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The Effects of PMBOK Knowledge Areas on the Phases of ERP Implementation

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ABSTRACT

The main current issue in Iran is the lack of standard mechanism in order to implement a successful ERP projects based on the project management's standards. In this paper, in addition to the views of the customer team (client), the views of the executing team (implementer) and the views of project management specialists were also considered. Expansion of the community created a better position for analysis. The Necessity/Implementation matrix is presented and the critical knowledge aspects are defined through the theoretical studies within this field and an analytical evaluation of standard inputs and outputs in PMBOK. Furthermore, the matrix is implemented by an evaluation of the importance of knowledge management during the variance phases within the implementation. The additional factor is the employer's view on the extend of how the knowledge is translated into practical and systematical solutions. Comparing methodology of two ERP projects as case study, and PMBOK knowledge areas as standard of project management, shows the critical knowledge areas based on the opinion of team of experts, the implementer team and the employers. Subsequently, the reasons for the criticality of each area of knowledge are analyzed.

Keywords: Project Management, PMBOK Knowledge Area, Human Resource Planning, ERP

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1. INTRODUCTION

The rapid and accurate distribution of information in large organizations, and tending sudden and sometimes arbitrary activities and decisions towards systems based on commonly accepted standards, is one of the most important factors in the success of the organization. Basically, the scope of information and data exchanged in large factories and enterprises is such that it is not possible to ensure the integrity of the information in the absence of an integrated information system, and often the extracted reports are influenced by specific conditions and different interpretations of the various providers, and may mislead management in the analysis of data and the adoption of appropriate decisions.

Today, advances in communications and information technology gift the digital economy and e-commerce to the world and this new phenomenon has made the competition to stay in the cycle of the economy very difficult. In such a situation, only those organizations have the ability to stay and win that prepared themselves for this challenge and take the necessary measures to accept the transformation quickly and accurately.

There are several means to mechanize an organization as an integrated form, i.e. the creation of a comprehensive information system. For example, the required systems are generated by a comprehensive study of the information flow and work processes in the organization,

design of databases, and programming. The above procedure is very time-consuming and cost-effective. But by selecting ERP software packages, you can choose a shortcut way and benefit from it. In this method, instead of programming and creating a specific information system for an organization, information systems and predefined standard programs are used.

ERP means the enterprise resources planning (firm), the simple concept of which is "a software solution that tries to define and create all the activities of different organizational units (including queues and headquarters) as an integrated form in a single software system, so that those units can receive their work and information needs." But scientifically, ERP is a software package and a system that mechanizes the organization's work processes by applying an integrated business environment, data and integrated databases, and integrated programming language in financial/sales/purchasing/warehouse/production and human resources.

ERP software suite is the result of more than 40 years of experience and try and error, and due to continuous improvement in the techniques of organization management and the rapid growth of information technology, this software package has also grown and evolved along with it. These standard packages can easily be implemented and deployed in any organization within a relatively short time that will only be used to localize the system.

2. LITERATURE REVIEW

The use of information systems that can cover all of the activities and tasks in an organization and provide the necessary information to the users in a timely manner is a vital tool in today's organizations.

Due to the novelty of the subject literature and the fact that the field of ERP systems seems to be new discussions, the literature review of the subject, which covers both ERP systems and the control of the project and the process of deploying these systems, is not an old argument.

2.1 Factors Affecting the Success and Failure of ERP Systems Execution

"Effective project management is crucial for ERP execution" (Umble *et al.*, 2003). In 1999, Bingi *et al.* (1999) found that "the lack of proper understanding of project requirements and the inability to provide leadership and guidance to the project" is a major factor in the failure of ERP execution. Thus, effective project management should be clearly defined in the objectives of the project, which develops this work and resource plan and carefully pulls the project forward (Bingi *et al.*, 1999). Fotso and Edoun (2017) investigated the management of ERP projects through critical skills assessment of a project manager and synthesis model of project lifecycle.

According to Helo *et al.* (2008) "Unlike other information systems, the main problems with ERP execution are not just technology issues, such as the complexity of technology, compatibility, standardization, etc., but often are organizations and human resources issues such as resistance to change, organizational culture, inconsistent and inaccurate processes of business, mismanagement of projects, senior management commitment, etc." (Hello *et al.*, 2008). Huang *et al.* introduced the ten risk factors that led to the failure of ERP execution. These ten factors are: senior manager's lack of commitment, ineffective communication with users, inadequate training for end users, lack of user guidance and support, lack of effective project management practices, attempting to make the connection to old software, incompatibility and conflict between users of different sectors, the combination of members of the project team, the failure to redesign the business process, misunderstanding of the required changes. These risk factors reflect various organizational considerations: organizational fitness, skill mixing and integration, project management and control, software system design, training and user involvement, and technology planning (Rao, 2002). In Table 1 and Table 2, a division is presented based on success factors and failure factors in the execution of ERP systems.

Table 1. Categories of success factors in ERP execution

Author name	Success factors in the execution of ERP systems
Umble *et al.* (2003)	Project Management
Rabaa'i (2009)	High level management commitment and support, management change, project management, business process restructuring and system customization, training, ERP team, planning and attitude, selection and leadership advice, communication plan, ERP system selection, ERP system integration, and post-execution evaluation measures.
Motwani *et al*. (2002)	Proper management to deal with potential challenges
Umble *et al.* (2003)	Commitment and support of senior management
Ehie and Mogens (2005)	Reconstruction of business processes
Ash and Burn (2003)	Effective management of employees
Bajwa *et al.* (2004)	Training the end users
Al-Mashari *et al.* (2003)	Strong communication across the organization

Table 1. Categories of success factors in ERP execution (Continued)

Author name	Success factors in the execution of ERP systems
Ram *et al.* (2013)	Project Management Teaching and learning Reengineering of business processes Systematic Integration
Totla *et al.* (2016)	Senior management support, teamwork, coordination and communication between departments, business perspectives and plans, project management, project manager, seller support, technical infrastructure architecture, software development and testing, user participation, process reengineering, change management, participation, system knowledge, delivery dates
Ozorhon and Cinar (2015)	Commitment and support of senior management, project effective leadership, coordination between team members
Leyh (2016)	(4 higher priorities): Organizational suitability with ERP system, ERP system testing, project team balancing, project management, etc.

Table 2. Classification of failure factors in ERP execution

Author name	Failure factors in the execution of ERP systems
Bingi *et al.* (1999)	Lack of proper understanding of project requirements and inability to provide leadership and guidance to the project
Helo *et al.* (2008)	Organization and human resources issues such as resistance to change, organizational culture, inconsistent and inaccurate business processes, mismanagement of projects, senior management commitment, etc.
Huang *et al.* (2004)	senior manager's lack of commitment, ineffective communication with users, inadequate training for end users, lack of user guidance and support, lack of effective project management practices, attempting to make the connection to old software, incompatibility and conflict between users of different sectors, the combination of members of the project team, the failure to redesign the business process, misunderstanding of the required changes
Lamers (2002)	Lack of accurate cost estimation and planning
Amid *et al.* (2012)	The division of 47 factors into 7 categories: Organizational structure: government structure in organization, conflict between departments, lack of flexibility, mismatch between organizational culture and ERP, mismatch between organizational structure and ERP, mismatch between IT and business strategy, non-transparent definition of strategy goals, unstable management positions Project management: Conflict between organizations and consultants, conflicts between organizations and vendors, lack of time and project team, poor project management, over-project cost, project delays, range change Human resources: employee resistance to changes, inadequate training, insufficient participation of employees, ineffective communication between users, lack of managerial change, lack of motivation among employees, weak key users, unrealistic expectations Management: The lack of proper evaluations before project execution, the lack of a performance evaluation system, unwillingness of management to long-term and medium-term planning, weak support of senior managers Supplier and consultants: poor supplier and consultant Process: Lack of process-oriented prospects, poor process of business reengineering Technical: high rate of customization system, high complexity of the system, inaccurate data

2.2 Roadmap and Methodologies Applied in ERP Execution

ERP is a multi-faceted information system that helps the organization to develop robust operation, better performance, better decision-making, and achieve competitive advantage. The advantages of an ERP system are not easy to achieve, and technology and social efforts are needed to implement it. Activists should be conducted and guided to implement the ERP system with a continuous road map. In order to successfully implement the ERP system for achieving competitive advantages, the activists require a comprehensive roadmap that applies the project management approach. But studies show that there is very little research in the area of roadmap for ERP execution that uses the knowledge areas of the project and its centralized processes. Therefore, further research is needed in this area. A roadmap will respond to three questions:

Table 3. Record coefficients

Group Name	Coefficient
Project Manager	3
First Level Expert (Senior)	2
Second Level Expert (Junior)	1

Where do we want to go?
Where are we currently?
How can we achieve there? (Leyh, 2016)

McGuinness and Huang have provided a new perspective on knowledge management and continuous improvement in their study. They believe that most information system researches stop ERP execution in the starting process and rarely come to the final execution issue. Although ERP is a continuous improvement, ongoing efforts after the start of the system will affect the success of implementing the entire ERP system. In this research, four phases are defined for ERP and the proposed model is combined with knowledge management. They believe that this increased knowledge model leads to a greater insight into the success of implementing ERP systems, and is also a guide for practitioners in this area (Chofreh *et al.*, 2014).

Ghafareh *et al.* (2014) in their research have reviewed road maps for implementing ERP in recent years and have identified research gaps for expanding future works. Literature review studies indicate that road maps in the execution of ERP systems have not used a comprehensive project management, including 9 knowledge area and process groups, as a methodology for this complex project. Therefore, there is a need for research, a road map for implementing ERP to help those activists in this area. In Table 3, a summary of the reviewed articles is provided in terms of the type of road map and the areas of knowledge and process concentration.

2.3 Introduction of Some Common Methodologies for ERP Execution

2.3.1 ASAP Methodology

SAP Company, formed in 1972 by five former IBM engineers, is now known as the bestselling ERP manufacturer in the world. ASAP is the company's methodology for implementing ERP. ASAP is composed of 5 consecutive phases (McGinnis and Huang, 2007).

2.3.2 ORACLE Methodology

After SAP, ORACLE Company is recognized as the bestselling ERP manufacturer worldwide. AIM's methodology for implementing ERP is composed of 6 phases.

2.3.3 SIGNATURE Methodology

EPICOR Company is another ERP manufacturer in the world. The company's methodology, SIGNATURE, is composed of 6 consecutive phases to implement ERP.

2.4 Combination of PMBOK Standard in the Execution of ERP Systems

Investigation of the literature review showed that there is little research in relation to the PMBOK standard combination in the execution of ERP systems. The PMBOK standard considers best practice and includes proven and efficient methodologies for project management, defining a project gradually from the beginning, in a unique and prioritized way.

According to PMBOK, project management refers to the application of knowledge, competence, tools and techniques in project activities to meet project requirements.

Project management work requires a balance between the various competitive elements in the project and the elements given in the 10 standard areas of knowledge, including: integrity management, scope management, time management, cost management, quality management, human resources management, communication management, risk management, procurement management and stakeholder management. Processes in five process groups cover knowledge area, including: Initiation, Planning, execution, Monitoring/Control, and Termination. In the PMBOK standard, a non-flexible life cycle is not defined, but is defined as the conventional sequence of phases that include the process groups mentioned.

From the point of view of project management, Flani *et al.* have examined two case studies of the ERP execution project in Portugal and compared the project management methodology adopted by these companies with Project Management Body of Knowledge (PMBOK). In this study, it was found that the understanding and application of PMBOK by project coordinator, taking into account important vital elements, could affect management's role. Major critical elements include: Planning that should be sufficient, accurate and complete; Commitment and effective participation of senior management; and stakeholder management to reduce their resistance and motivate them to succeed. As a result, the understanding and application of PMBOK concepts by the project manager and the qualifications achieved in the development of other projects is undoubtedly the main factor for success in implementing ERP (Gracheva, 2010).

Anne and Almodimigh have conducted a research on the impact of project management on the life cycle of the ERP project execution. This article investigates the impact of project management on ERP execution using a variety of methodologies. Also, the critical role of the project manager, project team and project management in the execution of ERP projects in organizations with different cultures and sizes were identified. As a result, this study proves that the life cycle of ERP execution will be successful using the theory and method of project management (da Silva Gomes, 2013).

3. RESEARCH METHODOLOGY

3.1 Designing a Network Model for Case Studies

The purpose of using ANP method is to determine the importance of each knowledge domain in the phases of ERP projects. Binary comparison matrices for areas of knowledge in each phase by the experts, which were in the selected sample of the project execution team, were the contractor. An analysis of the ANP method and the designed model and the formation of comparative matrices and eventually the ranking of options were used with Super decisions software.

To design a network model for the studied samples, the present research has been conducted on three levels: the first level of the project is the launch of the ERP project, and the second phase is the ERP project phase, and at the last level, knowledge areas are ranked as options.

3.2 Completion of Comparison Matrices to Rank the Importance of Knowledge Area in the Project Phases

To determine the importance of each area of knowledge in the project phases, samples of 7 experts were used for the Iran Yasa project and a sample of 9 experts in the Sayeh Saman project. The experts have more than 10 years of experience in the related field with bachelor's degree or higher. These people are active in the execution contractor deployment team and have mastered the PMBOK standard and have internal documentation for this standard.

For each phase, a comparative matrix of knowledge area is completed by each person. Finally, the sum of these matrices is combined with the following record coefficients table and entered into the Super decisions software.

3.3 The Result of Ranking the Importance of Each Knowledge Domain in the Deployment Projects Phases

At this stage of the research, after the introduction of comparison matrices in the software for each phase, the ranking of knowledge area is performed. It should be noted that it was necessary to compare the deployment phases in order to determine the final ranking, which was entered into the software with the help of the WBS weights of the project. In addition, the effects of phases on each other which was the main reason for choosing the ANP model and the non-use of the AHP method could not be overlooked. The comparisons were entered into the software in the manner described.

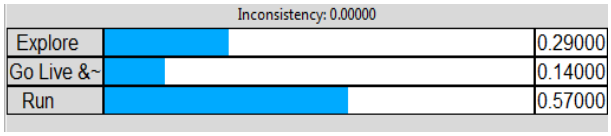

Figure 1. The weight matrix of phases for Iran Yasa project.

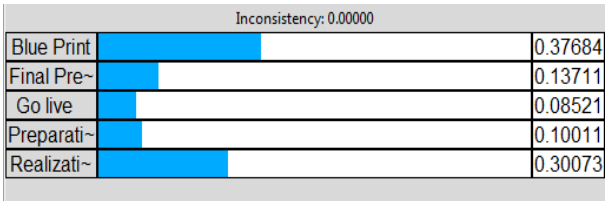

Figure 2. The weight matrix of phases for Iran Sayeh Saman project.

3.4 The Result of the Importance of Knowledge Areas for the Case Study Project

According to the methodology phases, the system deployments for each phase were obtained separately from the software. The final result is achieved by the combination of the project deployment phases.

Name	Graphic	Ideals	Normals	Raw
Communication Management		1.000000	0.244639	0.102735
Cost Management		0.244269	0.059758	0.025095
Human Resources Management		0.411807	0.100744	0.042307
Integration Management		0.336206	0.082249	0.034540
Procurement Management		0.449119	0.109872	0.046140
Quality Management		0.321436	0.078636	0.033023
Risk Management		0.175198	0.042860	0.017999
Scope Management		0.442905	0.108352	0.045502
Stakeholder Management		0.184504	0.045137	0.018955
Time Management		0.522213	0.127754	0.053650

Figure 3. The final result of the deployment phases of Iran Yasa project.

Name	Graphic	Ideals	Normals	Raw
Communication Management		1.000000	0.145881	0.056403
Cost Management		0.943326	0.137613	0.053207
Human Resources Management		0.915155	0.133504	0.051618
Integration Management		0.580336	0.084660	0.032733
Procurement Management		0.598854	0.087361	0.033777
Quality Management		0.534423	0.077962	0.030143
Risk Management		0.478191	0.069759	0.026972
Scope Management		0.618550	0.090235	0.034888
Stakeholder Management		0.524699	0.076544	0.029595
Time Management		0.661367	0.096481	0.037303

Figure 4. The final result of the deployment phases of Sayeh Saman project.

It should be noted that the inconsistency index is also considered in the results obtained, and the rate of this index is less than 0.1 in all results.

3.5 Analyzing the Extent of Execution of Knowledge Area in Each Deployment Phase

To analyze the extent of execution of knowledge area in each phase of the project deployment, a five-scale Likert questionnaire was set and distributed among the statistical population of the project users who actually analyzed the project from the perspective of the employer. The purpose of the questionnaire is to determine the contribution of the execution of each knowledge domain in each phase of the deployment methodology, taking into account the user's experience of the execution project in their company.

To do this, all users who were involved with the project during the execution process from the beginning to the end of the project were used. The statistical population for each project was less than 40 people that the questionnaire was distributed among all participants to complete. Validity and reliability of the questionnaire were evaluated and it was determined that all the indicators are in the accepted area.

After completing the questionnaires in both statistical samples, the data were entered into SPSS software. Then, for ranking knowledge area in each phase, descriptive statistics (mean and standard deviation) were completed and the following results were achieved.

For the final ranking, the mean score of questions related to a knowledge domain in all phases, including the weights of each phase given in the WBS project, was used, which is presented in the importance/execution matrix.

3.6 Formation of Importance/Execution Matrix

By combining the results of Super decisions and SPSS software, an importance/execution matrix for each phase of the project can be created. In the matrix, the importance ranking of the knowledge area that came from experts' opinion and with the help of Super decisions software was placed on the vertical axis and the execution ranking of the knowledge area in the horizontal axis. After using the opinions of the experts of the statistical population, the results are shown in Table 4.

Table 4. How to rank knowledge areas

The status of knowledge area in ranking	Rate
High importance knowledge area	Higher than 0.5 in the ideal ranking
Medium and low importance knowledge area	Lower than 0.5 in the ideal ranking
High execution knowledge area	Average rate higher than 4
Medium and low execution knowledge area	Average rate lower than 4

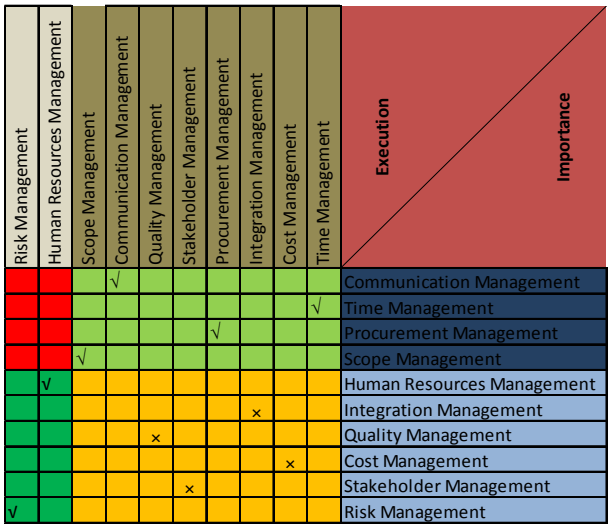

Figure 5. Matrix importance/execution of Iran Yasa project.

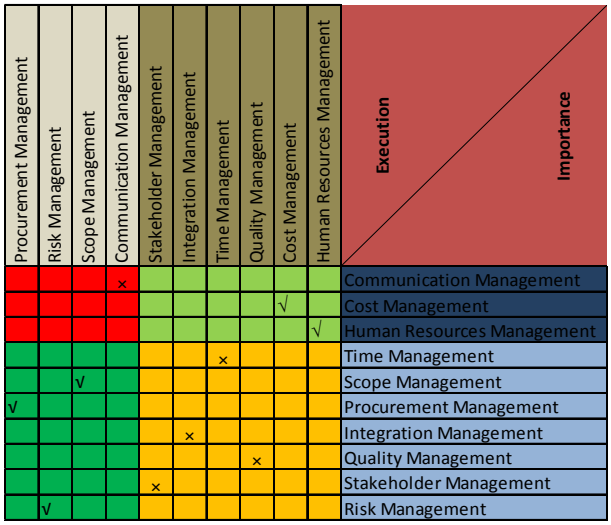

Figure 6. Matrix importance/execution of Iran Yasa project.

Using the above table, the categorization of the importance/execution matrix was made with four analytic areas, the final result of which is shown in the following figure.

4. DISCUSSION AND RESULTS

4.1 Identifying Critical Knowledge Area

There are four areas in the importance/execution matrix:

- Red area: Knowledge area are of great importance in this area and less attention paid to the execution of the project.
- Yellow area: Knowledge area are of less importance in this area, while more are being addressed in the execution of the project.

- Pale green area: In this area, knowledge areas are of great importance and they have received a lot of attention in the execution of the project.
- Bold green area: In this area, the knowledge domain is of little importance and has been underestimated in the execution of the project.

According to the four areas mentioned, the red area is a critical area. The yellow area is an area which can be analyzed and examined, because we can achieve the red areas by reducing the time and cost allocated to the knowledge area of these areas. Finally, both green areas are safe areas and have acceptable levels of importance and execution.

4.2 Identifying Project Problems in Each Phase of Its Execution

At this stage, a Delphi-based technique session was held at the employer's premises in order to form a list of the problems of the study sampled projects. In these meetings, both sides of the implementation project (employer and contractor) were present and, by examining the project process, presented the problems in each phase of the project. The final list was agreed by the parties and used for further analysis of the research. The purpose of collecting a list of problems is to find a links between critical knowledge area and problems in the project.

Table 5. The relationship between knowledge area and the problems of Iran Yasa project

Phase	Problems	Critical Knowledge area of Importance/Execution Matrix
Explore	Failure to consider transferring old system information to the new system (Convert) within the project scope, which caused disruption of the time schedule and cost of the project.	Scope Management
	Failure to consider appropriate infrastructure and hardware for user use in the later phases of the project	
	Lack of transparency in the basic software needs within the project scope	Scope management, communications management
	Lack of sufficient attention to the senior manager's reporting requirements in the field of software	Communication management
R	Lack of human resources to work with software	Human resource
	Problems in allocating time from specified users to hold meetings	
	Lack of coherence in some system training	
	Non-compliance of the parties with the project schedule	
	Managerial changes on the employer side	Human resources management
	Changes at the level of executive team	Human resources management
Go live	The mismatch between primary needs and system outputs	
	Inadequate training of some users to work with the system	

Table 6. The relationship between knowledge area and the problems of Sayeh Saman project

Phase	Problems	Critical Knowledge area of Importance/Execution Matrix
Preparation	Lack of stakeholder management document delivery	
	Lack of risk management document delivery	
	Incomplete documentation of the project communications plan	
	Failure to hold analysis meetings to determine the scope of the project	Scope management
	Lack of proper infrastructure for systematic activity in the warehouses of some branches	Procurement management
	The incomplete WBS project	
	Short duration of the mentioned phase and failure to complete some of the listed activities	
Blueprint	Not viewing some of the activities and processes in AS IS	Communication management
	Failure to hold TO BE design meetings	Communication management
	Lack of holding OCM meetings	Communication management
	The prolongation of the presentation process and presentation of blueprints	
	Lack of proper training meetings for users	
	Failure to document delivery of training programs	
	Failure to document delivery of quality management	
	Added mobile operator company to the project scope in the above phase	

Table 6. The relationship between knowledge area and the problems of Sayeh Saman project (Continued)

Phase	Problems	Critical Knowledge area of Importance/Execution Matrix
Realization	Lack of coherence and integrity in user training	
	Lack of a proper strategy for mechanized storage and tracking of goods	
	Problems to create a proper batch for all products	
	Failure to prepare develops for testing	Risk management
	Prolonging the training process	
	Prolonging the testing process	
	Failure to allocate appropriate time to work with the system by users	Risk management
	Problems in collecting basic data	
	Lack of timely testing of mobile software	
	The cost problems caused in the mobile contract and the software license	
	Lack of integrity in the tests	
	Changes in project personnel on both sides of the project	Risk management
Final preparation	The lack of documentary delivery of the go live strategy	
	Stopping the operation of pilot branches due to the lack of operational coherence in some of the logistics activities	Integration management
	Prolonging the final user training process	
	Delay in providing the final solution for parallel work	
	Failure to accompany key users in the training process	
Go live	Change in go live process	Time management
	The lack of an operational unit plan to set up branches on both sides of the project	Integration management
	Delay in establishing proper infrastructure in different branches	

4.3 Identifying and Analyzing Critical Knowledge Area Inputs/Outputs Using the PMBOK Standard

To analyze and examine the impacts of critical domains in each phase of project deployment and to comply with the PMBOK standard, we identify the inputs and outputs of critical knowledge area in the project phases.

The results of analyzes and studies carried out for each sample are summarized in the tables.

Phase	Critical Knowledge Area	Business Process	Inputs	Input status in the project	Outputs	Output status in project
Explore	Communication Management	Communication Management Planning	Project Management Plan	System Group Project Management Plan	Communication Management Plan	×
			Stakeholders Registration Form	×	Update project documents	×
			Organizational environmental factors	Only the infrastructure was carefully considered		
			Organizational Process Capital	System Group Project Management system		
	Scope Management	Scope Management Planning	Project Management Plan	System Group Project Management Plan	Scope management plan	×
			Project charter	System Group Contract and deployment plan	Requirements Management Plan	×
			Organizational environmental factors	Only the infrastructure was carefully considered		
		Collecting requirements	Scope management plan	×	Requirement documents	Support and training requirements
			Requirements Management Plan	×	Requirements tracking matrix	×
			Stakeholders Management Plan	×		
			Project charter	System Group Contract and deployment plan		
			Stakeholders Registration Form	×		

Figure 7. Iran Yasa analysis.

Phase	Critical Knowledge Area	Business Process	Inputs	Input status in the project	Outputs	Output status in project
Explore	Scope Management	Define scope	Project Management Plan	System Group Project Management Plan	Project Scope Statement	×
			Project charter	System Group Contract and deployment plan	Update project documents	×
			Requirement documents	Support and training requirements		
			Organizational Process Capital	System Group Project Management system		
		Creating Work Breakdown Structure	Scope management plan	×	Scope Baseline	WBS Milestones
			Project Scope Statement	×	Update project documents	×
			Requirement documents	Support and training requirements		
			Organizational environmental factors	Only the infrastructure was carefully considered		
			Organizational Process Capital	System Group Project Management system		

Figure 7. Iran Yasa analysis (Continued).

Phase	Critical Knowledge Area	Business Process	Inputs	Input status in the project	Outputs	Output status in project
Preparation	Procurement Management	Procurement Management Planning	Project Management Plan	Mammut System Project Management Plan	Procurement Management Plan	×
			Requirement documents	Infrastructure requirements	Procurement Statement	×
			Risk registration form	This item exists but was not delivered at the first stage	Procurement documentation	×
			Activity resource requirements	×	Resource Selection Criteria	×
			Project Schedule	Work Breakdown Structure	Making or purchasing decisions	×
			Estimated cost of activities	Solely for lateral software	Change Requests	×
			Stakeholders Registration Form	This item exists but was not delivered at the first stage	Update project documentation	×
			Organizational environmental factors	Infrastructure		
			Organizational Process Capital	×		
	Scope Management	Scope Management Planning	Project Management Plan	Mammut System Project Management Plan	Scope management plan	Scope Definition Document
			Project Statement	Commercial contract	Requirements Management Plan	×
			Organizational environmental factors	Infrastructure		
		Collecting requirements	Scope management plan	Scope Definition Document	Requirement documents	Requirements for support and reporting
			Requirements Management Plan	×	Requirements tracking matrix	×
			Stakeholder management plan	×		
			Project Statement	Commercial contract		
			Stakeholders Registration Form	Stakeholders form in the next phases		
		define scope	Project Management Plan	Mammut System Project Management Plan	Project Scope Statement	Scope Definition Document
			Project Statement	Commercial contract	Update project documentation	×
			Requirement documents	Requirements for support and reporting		
			Organizational Process Capital	×		

Figure 8. Sayeh Saman analysis.

Phase	Critical Know-ledge Area	Business Process	Inputs	Input status in the project	Outputs	Output status in project
		Creating Work Breakdown Structure	Scope management plan	Scope Definition Document	Scope Baseline	Work Breakdown Structure
			Project Scope Statement	Scope Definition Document	Update project documentation	×
			Requirement documents	Requirements for support and reporting		
			Organizational environmental factors	Infrastructure		
			Organizational Process Capital	×		
Blue print	Communication Management	Communication management	Communication management plan	Project Communication management	Project communication	
			Performance reports	Project Progress Report	Update project management plan	√
			Organizational environmental factors	Infrastructure	Update project documentation	√
			Organizational Process Capital	×	Update Organizational Process Capital	×
Realization	Risk Management	Risk control	Project Management Plan	Mammut System Project Management Plan	Performance information	×
			Risk registration form	Risk list	Change Requests	×
			Performance data	×	Update project management plan	×
			Performance report	Project Progress Report	Update project documentation	×
					Update organizational process capitals	×
Final preparation	Integration Management	Monitoring and controlling project work	Project Management Plan	Mammut System Project Management Plan	Change Requests	At the expert level
			Time forecasts	×	Performance report	×
			Cost predictions	×	Update project management plan	×
			Verified changes	Multi-stage verification at inappropriate speed	Update project documentation	×
			Performance information	×		
			Organizational environmental factors	Infrastructure		
			Organizational Process Capital	×		
		Integrated control of changes	Project Management Plan	Mammut System Project Management Plan	Approved Change Requests	Steering Committee
			Performance reports	×	Change form	×
			Change Requests	At the expert level	Update project management plan	×
			Organizational environmental factors	Infrastructure	Update project documentation	development list
			Organizational Process Capital	×		
Go live	Time Management	Schedule control	Project Management Plan	Mammut System Project Management Plan	Performance information	×
			Project Schedule	Updated Work Breakdown Structure	Time forecasts	×
			Performance data	×	Change Requests	At the expert level
			Project calendars	Milestone approved at project control meetings	Update project management plan	×
			Schedule data	×	Update project documentation	×
			Organizational Process Capital	×	Update organizational process capitals	×
	Integration Management	Project or Phase Completion	Project Management Plan	Mammut System Project Management Plan	Transmission of product, service or result	√
			Project Delivery Items	√	Update organizational process capitals	×
			Organizational Process Capital	×		

Figure 8. Sayeh Saman analysis (Continued).

5. CONCLUSION

According to the results obtained from the deployment execution experts' judgments that identified the importance of knowledge area in each of the phases of the ERP system deployment project and compared with the views of the team of key users of the employer regarding the extent of execution of each field of knowledge in the deployment phases, critical knowledge areas have been identified. Also, the adaptation of these domains to the problems in the project as well as the inputs and outputs of the standard PMBOK identified the weakness in the implementation and control of the methodology of the deployment under the study, which this requires a further review of the up-to-date project management standards by teams and deploying companies to cover the gap in implementing methodologies and to reform the process of deploying and implementing ERP systems within the country. The two knowledge area of scope management and communication management are very important in terms of employer and requires further studies, especially in the initiating and planning phases. Examining the effects of PMBOK knowledge areas on the phases of ERP implementation in other projects and other countries can be considered for future research.

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