

Evaluation of contractors of health – Medical projects by AHP method in Iran's southeast region

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ABSTRACT

Performance of construction activities in the development process of countries is an indicator of sustainable development. Given that the vast majority of projects will be assigned to the operation, implementation of any project requires suitable contractor; Of course, contracting the abilities necessary to carry out the project in terms of time and resources is anticipated and desired quality. The current method of selecting a contractor for construction projects based on the lowest bid, but the qualitative and quantitative indicators and with different degrees of importance of the fittest is a contractor. So this study was aimed to investigate evaluation of contractors of health -medical projects by AHP method in Iran's Southeast region and to determine the relationship between criteria and indicators and quantitative analysis to evaluate and select the proper rating schematic end model optimized to be presented in such projects. Therefore, after reviewing the literature and interviews with experts and managers to identify criteria, criteria that are within competence of contractors are often effective projects were extracted. The criteria were categorized in seven groups. The results of economic and financial criteria first place in the qualification and selection criteria for the contractor. Among the sub-indices as well as cost analysis, financial strength, bid qualification, respectively ranked first and fourth, respectively.

KEY WORDS: CONTRACTOR SELECTION, AHP, HEALTH PROJECTS, THE SOUTH EAST REGION

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INTRODUCTION

Construction activities and construction are considered basic indices of development countries and large part of investments in the public and private sectors will be spent on construction and infrastructure. Therefore, careful planning and efficient is felt to avoid waste of resources due to financial constraints in addition to increased efficiency in use of available resources, investment will also be optimized and in meantime, implementation of projects under planning can be critical to the success of projects. General criteria for success of development projects in the implementation process are based on three main elements. These three elements are: timely implementation (time), implementation according to budget approval (cost) and implementation in accordance with the requirements (quality), that these three are the most common factors in assessing the success of development projects (Alzahrani & Emsley, 2013).

Since the vast majority of projects will be spent on operating costs; so implementation of each project needs to the contractor with capabilities to suit the project to prevent the rise of operating costs and the project would be accomplish in terms of anticipated time and resources. In other words, the ultimate success of the project has also raised the role of contractors (Wu, 2016).

On the other hand, several studies have been done on the subject indicates that multivariate process should be used in the selection of contractors (Marzouk, 2013).

This process makes the cost element devoted to the neglect of important factors, characteristics and competence contractors and risk of project failure rises (Sandquist, 2012).

In fact, as an integral part of contractors and project implementation process are very important. In fact, a bountiful supply of services and equipment needed for the project (Zare et al., 2010).

Many companies and institutions use contractors to transfer their projects and the contractor have a lot of options to choose from them. So processes and tools should be used for selection according to standards to choose the best option. In conducted investigation, many causes of failures of projects directly and indirectly are concerned to the host contract. This issue shows necessity of carefully evaluation of contractors (Saaty, 2000).

Nowadays an efficient way and based on principles of modern management is not used for contractor's selection and in the choice of contractor according to the methods and techniques is not the right decision. While many researchers and experts defined management and decision-making equivalent that have same meaning and management is considered decisions and believe

that decisions form the main focus of management and perform tasks such as planning, organization or control, in fact, nothing but the decision about how and how not perform these activities (Saadati, 2002).

Hence majority of project construction problems have some problems such as increased cost, run-time prolongation or decrease in quality due to the lack of appropriate and qualified contractor selected for the project. Some contractors to win tenders are resorting to every trick. Including discounts too high and unreasonable to suggest that the employer assessment usually due to the weakness of existing laws and regulations to determine the winner of the tender and selection of the contractor, the tender winner and multiple problems in the process of implementing the project. On the other hand, numbers of contractors believe that the method of selecting the contractor in many cases does not lead to the actual selection of the fittest contractor.

This leads to reduce motivation of many qualified and competent contractors who among them is also significant number of contractors to participate in tenders for construction projects. Based on foregoing and considering the fact that management evaluate and select the contractor for transfer of development projects, an essential part of construction process, it is also necessary to carry out applied research to solve various problems of development projects, including problems in project management, dimensions and factors affecting contractor selection and use of scientific methods of decision-making in the field of contractor selection of the fittest, and ultimately avoid wasting national resources country of particular importance.

Evaluation of contractors for the projects, both in terms of time and cost of the project and the resulting quality of the project, it is important decisions (Javani, 2002). Due to number of indices and that many of criteria are qualitative selection of tools and appropriate indicators to assess necessity contractors (Asgharizadeh, 2010).

The method is based on the lowest bid is selected as the contractor for construction projects, it is clear that qualitative and quantitative indicators with different degrees of importance in determining the eligibility of a proposed contract and should be considered in decision-making. So far, several methods and models for evaluating, ranking and selection of contractors in construction projects are presented. One of the most common and widely used methods is AHP method. Analytic Hierarchy Process or AHP, which was developed in 1980 by the hour how to determine the relative importance of a multi-criteria decision, shows activity in the issues. This method is based on three principles: structure of the model - comparing of criteria and alternatives - synthesis of priorities.

By using PROMETHEE method in evaluating and ranking projects contractors six main criteria: good reputation, power supplies, power management and skilled manpower, economic and financial capabilities, experience and technical capabilities (Asgharizadeh, 2010; Nasrollahi, 2012).

Sahraei et al. (2013) used PROMETHEE method for ranking contractors in fuzzy environment and showed a strong theoretical basis of this method, accuracy and ease of contractors is required in assessing and ranking. (Manesh et al (2014). Assessment of the relationship between technical ability and quality contractors carrying out research projects using fuzzy neural models examined. In this study, by using fuzzy neural model, the relationship between the qualities of the project management contractor technical evaluation factors can be analyzed and evaluated. According to local linear neuro-fuzzy approach not only on average, but in each of the iterations are able to more accurately estimate the linear regression. Another result was that the collected data indicated a significant association between the quality of project implementation and three groups of four groups of indicators used indicator to assess the technical ability contractors.

Rohbakhsh and colleagues (2015) in ranking of supplier selection criteria by Quality Function Development Approach and AHP Fuzzy seven criteria and eighteen sub criteria to collect, evaluate and rank. Najafi et al (2016) have identified and ranked by Analytic Hierarchy Process (AHP) multi-attribute, implementation appropriate system for freeway projects.

Researches showed that criteria for selecting contractors have varied and sometimes contradictory due to a variety of qualitative and quantitative criteria decision requires much more complex is the right choice. In fact, the selection process, a multi-criteria problem which includes both qualitative and quantitative criteria. Since there are numerous methods and criteria so conducted the research to determine the appropriate methods and models in the evaluation and selection of contractors' optimal health projects in the field of research priorities is the Civil Administration.

As research's literature and according to studies on concerning this issue shows that there is no exact study about contractor selection criteria for projects in the field of health-medical projects. However there is few studies in the field of road projects and Municipality which can be achieved partly guidance in this ways. So this study was aimed to investigate evaluation of contractors of health -medical projects by AHP method in Iran's Southeast region and to determine the relationship between criteria and indicators and quantitative analysis to evaluate and select the proper rating schematic end model optimized to be presented in such projects.

METHODS

This research is an applied research in term of purpose and survey in terms of descriptive data and analysis methods.

Since responses to questions on questionnaire is important in relation with effective competence of contractors and the importance of each of them so their choice is important, because the lack of experts and technicians would reduce efficiency. The study population included all experts and authorities tender and assignment of development health - medical projects in Sistan and Baluchestan that number is 10 people and all of them have been selected as the sample using census method.

The AHP questionnaire was used for data collection. Questionnaire to determine the weight (importance) the main criteria the selection of contractors health - medical projects with AHP method in the South East of the country on the basis of paired comparisons between criteria based on fuzzy AHP method was used. The questionnaire consists of six main criteria that were mutually compared and ranked.

To ensure the validity, qualitative methods were used namely different experts' ideas and modifications to them after the discussion on the questionnaire has been applied. Since each question is based on research literature, it can be said that the questionnaire has validity. Cronbach's alpha coefficient was used to assess reliability. Cronbach's alpha coefficient for the questionnaire 39 items (0.85) was obtained that show high validity.

As explained earlier AHP method is used in the present study to analyze the data. In this case, in order to increase the accuracy and speed calculation software, Expert choice for weighting and ranking factors were used.

AHP is one of the most popular multi-criteria decision making techniques by Thomas L. Saaty was invented in the 1970s. This action decisions when faced with few options and decision criteria can be useful. Indicators can be quantitative or qualitative. The method relies on paired comparisons lies. The process of ranking and prioritizing options in AHP method includes the steps are as follows; *Criteria, Sub-criteria, Making hierarchy*

At this point the problem is defined. The aim of the decision is drawn in form of hierarchy of factors and components of decision-. Analytic Hierarchy Process needs to break the decision by several indicators to a hierarchy of levels. For this purpose, a decision tree that used to consist of four levels:

The first level includes general purpose of decision-making.

On the second level are the general criteria that take decisions based on them. They include: 1. technical,

Score	Definition	Explanation
1	Equal importance	In achieving this objective, two indexes are of equal importance.
3	Slightly more important	Experience shows that to achieve this goal, the importance i has little more than j.
5	more important	Experience shows that to achieve this goal, the importance of i has greater than j.
7	Much more important	Experience shows that to achieve this goal, the importance i has much more than j.
9	The absolute importance	Much more important i to j conclusively proven.
2, 4, 6 and 8		Intermediate preferences when there are intermediate.

2.experimental, 3. The economic and financial, 4. The management and staff, 5. Machinery, 6. good reputation and 7. The past performance.

In the third level sub-criteria placed

And in the last level of decision options here are contractors and health projects, are discussed.

Figure 1 shows the hierarchical structure prioritizes contractor is selected criteria.

PAIRED COMPARISON

At this stage of Experts comparisons between criteria and sub-criteria decision-making and points those towards each other set. This comparison is done based on the quantity table (Table 3).

A preferred option compared to operating his or equal to one, therefore, reverse the principle of an agent to others and preference for agent or option than his two main properties of Pair wise comparison matrix in standard or option, the AHP process. These two charac-

teristics make to compare the n decision-maker only to $\frac{n(n-1)}{2}$ answer the questions

In this section, contractor selection criteria and sub-criteria according to literature and theoretical frameworks in the field of paper were identified by experts and then final contractor selection criteria were selected by using experts' opinion.

RESULTS

MEASURES OF CONTRACTOR SELECTION CRITERIA

To determine measures, internal and external papers in this area were reviewed and after consultation with experts, the criteria and sub-criteria were selected for choosing of contractor. To prioritize the main criteria affecting the qualification and selection of contractors after each weight calculated paired comparisons of criteria and have been assessed based on the final weight.

The main criteria affecting the pairwise comparison chart above shows the qualification and selection of contractors. It can be seen that the biggest difference is the economic criterion compared with experimental measure and the least difference empirical criterion compared with standard management.

The above graph shows the relative importance of the main criteria affecting the qualification and selection of the contractor in experts' opinion. It can be seen that economic and financial criteria has the greatest weight to the final weight (0.218), so the first rank in the criteria for eligibility and selection of the contractor is economic and financial criteria. After it, good reputation with the ultimate weight standard (0.176) is ranked second. Criteria and standards for management and staff with final weight (0.142) are ranked in third and fourth. Then past performance with final weight (0.117) is ranked in the fifth and technical criterion with final weight (0.115) is ranked in sixth place. The final ranking is empirically with final weight (0.092). Comparison of rates paired incompatibility was 0.012 that indicates acceptable accuracy of these criteria is this comparison test.

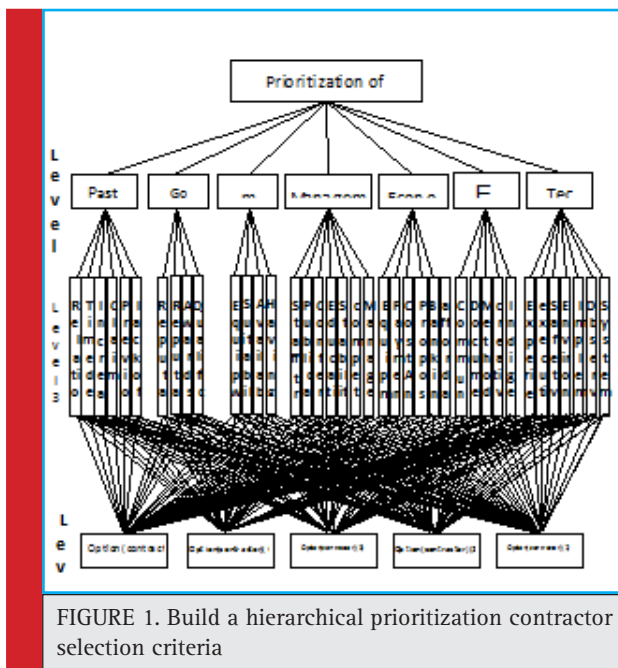


FIGURE 1. Build a hierarchical prioritization contractor selection criteria

Table 2. Relative preferences matrix of main criteria

Compare the relative preferences among the Cost Contractor							
	Fani	Tajrobi	Eghraadi	Modirat	Mashin	Sabagh	Ghabli
Fani	1.000						
Tajrobi		1.000					
Eghraadi			1.000				
Modirat				1.000			
Mashin					1.000		
Sabagh						1.000	
Ghabli							1.000

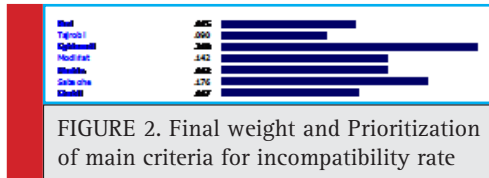


FIGURE 2. Final weight and Prioritization of main criteria for incompatibility rate

Calculation of relative weights of sub-indices of the target

Weighting and determine the importance of the project contractor selection criteria and indicators, should be

based on methods that are based on scientific principles as well as the stated factors of subjective judgment functionality to best meet the decision makers in small amounts. The calculated weights for contractor selection criteria in this study have been calculated by using fuzzy AHP therefore are acceptable accuracy and precision.

After sub-indices are calculated paired comparisons of final weight and final weight, based on these indicators have been assessed. To prioritize all factors affecting qualification and selection of contractors, first of all sub-indices were paired comparison then final weight of the sub-indices obtained in relation to the target.

Table 3. Final weight and Prioritization of sub-indices of target

Index	Final weight	Priority	Index	Final weight	Priority
Cost Analysis	0.066	1	ability to use machinery	0.023	21
Affordability	0.063	2	Observance of the standards	0.021	22
Proposed price	0.062	3	Equipment and personnel insurance	0.021	23
Qualification	0.053	4	Increased costs	0.019	24
Management system	0.043	5	Staff training	0.018	25
Having Machines	0.043	6	Reputation	0.018	26
Good reputation	0.039	7	Safety & Protection	0.017	27
lack of previous success	0.036	8	Equipping the ingot workshop	0.017	28
Implementation of previous projects	0.035	9	Awards and honors	0.017	29
Education and experience staff	0.034	10	Communication and coordination with the employer	0.016	30
Time delays	0.031	11	Board Stability	0.013	31
Comprehensive system	0.27	12	Indigenous	0.011	32
Experience in implementing similar projects	0.027	13	Claim of damages	0.011	33
relationship with previous employer	0.026	14	Methods and executive agencies	0.010	34
Record executive	0.025	15	creativity and innovation	0.009	35
Banking and financial records	0.025	16	Environmental laws and social security	0.007	36
Competent managers	0.025	17	Documentation	0.006	37
Previous safety performance	0.025	18	presented papers in conferences and journals	0.005	38
proportion machines	0.024	19	Publications and scientific research	0.005	39
Payment of wages	0.023	20			

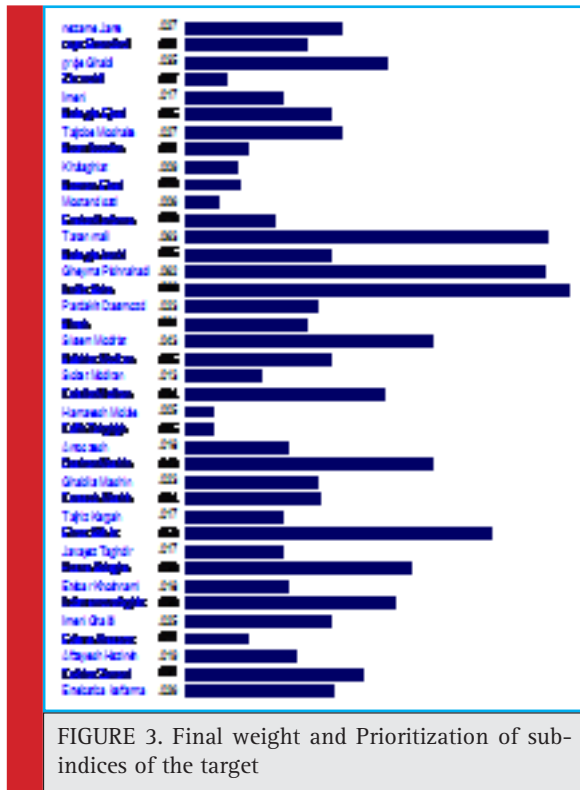


FIGURE 3. Final weight and Prioritization of sub-indices of the target

The above table shows final weight and priorities of sub-indices affecting on qualification and selection of contractors. It can be observed that Cost Analysis has the most weight-final (0.066), so this index has the first rank in the sub-indices. After that, final weight of index affordability (0.063) is ranked in the second place and final weight of proposed price index (0.062) is ranked the third. Indices of Qualification with final weight (0.053), management system with final weight (0.043), Having Machines with final weight 0.043, Good Reputation with the final weight (0.039), Lack of Previous Success with the final weight (0.036), Implementation of Previous Projects with total weight (0.035), education and experience staff with final weight (0.034) are ranked as third to tenth. As well as indicators of Time delays with final weight (0.031), Comprehensive system with final weight (0.027), experience of similar projects with a total weight (0.027), relationship with previous employer with final weight (0.026), Record executive with a final weight (0.025), Banking and financial records with a final weight (0.025), competent managers with a final weight (0.025), Previous safety performance with final weight (0.025), the proportion of machinery with final weight (0.024) and Payment of wages with final weight (0.023) are ranked in eleventh to twentieth.

As well as Stability Board with final weight (0.013), Indigenous with final weight (0.011), Claim of damages with final weight (0.011), Methods and executive agen-

cies with final weight (0.010), creativity and innovation with the final weight (0.009), Environmental laws and social security with final weight (0.007), Documentation with final weight (0.006) and presented papers in conferences and journals with the final weight (0.005) are ranked thirty-first to thirty-eighth and at the end publications and scientific research with the final weight (0.005) is ranked in the last place.

Technical criteria

To prioritize contractors based on technical criteria, after paired comparisons, the final weight calculated contractors were ranked based on the total weight.

Contractors	Final Weight	Priority
Contractor 1	0.415	1
Contractor 2	0.222	2
Contractor 3	0.112	4
Contractor 4	0.104	5
Contractor 5	0.147	3

Above table shows contractors based on the final weight and priority technical benchmark indices.

It is observed that contractor 1 has the most weight of with final weight (0.415) and based on the technical standard indicators contractor 1 is the first rank. After that, contractor 2 with final weight (0.222) is ranked the second. Contractor 5 with final weight (0.147) and contractor 3 with final weight (0.112) are ranked in third and fourth. Contactor 4 with final weight (0.104) is in last place.

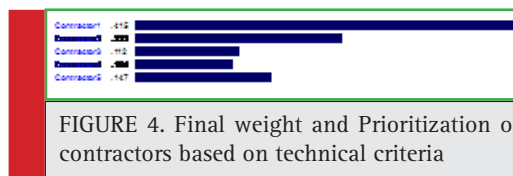


FIGURE 4. Final weight and Prioritization of contractors based on technical criteria

Experimental Standard

To prioritize contractors based on empirical benchmark indices, after paired comparisons, the final weight calculated contractors were ranked based on the total weight.

Above table shows final weight and contractors' priority based on empirical criteria. It is observed that contractor 1 has the most weight final weight (0.360) therefore based on empirical criterion contractor 1 is ranked as the first. After that contractor 5 with final weight (0.188) is ranked second. Contactor 2 with final weight (0.181) and contractor 4 with final weight (0.155) are ranked in the third and fourth. Contactor 3 with final weight (0.116) is in last place.

Table 5. final weight and Prioritization of contractors based on empirical criteria

Contractors	Final weight	Priority
Contractor 1	0.360	1
Contractor 2	0.181	3
Contractor 3	0.116	5
Contractor 4	0.155	4
Contractor 5	0.188	2



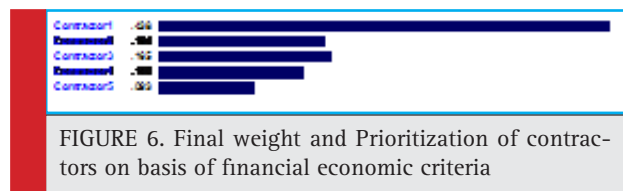
STANDARD INDEX OF FINANCIAL ECONOMICS

Contractors on basis of economic criteria for prioritizing financial indices, after paired comparisons, the final weight calculated contractors were ranked based on the total weight.

Table 6. final weight and Prioritization of contractors on the basis of financial economic criteria

Contractors	Final weight	Priority
Contractor 1	0.138	4
Contractor 2	0.164	2
Contractor 3	0.165	1
Contractor 4	0.140	3
Contractor 5	0.093	5

Above table shows final weight and contractors' priority based on financial economic criteria. It is observed that Contractor 3 has the most weight with final weight (0.165). Therefore, on the basis of financial economic criteria contractor 3 is ranked as the first. After that contractor 2 with final weight (0.164) is ranked the second. Contractor 4 with final weight (0.140) and contractor 1 with final weight (0.138) are ranked in third and fourth. Contractor 5 with final weight (0.093) is in last place.



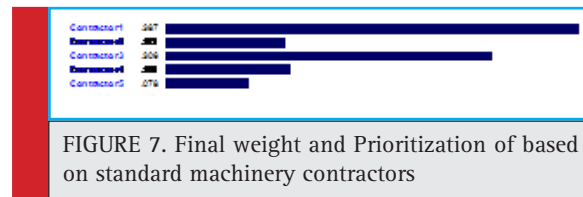
MACHINERY STANDARD INDEX

To prioritize criteria based on indicators of machinery contractors, so do paired comparisons, the final weight calculated contractors were ranked based on the total weight.

Table 7. final weight and Prioritization of the contractors based on standard machines

Contractors	Final weight	Priority
Contractor 1	0.387	1
Contractor 2	0.112	4
Contractor 3	0.306	2
Contractor 4	0.116	3
Contractor 5	0.078	5

Above table shows final weight and contractors' priority based on machinery standard criteria. It is observed that contractor 1 has the most weight with final weight (0.387) therefore based on machinery standard are ranked as the first. Then contractor 3 with final weight (0.306) is ranked second. Contractor 4 with final weight (0.116) and contractor 2 with final weight (0.112) are ranked in third and fourth. contractor 5 with final weight (0.078) is ranked in the last place.



MANAGEMENT AND STAFF BENCHMARK INDICES

Contractors according to standard criteria for prioritizing management and staff, after paired comparisons, the final weight calculated contractors were ranked based on the total weight.

Table 8. final weight and contractors on basis of criteria Prioritization of management and staff

Contractors	Final weight	Priority
Contractor 1	0.385	1
Contractor 2	0.205	2
Contractor 3	0.187	3
Contractor 4	0.088	5
Contractor 5	0.134	4

Above table shows final weight and contractors' priority based on management and staff criteria. It can be seen that contractor 1 has the most weight with final

weight (0.385) therefore based on criterion of management and staff is ranked as the first. Then contractor 2 with final weight (0.205,216) is ranked the second. Contactor 3 with final weight (0.187) and contractor 5 with final weight (0.134) are ranked in third and fourth respectively. Contactor 4 with final weight (0.088) is in the last place.

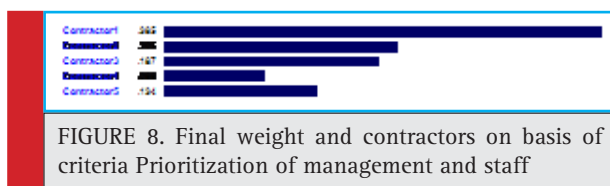


FIGURE 8. Final weight and contractors on basis of criteria Prioritization of management and staff

GOOD REPUTATION BENCHMARK INDICES

For prioritizing of Contractors according to standard criteria good reputation, after paired comparisons, the final weight calculated contractors were ranked based on the total weight.

Contractors	Final weight	Priority
Contractor 1	0.359	1
Contractor 2	0.261	2
Contractor 3	0.088	4
Contractor 4	0.230	3
Contractor 5	0.062	5

Above table shows finalweight and contractors' priority based on good reputation criteria. It can be seen that contractor 1 has the most weight with final weight (0.359) therefore based on criteria of good reputation is the first rank. After that contractor 2 with final weight of 2 (0.261) is ranked the second. Contactor 4 with final weight (0.230) and contractor3 with final weight (0.088) are ranked in third and fourth respectively. Contractor 5 with final weight (0.062) is in last place.

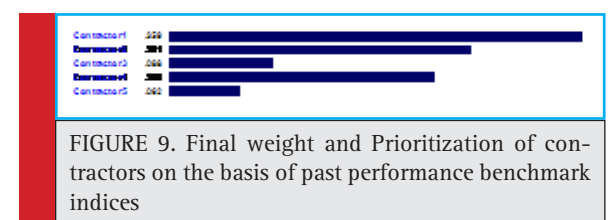


FIGURE 9. Final weight and Prioritization of contractors on the basis of past performance benchmark indices

Based on past performance benchmark indices to prioritize contractors, after paired comparisons, the final weight calculated contractors were ranked based on the total weight.

Contractors	Final weight	Priority
Contractor 1	0.465	1
Contractor 2	0.228	2
Contractor 3	0.149	3
Contractor 4	0.095	4
Contractor 5	0.072	5

Above table shows final weight and contractors' priority based on past performance criteria. It can be seen that contractor 1 has the most weight with final weight (0.465) therefore, contractor 1 ranked is the first based on past performance benchmark. After that contractor 2 with final weight (0.228) is ranked second. Contactor 3 with final weight (0.149) and contractor 4 with final weight (0.095) are ranked in third and fourth. Contractor 5 with final weight (0.072) is in last place.

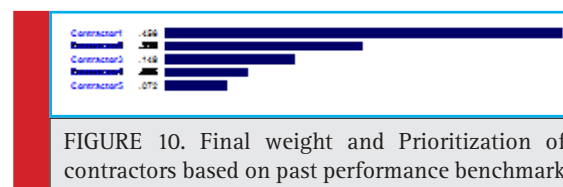


FIGURE 10. Final weight and Prioritization of contractors based on past performance benchmark

FINAL WEIGHT AND PRIORITIZATION OF CONTRACTORS

In this space to finalize the priorities of paired comparisons contractors after final weight calculated contractors were ranked based on the total weight. Final ranking is as follows. (Coding companies have been random).

Contractors	Final weight	Priority
Contractor 1	0.339	1
Contractor 2	0.198	2
Contractor 3	0.159	3
Contractor 4	0.140	4
Contractor 5	0.104	5

Above table shows final weight and contractors' priority. It can be seen that contractor 1 has the most weight with final weight (0.339), so the first rank is contractor 1. After that contractor 2 with final weight (0.198) is ranked the second. Contactor 3 with final weight (0.159) and contractor 4 with final weight (0.140) are ranked in third and fourth. Contractor 5 with final weight (0.104) is in the last place.

Investigation about evaluation of contractors of health -medical projects by AHP method in Iran's Southeast region and to determine the relationship between crite-

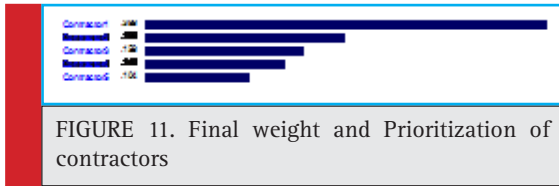


FIGURE 11. Final weight and Prioritization of contractors

ria and indicators and quantitative analysis to evaluate and select proper rating schematic end model optimized to be presented in such projects did not show accurate and reliable results are not achieved so in evaluation of suggestions, the final selection will be based solely on the lowest bid, in fact, many crucial differences between options are ignored decision and the differences between competencies and capabilities of the contractors participating in the tender would not affect the ranking and final selection. In other words, the selection was based on a comprehensive assessment of the options will not be decided. In the proposed model in this study, all the issues and problems of the intended bid is considered as one of the measures decided on the model, therefore, prioritization and final selection decision will be based on a comprehensive evaluation options based on the best choice, not necessarily the lowest price offered is not a contractor. The results of such prioritization and selection of long-term profitability and competitive ability for organization will follow.

According to extensive conducted studies, in this research in order to identify criteria and indicators chosen contractor as well as the use of scientifically based decision-making model, it is recommended for future tenders in health-medical projects in Iran's Southeast region; selected contractor will be utilizing the model proposed in this study. Applying this pattern results from the failure of such contracts as well as improving quality problems will be reduced and ultimately lead to lower costs.

Since the identification of fundamental studies and applied research criteria and no extreme measures cannot be made known; expanding the scope of the identified criteria adds richness to select the better. When evaluating and selecting contractors, should always consider the fact that real-world decisions are made based on criteria related to one another, therefore, the use of statistical technique to determine the dependence of measures to achieve more accurate results and more realistic is required.

In this study, the fuzzy AHP technique was used for ranking contractors. It is suggested that similar research methods and decision-making models such as data envelopment analysis (DEA), VIKOR, LINMAP, etc. are used for this work. These techniques there can be logical or used in a fuzzy environment.

Modeling, selection criteria, process logic, calculation of individual utility functions criteria to determine

weights, processes and procedures and decision-making models students in field of knowledge management and computer programming and visual design and create favorable environment in software is specialized field of engineering students.

The major limitation of this study is large number of the large number of references that should be taken to obtain expert opinion. Another limitation is limited basic criteria in the selection of the contractor in the research literature.

The third limitation of this study is that after identifying the criteria of fuzzy hierarchical analysis presented in this study is not just about the selection of contractors is true and probably many more results to be achieved in the population.

At the end of this research we hope to be able to scientifically explain some of the problems of development projects and presents the appropriate solution further testing is also helpful.

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Mohammadi and Ragh Abadi

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