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Evaluation of PMP construction projects -Alternative case study: (Anfis) (Makran steam-electric power station)

Abstract

Managers require an appropriate understanding of nature of the risks related to a construction project because the time and budget of a project are affected by these risks. Thus, it helps to identify the risks, prioritization determination and appropriate decision-making against these risk. This research aims to identify the risks of construction projects first in a hierarchical system structure of Makran steam-electric power station and recognize the project management program in order to evaluate the project evaluations. The use of the (PMP) method leads to a more efficient satisfaction with this method and we have tried to use method based on this standard instead of Anfis method because of successful pattern of this system in Gas and Steam plants. The methodology suggested by the projects managers and workshops' supervisors and safety experts and the people involved in evaluating the factors of the construction projects especially the power and steam plant and have been evaluated using this method.

Keywords: *Evaluating, PMP, Qualitative analysis, Project risk, Identification, Control.*

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Introduction

The PMBOK standard is the most famous universal project management standard. Because of the multiplicity and complexity of projects, executing the projects in large project-based organizations requires the use of a mechanism which is able to cover all processes of the project life cycle in an integrated manner from the time of notification to operation and inform the organization of delays and risks on critical routes on a daily basis in addition to provide the probability to access to classified information at the time of necessity. This is only possible by using a comprehensive intelligent software system as a project management tool. The PMBOK standard is widely applied in the field of project management. Today, the main activities of organizations and institutions are defined in the form of projects. A project is a set of temporary attempts to fulfill a commitment and acceptance in creating a specific product or service. If a project fails to meet the determined goals, that project is considered as a failed one. This is the shortest possible definition of project failure, but the following factors can lead to project failure if we want to examine the issue in detail:

1- when the project remains unfinished before reaching the desired goal and the project operation is suspended
2- when the final product of the project does not reach the desired standard level
3- when more than the expected budget is spend in the project operations
4- when the project is not completed on the set time.

Due to the specific structure of each project and the intrinsic differences existing in each project, it is nearly impossible to generally examine the failure or success factors for all projects and therefore, there is no choice except examining these factors as a case in a project. So, any project can be potentially considered as a new project and locative territory of this research has innovation aspect. In recent decades, many standards have been set in this field through the acceptance of project management as a separate and very influential field. PMBOK standard was one of these standards developed by the American project management association. This standard is registered as the national standard of project management in the United States and the application of this standard is common in all countries. Examining the success and failure factors of the project in the form of this standard helps to make a purposeful effective review regarding it. PMBOK standard has been used as a criterion for validation of each of the project indicators. In continue, some indicators are required which are developed in the form of PMBOK standard in order to help accurately evaluation the project. Determining these indicators requires recognition and review of the project by the elite. Project indicators should be consistent with the strategic goals of the project and attract the opinion of project owners.

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Research history

PMBOK was developed by an international private organization called the Project Management Institute (PMI). This standard was compiled by attempt of a very large group of project management staff and was based on successful models and experiences of these people, not just theory. The first draft of the standard was prepared in 1987 and its various versions were published in the next years. The latest version which is version 4 was published in late 2008. PMBOK is the most famous global standard in project management and is the most common standard for designing and evaluating project management systems. Many of the most common definitions, terms, and classifications used in project management today are taken from this standard. In other words, PMBOK is a global common language in project management.

The term PMBOK is abbreviation of project management body of knowledge and it is translated as extent of project management knowledge, body of project management knowledge or in more way simply, project management knowledge in Persian. Body of knowledge is a comprehensive set of information and skills which forms a profession.

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Aminbakhsh et al. (2013, Badri et al. (2012), Mitropoulos and Namboodiri (2011), Pinto et al. (2011)

Marhavilas and Koulouriotis (2012), Papazoglou et al. (2017), Buckley, 1985; Demirel et al., 2008, van Laarhoven and Pedrycz, 1983.

Methodology

PMBOK standard introduces 42 processes for project management. 42 type of works which is enough to manage any type of project. In PMBOK and most other standards, project management is separated from the specialized aspects of the project because manager does not involve himself in the specialized issues of the project in a successful pattern. Due to this abstraction, it is possible to form a general framework which is usable for any type of project. Some processes are optional and the most ones are obligatory. The project management team should identify the processes required for the project at the beginning and determine the order of implementation of each one of them. There are many guidelines for each process in PMBOK but these guidelines are not enough to make them operational, so, a complementary experience and knowledge that is expected to be present in the project management team are required for creating a complete project management system. 42 PMBOK project management processes are categorized in two ways to make them easier to understand for the audience. One classification is based on process groups and the other is based on scopes of knowledge.

Process groups

Process groups categorize MPBOK processes based on their conceptual sequence. There are 5 process groups in PMBOK.

The beginning process group which does some of the basic works required to start the project.

• Planning process group which is responsible for project planning.

• Execution process group which is responsible for executing project plans.

• Monitoring and control process team which evaluates compliance with the implementation and planning.

• The termination process team which does some of the final work on the project.

Following the project starts, planning will begin. The project can be started only following the initial planning is completed. Project planning continues to work to constantly review, revise, and correct the plans along with project implementation. The monitoring and control process group works simultaneously with planning and execution, and its main duty is to assess the compliance of execution and planning and giving some advices regarding corrective and preventive actions. Finally, after the project is completed, a number of processes will be done to end the project and its formal delivery. If the project is divided into several phases, all the process groups are repeated for each phase. None of the process groups can be deleted.

Scope of knowledge

The second classification of processes is based on scopes of knowledge. Scopes of knowledge divide processes according to the type of the required skills.

PMBOK scopes of knowledge include:

- The scope of project integration management knowledge
- The scope of project scope management knowledge
- The scope of project time management knowledge
- The scope of project cost management knowledge
- The scope of project quality management knowledge
- The scope of project human resource management knowledge
- The scope of project communication management knowledge
- The scope of project risk management knowledge
- The scope of project supply management knowledge

One of the topics of project management is managed in each area. For example, the time management method is specified (planning method, evaluation, reporting, etc.) in the scope of time management, the schedule is prepared, the real and planned time situation of the project are compared and corrective and preventive actions are suggested in case of deviation.

Establishing a project management system especially in project-oriented companies means developing standards,

instructions and processes which improve the level of project management of a project-oriented organization. The important point in establishing project management systems, especially in Iranian companies, is this issue that the relevant scientific principles and techniques should be personalized with high skills and experience and the establishment process should be done with training and full interaction with all organization's staff. The group of consultants and managers with long experience in the field of establishment and training of these systems, especially based on the PMBOK standard in various public and private organizations, is ready to provide services to you dear managers and entrepreneurs.

Uncertainty in projects

The most of the project management activities from the earliest stages of the project life explain and decide on a set of possible actions against the lack of project certainties. Some of the uncertainties in projects are due to the probability of changes in project performance criterion such as cost, time or quality. Uncertainty can also be attributed to some issues such as ambiguity in recognizing the behavior of factors and institutions present in the project, lack of information, lack of a clear structure for considering the project-related issues, hypotheses, known and unknown sources of deviation in the project and many more other cases.

Uncertainty and risk in the project

It is clear that all uncertainties in projects do not lead to risk. Like variable exchange rate in the organization which operates basically with unique currency. Thus, it is clear that only a limited subset of all uncertainties in a project is considered as project risk. If there was no uncertainty and the future was fully recognizable, there would be no risk. Similarly, there would be no risk if the goals were flexible and changeable instead of stable. Risk can be defined as uncertainty which affects one or more of the objectives of the project if it occurs.

Risk management planning

Risk management planning is the first stage and beginning step in the repetitive processes of risk management. Risk management planning includes risk identification, risk assessment (qualitative and quantitative), risk response planning and risk monitoring, control and review. The risk management process starts from the risk identification stage through arguing that if risks are not identified, they cannot be managed. Today, risk management processes begin with the definition or planning of management. Some decision are made regarding the type of approach and how to conduct risk management activities in the project in the planning stage,

Risk management scope

Defining the scope of the risk management process before beginning is very important because it will be possible to focus on the next steps appropriately. A project is conducted in a complex environment with many dependencies and benefits. Therefore, the risk management process may be limited to a subset of the whole the project environment. Even in some cases, the scope of risk management may include only the internal responsibilities of the project team and no other aspects of the project environment. Another important factor in definition of the scope is determining the types of risks will be considered in the risk management process.

The scope of project risk management of Chabahar power plant

Risk management program includes determining how to identify, evaluate and respond to negative risks (threats) and positive risk (opportunities). Risk management of Makran power and steam project does not include quantitative risk assessment process and only identified risks qualitative will be assessed qualitatively. The consequences of time and quality costs enjoy priority in project risk management and all of them have the same size.

Figure 1- Role and responsibilities. Explanation: R (responsibility), A (respondent), C (consultation), P (participation)

description	Executive director	Project team			Deputy of engineering	Deputy of equipment supply	Deputy of planning and informatics	startup affairs manager and warranty period	Systems management and comprehensive quality
Preparation of risk management plan		A	R		P	P	P	P	P
Risk identification	p	A	R	P	P	P	P	P	P
Qualitative evaluation		A	R	P	P	P	P	P	P
Responsese to risk									
Engineering		A	P	I	R	I	I	I	I
Equipment supply		A	P	I	I	R	I	I	I
Implementation		A	P	R	I	I	I	I	I
Delivery	I	A	P	I	I	I	I	R	I

Risk control and monitoring		A	R	P	P	P	P	P	P

At each stage, it will be possible to use experts inside or outside the organization with the opinion of the executive director and project manager.

Risk management program

Following preparing the initial version of the project work failure structure and schedule, the colleagues in the executive project take some actions in order to identify and record the initial risks in the form of risk (completed attached form) according to RBS classification for the purpose of identification of Makran project risks. A brainstorming session will be held to summarize and finalize the initial list of projects if it is necessary and based on the project manager's discretion. The risk is better to put it this way: one "event (risk)" may occur due to one or more reasons which lead to "one or more consequences". If a risk involves several consequences, the risk will be repeated depending on the number of consequences.

Qualitative risk assessment

Probability of occurrence and consequence is completed by the risk identifier according to the consequence and probability tables mentioned below. The time consequent is predicted for the relevant work failure structure. The time consequence of the risk is adjusted by the project management team at the time of necessity due to the buoyancy of activities. (3,4)

Qualitative indexes of consequence table

Figure 2 -Table of qualitative index of occurrence probability

Qualitative index	Time	cost	Quality
Very low	Up to 10 days	Up to 500 thousand euro	Quality decrease is negligible
Low	Between 11-20 days	From 501 thousand to 1 million euro	Just quality of quantitative part is affected
Average	Between 21-30 days	From 1 million to 1.5 million euro	Quality decrease requires project supporter's conformation
High	Between 31040 days	From 1.5 to 2 million euro	Quality decrease is not confirmed by project supporter
Very high	More than 40 days	More than 2 million euro	Final product is unusable

Figure3- table of consequence qualitative index and occurrence probability

qualitative index	**occurrence probability**
Very low	Less than 10%
Low	Between 10-20%
Average	Between 30-50%
High	Between 50-70%
Very high	Higher than 70%

This information was reviewed within a week and the risks identified by the probability-consequence matrix method which are prioritized into the following three groups of high-risk risks including the risks with high level of importance (the red part of the probability-consequence matrix, the risks with average level of importance (the yellow part of the probability-consequence matrix the risks with low level of importance (green part of the probability- consequence matrix). The risks with high level of importance will be classified into important risks list (top risk) and average and low risks level under watch list. If a risk has more than one consequence and considered higher in the overall category, this category will be applied equally for negative risks (threats) and positive risks (opportunities). (1,2)

Table 1- Positive and negative risks through probability-consequence matrix

Consequence / probability	Very low	Low	average	high	Very high	Very high	high	average	low	Very low
Very low										

Low										
Average										
High										
Very high										

Table 2- Explanation regarding the risks classification

Index	color	Risk classification
With high level of importance		Important risk
With average level of importance		Risk under investigation
With low level of importance		Risk under investigation

Planning of response to power plant risk

For the purpose of preparing response to risk plan, some actions are taken in order to respond to important risks one week following risk prioritization in one session. Also, for each of the important risks, a risk response trustee is appointed. One person is determined as respondent for each of the important risks.

The answers are determined for each one important negative and positive risk according to the following four strategies:

Four risk accountability strategies for negative important risks

- **Avoidance**: This strategy seeks to eliminate risk or protect project objectives from risk threats.
- **Transfer**: All or some part of the negative consequences of the risks is transferred to the third party in this strategy.
- **Reduction**: The probability or consequence of risk occurrence is reduced to an acceptable threshold and exit from the list of important risks in this strategy.
- **Acceptance**: If a proper response cannot be provided to project's important risks through one or a combination of the above three methods, acceptance strategy will be used.

Three risk accountability strategies for positive important risks

• **Sharing:** In this strategy, all or some part of the positive consequences of the risk is shared with a third party.

• **Increase**: this strategy aims to increase the probability or consequence of the occurrence of risk.

• **Acceptance:** If a proper response cannot be provided to project's important positive risks through one or a combination of the above three methods, acceptance strategy will be used.

An event plan is prepared over a two-week period in which the necessary actions which should be taken at the time of the risk are described step by step for each one of the accepted risks (negative and positive) and the rest of the risks (residual risk) following examining the probability of negative and positive (and the remaining important risks or new risks -secondary risk- due to implementation of these strategies).

The cost, time and resources required are estimated by the risk response officer following determining the risk response plans for the programs which have financial and time burden. In continue, estimated costs are confirmed by the project manager and approved by the respected executive manager and the project reserve is used for conducting it. (1,2)

Research Findings

Follow-up sessions of the responding program to important risks and reviewing the change in their status or checking the level of certainty of the occurrence of important risks are formed simultaneously with the project control sessions according to their defined indicators simultaneously with the project control sessions .As required, if each one of individuals of project team identify a new risk, they should submit it to the project manager accompanied with other risk's features which occurred at that time for identifier. Project manager can hold a meeting with the desired person or persons as required after reviewing the risk and in order to take some action regarding its qualitative analysis. If this risk is included in the list of important project risks, as other important risks, a trustee and response program will be prepared and whose status will be investigated at the sessions of project control.

The purpose of this implementation method is providing a systematic approach to identify, evaluate, respond and control project risks. The scope of implementation application of this method is applicable to all power plant projects. Project management team includes project manager, workshop supervisor, engineering coordinator, coordinator of equipment supply and responsible for planning and controlling the project. It should be mentioned in defining the risk that it is an uncertain event or situation which is called a positive effect (positive risk or opportunity) or negative (negative risk or threat) if occurred. In the risk failure structure, the display is the hierarchical structure of the source of the project risks which help to identify the risks. The management team of project in power plants project is responsible for identification,

evaluation, responding and controlling the project's risks in its life cycle and project management team prepares the project risk failure structure to identify initial risks (for completing project charter) and proceed to recognize and record the initial risks in the risk registration format after reviewing it, accordingly. There are several factors in identifying risk as input including critical path activities, specific project conditions, the first and second category stakeholders as the most important ones.

At this stage of the project, members of the project management team and other experts and managers of the organization should notify one of the members of the project management team as soon as possible if a new risk is identified and this risk is evaluated and reviewed in the meetings of the project management team and the risk will be added to the project risk registration format if necessary. It is better to express the risk in this way that one or more reasons may occur that lead to a consequence. The purpose of risk assessment is identification of the important risks of the project. Since determining the extent of each of the two features is relative, guideline table is applied for homogenization of the viewpoints of the project management team. The following (1,2)

The guideline table 3- prediction of estimating the risk's consequences

Qualitative index of level of consequence	time	Cost	quality
Low	Less than 5% delay with acceleration during the entire project time	0.5 percent increase / decrease in the participation letter (company share)	Slightly Threat: decrease in quality is negligible Opportunity: for customer and application of insignificant product
Average	Between 5-10 percent delay with acceleration during the entire project time	Between 0.5 – 2 percent increase / decrease in the participation letter (company share)	Average Threat: rework and can be modified, irreparable Opportunity: increase in customer's satisfaction and increase the effectiveness of pure application
high	More than 10 percent delay with acceleration during the entire project time	More than 2 percent increase / decrease in the participation letter (company share)	So serious Threat: Opportunity: very high quality which leads to admiration and appreciation- product application is beyond the custom of industry

Point: If the risk has consequences of the range (increase / decrease or modification of the contract range), the consequences of time and cost should also be considered but other cases (consequences of time and cost) in case of being affected should be considered if the risk has no consequences of the range. The general importance of risk will be calculated by combining these two factors (probability) and (consequence). In the following matrix, the risks of the red zone are considered as high importance, the risks of the yellow zone as average importance and the green zone as low one. (1,2)

Probability

Table 4- probability and consequence table

			High
			Average
			Low
high	average	Low	

Important risks:

The risks that the probability of their occurrence and the extent of its consequences are high / high or high / medium or vice

versa (red zone) are considered as project's important risks and an appropriate response must be determined and implemented for them. This type of risk is continuously pursued in the weekly project's control sessions until the achievement of the result is or the occurrence of the risk. The project manager is responsible for these types of risks.(1,2)

[3]Corresponding authors. Anagnostopoulos and Vavatsikos (2012, Wang and Parkan, 2006; Anagnostopoulos and Vavatsikos, 2012) according to Eq. (8).,

4Corresponding authors: Aminbakhsh et al. (2013), Marhavilas, 2015, Marhavilas and Koulouriotis, 2008, Ishizaka and Labib, 2011

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Risks under supervision

Other risks are listed as the risks under supervision. If the consequence of a negative risk is damage to the project team or contractor with any degree of probability of occurrence, this risk is considered as important and an appropriate response should be considered for it. These types of risks are reviewed by the project management team once a season.

Risk response planning

Some actions are taken in order to plan the risk response following the identification and evaluation of the risks for the purpose of preparing the risk response strategy according to the considered form. A risk response trustee is identified for each of the risks. Finally, the registration form of project's risk will be approved by the project manager and communicated to the implementation trustee for implementation. The answers are as the multiple choice solutions and determined for each one of the positive and negative risks.(3,4)

6,6,7Corresponding authors: Eurostat Methodologies & Working papers, European Union, Edition 2001 (Doc. ESTAT/E3/HSW/2001/1130) and 2013 (ISBN 978-92-79-28419-9)"]., Lamata (2004), Marhavilas and Koulouriotis (2008), Table 1~7.

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Conclusions and suggestions

The importance of time, cost, resources and budget becomes obvious more than before along with the development of technology and the increase in speed of societies progress. Therefore, evaluating the management process of organizations seems necessary in order to identify strengths and weaknesses and improve and correct it. This article has considered the standard criteria of the knowledge management body (PMBOK). Accordingly, a questionnaire containing 60 questions has been prepared and selected as a case study of Chabahar power plant project because of its success in performing its projects on time and with quality. This article aims to determine the priorities in this type of projects and also determining the effect of the management process on the success of the projects. Thus, the maturity of the scope of the project management knowledge and key points for improvement and how to modify conditions in other executive projects are determined.

Several solutions to respond to negative risks

Reduction: In this strategy, the probability or negative consequences of the risk are transferred to a third party.

Avoidance: This approach seeks to eliminate the risk or protect project objectives against risk threats.

Reduction: In this solution, some actions are taken regarding the probability or consequence of the risk to the threshold of acceptability and removal from the list of important risks

Conscious acceptance: If the above three methods or a combination of them cannot achieve an appropriate result, the conscious acceptance strategy will be used.

Several ways to respond to positive risks

Increase: This strategy attempts to increase the probability or consequence of the occurrence of risks.

Sharing: In this solution, some part or all of the positive consequences of the risk are shared with the third party.

Utilization: Some attempts have been made to provide risk conditions so that the project benefit of it as much as required.

Conscious acceptance: If a proper response to positive risks cannot achieved through one or a combination of the above three methods, this strategy is used.

Risk monitoring and control

Pursuing the response planning to important risk, reviewing the changes and status of the risks under supervision or identification and evaluation of new risks is done in the meetings of the project management team. This implementation method is obligatory for each project from the time of approval of the project charter and will be continued until the temporary delivery of the project. Meanwhile, the project life cycle is periodically reviewed if new risks are identified or the status of a risk is changed and also the latest status of important risks are reviewed and investigated in the project control meetings of the project headquarters. It should be noted that the risks users include the deputy of project

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planning and control in the headquarters and workshop, project management and the deputy of equipment supply and engineering.

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