

# An investigation of risk management strategies in projects

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## ABSTRACT

Risk is considered as an inseparable part of any project and since all the effective factors in projects are not predictable, risk management is inevitable. One of the biggest administrative problems with internal projects is the managers' neglect of the importance of risk management which leads to delay in projects delivery and increase of the cost of the projects. Since not all risks are regarded as threats but also as opportunities, risk management is considered as a balance factor between the loss of threats and the profit earned through opportunities. It has focused on some strategies for successful implementation of risk management in projects as well. In the risk management, the most logical way of planning is managing risk before taking risk. This study investigated risk and risk management, its aims, components, and different stages of risk to reach the expected aims and outcomes of the study.

### Keywords:

Management, Risk  
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## Introduction

Management and its related processes have a leading role in continuity of the activities and survival of companies in a competitive and frantic environment of business. Due to the shift of dominant paradigms of economic environment, the traditional approaches of management are not able to handle the present situation. Approaches such as strategic management and risk management are being adjusted to these new paradigms (Rahnamaye Roudposhti & Eftekhari Aliabadi, 2011). The complexity of competitive environment of business and the increasing expectations of customers have highlighted the necessity of identifying weaknesses and strengths of the organization and the continuous improvement of efficiency. Therefore, one of the major concerns of modern organizations is to develop a method for

comprehensive, reliable, and flexible performance management; so that the organizations will gain adequate and detailed knowledge about their current position and will adopt accurate strategies based on this knowledge (Paseban, Asadi, Ghadernejad, & Lotfi, 2014). To implement these strategies, organizations must set yearly objectives, develop policies, motivate employees, and allocate resources in a way that the strategies to be implemented (Davari, 2014). Risk management is one of the most effective strategies which companies and financial institutions must adopt it in their major projects. Risk management is considered as a part of project management but it has been neglected in our country and only a small number of organizations hold a clear view on risk management process. Developing scientific attitude towards risk management and introducing the processes and techniques of risk management thoroughly and scientifically will lead to systematic codification and application of project risk management in the country and the companies (Sheikh & Sobhiye, 2012). In the current study, risk management will be introduced and then, its various stages will be explained. Through identifying the stages, characteristics and requirements of each technique and comparing it with the conditions, and features and the nature of the project, we are able to choose and apply the appropriate technique to identify the risks of the project. Therefore, the results of the stage of identifying the risk in risk management process are more reliable and appropriate for the next stage of risk management process such as evaluation and analysis of the risks.

### **Risk**

Risk means the probability of losing all or part of the profit or the principal. In other words, risk is considered as the fluctuation in return on investment (Rahnamaye Roudposhti & Eftekhari Aliabadi, 2011). This means that the more the return of an item varies, the more the investment carries risk (Abzari, Samadi, & Teimouri, 2008). Generally, risk is categorized into two types, namely systematic risk and non-systematic risk. Systematic risk includes that part of total risk that is along with the market volatility and the investor is not able to lower its level like unexpected events, war, and sanction. Besides, non-systematic risk includes that part of total risk which is related to the capital market volatility and the investor is able to lower it through careful management and stock selection (Rahnamaye Roudposhti & Eftekhari Aliabadi, 2011).

### **Risk Management**

Risk management is a process which is performed by the board of directors, the manager, and other employees of an economic unit; it is applied to the strategic process and the whole institution; also, it is designed to identify the potential happenings that may influence the economic unit, and manages risk according to the risk appetite of the economic unit until the achieving the objectives of the economic will be assured.

Risk management is a continuous and progressive process throughout an economic unit; it is performed by the employees in all the levels of an organization and it is applied to the strategic process. Following this, it is applied to the institution in all levels and units and has a portfolio view of the risk of the company. Besides, it is designed to identify the potential happenings that may influence the economic unit. Also, it is designed according to the risk

appetite of the economic unit and is capable to assure the manager and the board of directors of the economic unit. In addition, it is connected with achieving the objectives in some distinct but overlapping categories.

This definition is pervasive in terms of objective and includes key concepts that are the basis for how to provide risk management in companies and organizations. These concepts also provide the foundation for applying risk management in organizations, industries, and departments. This definition is directly concentrated on the established objectives of an economic unit and provides the foundation for defining the effectiveness of risk management.

### **The Objectives of Risk Management**

Management in the context of the vocation or prospective of an economic unit sets strategic objectives, selects strategies, and defines parallel objectives which exist throughout the institution. This framework of risk management is connected with achieving the objectives of an economic unit. These objectives include strategic, operational, reporting, and compliance goals.

Strategic refers to high ideals which are parallel in and supportive of the vocation of objectives; operational is effectively and efficiently using the resources of objectives; reporting involve the reliability of reporting; and compliance refers to complying with rules and regulations.

This category of objectives of an economic unit allows concentration on separate aspects of risk management. This distinct but overlapping category of objectives (a particular objective may belong to more than over one category) deals with different needs of economic unit. Moreover, different executive directors may take the direct responsibility for this category. This category also allows clarifying the distinction between all the things we expect from each category of objectives. Resource protection which is adopted by some of the economic units is described as well. Since the objectives are connected with the reliability of reports and compliance with rules and regulations in controlling the company, it is expected that risk management may assure the achievement of these objectives. However, achieving strategic and operating objectives are dependent on external events (extern-organization) which are sometimes out of the control of the economic unit. Therefore, risk management may assure these objectives, so that the manager and the board of directors, as observers, will be informed about how much the economic unit has moved towards the objectives in the appropriate period.

### **The Components of Risk Management**

Risk management includes eight related components. These components are derived from the way management manages an institution and are consistent with management process. The components are internal environment, objective setting, identification of events, evaluation of risk, reaction to risk, control measures, information and communication, and monitoring.

Internal environment is the space in an organization that provides the foundation for employees of an economic unit to deal with risk and includes the philosophy of risk management and risk appetite, rectitude and moral values, and an environment for the employees to work.

In an objective setting, objectives must exist before the stage that management identifies the potential happenings that are effective in the achievement of them. Risk management assures that management will provide a process for setting objectives. The selected objectives will support the vocation of economic unit and are compatible with it and its risk appetite.

In identification of events, the external and internal events that are effective in achieving the objectives of an economic unit must be identified and divided into risks and opportunities. Opportunities are canalized through the support of strategic or objective-setting processes of management.

Concerning evaluation of risk, risks are analyzed according to the probability of their influence as a foundation for how to manage them. Risks are evaluated as inherent and residual risks. Following this, in reaction to risk, management selects the reactions to risk including avoidance, acceptance, reduction, or distribution through describing a set of actions to make the risks parallel to risk tolerance and risk appetite of an economic unit.

Control measures are policies and procedures that are implemented; so that through them we assure that reaction to risk is occurred effectively. Regarding the information and communication, the information must be identified, gathered, and imparted in a time frame, so that the employees will be enabled to carry their responsibilities. Effective information in its broader meaning exists in all over the economic unit.

Risk management must be monitored and adjusted, if necessary. Monitoring is carried out through constant management activities or separate evaluations or both of them. Risk management is not merely a successive or serial process in a way that a component only influences the following component. In fact, risk management is a multi-directional and repeatable process and every component of it can influence other component.

### The Stages of Risk Management

The main stages of risk management include plan risk management, risk identification, qualitative risk analysis, quantitative risk analysis, risk responses planning, and risk monitoring and control. The relationships between these are demonstrated in Figure 1.

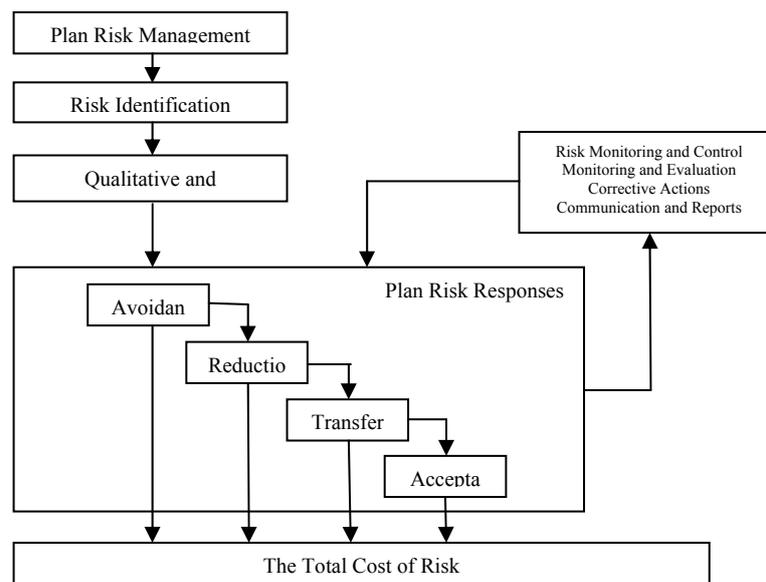


Figure 1. The relationship between the stages of the risk management

In Figure 2, the association between these stages in producing risk management process are presented. Although these stages are depicted separately, there is a considerable overlap between them. Moreover, some of the stages may be repeated throughout the project life cycle (Jadidi Gili & Orouji, 2013).

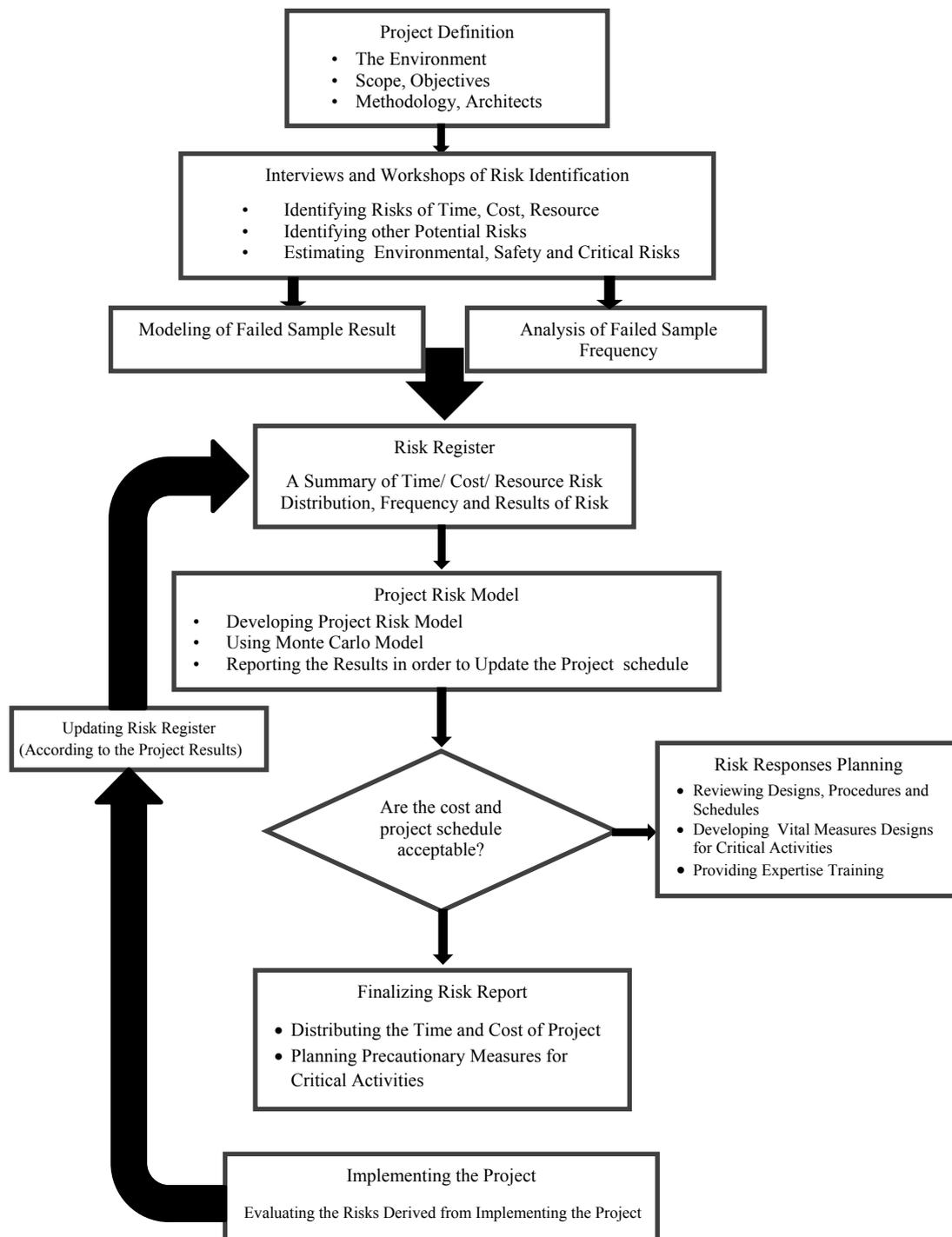


Figure 2. An example of risk management process

### **Risk Management Planning**

Before implementing risk management process, providing and presenting the design of risk management is the most logical step (Mulcahy, 2009). Risk management planning is the process of making decision about the approach and method of conducting the activities of risk management in a project. In this stage, the level and the type of risk management is determined according to the risk and the importance of project for the organization, the needed resources for the activities of risk management, and according to the foundations of facing risks (Nazari, Forsat Kar, & Kiafar, 2008). For example, a project with only one rudimentary design development requires a simpler structure than a project with a sophisticated design development and modern production techniques (Jadidi Gili & Orouji, 2013).

### **Risk Identification**

When preliminary measures for starting risk management process were taken in every respect, the project can be entered into the first stage of the cycle of risk management such as risk identification. In this stage, the risks of project (whether threat or opportunity) are described and documented through the special methods and tools of identification (Nazari et al., 2008).

The objectives of risk identification include encouraging free discussion on risks among the participants of project to develop team making and influence on the success of the project. It also involves getting feedback from all the participants of project on the risk and requires identifying and categorizing the project risks and presenting a foundation for qualitative and quantitative analysis of risk

To achieve these objectives, a workshop must be held for the project team and other beneficiaries and ask them to discover the probable risks to the success of the project through brainstorming. If the risk category is presented to the team, it will be more effective since the team can categorize risks (Jadidi Gili & Orouji, 2013).

According to Nazari et al. (2008), this category includes risk category according to the effect on the project objectives. To report the state of the project, we can categorize risks according to their effect on the project objectives, namely project schedule risks (not completing the activities in the time limit or risks to logical dependencies in the network), project cost risks (not completing the activities within the approved budget), project scope risks (risks to changes of scope or need to modifications to get the delivered items which are required), and quality risks (failure to complete the activities according to the required level of qualitative or quantitative function or in simple terms, failure to meet the customer's expectations).

To identify and face the risk, determining the risks groups according to their roots rather than their effect is the most appropriate approach. Risk groups include external-unpredictable risks (amendments to the rules and natural disasters), external-predictable risks (market, inflation, and primary resource access risks), internal- non-technical risks (management and schedule), technical risks (changes in technology, operation, and designing issues), and legal risks (licenses, patent, and contractual issues).

We can also categorize risks according to the part that controls risk. Rodney Turner, an expert in project management, has categorized risks according to their effects and where they are controlled (Nazari, et al., 2008). The categorized risks involve internal risks, external risks, and compliance risks (legal risks).

Internal-technical risks are directly related to technology, designing, building, and using facilities or designing final product. These risks may be derived from changes or failure to fulfill the desired function (Nazari, et al., 2008).

Internal-non-technical risks are under the control of projects managers or their organization and are non-technical in nature. These risks are usually derived from the failure of project enterprise resources (individuals, materials and financial resources) to fulfill the expected function. These risks may lead to delay in schedule, increasing the costs, or pause in the project cash flow (Nazari, et al., 2008).

External-predictable-assessable risks are not under the control of managers or their organization and we expect to face them, but their extent is not clear. Typically, there is some information that allows us to estimate their average effect. The risks of this group are of two kinds: The first one is related to the activities dealing with producing raw materials, merchandise, and services which includes prices, supply, and demand. The second one is related to fiscal policies which affect the circulation of money, inflation, and tax. These risks also include operational requirements like retention and environmental factors such as weather and social effects (Nazari, et al., 2008).

External-unpredictable risks are not under the control of managers or their organizations and are unpredictable in every sense. We can determine their list but it is not possible to predict with which of them we will encounter in a particular project. These risks may be derived from the government measures or external groups, force majeure or failure to complete the project due to the external effects. Government intervention or the intervention of regulatory organizations may be in connection with producing raw materials or goods, environmental needs, designing and production standards, and pricing. The measures of external groups may include disruption or business disturbance. Force majeure includes earthquake, flood, or shipwreck. The external organizations' inability to provide infrastructural and financial support or their bankruptcy or inappropriate designing may lead to project failure (Nazari, et al., 2008).

In every country, the domain of applicable regulations is different in various levels of working. In Iran, there are two types of legal risk, namely risks of law and government criteria or the internal regulations of the organization and risks of contracts, pacts, and commitment (Nazari, et al., 2008).

### **Qualitative Risk Analysis**

Since the identified risks in a project are numerous and studying all of them is time-consuming and costly, to manage them logically, first we must prioritize them. In the stage of qualitative assessment, the priority of risks is determined according to the risk occurrence probability and its impact on the project objectives; so that the management will observe the more serious risks and the more risky dimensions of the project will be noticed in the following steps (Nazari, et al., 2008). Figure 3 demonstrates the risk qualitative analysis of

risk probability and impact matrix which can be used to assist the workshop participants with estimating the risk and its results (Jadidi Gili & Orouji, 2013). In Table 1, factors of risk occurrence probability and its impact are shown. We can interpret the terms of occurrence probability by detailed phrases, so that the intention will be expressed better. A sample of these interpretations is presented in Table 2.

probability factor	High Probability (5)	5	10	15	20	25
	Probable (4)	4	8	12	16	20
	Possible (3)	3	6	9	12	15
	Improbable (2)	2	4	6	8	10
	Highly Unlikely (1)	1	2	3	4	5
		Trivial/ Little (1)	Insignificant/ Secondary (2)	Important/ Significant (3)	Serious/ Great (4)	Major/ Primary (5)
Impact factor						

A common event that probably occurs 6 times a year or more.	15-25 Impermissible
It probably occurs once or twice a year.	6-12 Permissible within Limitation
It may occur or has already occurred.	1-5 Permissible

Figure 3. Risk probability and impact matrix

Table 1  
User Guide for Probability and Impact Factors

Probability Factor	Quantity
High Probability (5)	A common event that probably occurs 6 times a year or more
Probable (4)	It probably occurs once or twice a year.
Possible (3)	It may occur or has already occurred.
Improbable (2)	Improbable event, but it occurs.
Highly Unlikely (1)	Unknown events, but they may occur.

### Quantitative Risk Analysis

Quantitative assessment is carried out for risks of high priority in qualitative assessment, which can affect significantly the project objectives. Quantitative risk assessment analyzes these risks quantitatively and allows the possibility of deciding under conditions of uncertainty.

The applications of quantitative assessment include the quantization of probable consequences in the project alongside the occurrence probability of them, probability assessment of achieving the particular objectives of the project, identification of those risks which deserve more attention and consideration through quantitative assessment of their relative impact on the total risk of the project, identification of realistic and attainable objectives for the project especially in terms of cost, time, and scope considering the project risks, and help with making managerial decision under the conditions of uncertainty (Nazari et al., 2008).

Generally, the process of quantitative risk assessment is carried out after qualitative assessment and risk prioritization. Observing this sequence is not necessary and with the help of quantitative assessment, we can prioritize the risks. However, due to complex, costly, and time-consuming numerical methods, quantitative assessment is implemented after qualitative assessment and risk prioritization. Sometimes, there is no need for quantitative assessment to find appropriate and effective answers for risks (Nazari et al., 2008).

Features and advantages of conducting quantitative risk assessment involve a tool for evaluating the effect of risks on the project as a whole instead of evaluating them separately. Besides it include some other elements such as determining the quantitative amount of probability and impact occurrence of the risks through number or numeric range instead of using descriptive phrases like little, much or middle; universality in analysis due to applying clear and specific methods, regardless of personal taste and thought; ability to identify, implement, and analyze various alternatives alongside the preliminary base design; ability to evaluate and analyze the complexity of emerging various risks and predict their probable outputs which are out of humans' depth; and ability to draw the diagram of probability distribution for every project objective instead of considering a definite amount for them.

Regarding Nazari et al. (2008) some weaknesses of quantitative assessment can be stated. Conducting these methods usually requires computer software. Although they have the function and ability to analyze precisely, they impose more cost on the project management and they require expert human forces. They also must be in harmony with other tools of project management. Besides, analyzing the outputs of this method needs the interpretation and judgment of experienced people. Otherwise, wrong understanding is probable. In addition, more than enough trust in outputs and software results without engineering judgment may lead to error and using advanced systems or tools which the management team is not aware of their function may lead to the misdirection of the management team.

According to the mentioned weaknesses and strengths, in this stage, we must pay considerable attention to using the quantitative assessment. In most instructions of risk management, applying quantitative assessment is optional and unnecessary and to manage the known risks effectively, qualitative risk assessment is sufficient. Relative awareness of the probability and impact of every risk can lead the project team to the appropriate response without the need for complex assessments that provide numerical values. Moreover, in most common projects, the exposure to risks is so brief that there is no need for quantitative assessment and the simple qualitative methods can answer the needs of risk management. In some cases, the available time and resources for management are limited; therefore, precise and detailed assessments are not possible. There are various methods for quantitative assessment such as the method of expected value of money, decision trees and simulation, and modeling methods like Monte Carlo method. There are also more complex methods like system dynamics or neural network. Concerning Nazari et al. (2008), the points we must consider in using these methods must take into account that none of the methods is perfect. Each of them has its own strengths and weaknesses. Using some of the methods is simpler than others. Some of them need complex calculations and some have been formed based on guesses and subjective judgment. In addition, providing more details by a method does not necessarily show more accuracy. In a probable phenomenon, the information changes or loses

its validity according to the situation. Following this, the impact of hypotheses on the result of quantitative assessment is inevitable. However, we must prevent the impact of taste on these hypotheses as much as possible and apply them after reaching collective agreement.

According to the project risk, the need for numerical information and the outputs of quantitative assessment and the needed resources including tools, expert, and other resources, the project management team must decide that whether using quantitative methods are economical and logical or not. Therefore, we must determine specific objectives for quantitative assessment and clarify the applications of obtained outputs in the process of decision-making. Otherwise, all the time there is the danger that the weaknesses of quantitative assessment may overcome its benefits. These cases are usually included in the risk management planning alongside the reasons for applying or not applying the methods of quantitative assessment (Nazari et al., 2008).

### **Risk Responses Planning**

Before initiating the process of plan risk management, the following prerequisite information is necessary (Nazari et al., 2008). The final list of identified risks and their assessment (ensuring that the real risks are in the residual list), in a way that their probability and impact occurrence have been evaluated and according to the origin of risk and the effected part of the project, they have been categorized. In case of time limit for the risk responses planning, after risk prioritization, first it would be better to study the importance and priority of threats and opportunities.

Determining the accepted and agreed risk threshold of the project, so that it may be considered as the foundation for how to respond to risks. It must be considered that if any of this prerequisite information does not exist, the defined responses and solutions to the risks will not be desirably effective.

The first prerequisite to the planning stage is that the previous stages of risk management process have been completed successfully. Moreover, we must determine that which risks need responses and how is their priority. Therefore, the outputs of previous stages of risk management process will be transformed into the inputs of risk management plan stage. The second prerequisite is about the project beneficiaries who must be committed to considering the threats and opportunities in their range of duty and bearing the responsibility of risk response. This issue exists in the entire organizational levels. For example, the project manager accepts the responsibility of general project risks and the chief officer accepts the responsibility of responding to strategic risks. Finally, the acceptable risk threshold will become the foundation for measuring the effectiveness of responses. Without considering this foundation, a lot of attempts may be made to modify risks more than what is considered as an acceptable risk or the responses are not sufficiently helpful in reducing threats and increasing the opportunities (Nazari et al., 2008). Therefore, the objectives of risk responses planning involve increasing the probability of success through reducing the probability or result of risks with high probability occurrence, identifying and dealing with the category of more serious risks and cost or schedule, and preparing a forward plan to reduce risks which include measures, responsibilities, and dates (Jadidi Gili & Orouji, 2013).

Risk responses planning begin with reviewing the result of risk analysis for determining that which risks have higher priority to be reduced. Risk acceptance is the strategy which is used due to the fact that hardly we can eliminate all of the project risks. Most of the measures are developing probable reserves including amount of money, time, or resources to apply the known or unknown opportunity or threat. Reduction may be achieved through many ways like substitution of high-risk techniques or equipment or alternatives with lower risk, specialized training for construction workers, applying high quality insurance standards to staff and equipment, and planning to take precautions against risk occurrence. Another measure is risk avoidance which includes changing the project management plan to eliminate the threat of a discordant risk, keeping the significant project activities apart from the risk impact, or reducing activities with high risk like extending the schedule or reducing the scope. We can prevent some of risks which are posed at the beginning of the project through needs description, information selection, communication improvement, or professional acquisition. We can also transfer some risks such as transferring and assigning the risk and the responsibility for responding it to the third party. Risk transfer gives the responsibility of risk management to another section. Transfer does not eliminate the risk and it is the most efficient ability that we can provide for financial risk. Risk transfer usually includes paying the third party insurance premiums. Transfer devices can be variable and unlimited including using insurance premiums, guarantee, and commitment.

### **Risk Monitoring and Control**

The project team must attempt to consider the risk monitoring and control as the inseparable part of management process. The objectives of this stage incorporate monitoring the identified risks and the new ones, making sure of the accurate reaction occurrence and reviewing their effectiveness, and monitoring the risk changes in all the stages of project (Jadidi Gili & Orouji, 2013).

Throughout the process of planning and conducting the project, we must adhere to a series of principles such as cancelling or reducing secret precautions; the precautionary time and cost must be considered in the uncertain activities; reducing the required precautions through effective use of risk response must be taken into account. The potential extra cost must be controlled through avoidance, reduction, or transfer of separate risks in the project.

Concerning the pressure of need for communication between the project employees, one of the most important problems of projects is the lack of communication. Risk assessment is not able to solve this problem and it can be merely solved through the improvement of communication among the members of team project in all the sections of the project.

Regarding identifying and responding to all risks throughout the phases of the project, risks can occur in all the phases of the project from the initial design to the final performance. It is necessary to identify and manage all the risks that can exist potentially in the project (Richman, 2012).

### **Conclusion**

In this study, the initial definitions of risk and risk management are provided. Then, the stages and procedures of them are given. It worth noting that to achieve the project objectives

of the companies or organizations, risk management and risk identification are inevitable. Therefore, the risk management must begin in the initial stages of the project and must be continued throughout the project life cycle as far as possible. The managers and the project risk team must apply the risk monitoring and control (which is the inseparable part of the management process) to the project; so that they will monitor the identified risks and the new risks and will make sure of their accurate performance throughout the project. It is clear that the benefits of risk management may not be tangible up to the project conquest of risks. However, it must be noticed that the avoidance of risk management plan as a result of extended period of time or price increase of the project will lead to failure or a disaster for the project.

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