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Implementing Enterprise Resource Planning ERP System in a Large Construction Company in KSA

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Abstract

The construction industry has become more challenging and competitive. Construction firms are in the hunt for any mean to increase productivity, achieve integration and stain competitiveness. Enterprise Resource Planning (ERP) system is an Information Technology (IT) business solution that enables construction companies and their contractors to manage capital projects effectively and efficiently throughout the project lifecycle. Many studies have demonstrated the benefits of ERP systems in construction, correspondingly, more studies have reported the importance of investigating the critical success factors (CSFs) of the implementation process. This paper aims at finding the most CSFs impacting the implementation process from the point of view of ERP users working in a large construction company. A total of 26 factors were identified from the literature and a questionnaire survey was conducted among ERP users to find out the most critical ones. The data were collected through a structured interview from 25 users who experienced the ERP implementation process. The results showed that top management involvement and awareness, training and support for users, and implementation team composition are the most significant factors of ERP implantation success. The findings agree with previous studies which conclude that despite being IT process in its core, the ERP implementation process is largely impacted by the human factors.

Keywords: Enterprise Resource Planning ERP; Implementation Success Factors.

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1. Introduction

The new advancement in Information Technology (IT) sector provide construction organizations with several tools and techniques to achieve their goals. Enterprise Resource Planning (ERP) systems are among these tools that showed potential enhancement in managing such organizations [1]. Enterprise Resource Planning (ERP) is an Information Technology (IT) solution that enables enterprises and their suppliers to manage large projects effectively and efficiently all over the project lifecycle. The main aim of an ERP system is to standardize the processes of project development, delivery, and execution. ERP facilitates a consistent project performance and implementation approach. The standardization and consistency that the ERP provides, will improve reporting and documentation in the projects. ERP provides the project management team with tools and functionalities that streamline project data and reports throughout the project life cycle. The benefits expected from using ERP, such as improve project execution efficiency and enhance project controls.

ERP systems promise flawlessly integration of business processes throughout the organization. Yet the implementation of these systems is significantly challenging. Usually, organizations spend a huge amount of resources in terms of time, money, and energy on the implementation process with little to show for it. High failure rates in implementing ERP systems have been widely reported in the literature [2]. Given this background, it is significantly important to define the critical success factors of ERP implementation. It is also necessary to quantify their influence on the implementation process. Good understanding of these factors contributes directly to choose the appropriate implementation strategies.

The main objectives of this study are as follows: (1) define the major challenges facing construction firms during the implementation process, and (2) identify the critical success factors and quantify their impact on ERP implementation in construction. The first objective will be achieved through a literature review study that includes previous research in the construction area. The second objective will be achieved using a questionnaire survey designed to collect data from ERP users. The collected data will be analyzed to investigate the perceptions of ERP users in terms of implementation success of such systems. The findings of this research are expected to provide leaders in construction firms with guidance to implement ERP systems effectively and efficiently.

1.1. ERP Definition and Description

The definition of ERP systems may have different meaning based on entity concerned. Usually, ERP systems refer to these comprehensive software packages that seek to integrate all business processes and functions in order to provide a complete view from one IT architecture [3]. In construction field the ERP system can be defined as "IT-based computer platform that allows for the integration of various business processes of an organization in order to increase efficiency, and thus profits, using a single database" [4]. In more details, ERP replaces all standalone software packages in finance, HR, inventory, planning, etc., with a single unified software that is divided into modules. Each module approximately functions as a standalone system however, all modules are linked together and share information and data. The ultimate goal of ERP software vendors is to provide flexible modules that have more ability to share effectively business data and information [5].

1.2. Benefits of ERP systems

Organizations are willing to invest in ERP systems to gain benefits from integrating their business processes into one IT architecture. The direct benefits of this integration include simplifying operations and speed up the decision-making process. Previous research showed that the key drivers for ERP implementation are: (1) corporate growth; (2) improved customer services; (3) efficient distribution system; and (4) reduced operational expenses [6].
Shang and Seddon (2000) [7] developed a classification for the benefits expected from ERP systems. Focusing on benefits from systems in use and considering the point of view of top management of the organization, the study identified five dimensions of benefits and they are: (1) Operational Benefits, (2) Managerial Benefits, (3) Strategic Benefits, (4) IT infrastructure benefits, (5) Organizational benefits.

ERP systems are being implemented by more and more organizations around the world from different industries and sectors. This trend shows that there is a need for such systems so that there is a need to understand the drivers of

organizations to implement ERP systems. [8] introduced three main reasons why an organization may consider implementing an ERP system. The first reason was to create a common database throughout the entire enterprise. The second reason was to automate as much as possible of the organization's business process. The third reason was to generate and get access to business information in a real-time environment. [9] outlined the benefits of ERP systems as follows: (1) it provides a solution to the problems of legacy systems; (2) it reduces the development risk; (3) it increases competitiveness; and (4) it improves the business efficiency.

1.3. ERP Implementation Challenges

However, ERP systems have been widely adopted, Momoh et al. [10] stated that post-implementation challenges are still a rising concern. Furthermore, the ERP implementation process is a lengthy process and requires a continuous change in the organization. According to Huang et al. [11], ERP implementation may result in "complex technical organizational, cultural and political issues that make the integration process a very challenging task". Additionally, ERP systems have to deal with today's unpredictable business environment, expanding markets, and growing costumers expectations [12]. While ERP systems providers strive to integrate all processes of a firm, their packages are usually missing some essential functionalities. The transition process from a traditional system to the ERP may require re-engineering of some of the business processes at the organizational level. The long-term implementation process of ERP systems can be a source of employees' fatigue and dissatisfaction. Additionally, most organizations mistakenly expected to get the benefits too early before completing the whole implementation process. They see that "go live" stage as the destination or goal which is not the case [8].

1.4. ERP Implementation costs

ERP implementation costs may include but not limited to the costs of hardware, software, professional and consulting services, and internal staff costs. The costs are incurred during the initial installation of the system and may continue for several years afterward. Studies showed that ERP implementation is costly no matter what the industry it is being used for. The results of a study conducted by Meta Group in 2002 that included 63 small, medium and large companies in different industries. The study showed the average cost of ownership of ERP was $15 million (the highest was $300 million and the lowest was $400,000) [13]. Usually, there are certain cost items that are overlooked during the budgeting process. These items may be considered as hidden costs of ERP which may include: (Training, Integration and Testing, Customization, Data conversion, Data analysis, consultation, Implementation teams can never stop, Waiting for ROI, Post-ERP depression) [5].

1.5. ERP implementation life cycle

The main four fundamental phases of the ERP life cycle as frequently mentioned in literature are (1) planning, (2) implementation, (3) stabilization, and (4) enhancement. In the third stage "stabilization" the implementing organization strives to reach into a normal operation using the new ERP software. While in the fourth phase the organization seeks to continuously improve the system and adding more functionalities. According to the literature, the fourth phase may be subdivided into three sub-phases such as backlog, new module, and major upgrade. These sub-phases have a unique nature because they are taking place in the post-implementation period. In this period the new ERP system is actually in use and forming a new reality [14].

Several ERP life cycles have been proposed in the literature among them are (Markus & Tanis) and (Esteves and Pastor) models which describe the flow of the process from the start until the full stabilization of the system. On the other hand, researchers have proposed other models to solve some problems associated with the implementation process. One of them was proposed by Brehm and Markus (200) [15] which gives more attention to post-implantation activities such as software development, maintenance, enhancement, and support.

2. LITERATURE REVIEW

This section provides an overview of studies conducted on ERP system implementations. The overview specifies the aim of the studies and methodologies used to achieve the objectives and outlines the main results. This section also casts a shadow on the most critical factors impacting the implementation process.

Razmi et al. (2001) [16] conducted a comprehensive literature review to find out the critical success factors for enterprise systems implementation. The study showed that 11 factors were found to be critical. The study classified these factors according to their phase in the implementation process. Markus and Tanis' ERP life cycle model, which contains four phases (chartering, project, shakedown, onward and upward), have been used to show the significance of each factor. Summer (2000) [17] investigated risk factors associated with the implementation process of management information systems. In addition, the study identified and described the risk factors that are unique Enterprise Resource Planning (ERP) projects. The findings highlighted the main challenges facing ERP projects which they are, (1) the risk of redesigning the business processes to fit the processes supported by the ERP software. (2) the need to hire new staff for the new technology. (3) the challenge of integrating external knowledge and expertise with current teams. (4) the risk of technological bottlenecks through client-server implementation. (5) the risk of recruiting business analysts who combine technology and business skills. Eshaq (2013) [18] explored the strategic and tactical success factors of implementing ERP systems in Jordan. The data were collected using a questionnaire study of employees who ERP systems in telecommunication and hospitals sectors. A total of 221 questionnaires were collected and analyzed using the regressing technique. The results showed that at the strategic level the most critical factors were (1) top management support, and (2) project management. AT the tactical level the most critical factors were (1) communications, (2) training of users, and (3) supporting ERP systems suppliers. The results also highlighted that the reengineering of business process has no impact on ERP implementation. Loonam et al. (2018) [19] conducted a comprehensive literature review study involving ranked articles form refereed journals. The study identified 34 key critical factors for successful implementation of ES systems. The findings ranked the top critical factors and provided a discussion of the top ten. Rahnavard and Bozorgkhou (2014) [20] identified the key success factors of implementing ERP systems using a questionnaire study involving 185 participants who are managers, professionals, and experts in this field. The findings indicated that the most critical factors were: (1) user-friendliness; (2) project management; (3) satisfies user needs; (4) management of organizational changes, and (5) considering the principles of successful implementation of ERP systems. Chung et al. (2009) [21] developed an ERP systems success model that ensures successful implementation and highlights the key success factors of ERP system. The developed model investigates the relationship between key factors and the successful implementation process of ERP systems. The proposed model incorporated the technology acceptance model and DeLone and McLean's information systems success model along with the key project management principles. The main goal of the model was to help top managers making the best decision concerning the implementation of ERP systems in their organization. Kim et al. (2015) [22] Conducted a survey of employees working at Texas Department of Transportation (TxDOT) to identify the key strategies in management and communication that TxDOT adopted and what was the lessons learned from the ERP implementation. The study concluded that the key success drivers included the following: (1) the unique makeup of the implementation team, (2) top-management, (3) promote awareness, (4) the use of ambassadors for better communication, (5) the use of multiple communication channels. Shi and Halpin (2003) [1] highlighted the importance of defining the basic theory for construction enterprise resource planning (CERP) systems development. The study discussed the key features of CERP that must be addressed to accommodate the nature of the construction industry. The study proposed a three-tiered client/server architecture and included a discussion on each tier functions and components. Additionally, the study provided a discussion for future research and major issues such as; CERP architectures, project management functions, advanced planning techniques, standardization of management functions, and modeling human intelligence. Skibniewski and Ghosh (2009) [23] discussed the development of unified Key Performance Indicators KPIs based on the time-system theory. Two dimensions of KPIs have identified the knowledge specificity and time specificity. Different approaches to studying knowledge and time sensitivities were presented. The paper studied the empirical and specialized construction processes to identify business processes that are not covered by current ERP systems. A survey study was conducted to focusing on qualitative characteristics of ERP systems implementation in construction firms. The purpose of the survey was to validate the theoretical framework proposed in the paper. Chan and Mills (2011) [24] studied the implementation of enterprise resource

planning (ERP) system in a major construction firm in Hong Kong. The data were collected using structured interviews and observations. The findings highlighted the importance of leadership and culture in the implementation process. The research showed that knowledge management can be more effectively performed in construction firms using the ERP system. Chung et al. (2011) [25] identified and analyzed critical factors for ERP system implementation in construction projects. The study introduced success indicators to evaluate the performance of ERP systems. Moreover, an information system success model was developed to analyze the relationship between factors and success indicators. In the end, the paper provided recommendations for successful ERP systems implementation based on the findings of the study. The authors considered these recommendations helpful for senior managers for making the best decisions to improve the implementation process of ERP systems. Ozorhon and Cinar (2015) [26] investigated the critical success factors of ERP system implementation in the construction industry focusing on developing countries. 14 critical success factors were identified from a comprehensive literature review. A survey study was conducted to analyze the impact of these factors on ERP systems implementation. A questionnaire was designed and distributed on 90 Turkish construction companies. The results from the statistical analysis showed that the most significant factors for successful implementation were; (1) top management support, (2) clear goals and objectives, (3) project team competence, (4) effectiveness of the project leader, and (5) cooperation between team members. While the results from factor analysis showed that factors were grouped in three dimensions (1) human factors, (2) organization, and (3) technology. The findings from this research considered valuable for top managers to ensure effective implementation of ERP systems.

3. METHODOLOGY

A questionnaire was designed to investigate the impact of various success factor on the implementation process of ERP systems. The questionnaire is a modified version from a study conducted by Ozorhon and Cinar (2015) where the success factors were slightly modified to suit the situation of the company under study. In addition, new sections were added to the questionnaire seeking to find relationships between system performance parameters and the life cycle stage of the implementation process. The survey was administered to the members of a large construction company in Saudi Arabia. This company is going through the implementation process. The survey investigated the new system users about their perception of the most critical challenges and the key success factors that need to be considered. In the first part, the respondents were asked to provide information about themselves and the type and phase of the ERP system in use. In the second part, the respondents were asked to evaluate the critical success factors of ERP implementation. The respondents were asked to evaluate the importance of the listed CSFs using a (1–5) point Likert scale (1, very low; 2, low; 3, medium; 4, high; and 5, very high). In the third part, the respondents were asked to provide feedback about their satisfaction level of using the ERP solution ant the level of automation they think the new system achieved. The feedback of users could vary due to the implementation level they are performing in which it is what this section investigates.

4. RESULTS

A total of 25 questionnaires were collected from users of the ERP system working in different departments and functions. All respondents utilize the same ERP system, but they have different tools and authority based on their positions. However, all respondents are utilizing the same ERP system, the implementation level varies from department to another. The respondents provided their feedback about the performance of the ERP system. Figure 1 shows a summary of the results.

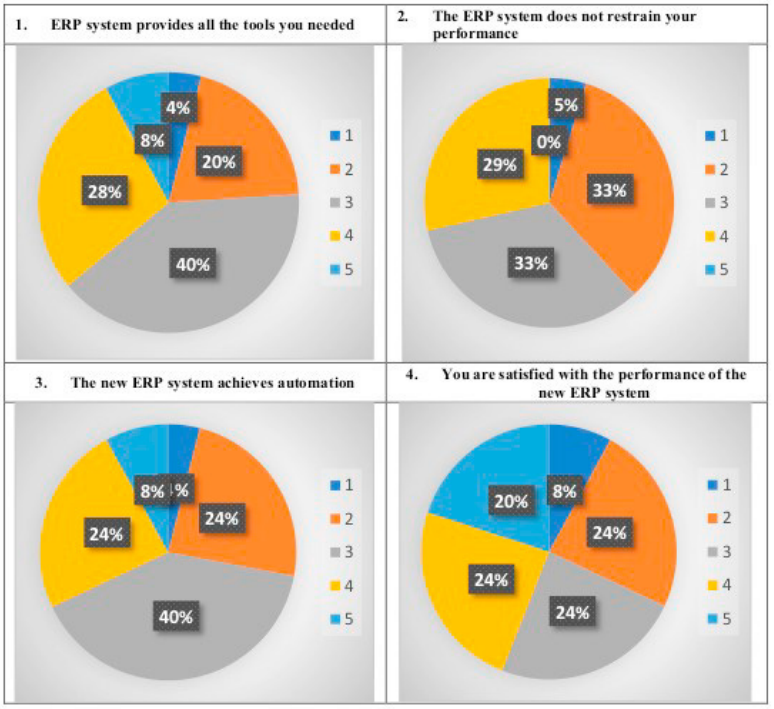
The respondents evaluated the new ERP system based on four factors: (1) ERP system provides all the tools you needed, (2) ERP system does not restrain your performance, (3) ERP system achieves automation, (4) ERP system performance is satisfactory. Two main comments can be drawn from the graphs:

1. In question (2) a high percentage of respondents claimed that the ERP system restrains their performance. This can be explained by restriction and the absence of flexibility in some aspects of the ERP system. We may connect the lack of flexibility due to that most of the respondent are working in a new implemented

ERP system (less than one year). This is a time were additional functions and flexibility could still be introduced.

2. In question (4) an increasing percentage (20%) of respondents showed that they are completely satisfied with the overall performance of the ERP system. However, the maximum percentage who completely satisfied with the other questions didn't reach 8%. This is could be related to that users believe that ERP system improves the overall performance of the organization despite the few deficiencies that they are facing right now.

Figure 1. Results from the third part of the Survey.



4.1. Results from the second part of the survey – Critical Success Factors

The results of this section show that seven factors are considered to have the highest impact on successful ERP implementation. These factors were determined based on RII above (0.72) which they are:

1. Top management support for the project and the implementation team.
2. Top management awareness regarding project goals and complexity.
3. Top management participation in the project schedule and goals definition.
4. An adequate training program suitable for the enterprise's needs.
5. The project manager is responsible for the implementation duties.
6. The formal introduction of the implementation project in the enterprise investment plan.
7. The implementation team is strongly involved in the implementation duties.

However, these factors could be related to three main categories: (1) top management involvement, (2) project definition and organization (training), and (3) factors related to the implementation team. A comprehensive literature review conducted by [26] identified 14 CSFs that are related to construction Figure 1. Most of the previous studies concluded that these factors are believed to be the most critical ones. The three identifies factors from this report are included in the 14 factors which written in bold line Table 1. It is worth to mention that both studies agreed that top management is most CSF.

Table 1. List of CSFs identified by [26].

1. Top management support and commitment	2. Vendor support
3. Project team competence	4. Choice of ERP modules
5. Clear goals and objectives	**6. Training and support for users**
7. Team composition	8. Organizational change management
9. Effectiveness of project leader	10. Use of consultants
11. Cooperation between team members	12. End-user involvement
13. Choice of ERP software package	14. Testing and start-up the system

5. Conclusion

Considering the competitive environment in the construction industry, construction companies should improve their efficiency and effectiveness in managing projects. Several IT tools are created to enhance the performance of managing construction projects over its whole life cycle, however, the integration of these systems is considered a big challenge. ERP systems provide a suitable solution for these integration challenges. Many studies have been conducted to study the benefits of ERP systems in construction. However. In order to achieve the benefits of ERP systems, the critical success factors of the implementation process should be investigated.

This paper aimed at finding the most CSFs impacting the implementation process from the point of view of ERP users working in a large construction company which is already started the implementation process. A total of 26 factors were identified from the literature and a questionnaire survey was conducted among ERP users. The data were collected from 25 users who experienced the process of ERP implementation.

The statistical results show that top management involvement and awareness, training and support for users, and implementation team composition are the most significant factors of ERP implantation success. The findings are of this report agree with the findings of previous studies. The perception of these critical factors can enhance implementation performance. However, the ERP implementation process is an IT process in its core, most of the critical success factors point that the human factors are the most critical. In this regard, the top management, the implementation team composition and training of users are reported the most CSFs.

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