

# Assessment and Analysis of Risk Associated with the Implementation of Enterprise Resource Planning (ERP) Project Using FMEA Technique

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## Abstract:

Enterprise resource planning (ERP) is one of the latest management tools that can take advantage of information technology to comprehensively gather resources and information in all parts of the organization by an interlocking, system with fast speed and high quality and help users in all organizations and sectors by giving certain modules for managing different sectors such as projects, human resources, and services. Despite the many benefits this system can have for the organization, its implementation and deployment is very risky and costly. Therefore, the overall risk of the project can be reduced by studying and understanding factors causing failure in the implementation of the system as well as identifying implementation risk factors. The present study investigates risk management using an integrated model of risk management provided in the PMBOK standard and FMEA technique as a case study in Power Engineering and Development Company (Mapna Pars) on ERP implementation project. The present study is applied in terms of its objective and is causal in terms of its nature. Critical risks were identified to be five. Solutions to reduce or remove critical risks were proposed based on experts' opinion.

## Keywords:

Risk Management, Enterprise Resource Planning (ERP), Risk Assessment, FMEA Technique

## 1. Introduction

Since the beginning of trading in human societies, people have dealt with risk. In most cases, managers have only focused on the presence or absence of risk in projects

and made decisions about it. In the past, few qualitative studies were done on projects' risk. One of the important topics of project management standard is project risk management. The project environment is highly affected by uncertainty conditions and the situation is worse for large projects.

Thus, the need to identify and manage risks in the project is quite clear. Given the importance of project management in recent years, various standards have emerged in this field. The standards include basic principles and requirements that seem necessary for the successful management of a project or implementation of a project management system of an organization [1].

Today, information technology helps companies to exchange, integrate, and transmit information faster and better. The need to use software systems for companies in the past decades has led to the use of island systems and integrated systems, which were created in the 1990s to solve the problem of the lack of integrity of the system and take advantage of integration [2]. In recent years, the use of integrated systems has been at the helm of the company's plans.

Taghipour et al. [3], studied Supply Chain Performance Evaluation in the IT Industry. The appraisal of several performance measure agendas and metrics already accessible proposes that supply chain performance measure can be detected under different categories such as cost and non-cost. In this study, developed supply chain of IT industry based on BSC from existing decision making models. Then, industrial projects performance and performance evaluation measures have been determined using a designed questionnaire [3]. These systems, on one hand, architect all organization information in the defined form as a manifestation of information in the operational forms and they control all organizations' activities, on the other hand [4]. The creation of a centralized database has caused experts to introduce these systems as a prerequisite for success in the twenty-first century [5].

## 2. Statement of the Problem

Project risk is an uncertain event or condition that will have a positive or negative effect on project objectives if occurs. Therefore, risk management is defined at this time. Risk management is a systematic planning process to identify, analyze, respond, and assess project risk. The main purpose of the risk management process is effective management of project risks and opportunities. The project under review is the ERP implementation project.

Enterprise Resource Planning (ERP) systems that are the most obvious enterprise systems are computer-based information systems designed to interact information and facilitate the integration of information in order to plan better and respond more quickly to customers' needs. ERP systems can be considered as the information backbone of the organization's core business processes. Organization's planning system projects are those IT projects that account for the high failure rate. Therefore, it is necessary to analyze challenges related to the successful implementation of projects as well as the risks in the implementation of projects. Identifying risks associated with the implementation of a project has a significant effect on the decision to do it or not.

The purpose of this study is to investigate the details of the implementation of the enterprise resource planning system and to determine the risk of factors affecting its implementation in MAPNA (Pars) company. To avoid spending a lot of time and

money to implement ERP project in Iranian organizations that may eventually lead to project failure and bankruptcy of some organization, it is necessary to analyze project risks in order to take the necessary measures in the face of risk and avoid harming the organization.

The overall objectives of the study:

- a. Classification and identification of ERP implementation project risks
- b. Identification of critical project risks
- c. Providing enterprise resource planning risk management methodology

Factors causing project risks and the probability of failure are identified by identifying project risks and classifying them by risk breakdown structure that is source-oriented. Accordingly, confidence in the implementation of this project will increase and organizations similar in terms of project purpose and structure can take advantage of this risk assessment methodology to implement ERP project in their organization.

### **3. Theoretical Foundation of the Study**

#### **3.1. Risk Management**

Taghipour et al. [6], studied Risk analysis in the management of urban construction projects from the perspective of the employer and the contractor. Imbalance between anticipated and actual progress in the development of urban construction projects suggests that there are many obstacles and risks which not only causes the urban management be unsustainable, but the reconstruction and development of urban space is also seriously threatened. The results indicated that the experts listed the most significant risks as the delays in the payment of contractors' claims and statements due to the lack of handling financial instruments, the governance of relationships rather than rules in the tenders resulting from employer actions, low commitment to the quality of work provided by their subcontractors, failure to complete the detail engineering by foreign contractors on time, weaknesses in contractors' financial resources, and offering lower prices than reasonable by contractors to win the tender. Finally, the solutions for eliminating or reducing risks in high risk areas have been offered to provide tranquility for contractors and employers.

Taghipour et al. [7], studied Evaluation of the effective variables of the value engineering in services. The value engineering is a systematic method for resolving the problems, reducing the cost and improving the function and quality simultaneously and this leads to the increase of customer satisfaction by investigating and improving the value index. The results of this research which are based on the post managers and specialists responses show that applying value engineering by the post managers has significant effects on reducing the cost, saving time and customer satisfaction [7].

Risk in the international standard of ISO "10006: 2003" has been used as uncertainty, which entails both positive and negative aspects. Nigel states that risk is the probability of the occurrence of an unknown incident in circumstances in which it could cause problems.

Rezvani Befrouei MA et al. [8], discussed Identification and Management of Risks in Construction Projects. Today, risk management in construction projects is

considered to be a very important managerial process for achievement of project's objectives in terms of time, costs, quality, safety, and environmental sustainability. Instead of employing a systematic approach for identification of risks, their probability and their effects, most of the studies conducted in this area have focused only on a few aspects of risk management in construction project. The present study aims to identify and analyze the risks associated with development of construction in the greater city of Tehran, employing a comprehensive approach that is consisted of five aspects. After the collection and observation of the data, the output was examined by Pearson correlation also, using charts and tables. The results indicated that "tight project schedule" present in all five categories- imposed the maximum risk. Also "design variations", "excessive approval procedures in administrative government departments" and "unsuitable construction program planning" were identified as next high risk factors.

Taghipour et al. [9], studied Analysing the Effects of Physical Conditions of the Workplace on Employees Productivity. One of the issues that today will improve the productivity of any organization is attention to the human factors engineering. The aim of this study was to find the amount of employee's satisfaction from environmental and organizational factors of their jobs, thus providing guidelines for improving the identified problems which eventually will lead to increase the productivity.

Arthur Williams and Richard Haynes define risk as diversion of events that can occur during a specified period in a given situation. If one event is only possible, deviation and thus the risk is zero and if many events are possible, risk is not zero anymore. The larger the deviation, the greater the risk is. Krasner considers risk as the measurement of the probability of not reaching a pre-defined project goals and, in general, risk is not having knowledge of a future event.

Baghipour sarami et al. [10], studied Modeling of Nurses' shift Work schedules According to Ergonomics: A case study in Imam sajjad (As) Hospital of Ramsar. In this study, 35 nurses working in the emergency ward of Imam Sajjad (AS) Hospital of Ramsar city, Iran, were considered. The final model was implemented with GAMS and at the end, shift working with ergonomic criteria were proposed. The results showed that the proposed working program on one hand will improve satisfaction and efficiency of nurses and on the other hand it can decrease the effects of disorders on shift work.

Taghipour et al. [11], studied the Study of the Application of Risk Management in the operation and Maintenance of Power Plant Projects. one of the methods used in good decision making, pay attention to risk management, which is known as an important part of project management and control. Risk management has evolved over time and its systematic method has provided managers with a definite path so that they reduce potential threats to a minimum and reach project goals by the least possible deviations. In this paper, subsequent to an introduction of fundamental concepts of risk, risk management, an account of risk management, methods and its techniques are presented. In the end, following a discussion on how it is practically used in projects in a real and practical sample, risk management and its application are implemented and essential investigations are undertaken into its effects.

Mahboobi et al. [12], discussed Assessing Ergonomic Risk Factors Using Combined Data Envelopment Analysis and Conventional Methods for an Auto Parts Manufacturer. occupational injuries are currently a major contributor to job loss

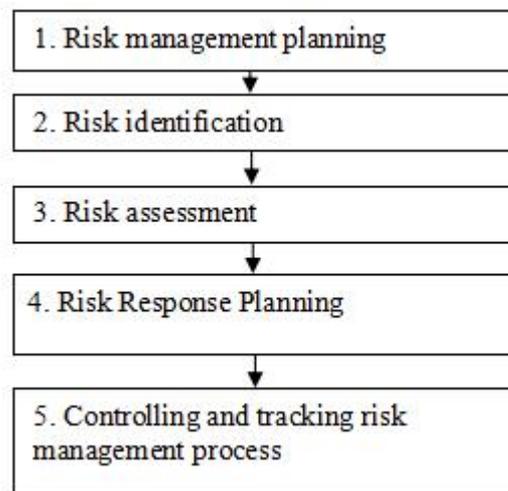
around the world. They are also costly for business. The absence of rational analysis is felt in this area, so mathematical analysis is needed to obtain the logical results of these injuries in order to find gaps or loss points of industry. OBJECTIVE: This paper assesses the effect of five demographic factors on ergonomic risk and occupational injuries using an integrated mathematical programming approach. The obtained results will help managers to carry out any required corrective actions or establish benchmarks.

Risk management provides a systematic way to manage uncertainties so that its use increases the chances of achieving the objectives of the project.

### 3.2. Project Risk Management

The PMBOK standard was selected as the basis model according to experts' opinion and due to the familiarity of employees with the process and simplicity and completeness of project risk management standard.

Processes related to risk include:



*Figure 1. PMBOK standard.*

Taghipour et al. [13], studied Construction projects risk management by risk allocation approach using PMBOK standard. Projects' managers in plenty of construction projects which are assumed that are under control, are facing risk as an unknown occurrences and they are attempting to control it and are suffering more costs. Though, by a comprehensible effort and applying risk management, risks are identified and controlled before happening or a plan is provided in order to deal with these occurrences and time and cost are saved. Thus, they have to be controlled and appropriately responded by risk management methods. In this regard, risk management process in PMBOK standard can be a suitable approach to solve this problem.

### 3.3. Failure Modes and Effects Analysis

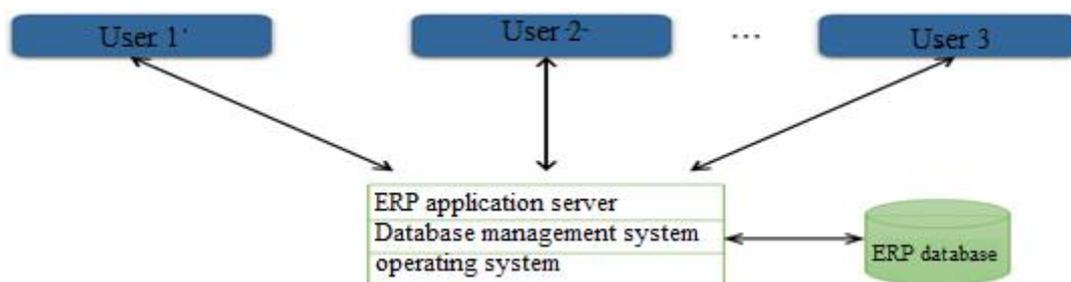
Failure modes and effects analysis, FMEA, is a systematic tool based on team work that is used to define, identify, prevent, eliminate, or control the failure modes, causes and potential effects in a system, process, project or service, before the final product or service is delivered to the customer [14].

The use of this technique in the form of risk management is possible and it can be considered as failure modes and effects analysis (FMEA). In fact, FMEA is one of the most used techniques for risk analysis and predicting its effects on risk objectives [15].

### 3.4. Enterprise Resource Planning (ERP) System

Enterprise resource planning system is a comprehensive software that provides a wide range of operations and processes in order to give a general view of the information and the general structure of the IT [16]. The system entails a wide range of software products supporting daily business operations and decisions [17]. The aim of this system is integrating information and its flow [18]. in the form of a database and architecting common information and standards across all parts of the organization including human and financial resources, supply chain and customer relationship management [18]. relying on a process-oriented approach throughout the organization. It provides a smooth flow of information between different sections of the organization [19]. The system makes use of information technology and allows data and information sharing within the organization and gives it to users who need them in a desired manner and in a good time. The ERP system enables organizations to manage the effectiveness and efficiency of resource use.

ERP stands for enterprise resource planning and is the core of management ideas and methods. During ERP system implementation, integration can be unified management of logistics. The main trend and information flow help allocate current resources properly, which will be followed by facilitation of the effect of integration [20]. Risk assessment and risk management, and ERP implementation project are complex issues. In the course of implementing ERP, project risk management is an important factor that may delay the project, increase the cost and thus cause the failure of the project. The whole risk management and the holistic method is essential for ERP project management. Any detour on implementing ERP may destroy all the achievements [21].



*Figure 2. Implementation of ERP system.*

Enterprise resource planning system implementation is usually a huge commitment to the organization. Implementation of ERP systems requires deep and complete study of feasibility due to their complex nature and major changes they create in the work culture of the organization. This is because in addition to the software system changes, implementation of such large systems is followed by process changes. This means that existing processes shall be changed according to the best patterns experienced for many years and have been offered by the company providing system [22].

Recent studies indicate that successful implementation of this system has been reduced and the implementation risk has been increased by the same amount. Therefore, organizations that are looking to benefit from the advantages of enterprise resource planning face numerous problems, most notably related to the

implementation of the enterprise resource planning. ERP implementation problems are often due to cultural problems that exist in the depths of the organizational structure. Enterprise resource planning involves the use of complex information systems in terms of model and technology; therefore, implementation of these projects in the organization has been devoted considerable time and resource.

#### **4. Research Background**

Due to the volume of money spent and as the statistics show, more than 11 percent of enterprise resource planning projects are unsuccessful; therefore, careful examination of the causes of success and failure of these projects and understanding implementation risk for companies is crucial. For example, Abolhoseini and Mollahoseini (2011) [23] analyzed ERP project implementation risk in one of the companies engaged in the automobile industry. The results of this study indicate that the company is in the range of mild failure [23].

Taghipour et al. [24], studied The Evaluation of the Relationship between Occupational Accidents and Usage of Personal Protective Equipment in an Auto Making Unit. One of the problems that encounter each work society is occupational accidents. Today, despite the improvements of facilities and working conditions, the possibility of accident occurrence in workplaces and especially in industrial places is inevitable. Since the non-use or misuse of PPE is one of the main causes of accidents in industrial units, the aim of this study is to evaluate the association between occupational accidents and the use of PPE in the body section of a vehicle manufacturing unit. The results showed that there is a meaningful positive relationship between the factor of inadequate PPE and probable hazards of the industrial workplace.

The results of the study by Shirazi et al. (2012) on risk management of enterprise resource planning systems imply that after rating risks, changes in market demand have the highest rate of risk and risks related to the control and supervision have the lowest rate of risk [18]. Khvalev (2010) [27] investigated key risks in ERP implementation and stated that successful implementation of ERP system depends on effective risk management. He has divided ERP implementation risks into two parts including operational risks and technological risks. He stated that identifying key risks allows managers to gain a better understanding of the issues in the field of project implementation [25]. Zeng (2010) reviewed risk management in the implementation of enterprise resource planning and classified ERP implementation risks in six factors of: organizational risks, managerial risks, operational risks, technological risks, human risks, and other risks [26].

##### ***4.1. Risk Management in the Implementation of Enterprise Resource Planning System***

Unfortunately, despite the numerous benefits associated with the successful deployment of enterprise resource planning systems, its implementation in organizations is associated with high risk due to the complexity of these systems and lack of comprehensive models and solutions to deploy the system. It is to an extent that according to studies in this area, this system has been failed in 50 percent of implementation projects and in 90% of them, the project has gone beyond the initial approved budget and time.

Taghipour et al. [27], studied Necessity Analysis and Optimization of Implementing Projects with The Integration Approach of Risk Management and Value Engineering. Risk management and value engineering have appeared as modern management tools since the mid-19th century and have been used separately in different projects. Due to the ineffectiveness resulting from separate implementation of the two approaches in major projects as well as the similarity between them in terms of their goals and executive structures, this research tries to analyze the separate role of each approach in the project process and examine the possibility of integration and correlation between their different phases. This article aims at introducing and examining a tool that simultaneously has the capability of the two categories.

Taghipour et al. [28], studied Evaluating Project Planning and Control System in Multi-project Organizations under Fuzzy Data Approach Considering Resource Constraints. Projects can be repetitive tasks in specified periods of time and also it may involve some functions which are performed just once. However, in any project, managers and experts consider three basic and important goals: least time, lowest cost and best quality, so all efforts are directed toward achieving these basic goals. Statistics indicate that projects are either conducted on estimated time or delayed and rarely are delivered before due date.

Taghipour et al. [29], studied Implementation of Software-Efficient DES Algorithm. By increasing development of digital telecommunication and the increase of sending and receiving data of various network of data transfer, protection of the safety of data are the most important necessities of the current world. The increase of different bank trading, increasing use of smart cards, moving to electronic government, are the examples of significance of this issue. In this study, an efficient algorithm implementation by MATLAB and C language is presented and is compared with the latest works in this field.

ERP deployment is risky and expensive because its implementation is usually associated with the following events: changing the organizational culture, great expertize work, expensive software, disruption of current affairs, disturbing the balance of power, increasing organizing and facilities, design flaw, changing the terms and needs [30]. Implementing enterprise resource planning systems requires observing some important points such as logistics support of senior managers, middle managers participation, and good organization, appropriate phasing, shortening the project, the gradual development, training, and secure platform [31].

#### **4.2. Research Method**

In this study, documents of the company are used to prepare data and requirements. Strategies presented in the PMBOK standard are appropriate approaches in line with risk management. Use of techniques through which project risks are ranked by spending little time is FMEA.

The present study is applied in terms of the classification based on objectives. It is also causal in terms of the nature and research method since it identifies risk factors. Causal studies investigate the cause or causes of a desired event or phenomenon. The present study sought to identify critical risks of ERP project implementation in the company under study. Exploratory library methods such as: books, articles, theses, internet search, and seminars were used to collect the data needed for the study and non-library tools such as interviews and consultation with experts were used to investigate, adjust, and analyze hypotheses. IT project management in Mapna

Company has been done through conducting brainstorming sessions and interviews with experts, including senior managers, ERP project managers, managers, and experts of systems.

### 4.3. FMEA Technique

FMEA stands for failure modes and effects analysis. FMEA is a systematic and group-based technique to identify and prevent occurrence of problems in product and its process. This method focuses on preventing flaws, enhancing safety and increasing customer satisfaction. One of the main differences of FMEA with other qualitative techniques is that FMEA is a proactive action, not reaction. If FMEA is implemented correctly and timely, it is a live and eternal process. It is a dynamic tool that is used in a cycle of continuous improvement. The purpose of FMEA is finding all the items that cause failure of a product or process, [32].

Taghipour et al. [33], studied Risk assessment and analysis of the state DAM construction projects using FMEA technique. Dam construction projects are the most important projects of the country and absorb a considerable amount of the state budget on annual basis. As they take a long time to be completed, they always face risks and many uncertainties. In this study, the researcher intends to use a highly applied qualitative-quantitative methodology (FMEA) to analyze the risks of state dam.

In addition to the two measures of probability and risk effect, the third criterion as “discovery coefficient”, which can improve the accuracy of qualitative risk analysis, is used in FMEA technique to rank risks. In this technique, the product of the probability and effect determines a coefficient as "risk score". After calculating the risk score, discovery coefficient or value should also be determined. This factor is the ability to discover and track a risk with sufficient time for a contingency planning to respond to risk. By multiplying the value of the discovery coefficient by the risk score, a new value as RPN coefficient is achieved and any risk with higher RPN value is in a higher priority [34].

Calculation of risk score:

$$\text{Risk score} = \text{Probability} \times \text{intensity of effect}$$

Calculation of RPN (risk priority score):

Risk Priority Number is considered as risk priority score.

$$\text{RPN} = (\text{Coefficient of determination}) \times (\text{probability}) \times (\text{intensity of effect})$$

**Table 1.** FMEA values: probability, intensity of effect, and discovery coefficient.

Probability values	Effect on objectives	Discovery coefficient	Values
Very high	Timing: an increase of more than 20 percent of the standard time set by the Project Implementation Consultant	There are no specific discovery methods that warn the occurrence of risk in due time.	9 or 10
	Technique: final plan of the project is impossible.		
High	Timing: increase of 10-20% of the standard time set by the Project Implementation Consultant	Discovery method is uncertain, or the effect of discovery method to identify in due time is unclear.	7 or 8
	Technique: changes in the scope of the project and rejection of project by implementation consultant		
Medium	Timing: increase of 10-5% of the standard	The discovery method	5 or 6

	time set by the Project Implementation Consultant	is moderately effective.	
	Technique: changes in the scope of the project and acceptance by project implementation consultant		
Low	Timing: increase of less than 5% of the standard time set by the Project Implementation Consultant	Discovery method is almost highly effective.	3 or 4
	Technique: very little changes of the scope.		
Very low	Timing: subtle effect.	Risk discovery method is very effective and it is very clear that risks are easily identified and there is enough time to respond to it.	1 or 2
	Technique: non-significant changes.		

**Data analysis:**

Documents of the projects and ERP project implementation process are evaluated and then the project implementation team and executive team are interviewed with the goal of data analysis. Some variables are defined and evaluated according to the model introduced for risk analysis.

Variables under study in the form of a conceptual model and description of how to assess and measure the variables:

Risk identification and analysis is done through brainstorming technique as well as the risk breakdown structure (RBS) so that the source of risks and their roots become quite clear.

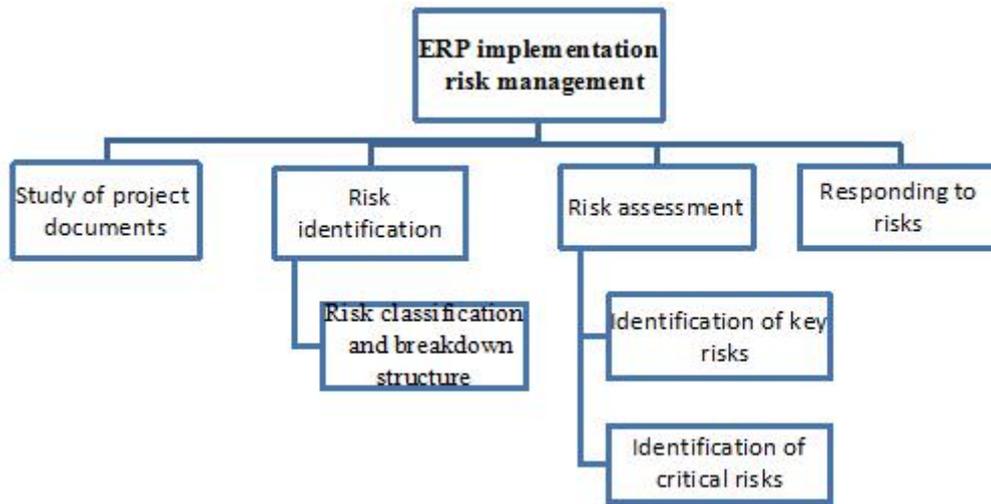
A list of risks that may occur during the project is prepared by qualitative identification and analysis of risk through risk breakdown structure and project managers' opinions. A list of key risks is prepared and steps of FMEA technique process are run at a meeting with company executive managers and using specialists' opinion. Three values of risk probability, effect of risk on the main objectives of the project, and discovery coefficient of all risks are determined in this process. Risks with a risk score of at least 20 and RPN coefficient of more than 125 are deemed to be critical at this stage.

After determining the quantitative effect of any critical risk, it should be planned to respond to risks in the case of occurrence. In fact, response to each risk should be a suitable solution to solve it. Finally, suitable responses to any critical risk is determined through free interviews in this process.

**Table 2.** Standard time of the ERP implementation phases.

Implementation phases	Time period (month)
1. Project preparation	2
2. Business plan preparation	4
3. Realization	4
4. Final preparation of the project	4
5. Setup and Support	2

The proposed risk management implementation model of the study is as follows:



**Figure 3.** The proposed risk management implementation model of the study.

Risk identification steps:

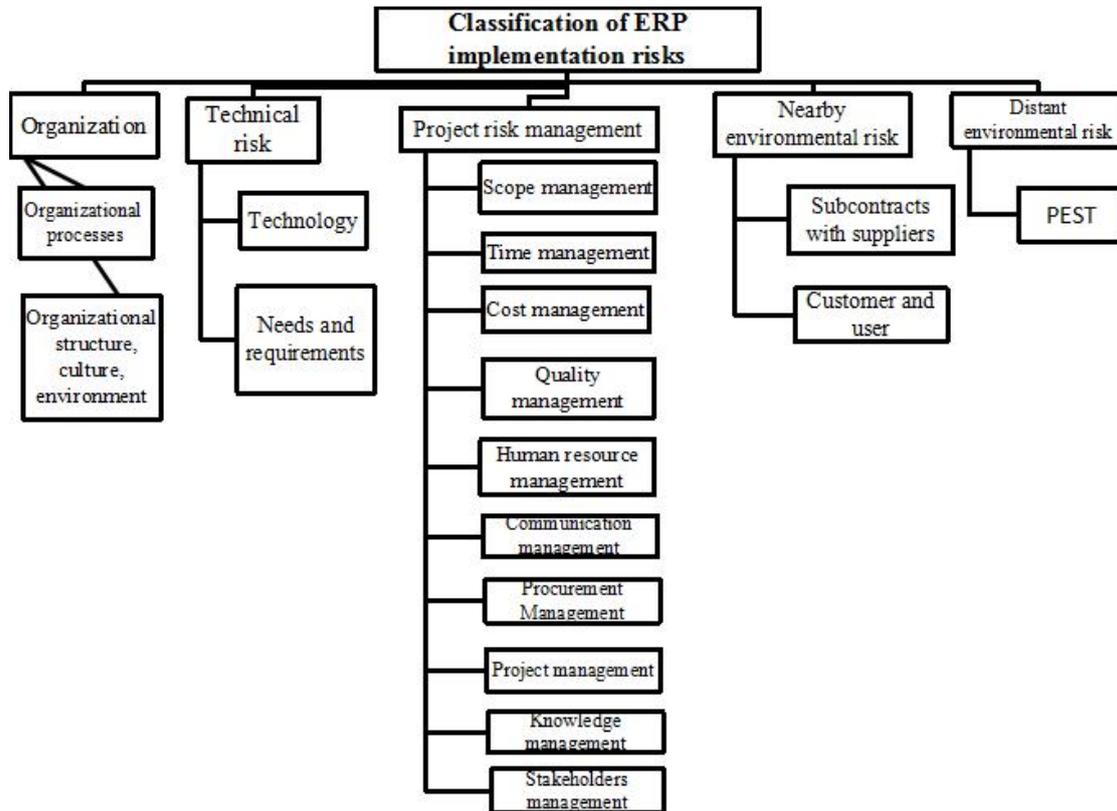
Risks have been classified using brainstorming techniques as well as the risk breakdown structure.

**Table 3.** The basic risk breakdown structure of the project.

First level	Second level
Environmental risks	<ul style="list-style-type: none"> <li>- Subcontracts with suppliers</li> <li>- Customer and user</li> <li>-PEST</li> </ul>
Project management risks	<ul style="list-style-type: none"> <li>- Time Management</li> <li>- Communications Management</li> <li>- Stakeholders Management</li> <li>- Procurement Management</li> <li>- Quality Management</li> <li>- Project Management</li> <li>- Scope Management</li> <li>- Cost Management</li> <li>- Human Resource Management</li> <li>- Knowledge Management</li> </ul>
Technical and technological risks	<ul style="list-style-type: none"> <li>- Technology</li> <li>- Requirements and needs</li> </ul>
Organizational and structural risks	<ul style="list-style-type: none"> <li>- Organizational processes</li> <li>- Cultural structures and systems</li> </ul>

Taghipour et al. [35], studied the impact of ICT on knowledge sharing obstacles in knowledge management process. Today, knowledge is known as a valuable asset in any organization so management of such insensible asset is one of the factors cause success in organizations. But knowledge can be effective when it is shared across the organization. Therefore, knowledge sharing is a key element in the process of knowledge management. This study aimed to check the impact of ICT on knowledge sharing barriers in one of the mobile operator, in Tehran.

Taghipour et al. [36], studied Assessment of the Relationship Between Knowledge Management Implementation and Managers Skills. The Purpose of this study is to consider the effects of knowledge management implementation on manager’s skills of Reezmouj System Company. Results showed that there is a relation between knowledge management.



**Figure 4.** Classification of ERP implementation risks.

A meeting was held with company executives and three values of risk probability, effect of risk on the main objectives of the project, and discovery coefficient of all risks were calculated and the results are presented in the table below. Risks with a risk score of at least 20 and RPN coefficient of more than 125 were deemed to be critical at this stage [34].

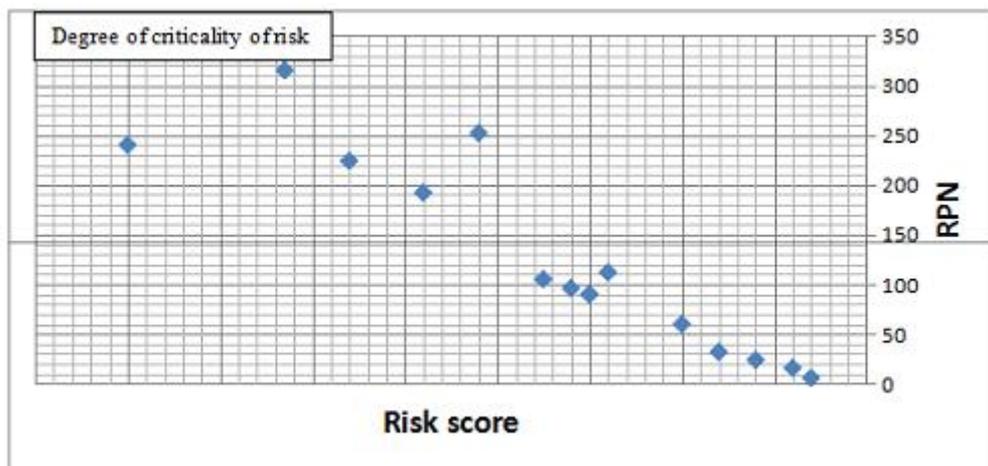
The FMEA technique was used to determine the critical risks of the project. The steps of this technique are explained in the table below.

**Table 4.** A list of risks with high priority along with risk scores and RPNs.

RPN	Discovery coefficient	Risk score	Effect	Occurrence probability	Risk	Risk breakdown structure – level 2
252	6	42	7	6	Lack of allocation of appropriate consultant in the field of ERP implementation	Contract
16	2	8	2	4	The procedural immaturity of customer organization	Customer and user
192	4	48	8	6	Lack of training for key users	
24	2	12	4	3	Ambiguity of project scope	Scope management
90	3	30	6	5	Lack of allocation of enough time by key users	Time management
6	1	6	2	3	The system outputs with low-quality	Quality management
60	3	20	5	4	Change of key users	Human resource

					and consultant	management
96	3	32	8	4	Lack of misallocation of end users	
240	3	80	10	8	Lack of appropriate allocation of clean data	Knowledge management
224	4	56	8	7	Lack of top management support	Stakeholder management
32	2	16	4	4	Lack of adequate hardware platform in the organization	Technical and technological
112	4	28	7	4	Define unreasonable exceptions as the practice of the organization that bring fundamental changes in the ERP implementation standard	
315	5	63	9	7	Resistance of the organization in the face of change	Organizational
105	3	35	7	5	Lack of training for end users	
90	3	30	6	5	Readiness of the organization (Lack of organizational readiness)	

In the diagram below, the risk score and RPNs for all risks are listed.



**Figure 5.** The risk score and RPNs for all risks.

Critical risks identified by FMEA technique:

- a. Resistance of the organization in the face of change
- b. Lack of allocation of appropriate consultant in the field of ERP implementation
- c. Lack of appropriate allocation of clean data
- d. Lack of top management support
- e. Lack of training for key users

Responding to risks:

After determining the effect of any critical risk, it should be planned to respond to risks in the case of occurrence. In the implementation of the enterprise resource planning project, there are solutions for any critical risk that are explained below.

**Risk 1: Resistance of the organization in the face of change**

Almost half of ERP projects have failed because the managers have not made the effort required for the proper management of changes. To reduce this resistance, the employees should be involved in the change process. Change management team is formed. Changes management team in the organization consists of three deputies of the organization. If the resistance is created, the task of the team is removing and in fact, reducing the occurred risk.

**Risk 2: Lack of allocation of appropriate consultant in the field of ERP implementation**

A personal or group of individuals who must take responsibility for successful promotion of ERP projects should be of sufficient expertise and techniques. Use of consultants who carry out similar projects in companies that have the same structure significantly help decrease the risk happened.

**Risk 3: Lack of appropriate allocation of clean data**

If pure and raw data are not available, no matter how efficient the system is implemented, the output will not be good. Responsibility for collecting appropriate clean data must be borne by individuals with more experience and expertise. Individuals should also collect appropriate clean data according to the re-engineering process.

**Risk 4: Lack of top management support**

Senior management support is defined as willingness to provide the necessary resources and authority for successful management of projects. Senior management, being active in the creation of sufficient resources, taking quick decisions, supporting and protecting the project acceptance within the organization are so essential. It is, therefore, necessary for the senior management to be sufficiently involved in all phases of the projects.

**Risk 5: Lack of training for key users**

ERP systems are complex systems that require serious training. Inadequate training or not paying attention to this issue is one of the factors that can lead to failure of the project. Key users must have enough information about how the system performs and also require relevant trainings. One way to reduce this risk in the organization is use of implementation consultants for key user training.

## **5. Conclusion**

Implementing an ERP system usually requires a commitment from the organization that is costly and may take several years to be implemented. However, if they are successfully implemented, they can have major benefits. But in today's competitive and IT-based environment, facing the risk of implementation of these projects is inevitable. Therefore, the main challenge is how to manage risk and reduce its damaging effects. Providing appropriate trainings has an important impact on the acceptance of the system by users. This also requires a series of changes in the

organization, processes and jobs. Therefore, an appropriate program of implementation should be defined before implementing ERP systems.

In this paper, an integrated model of the risk management approach proposed in PMBOK standard and FMEA technique was used to evaluate risk management as a case study in Power Engineering and Development Company (Mapna Pars) and on the Enterprise resource planning (ERP) implementation project.

In addition to providing a method to design risk management model in organizations, the present study provided risk breakdown structure and risk management model in a project-based industrial organization with the methods of implementing each process. In addition, requirements and organizational infrastructures needed to implement the model were explained. The results of this study can be used in organizations with similar projects including high technology, limited financial and human resources, wide communication within and outside the organization, and industrial production. Since the cost of implementing this project is very much, a high percentage of success will be achieved if risk management is done in these organizations.

### Conflicts of Interest

The authors declare that there is no conflict of interest regarding the publication of this article.

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