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Hybrid fuzzy linguistic method for Construction project manager selection

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ABSTRACT: Selecting a construction project manager is one of the most important processes in human resource management in the construction industry. Deciding on the issue of hiring a project manager will be a complex and multivariate issue. The purpose of this study is to provide a hybrid model that optimally solves the issue of ranking and selection of a construction project manager by using decision-making techniques. The proposed model is based on fuzzy linguistic decision criteria to solve the construction manager selection based on criteria derived from the Delphi method based on previous studies. In this research, two methods of group decision making in ranking and selecting the construction project manager are presented. The Delphi method extracts the criteria, while the fuzzy TOPSIS method selects the optimal candidate. The results show that the use of multi-criteria decision-making methods in the Construction manager selection increases the efficiency of the process and because it considers various criteria, in the end, efficient managers in accordance with the needs of the project-based organization is a candidate in the recruitment process. One of the features of the proposed approach is to minimize the involvement of subjective judgments in the selection of the construction project manager. This approach can also help decision-makers of project-based organizations in identifying and determining the basic criteria before selecting a construction project manager and facilitate the decision to select the best construction project manager based on multiple criteria and options.

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1- Introduction

One of the important and strategic factors in the success and effectiveness of any project-oriented organization is the selection of suitable people to hold positions [1]. Given that the focus of this research is on the project-oriented organization, and one of the people who plays an important role in the success or failure of the project team in each project is the project manager, so help to select the best project manager based on the necessary criteria considered as the research goal. Despite the importance of selecting the best project manager of a project-oriented organization in the construction industry, most project-oriented managers face difficulties in selecting the best project manager and are confused when faced with multiple options. Selection of the best project manager is one of the multi-criteria decision-making problems and to solve such problems, a multi-step approach should be used to make decisions with multiple criteria and multiple options [2].

Due to the need of our country to have a specialized project manager and in order to identify the necessary criteria as a basis for future planning regarding the selection of a project manager in this study, the criteria for selecting a project manager are extracted using the opinions of PBO experts. In this regard, and in terms of the basic role that the project manager has in the project-oriented organization, it is necessary to select the project manager in a suitable way from among the existing personnel. There are some shortcomings in the literature that will be addressed by this research.

2- Methodology

This research presents a decision model based on the combination of the Delphi method [3] and fuzzy TOPSIS [4] for selecting a project manager with a fuzzy approach and then we use this model in selecting a project manager who can validate the proposed model. To prove. In summary, the research method includes the following steps:

1. Determining the candidates and evaluation criteria
2. Forming a decision committee
3. Calculation of weight vectors of criteria for each of Delphi and fuzzy TOPSIS methods
4. Calculating the ranking criteria of both Delphi and fuzzy TOPSIS methods
5. Ranking of candidates based on the mentioned criteria
6. Comparing the ranks of the candidates

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According to the purpose of the research and the research literature, it seemed that the main way to achieve the correct and practical result is to use the opinions of a panel of experts and specialists in this field. The multi-criteria decision method is used in two parts. Since the Delphi method can be a good answer to the initial questions of the research by collecting and analyzing the opinions of experts, it was considered and selected by the researcher. The Delphi method is widely used in policy-making and goal setting and is therefore used in many such studies. On the other hand, in the first part, this research designs a model for extracting criteria for selecting a project manager and presents a new plan for selecting human resources. In addition, in this research, the fuzzy TOPSIS method has been used to rank candidates for construction manager position. In the classical TOPSIS method, precise and definite values are used to determine the weight of the criteria and to rank the options. In many cases, human thinking is associated with uncertainty, and this uncertainty is influential in decision-making. In such cases, it is better to use fuzzy decision methods, of which fuzzy TOPSIS is one. In this case, the elements of the decision matrix are evaluated by linguistic variables represented by fuzzy numbers.

3- Results and Discussion

In the first Delphi round, 28 basic criteria taken from the literature were sent by the researcher with an explanation to select the criteria for the experts. These criteria helped the panel of experts to prepare a list of criteria they wanted. In the answers provided in the first stage, 67 different criteria were presented by experts, which were summarized by the analyst in 24 criteria.

In the second Delphi round, the criteria of stage one were sent to the experts after summarizing and the experts were asked to view the answers of stage one and to rate each criterion separately and to announce if they think something new. The purpose of this action is to reach the desired systematic consensus of the Delphi method among experts. In addition, experts should comment independently and not face other experts. Expert panelists used the Five Likert-type scale to score.

In the third Delphi round, the analyzed results of the second stage were reflected to the experts. The experts reviewed and corrected their previous opinions without face to face and separately and without presenting the source of the corrective comments.

The results of the consensus of experts in the third stage of Delphi can be seen in Table 1:

As mentioned, in the first phase of Delphi-based research, the opinions of relevant experts were used. In the second stage, based on the decision model, it will be necessary to cite the opinion and evaluation of decision-makers. In this study, the deputies of the project-oriented organization help to sort the candidates by evaluating them. The method of similarity to the fuzzy ideal option or fuzzy TOPSIS is used to rank project management candidates in the opinion of deputies. After completing the steps of the TOPSIS method, the similarity index for all candidates is given in Table 2.

Table 1. The result of Delphi round three

Criteria	S.	Consensus (%)	SD
Public relations	15	100%	0.41
Decision-making	15	100%	0.26
Staff cooperation	15	100%	0.49
Communication	15	100%	0.46
Work discipline	15	100%	0.63
HRM	15	100%	0.52
Fairness	15	100%	0.72
Ethical principles	15	100%	0.35
Character	15	100%	0.64
Participation	15	100%	0.49
Team Working	15	100%	0.62
Work experience	15	100%	0.49
Education	15	100%	0.46
Problems solving	15	100%	0.41
Follow PBO goals	15	100%	0.41
PM knowledge	14	93.3%	0.56
IT knowledge	13	86.7%	0.68
Working skills	13	86.7%	0.46
Project Finance	13	86.7%	0.46
Stress Manag.	13	86.7%	0.59
P. Financial M.	12	80%	0.94
Personnel Manag.	11	73.3%	0.70
Organizing	10	67.7%	0.35
Administrative M.	8	53.3%	0.74

Table 2. Similarity index for candidates

Candidate	Similarity Index (CC)
1	0.6453
2	0.5638
3	0.4862
4	0.5336
5	0.4985

The alternative with the largest similarity index value is selected as the best alternative. Therefore, the first candidate is the best alternative. The third candidate also has the lowest score.

4- Conclusions

The purpose of this research was to propose a method based on the systematic consensus of experts in identifying the necessary criteria for selecting a construction project manager. Moreover, the development of a group decision model based on fuzzy linguistic logic to evaluate candidates in selecting a project manager. In this study, to use the advantages and avoid the disadvantages of both group decision-making methods, include the Delphi method and fuzzy TOPSIS, both methods are selected together in a combined method. The innovation of the present study was the use of a systematic method for extracting decision criteria, which is less found in similar studies. Also, the combination of fuzzy decision-making and Delphi group decision-making will reduce the decision error. The results show that the use of multi-criteria decision-making methods in the problem of hiring a project manager increases the efficiency of the process. In this study, identified the necessary criteria and prioritized the candidates for the position of project manager using Delphi and fuzzy TOPSIS methods. However, the exact type and extent of its impact on the success of the project-oriented organization was not examined; Therefore, it is suggested that a future study be conducted to examine the type and extent of the impact of each of the types of personnel selection decision-making methods on the productivity of the project-based organization. In addition, since this research has been done using the fuzzy TOPSIS method, it is suggested to use other common methods such as FANP, FAHP, ELECTRE and SAW, etc.

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