSF shows that it has several relations with other CSFs. Table 4 illustrates these correlation results.

Table 4. Business re-engineering dimension results.

Questions	CSFs	Q-Mean	F-Mean	Std. Dev	Results
21	BPR	4.32	4.03	0.793	Strongly agree
22		3.74		1.244	Agree
21	Number of customizations	4.32	3.55	0.793	Strongly agree
23		2.77		0.966	Neutral
24	Maturity	3.81	3.80	0.846	Agree
25		3.78		0.894	Agree
19	Data Accuracy	3.74	3.74	0.789	Agree
20		2.95	2.95	0.977	Neutral
Business Reengineering Dimension results		3.68	----------	0.561	Agree

4.4 Management Dimension

Dimension4 includes four CSFs that are concerned with the ERP management; namely, number of customization, communication, project management, and cost. Communication is the ranked the second most important

parameter of this Dimension (mean value, 3.66); it is one of the most recognized CSF for enabling people to work with the system is the training in all levels of the organization [1]. Proper communication help to avoid potential conflicts and misunderstandings and builds high confidence relationship among implementation team and the rest members of the ERP project team [6]. Moreover, communication has to encompass the goals, scope, in addition to the tasks [12]. Wong et al (2005) place three CSF for training and communication [15]. Ehie (2002) places the communication under the human resource development but it doesn't specifically address the issue of effective communication and training [11], whereas Finney and Corbett (2007) place it as tactical factor where the redesign of the training and jobs is required, as well as a good communication plan for ERP to succeed [13].

Project management is the ranked the third important parameter of this Dimension (mean value, 3.22); it is a continuous management of the ERP implementation plan to ensure that goals are accomplished, guarantees that decisions are made by the right organization's members and schedules are met [7]. It composes the resources used to implement the ERP system project putting into consideration the financial constraints and schedule estimations. Project management practices are huge significance during an ERP implementation. It involves the assignments of roles and responsibilities to the project team as well [13].

Cost is the ranked the fourth important parameter of this Dimension (mean value, 2.45); ERP is known for its high costs in all its implementation phases. It includes ERP package licensing fees in addition to the other related fees such as consultation, project team members, and user training, in addition, 90% of the ERP projects terminated with over budget or postpone. Financial constraints play a major role in the rejection of ERP systems. ERP research over 60% of them exceeded schedule, over 50% of the projects exceeded costs, and fully 60% of them received half or less than the expectations [13, 15]. In this study, the correlation test on the management CSF shows that it has several relations with other CSFs. Table 5 illustrates these correlation results.

Table 5. Management dimension results.

Questions	CSFs	Q-Mean	F-mean	Std. Dev	Results
6	Project Management	3.61	3.14	0.907	Agree
7		2.67		0.988	Neutral
8	Cost	2.45	2.45	0.899	Strongly disagree
9	Communication	3.66	3.66	0.681	Agree
21	Number of customizations	4.32	3.55	0.793	Strongly agree
23		2.77		0.966	Neutral
Management dimension results		3.39	-----	0.537	Neutral

4.5 Goals Dimension

Finally, the goals dimension correlates with one or more CSFs from each group. In the package group, it correlates with the package selection and training CSFs. In the organizational group, it correlates with the implementation team and maturity CSFs. In the business-reengineering group, it correlates with the change management and the BPR CSF. This will put the goals CSF in the middle between all groups with a new group called (objectives group).

Goals CSF is the most important parameter (mean value, 4.01); without a clear goals and thorough strategic planning, ERP implementation initiative can suffer a huge

failure. By analyzing this from the management perspective and puts it in the planning management function by exclaiming that there should be clear project goals, detailed formal plan and well-defined tasks [8].

Clear goals, the business vision and mission, strategic plans, focus and scope are factor in most authors that deal with critical success factors [12][13][14]. Clear goals require formulating an organization vision and providing a link between business goals and the organization strategy. It is highly associated with top management. This is essential to control the direction of the ERP project. Therefore, a business plan has to outline resources, calculates costs, and identifies risks as well as specifies a clear timeline that is critical to an ERP implementation. Appropriate involvement of the top management is also described by Somers [14], who proposes that a steering committee if formed consisting of senior managers, project managers, and end-users. Without top management sponsorship, ERP project have little chance of success [12, 13]. Table 6 illustrates these correlation results.

Table 6. Goals dimension results.

Questions	CSFs	Q-Mean	F-Mean	Std. Dev	Results
26	Goals	4.15	4.15	0.915	Agree
27		4.19	4.19	0.627	Agree
28		3.68	3.68	0.997	Agree
Goals Dimension results		4.01	-------	0.679	Agree

5. Results Summary and Discussion

$t-test$ was calculated to study whether there is a significant difference between the responses in terms of the significance of CSFs. The Independent sample test in Table 7 shows that the results of the government and private sectors are similar in terms of the package dimension according to the t-test. However, all other dimension results are different. $t-test$ group Table 7 shows that the private sector has better results than the government sector. This may be due to the nature and orientation of the organizations.

Table 7. t-test groups (government and private sectors).

Rank	CSF	Mean	Std. Deviation
Package	Government	3.61	0.67
	Private	3.87	0.45
Business re-engineering	Government	3.39	0.70
	Private	3.99	0.46
Organization	Government	3.57	0.40
	Private	3.97	0.53
Management	Government	2.98	0.55
	Private	3.45	0.50
Objectives	Government	3.80	0.65
	Private	4.25	0.63

For the rapprochement in package dimension results, we assume that this can be due to the limited number of trusted ERP vendors in Saudi Arabia who are capable of supporting and participating in such projects, since many organizations trust them in the implementation project and try to find the best vendor available.

We employed the Factor analysis using SPSS to define ERP implementation success factors. The cumulative percentage of variance value (76%) achieved for four components is good enough. Factor 1 explains 28%, Factor 2 explains 24%, Factor 3 explains 22%, and Factor 4 explains 18% of the total variance. If a fifth component was added, only 6% more of the data would be explained.

The elements of the factor analysis were found to be Table 8:

- *Technical Capabilities:* The CSFs contained in this dimension are project management, project champion, testing, data

accuracy, BPR, number of customizations, goals, package selection, consultant, vendor support, change management, and training. These CSFs are related to work field, practical issues, and procedures.

- *Organizational Capabilities:* The CSFs that are contained in this dimension are: communication, IT infrastructure, maturity, implementation team and top management. All these CSFs are related to the maturity of the organization, skills, experience and capabilities.

- *Financial Capabilities:* The cost CSF is the only CSF in this dimension. This can be explained as that the cost CSF has indirect effect on the success or the failure of the ERP system implementation. The correlation test results confirmed that cost CSF can be affected by the number of customizations CSF in Saudi Arabia environment. The cost CSF will affect everything else if not managed properly. That is, because it is closely related to other CSFs in the management dimension which spans all three dimensions. Table 8 shows factor analysis and the management capabilities is the most important dimension.

Table 8. CSFs factor analysis in Saudi Arabian organizations.

Technical capabilities	Organizational capabilities	Financial capabilities
Project management	Communication	Cost
Number of customization	IT infrastructure	
Goals	Maturity	
Project champion	Implementation team	
Package selection	Top management	
Consultant		
Vendor support		
Training		
Change management		
Data accuracy		
BPR		
Testing		

Our proposed framework is designed based on the factor analysis test result and based on reviewing the results of the correlation test. In particular, we observe that the management dimension spans over all the three dimensions in the factor analysis test, which makes it as the heart of the other dimensions and any drop occurs within this dimension will cause project fluctuations. As depicted in Fig. 2, the cost CSF is located in the financial capabilities dimension and it is the only CSF in this dimension because there is a correlation between the cost CSF and the number of the customizations. The cost CSF is a common CSF between the technical and financial capabilities dimensions. The most critical CSFs in Figure (Fig. 2) below are:

1. Cost,
2. Number of customizations,
3. Project management and
4. Communication

The cost CSF is a common CSF between the financial capabilities dimension and technical capabilities dimension. Any project cost mismanagement will have a direct influence on the number of customizations and project management CSFs because they are correlated. This impact will be extended to reach the communication CSF because there is a correlation between the cost CSF and the communication CSF *via* the project management CSF.

6. Conclusion

In this study, we have introduced a new classification of the CSFs in Saudi Arabia; it based the experiences of the surveyed organizations. Hence, results may assist in guiding Saudi Arabian organization to effectively implement ERP projects. Furthermore. Our work resulted in the consolidation of more 65 CSFs mentioned in numerous previous studies into only 18 CSF's. The critical success factors are identified through an analysis of prior research papers

and is more comprehensive and straight forwardly employable for use. The survey collected responses from organizations that attempted to implement any ERP system in Saudi Arabia. A mix of governmental and private organizations were involved in this survey. The statistical analysis results show that IT infrastructure, training, goals, vendor support, BPR, top management, maturity are the most important and significant drivers of success, whereas cost, project management, consultant, data accuracy are less significant important factor in the Saudi organizations. One of the contributions addressed in this work is that it identified a three factors using factor analysis through which the most critical group of CSFs is revealed.

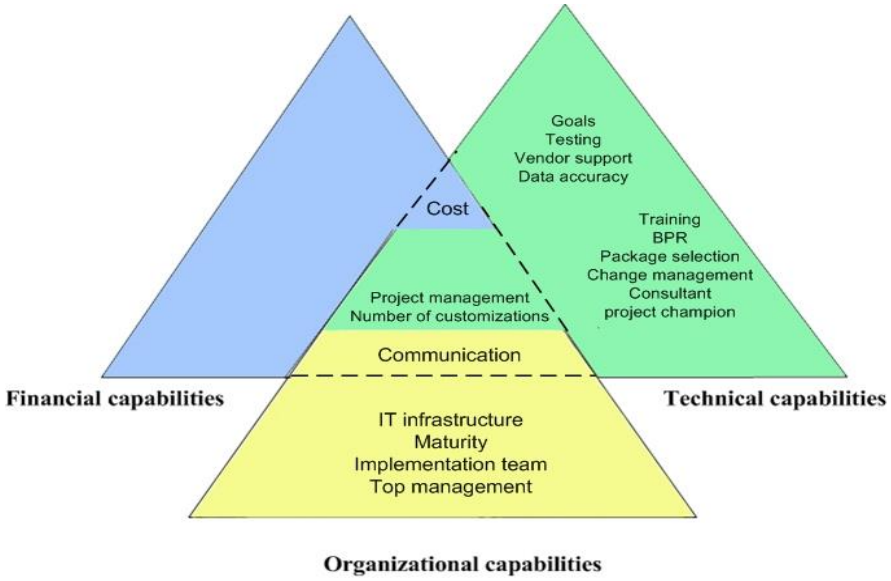

Fig. 2. The proposed CSFs Framework in Saudi Arabian organizations.

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دراسة تطبيقية لعوامل النجاح الحرجة لتطبيقات نظم تخطيط موارد المؤسسات في المملكة العربية السعودية

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المستخلص. طبقت نظم تخطيط الموارد المؤسسية (ERP) للتغلب على العديد من قضايا الأعمال التجارية، وعلى الرغم من ذلك وبسبب وجود أنوع من العوائق التنظيمية والتقنية تواجه الشركات صعوبات في تنفيذ مثل هذا النوع من المشروعات، تتمثل في التكلفة الباهظة في تنفيذ هذه النظم، فضلا عن بعض العوامل الأخرى. يهدف هذا البحث إلى دراسة وتحديد عوامل النجاح الحاسمة CSF في تنفيذ نظام تخطيط موارد المؤسسات في الشركات في المملكة العربية السعودية. وفي هذا السياق، تم تحديد ١٨ وحدة CSF لتحليل أثر هذه المجموعات المحددة على أداء مشاريع تخطيط موارد المؤسسات في الشركات السعودية. كما يقدم هذا البحث التحليل العاملي لعوامل النجاح CSF المترابطة.

الكلمات المفتاحية: أنظمة تخطيط الموارد المؤسسية، عوامل النجاح، أبعاد تنفيذ نظم تخطيط الموارد المؤسسية، التحليل العاملي لعوامل النجاح الحاسمة.