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THE PHILOSOPHICAL INTERPRETATION OF RISK ASSESSMENT IN MUNICIPAL PROJECT MANAGEMENT

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Abstract: Project management emphasizes the process of risk assessments, because any project is attended not only by the risks of failure due to lack of funding, but also by the design of the required quality and quantity of final results. Consequently, there is a need to show a new philosophical approach to the identification, evaluation and decision-making of the risks in programs, implemented in municipal structures, because the range of beneficiaries related to this field is not only wide, but also more multi-layered (government, municipal authorities, investors, middle-level and top managers, population, etc.).

The article proposes a model of risk management of projects, implemented in municipal facilities, which enables not only to form a management information feedback between all beneficiaries, but also to include them in participatory risk prevention processes. A ranking process of risk factors related to the management of municipal projects is also proposed, which increases the effectiveness of managerial decisions, aimed at risk prevention and the justification of philosophical interpretations related to it.

Keywords: project management risks, philosophy of risk recognition, philosophical approach of risk management, philosophical interpretation of risk management reporting.

Introduction

Project management is one of most important and most used branches of management during recent decades. With growing, complication and sensitivity of projects, also specialists of project management always were seeking to find better and more effective tools and solutions for projects management. For this reason, very varied tools and techniques were created for projects management until present time that every had assisted to facilitate and accelerate levels of project management process in a manner (Vahedi, 2006, pp. 14-25). Many project managers, senior managers of companies and clients are interested to know what will happen to project in future and how long will it take and how much will it cost. Earned value management system provides such essential and important information and alerts the project

manager to take necessary corrective actions (Akbari & Salehipour, 2012).

One of most important indexes of projects success is conformity of cost performance and project schedule to what is planned. Obviously, utilizing an efficient and integrated technique with futuristic and continuous control approach has important role in a project success. Most practical management new technique in cost-time management, considering that cost and time are very important in creation of focus on project progress in order to maximize probability to attain project goal, is earned value management that is a systematic technique to integrate, measure and compare process of cost, time and limit progress in a project (Larkhaba et al., 2013).

For the EPC system, compared to the standard technique of project implementation, we can point out certain advantages that made employers welcome this system. Decrease of execution time, costs finality and financial support from non-governmental resources are some of main advantages of design and construction that were cause of employers' welcome to this system. One of tools that creates this advantage for engineering-purchasing-construction (EPC) project, is increase of compatibility and using earned value management. However, the use of these privileges requires compliance with the requirements and the existence of preconditions in the executive organization and the project structure, the absence of such a requirement causes the inefficiency of the system implementation (Khazaeini & Ahmadi, 2008).

The present study is a systematic search of data and information centered on the analysis, identifying and evaluating challenges of project cost and time control in EPC contracts using multi-criteria decision-making in Tehran municipal infrastructure projects. In terms of the nature and method of the research, it is a descriptive survey type. Since this research addresses how to identify and evaluate challenges of project cost and time control in EPC contracts using multi-criteria decision making in urban infrastructure projects of Tehran municipality, it is descriptive (non-experimental) in terms of nature and research methodology. This research is a non-experimental study in which the research variables are not manipulated.

In the field, implementation and operational steps, a questionnaire was created, designed and distributed to collect the required data. In other words, the present study is classified by descriptive (non-experimental) based on the purpose of the study and the nature and method of data collection and in the survey type is classified as a cross-sectional method, because the data has been collected on one or more attributes over time. 2021 was done through community sampling.

The Philosophical Framework of Project Management Risk Assessment

The results of the research in relation to its questions are discussed in philosophical framework.

Question 1) What are the challenges of controlling projects with EPC contract model in terms of time and cost of projects in Tehran Municipality?

In order to answer the research questions, by reviewing the literature and research background, and analyzing the data obtained from interviews with experts, the most important risks and challenges were identified and determined. These risks include:

- Financial burden imposed on the organization in case of implementation of standard project control
- Inaccurate initial estimation and lack of complete identification of beneficiaries needs at the beginning of the project, which leads to project changes
- Intra-organizational and soft processes and organizational culture
- Insufficient attention to scheduling and more accurate estimates in projects
- Failure to apply risk management in project control areas in the organization
- Lack of easy access to lessons learned and useful information in previous projects
- Lack of cooperation of senior managers due to unwillingness to make changes in the organization
- Lack of information integrity and interactions between the employer and the contractor
- Shortage of expert personnel
- Financial problems in the organization in funding projects

Question 2) What are the criteria for evaluat-

ing the control challenges of projects with EPC contract model in terms of time and cost?

To identify the criteria for evaluating the challenges of controlling projects with the EPC contract model in terms of time and cost, the literature and research background were used and the desired criteria were identified and determined as follows:

1. Project duration
2. Implementation risk
3. Project budget
4. Flexibility
5. Access to technology

Question 3) How is the weight and importance of challenges of the projects control with EPC contract model in terms of time and cost?

With the help of experts' opinions, the degree of importance of each of these criteria has been determined. This factor has been used as a basis for comparing the importance of options in order to determine the weight of effective criteria in the importance of challenges of projects control with the EPC contract model in terms of time and cost. In other words, the weight and position of each option (project control challenge) was determined based on the desired criteria, and finally, with the help of the governing relations in the Fuzzy Vikor method, the share of each criterion in the importance of the project control challenge was determined. After the considered calculation, it was observed that prioritizing the importance of 12 project control challenges in Tehran municipality projects in order of weight is as follows:

Table 1.

Weights of Importance of Each Project Control Challenge

Project control challenges	*Q(V=0.5)*	*Ranking based on Q*
Familiarity of employees with project control methods based on PMBOK standard	0.133	1
Financial burden imposed on the organization in case of implementation of standard project control	0.597	10
Inaccurate initial estimation and lack of complete identification of beneficiaries needs at the beginning of the project, which leads to project changes	0.663	12
Intra-organizational and soft processes and organizational culture	0.134	2
Perception of inefficiency of project control and earned value indices and PMBOK standard among the effective factors	0.299	5
Insufficient attention to scheduling and more accurate estimates in projects	0.439	7
Failure to apply risk management in project control areas in the organization	0.161	4
Lack of easy access to lessons learned and useful information in previous projects	0.552	9
Lack of cooperation of senior managers due to unwillingness to make changes in the organization	0.445	8
Lack of information integrity and interactions between the employer and the contractor	0.398	6
Shortage of expert personnel	0.154	3
Financial problems in the organization in funding projects	0.639	11

Question 4) What solutions can be provided to improve control and management of cost and time of projects in EPC contracts of Tehran Municipality?

Considering the importance of each of the challenges, the solutions suggested by library studies, consultation, obtaining expert opinions and recommendations are as follows.

According to the opinions of experts and the application of pairwise comparisons, the most important challenge of implementing standard and effective project control are the financial problems of the organization in funding projects. Unfortunately, the organization has been facing

funding problems in recent years, which is the main source of projects. Solutions to get out of the organization's financial problems are beyond the scope of this study. At present, measures have been taken in the organization to attract capital and financing, and the financial situation of the projects is expected to be improved. However, shortage of resources has a great impact on all aspects of the project, and the proper allocation of the organization's scarce resources must be on the agenda. As a solution to implement standard project control in this situation, it is possible to initially implement the items that create less financial burden for the organization and have more short-term effects. Also, due to lack of financial resources and manpower, it is possible to start the project control process from smaller parts of the organization and a few selected executors. After obtaining the results and gathering the knowledge learned, in the next phases, it spread to other departments of the organization. Also, due to shortage of financial resources, project control can be very useful in controlling portfolios, plans and programs.

Another challenge of creating project control based on the PMBOK standard has been understanding the ineffectiveness of project control and earned value indicators, which have been examined and compared in the studies conducted in this research with time earned indicators, and the reasons for the inefficiency of using the physical progress index of the project or earned value in the project that is currently being used have been discussed and investigated. The results of the present research can have a significant impact in removing the misconceptions created about indicators. Also, this misconception will be corrected if the project control unit starts to provide the time indicators introduced in the same research as a pilot, and the results are visible to project managers and agents.

As stated, the challenge of the financial burden imposed on the organization can be effective with measures such as starting project control from selected factors, starting project control items that have less financial burden, as well as documenting the improvement of project control in the organization and enumerating the positive financial results and improvement of projects for managers. The financial burden of its implementation after limited implementation is a very economical process of the organization in terms of return on investment and capital.

By presenting the implementation results as well as the results of this research, which have been obtained with the opinions and suggestions of the experts of the organization involved in the projects, it is possible to plan to attract the opinion and cooperation of senior managers of the organization.

Utilizing the lessons learned from previous projects is very effective in project management and control and making key decisions in the project. In a large organization such as Tehran Municipality which is known as one of the main components of the country's economic production, efforts should be made to establish and apply project knowledge management. Establishing project knowledge management, in addition to having a great impact on increasing the efficiency of project management and control, is also a great resource for employees to use the experiences of other projects by will increase the efficiency of the entire organization in project management processes. Also, holding practical training courses for personnel in the field of project control and making it mandatory for project agents, will play an important role in increasing the knowledge of personnel in the field of effective and standard project control.

Another challenge is the lack of accurate initial estimation which leads to inefficient planning and due to many changes in the project, the initial schedule has undergone many changes and the project control in this case will not have the desired function. Also, failure to consider risks in planning is another factor in the inefficiency of initial planning. Therefore, the following items are suggested to improve the status of projects and ultimately the optimal function of project control in projects (Terrell & Richards, 2018):

- Specify more precisely the scope of the project with more attention to the needs of beneficiaries
- Improve the structure of work failure in projects by following the existing standards in this field
- More accurate planning according to the existing risks and using the information of previous projects
- Integrate earned value management with risk management

- Take into account risk mitigation programs in the project schedule (pp 59-67).

The present study has been used in terms of applied purpose and in terms of hybrid approach method. In this way, first, in order to design the model and identify the components, dimensions and variables of the model, a qualitative approach has been used in the research, and after designing the model and identifying the components of the model, a quantitative approach has been used to finalize the model (see Figure 1).

Decision Making - Data Collection

After the content analysis method of identifying and evaluating risks and challenges in terms of cost and timing of EPC projects and providing appropriate implementation solutions were evaluated. In the next step using the Delphi method to identify the relevant dimensions and components According to the experts. At the end, these variables and related components were monitored and used in the form of a questionnaire in a special method developed in the Delphi method. The main research data collection tools are interview, questionnaire, case study and document review. A researcher-made questionnaire was used to explain the model.

The statistical population of the study consists of managers and experts of urban infrastructure projects in Tehran Municipality. They are about 68 people. The target population to select a sample from among experts and university professors who had the necessary criteria, 10 people were selected as a statistical sample in the qualitative section. Also in the quantitative part of the research, After surveying the target population in the statistical population and systematic screening, 40 statistical samples (who have 10 years of management experience in the municipal infrastructure projects, have a Master's Degree or higher and have project cost and time control issues knowledge) were selected as the sample size.

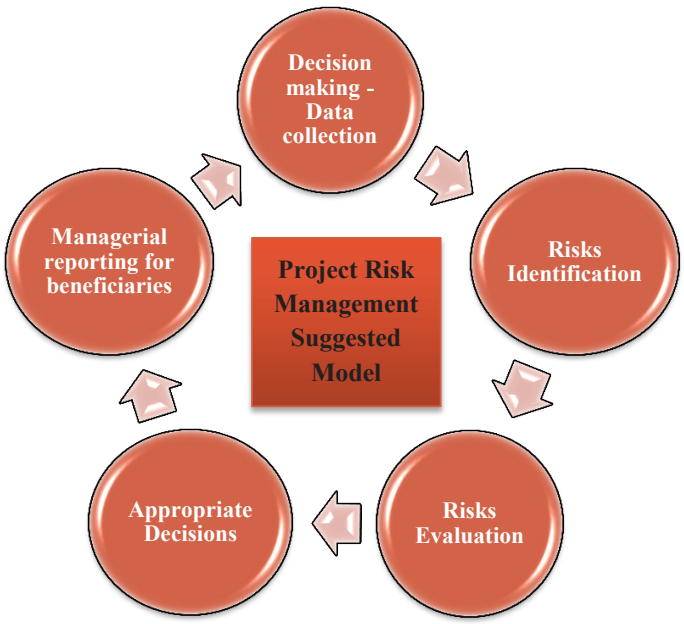

Figure 1. Project Risk Management Suggested Model[1]

[1] Composed by Authors.

Risks Identification

In this research, risks and challenges were identified through the qualitative section and modeled through MAXQDA software.

Qualitative analysis methods can be divided into two categories: one is methods that are mainly derived from a particular theoretical or epistemological position, and interpretive phenomenology analysis, such as conversational analysis, using of which has a relatively limited diversity; some of these methods, such as data theory, use a large theoretical foundation.

The second category is methods that are fundamentally independent of a particular theoretical or epistemological position and can be used in a wide range of theoretical and epistemological methods. Thematic analysis is placed in this category; hence, they are a flexible and useful research tools that can be used to analyze large volumes of complex and detailed data (Braun & Clark, 2006).

Qualitative methods are very diverse and complex and have very partial and concise differences. Thematic analysis can be considered as one of the basic methods of qualitative analysis that differs from other methods of analysis that seek to describe the patterns of qualitative data - such as interpretive phenomenological analysis, grounded theory, discourse analysis and thematic analysis.

The method of interpretive phenomenological analysis seeks to identify patterns in the data that are placed in a theoretical framework. In phenomenological epistemology related to the above method, experience is given importance. This method seeks to identify the phenomenon by understanding the real experience of people in everyday life.

Grounded theory also uses a set of methods similar to thematic analysis to encode data; but thematic analysis does not adhere to the principles of grounded theory (which requires analysis to arrive at theory). In opinion of Braun and Clark (2006) in thematic analysis, if case researcher does not want to arrive at a complete theory, she/he does not need to adhere to the principles of grounded theory. While in grounded theory, analysis starts from the data source and continues until theoretical saturation; but in thematic analysis, all data sources are analyzed and the contents of the whole data are analyzed and interpreted.

Discourse analysis also refers to a wide range of pattern-based analyzes that are introduced in constructivism epistemology, based on which the patterns of society are known. Thematic analytical analysis also recognizes patterns in which language is used to understand social structure. These different methods, instead of a specific data, look for specific themes or patterns in the whole data (such as personal interviews or various interviews with a person about case study and biography). Therefore, such methods also overlap to some extent with thematic analysis. Since thematic analysis does not require specific theoretical and technical methods (such as founded theory and discourse analysis), it can be used like an easier analytical method at the beginning of qualitative researches.

Content analysis is one of other methods that can be used to identify qualitative data patterns and is somewhat similar to content analysis. However, content analysis focuses more on the smaller levels and often shows the abundance of data and allows quantitative analysis of qualitative data. One of the problems of content analysis is that either the context of the data is usually ignored or very little attention is paid, which greatly reduces the richness of the data. But in thematic analysis, the unit of analysis is more than a word or phrase, and more attention is paid to the context of the data and their nuances. Also, thematic analysis goes beyond counting obvious words and phrases and focuses on recognizing and explaining explicit and implicit ideas. Then, the main theme codes are used for deeper data analysis. In thematic analysis, the relative abundance of themes can be used to compare them and prepare a matrix of themes and draw a network of themes (Anderson, 1998).

Thematic content analysis is one of the methods of content analysis that is similar to thematic analysis in identifying common themes of data. But the researcher uses it based on objectivist epistemology. In thematic content analysis, unlike thematic analysis, interpretation is used as little as possible and is only used to name and group the themes. In thematic content analysis, the researcher's feelings and thoughts about the themes are not taken into account. For this reason, the researcher avoids any interpretation and explanation of the meanings of the themes, and only explains the themes very briefly in the dis-

cussion of the conclusion. In general, thematic content analysis is more descriptive analysis, while thematic analysis is interpretive analysis (Anderson, 2007).

Therefore, content analysis, unlike the above qualitative methods, does not depend on a pre-existing theoretical framework, and it can be used in different theoretical frameworks and for different affairs. Also, thematic analysis is a method that is used both to express reality and to explain it. Of course, due to the interpretive nature of thematic analysis, more attention should be paid to its validity and reliability; this requires the use of independent coders and makes thematic analysis more accurate and time consuming than other qualitative methods.

Considering the system related to qualitative interviews that is accompanied by deep questions and is conducted in a semi-structured manner, an attempt was made to ask other questions according to the direction in which the interview takes place, which we referred to as sub-questions. According to the coding in 10 interviews conducted with experts of infrastructure projects of Tehran Municipality, 269 initial codes were formed. After the initial classification of the obtained data, the concepts of open coding based on orientations, appropriateness and nature of semantic load were divided into 12 categories.

Risks Evaluation

The data collected are meaningless numbers and figures that can be used to value them in order to achieve research goals. Information analysis as part of the process of scientific research method is one of the main foundations of any study and research whereby all research activities are controlled and guided until a conclusion is reached. In other words, in this research, the researcher uses various methods of analysis to answer the question or to decide whether to reject or confirm the hypothesis or assumptions intended for the research. Therefore, it is important to note that the analysis of the data obtained alone is not sufficient to find the answer to the research questions. First, the data should be analyzed and then the results of this analysis interpreted.

The present study is performed using Fuzzy Vikor analysis method. In this way, we first determine and identify the weight of each method of project cost and time control in EPC contracts using the Fuzzy Vikor method. Then, the cost and time control methods in EPC contracts are ranked using the weight calculated in the previous step. In other words, the weight and position of each option (project control challenge) was determined based on the desired criteria, and finally, with the help of the governing relations in the "Fuzzy Vikor" method, the contribution of each criterion to the importance of the project control challenge was determined.

Reasons for applying the Fuzzy VIKOR method:

- This method introduces a multi-criteria ranking list based on the near-ideal specific size and a set of agreed-upon solutions that are acceptable to the decision-maker, which provides the relative satisfaction of most criteria close to ideal and provides the least amount of discomfort to each criterion of non-ideal choice or proximity to multiple ideals.
- The highest-ranked option in this method is the closest to the ideal. While in the TOPSIS method the highest-ranking option is not always the closest to the ideal.

In order to simulate, we examine the proposed algorithm on a problem, which can be generalized. In this study, 12 components as project control challenges and five evaluation criteria in Tehran Municipality projects were selected and determined. By using quantitative and qualitative indices on the most important challenges of project control with the EPS contract model and their importance and also according to the opinion of experts, the matrix of pairwise comparisons of indices with respect to the target was determined. According to this issue, a researcher-made questionnaire has been used to compare the group decisions based on Fuzzy Vikor method, main indices and options in pairs. A number of questionnaires are prepared and by referring to the statistical population and using the techniques of distributing the questionnaire and conducting interviews, the judgments of the selected individuals about the importance of the indices and their pairwise comparisons are made. In this section, using the obtained data, the pairwise comparison matrixes of the main indicators against the target, the pairwise comparison matrixes of the project control challenges, the final weight of the main indices with respect to the target and the relative weight of the financing

challenges are calculated.

The validity (justifiability) and reliability of the variables measuring tool is an essential step in the measurement. In other words, the measurement of the validity and reliability of the measuring instruments are two important criteria to be sure about them. Validity is intended to be a useful tool for the purpose of measuring the research variable. Reliability also means the ability to trust, consistency, homogeneity, predictability, and accuracy. The validity of the questionnaire was assessed and confirmed by "Discriminant Validity". In order to make the questionnaire reliable, it was measured by calculating the "Incompatibility Rate".

Appropriate Decisions

Considering the importance of each of the challenges, the solutions suggested by library studies (*Practice standard for earned value management*, 2011, pp. 166-174; *A guide to the project management body of knowledge,* 2013, pp. 68-75), consultation, obtaining expert opinions and recommendations are as follows:

- Implementing items of the standard with less financial burden and more short-term effects
- Starting standard implementation from several chosen executors in the organization
- Presenting results of this research to identify the weaknesses of earned value management for projects factors and the benefits of using the time gained
- Starting a pilot of using gained time by the project control unit of the organization and examining and presenting its results
- Documenting project control improvement factors to present to senior managers
- Establishing project knowledge management
- Holding project control standards training courses for personnel
- Hiring consultant to do some standard requirements
- Determining more precisely the scope of the project with more attention to the needs of beneficiaries
- Taking action to improve the structure of work failure and scheduling in projects by following the existing standards in this field
- More accurate planning according to the existing risks and using information of previous projects
- Integrating earned value management with risk management
- Taking into consideration risk mitigation programs in project schedule
- Designing and implementing PMIS in organizations
- Using new methods to improve the workflow based on information technology
- Submitting system deployment performance reports and improvements and successes to managers.

Managerial Reporting for Beneficiaries

The executive suggestions for establishing earned value management system and effective project control in the organization and the recommendations of experts are as follows:

- Implementation of earned value system should be seen as a project itself, so it should be managed with a regular approach, an approach that is consistent with the principles of project management.
- Implementing earned value at the beginning of the project.
- Integrating earned value system documentation with existing organizational processes.
- Using the process of change management in implementation of methods along with the maturity of the system and its continuous improvement.
- Seeking help from a consultant to establish systems.
- Draft of the system design should be prepared by thought groups in order to obtain opinions and recommendations.
- Justification document for the establishment of project control should be prepared and adjusted based on the PMBOK standard in the organization.
- The system should be customized according to the needs of the organization.
- Improvements must be documented, identified and quantified, and the success of the system must be demonstrated to management during deployment.

- Finally, it is the culture of the organization that must accept the use of the system at all levels of management with open arms, so attracting the opinion and cooperation of senior managers is very important and necessary.

Conclusion

The risk management process related to the projects implemented in municipal structures has certain peculiarities (Kolesnichenko, 2019). First of all, these programs are aimed at meeting the needs of the public and are mainly implemented under the supervision of the city authorities. In this case, the philosophical approaches to program risk management change, especially in the "Engineering-Purchasing-Construction" sector, because municipal projects cannot have both financial risks of failure and risks of incomplete final results. The range of beneficiaries of this sector is not only broad (from the government to the population), but also multi-layered (municipal authorities, investors, mid-level and top managers).

There is a problem of identifying the risk loops of the programs implemented in the municipal structures at different levels and taking measures to prevent their formation (Yakimova & Krasilnikov, 2015). In this regard, it is important to show such a philosophical approach to risk management that will enable a participatory approach to risk prevention for all stakeholders (city authorities, project managers, investors, end-result consumers, urban population, etc.). And for this, new philosophical approaches will be implemented not only in the directions of implementation of managerial decisions in municipal programs, but also in the aspects of reviewing reporting formats aimed at beneficiaries. Consequently, there is a need to introduce a new culture of risk management in the municipal program management system, in which case the concerns of all the beneficiaries of the implemented programs are taken into account and thus management decisions aimed at risk prevention become more effective (Arabzad, 2012).

Recommendations for Future Research

In the end, practical recommendations are provided for those who are interested:

- In future research, other methods such as DIMTEL can be used to rank risk factors and challenges. The fuzzy map method can also be used as a model.
- It is also possible to compare the results of this research with another country adaptively in the next research and publish the result as a separate research.
- Examining modern methods of project control system in other organizations.
- Analyzing strengths and weaknesses of the project control system.
- Examining the present research model among other countries that implement project control system with EPC contract model.
- Comparative study of project control methods and strategies with the EPC contract model.
- Examining the subject of the present study in a comparative manner in two other industries or organizations.

Research Limitations

Undoubtedly, conducting any study is associated with a series of limitations that make research work difficult. These limitations are as follows:

1. Shortage of time and cost to conduct this study caused us to not be able to include all the risks and challenges in the conceptual model.
2. If we could have more access to higher number of experts, Finally the validity of the results of this study will be increased.
3. Lack of familiarity of personnel with the pairwise comparison questionnaire and errors in completing the questionnaire.
4. The applicant's impatience in answering the questionnaire and paying no attention and spending enough time.
5. Difficulty in accessing information and documents due to confidential classification.

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