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Contractors ranking in construction projects based on a fuzzy decision-making method: A case study in the National Iranian Oil Company

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Abstract

Prepared platforms and infrastructures are required for all companies' improvement to carry out their assigned missions. In this regard, construction contractors play their role as one of the main managers' levers and are responsible for building the infrastructures. Quantity and quality of contractors' services can have a quite direct impact on corporate strategies and their life trend, and outbreak as an advantage in competitive markets. Having a contractor that is the closest match with the project is intended to be among the principal tasks of the managers in project performance department. The contractor must have talents which effectively meet project requirements. A decision support system is obtained by prioritizing the determining and influential criteria in decision making, contractor selection, performing and defining the documents. Therefore, considering most of these numerous quality based indicators, Fuzzy multi-criteria decision-making methods can be used for contractor pre-qualification and selection to meet this objective. Accordingly, in this paper, a method based on FUZZY TOPSIS approach is presented to evaluate and rank the development of the National Iranian Oil Company Contractors.

Keywords: FUZZY TOPSIS, FUZZY AHP, Fuzzy multi-criteria decision making

Introduction

It is obvious that each community or association requires management, policy, organizing, and rational and realistic planning. The absence of any of these things creates a lot of problems which solution is so difficult and sometimes impossible. That's why, only suitable organizing and planning is capable of presenting the perfect combination of acceptable and appropriate manpower and material resources to meet needs and solve problems. One of the most important tasks that can be done effectively in planning and decision-making to successfully implement projects is the suitable contractor selection for the projects. In fact, contractors are proposed as a very important and an integral part of the projects process. They are actually the major supplier of needed services are for projects.

Thereare a number of contractors which potentially have the necessary qualifications and abilities in the field of various projects, but here's a question that must be answered and it is: which contractor should be selected. Civil projects are done by contractors in most countries. Failure to select the right contractor can lead to a decline in project performance quality and even in some cases is followed by pending and unfinished projects. Traditional contractor selection (minimum bid) makes contractors to be encouraged to undertake the project with the lowest price and the lowest price of any performance can lead to quality loss. Given that civil projects usually have very large budgets, inappropriate contractors selection for these plans can impose large losses on the organization.

The necessity for a detailed and applicable plan to be cost-efficient and prevent performance cost wasting highlights the need to have contractors with the abilities proportional to projects. The main factors in the contractor selection process are identifying the contractor selection criteria and a choosing reasonable evaluation method, so that the selected contractor's ability to obtain and estimate the cost, time, and quality is ensured and guaranteed. Thousand million dol-

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lars of the national capital is being spent in the public and private sectors, directly or indirectly, on construction and infrastructure annually. However, mismanagement of national projects is a massive waste of the national capital. Most of the investment is allocated to the performance phase in a civil project and so any mistake in this phase is associated with the investment loss to a great deal. Thus, perhaps one of the most important issues in the implementation of civil projects is choosing the best contractor with the highest performance quality and safety while running the project or after it is implemented and finalized. Therefore, identifying and evaluating a range of selection criteria for contractor bidding process to eliminate incompetent contractors will be a safe margin for managers.

Theoretical and research background

Anagnus Topolus and Vavatsykus (2006) in their study and research present a hierarchical model to assess the capabilities of civil contractors on these four main criteria: financial performance, technical performance, safety and health policies, and their past performance and also the importance of each of these standards have been defined by the mentioned relevant criteria.

Zavadskas *et al* (2010) using gray TOPSIS and gray Sao method presented a model to select construction contractors considering six criteria: managers experience, construction projects performance level and amount, turnover, number of managers, market share and construction methods. They began to evaluate five construction companies by these criteria and then –according to the results of this research- announced that the research methods have a high performance quality in construction contractors' qualification process.

Zala and Bhatt (2011) studied 19 research methods and models on contractor selection and presented an analytic hierarchy model. In this model, 63 sub- criteria have been presented and 10 of which are the main criteria to evaluate the eligibility of three companies.

Mahdi *et al* (2002) presented a multi-criteria decision-making method based on analytic hierarchy process, to introduce a model to support the decision process for contractors selection.

Perera and Sutrisna (2010) used AHP to analyze the causes of delays in construction projects in the United Arabic Emirates. Accordingly, we have found out that this exquisite technique (AHP) is a useful tool in the decision making process and can be a good way to decide and to be used as a suitable method on the Multi Criteria issues.

In this paper, a fuzzy logic based risk management process is used to identify and assess the risks of choosing the wrong contractor to contractor selection algorithm for solving problems in high-risk environments.

Khodadadi and Kumar (2013) in their article named "Selecting contractors with risk assessment using fuzzy AHP" decided to act and choose the best top contractor unlike conventional methods that are based on the lowest setting value for the proposed project. They have done this research according to the factors in the successful implementation of the project. In this paper, an algorithm has been provided for solving problems of choosing a contractor in high-risk environments for identification and evaluation of the dangers caused by wrong contractor selection according to risk management process and fuzzy logic.

Gohar, Khanzadi, and Jalal (2011) provide a model based on the method of Buckley and Wang using a Fuzzy multi-criteria decision making method and 9 main indicator and 38 sub-criteria for risk evaluation in construction projects to prevent the dangers caused by the risk in environment and failure possibility in civil projects.

Rezakhani (2012) has proposed fuzzy Multi Attribute Decision Making Model for Risk Factors selection in construction projects with a comprehensive risk factors study and modes of decision-making review belonging to Larhung and Pedrik, Buckley, Burendier, *et al*, and Cheng.

Tomosaitien *et al.* (2011) presented a complex multi-criteria model for profitability analysis of construction projects to study Engineering Economics in project implementation and based on this, analyzes and modifies the software and hardware environment and economy in construction projects with study of 10 choices in the framework of its model, with analyzing 6 levels, to choose the best and top option.

Chang and Li (2004) found out that contractor selection is one of the main actions for the employer. They proposed the MCDM methods to achieve this goal and then found out that one of the suitable methods in these kinds of decisions is AHP. They also suggested in this research that one can benefit from ANP method in complicated decision makings which include factors influences on each other.

Darvish, Yasaaee, and Saeedi (2009) presented a method based on graph theory and matrix approach to study the influence of effective factors in contractors ranking and introduce this method as an efficient way to evaluate factors mutual influence on each other.

Methodology

In classic decision-making hypothesis, there is a set of options which is called the decision space and is together with a state space and an allocation decision relation between each of the states and a utility/desirability function. Utility function identifies the optimal decisions and compliance with state and relations between them. In classical decision, the decision maker is aware of the phase and situation he/she is in, so he/she selects the option that has the highest utility/desirability. While in the decision making under risk, the one who decides doesn't definitely know what will happen in the future, and he knows only the probability of future situations; so the decisions would have a more complex structure than definite conditions. With introducing fuzzy systems hypothesis and their capability in non accurate and relative information modeling, a new path was introduced to scientist, managers, and engineers to increase modeling and system analysis capabilities with human interference.

Fuzzy Analytic Hierarchy Process

AHP method was suggested by an Iraqi-born man named Saaty (1980). This procedure is performed as it is done in the human brain and deals with the issues analysis. AHP enables decision makers to determine the simultaneous interaction of many complex and uncertain situations. This process helps decision-makers to prioritize and set up targets based on their goals, knowledge, and experience; as to fully consider their feelings and judgments. In 1983, two Dutch researchers named Laarhoven and Pedrycz (1983) offered a method for fuzzy analytic hierarchyprocess, which was established and based on logarithmic least squares method. The amount of the calculations and their steps complexity, made it not to be successful. Another method was presented by a Chinese scholar named Chang (1996) which was "developed analysis method". After that, fuzzy analytic hierarchy process was appreciated by researchers and many articles were issued on this subject.

In this paper, the triangular fuzzy numbers are used in the forms of fuzzy numbers, in which triangular fuzzy number is the most common. Triangular fuzzy number is a fuzzy number which is shown by three points A = (l, m, u) and is defined as a membership function in Equation 1.

$$\grave{\imath}_M(x) = \begin{cases} 0 \; x < l \\ (x-l)/(m-l) \; l \le x \le m \\ (u-x)/(u-m) \; m \le x \le u \\ 0 \; x > u \end{cases} \quad (1)$$

The development analysis process of Chang is as follows:

Step 1: Calculating the extended complex phase

Since the numbers used in this procedure are triangular fuzzy numbers, the scales used in the fuzzy analytic hierarchy process is shown in Table 1.

Table 1.Triangular Fuzzy Numbers Scale

Triangular Fuzzy Scale (l, m, u)	Domain (approximate)	Model operators	fuzzy numbers for fuzzy AHP	Linguistic scale for importance
(1,1,1)	-	-	-	Exactly equal
(1,1,3)	$1 \le x \le 3$	$\mu_M(x) = (x-7)/(9-7)$	$\tilde{1}$	Equal importance or without priority
(1,3,5)	$1 \le x \le 3$	$\mu_M(x) = (3-x)/(3-1)$	$\tilde{3}$	Relatively important
(3,5,7)	$3 \le x \le 5$	$\mu_M(x) = (x-1)/(3-1)$	$\tilde{5}$	Important
	$3 \le x \le 5$	$\mu_M(x) = (5-x)/(5-3)$		
(5,7,9)	$5 \le x \le 7$	$\mu_M(x) = (x-3)/(5-3)$	$\tilde{7}$	Very important
	$5 \le x \le 7$	$\mu_M(x) = (7-x)/(7-5)$		
(7,9,9)	$7 \le x \le 9$	$\mu_M(x) = (x-5)/(7-5)$	$\tilde{9}$	Too important
	$7 \le x \le 9$	$\mu_M(x) = (9-x)/(9-7)$		
$M_1^{-1} \approx (1/u_1, 1/m_1, 1/l_1)$			When the activity of i is compared to j, one of the above numbers is assigned to it and when	

If $M_g^1, M_g^2, \ldots, M_g^m$ is the development analysis amounts of the "i"th target with the desired value of m, then Combined expansion phase of m for the "i"th target is defined as:

$$S_i = \sum_{j=1}^{m} M_{gi}^{j} \otimes \left[\sum_{i=1}^{n} \sum_{j=1}^{m} M_{gi}^{j} \right]^{-1} \quad (2)$$

if $M_g^j = (l_i m, m_i m, u_i m)$, then $\sum_{j=1}^{m} M_{gi}^{j}$, by Fuzzy operator on development analysis of m is defined as:

$$\sum_{j=1}^{m} M_{gi}^{j} = \left(\sum_{j=1}^{m} l_j, \sum_{j=1}^{m} m_j, \sum_{j=1}^{m} u_j \right) \quad (3)$$

$$\sum_{i=1}^{n} \sum_{j=1}^{m} M_{gi}^{j} = \left(\sum_{i=1}^{n} l_i, \sum_{i=1}^{n} m_i, \sum_{i=1}^{n} u_i \right) \quad (4)$$

Also, for obtaining $\left[\sum_{i=1}^{n} \sum_{j=1}^{m} M_{gi}^{j} \right]^{-1}$ by applying the fuzzy operator , we will have:

$$\left[\sum_{i=1}^{n} \sum_{j=1}^{m} M_{gi}^{j} \right]^{-1} = \left(\frac{1}{\sum_{i=1}^{n} u_i}, \frac{1}{\sum_{i=1}^{n} m_i}, \frac{1}{\sum_{i=1}^{n} l_i} \right) \quad (5)$$

Step 2: Calculating the degree of preference (degree of feasibility) S_i to S_k. If $S_i = (l_i, m_i, u_i)$ and $S_k = (l_k, m_k, u_k)$, then the degree of preference S_i with S_k, which is displayed as $V(S_i > S_k)$, defined in equation 6 is:

$$V(S_i \geq S_k) = \sup_{y \geq x} \left[\min\left(\alpha_{S_i}(x), \alpha_{S_k}(y) \right) \right] \quad (6)$$

That for triangular fuzzy numbers is equivalent to equation 7:

$$V(S_i \geq S_k) = \alpha_{S_i}(d) = \begin{cases} 1, \; if\, m_2 \geq m_1, \\ 0, \; if\, l_1 \geq u_2, \\ \dfrac{l_1 - u_2}{(m_2 - u_2) - (m_1 - l_1)}, \; otherwise \end{cases} \quad (7)$$

Which is corresponding to the largest intersection point between α_{sk} and α_{si}. Figure 1 shows $V(S_i > S_k)$

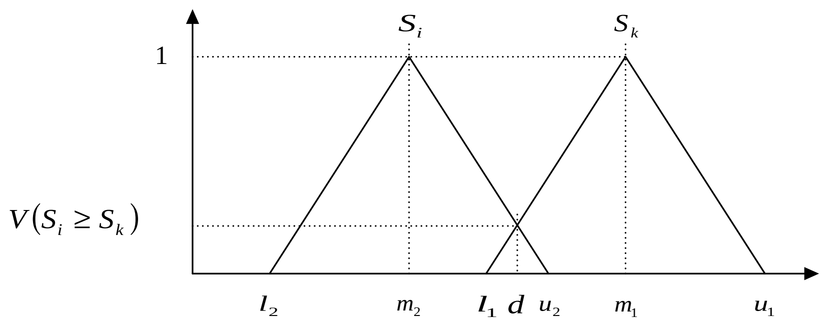

Figure 1. Intersection point of between α_{sk} and α_{si}

Step 3: Calculating the degree of preference (degree of feasibility): is a convex fuzzy number and if it is greater than which is a convex fuzzy number , it is defined as in Equation 8:

$$V(S \geq S_1, S_2, \cdots, S_k) = V\left[(S \geq S_1) \text{ and } V\left[(S \geq S_2) \text{ and} \cdots \text{ and} (S \geq S_k)\right]\right] = \min V(S \geq S_i),\ i = 1,2,3,\cdots,k. \quad (8)$$

If we assume that $d'(A_i) = minV(S_i \geq S_k)$ for k = 1, 2,..., n, then the weight vector is calculated as equation 9:

$$W' = \left(d'(A_1), d'(A_2), \cdots, d'(A_n) \right)^T \quad (9)$$

It is noteworthy that the weights obtained are not fuzzy.

Step 4: normalizing W′ vector and obtaining the normalized weight vector W. The coefficient of the non-normal vector is calculated to obtain a normal vector, using equation 10.

$$W_i = \frac{W'_i}{\sum W'_i} \text{ Fuzzy TOPSIS} \quad (10)$$

TOPSIS technique is one of the well-known MCDM techniques, which was first introduced by Hwang and Yoon(1981). In this method, option m is evaluated by index n. This technique is based on the notion that the choice should be based on the minimum distance to the positive ideal solution (best case scenario) and the maximum distance from the negative ideal (worst case scenario)(Wang and Elhag, 2006). Problem solving with this approach, requires six steps.

Step 1 - Decision matrix transformation into an amorphous matrix scale, using equation 11:

$$\tilde{r}_{ij} = \begin{cases} \tilde{x}_{ij}(\div)\tilde{x}_j^* = \left(\frac{a_{ij}}{c_j^*}, \frac{b_{ij}}{c_j^*}, \frac{c_{ij}}{c_j^*}\right) \text{if } C_i \text{ is benefit criterion } c_j^* = {}^{max}_{i} c_{ij} \\ \tilde{x}_j^-(\div)\tilde{x}_{ij} = \left(\frac{a_j^-}{c_{ij}}, \frac{a_j^-}{b_{ij}}, \frac{a_j^-}{a_{ij}}\right) \text{if } C_i \text{ is cost criterion } a_j^- = {}^{min}_{i} a_{ij} \end{cases} \quad (11)$$

Step 2 - Creating a scale less weighty matrix Vector W is given as input to the algorithm. (Using equation 12)

$$\tilde{V} = \left[\tilde{v}_{ij}\right]_{n\times j} \; i = 1, 2, \cdots, n, \; j = 1, 2, \cdots, J \text{ where } \tilde{v}_{ij} = \tilde{x}_{ij}(.)w \quad) \quad (12)$$

Step 3 - Determining the ideal solution and negative ideal solution. For an ideal option for a negative ideal are defined. (Using equations 13 and 14)

$$A^* = \{\tilde{v}_1^*, \tilde{v}_2^*, \cdots, \tilde{v}_i^*\} = \left\{\left(\begin{matrix} max\, v_{ij} \middle| i\epsilon I' \\ j \end{matrix}\right), \left(\begin{matrix} min\, v_{ij} \middle| i\epsilon I'' \\ j \end{matrix}\right)\right\} \; i = 1, 2, \cdots, n, \; j = 1, 2, \cdots, J \quad (13)$$

$$A^- = \{\tilde{v}_1^-, \tilde{v}_2^-, \cdots, \tilde{v}_i^-\} = \left\{\left(\begin{matrix} min\, v_{ij} \middle| i\epsilon I' \\ j \end{matrix}\right), \left(\begin{matrix} max\, v_{ij} \middle| i\epsilon I'' \\ j \end{matrix}\right)\right\} \; i = 1, 2, \cdots, n, \; j = 1, 2, \cdots, J \quad (14)$$

Here, j = 1, ..., n and I' represents measures made of profit and I" represents measures made of costs.

Then the sum of the distances from the ideal positive and negative options can be calculated. If and are the two triangular fuzzy numbers, then the distance between these two numbers will be calculated by equation 15:

$$d\left(\tilde{a}, \tilde{b}\right) = \sqrt{\frac{1}{3}\left[(l_1 - l_2)^2 + (m_1 - m_2)^2 + (u_1 - u_2)^2\right]} \quad (15)$$

Distance of each alternative from the positive ideal is shown by and from negative ideal distance is shown by .

Step 4 - Calculate the size of the separation (distance) between the ideal option i using equations 16 and 17 will take place. Accordingly, the fuzzy positiveideal solution option is shown as and fuzzy negative idealsolutionchoice is introduced as.

$$D_j^* = \sum_{j=1}^{n} d\left(\tilde{v}_{ij}, v_i^*\right) j = 1, 2, \cdots, J \quad (16)$$

$$D_j^- = \sum_{j=1}^{n} d\left(\tilde{v}_{ij}, v_i^-\right) j = 1, 2, \cdots, J \quad (17)$$

Step 5 - Calculating the relative closeness of to the ideal solution. (Using equation 18)

$$CC_j = \frac{D_j^-}{D_j^* + D_j^-} j = 1, 2, \cdots, J \quad (18)$$

Step 6 - Ranking of options. the options from the relevant issue can have the rating and ranking according to the highest amount of possible.

Application of the proposed method

In this paper, construction contractors ranking has been done by fuzzy multiple criteria decision weighting the criteria method. Then, using fuzzy TOPSIS method, contractors ranking have been attempted. For this purpose, an expert has been designated as the decision maker by senior decision makers. Then the research criteria and hierarchy (conceptual model) has been created with respect to literature and expert opinion and their organization policy using AHP techniques (AHP). Decision making Tree is shown in this model (Figure 2).

Step 1: Create a hierarchical concept for the issue.

The hierarchical model consists of 4 options (contractor) and nine criteria are as follows:

Estimation and performance accuracy
Good experience in previous work
Machines Power
Geographical Location
Financial power
Safety instructions compliance
Contractors blank Capacity
Management and organization
Manpower specialties

Judgment action to determine paired comparison matrices is presented here. In fuzzy mode, Table 1 is used to apply judgments. It means that the corresponding amount related to linguistic preferences are being introduced with triangular fuzzy numbers at the matrix of paired comparisons. The conventional fuzzy numbers, presented a linguistic scale are not multiplied from 1 to 9 times, but they are suitable and used for Fuzzy AHP. It is notable that all the elements on the main diagonal paired comparison matrices are equal to the (1, 1, 1) and also, if the "i"th row and "j"th column of the paired comparison matrix is equal to $M_{gi}^{j} = (l_{ij}, m_{ij}, u_{ij})$, then the element in "j"th row and "i"th column of this matrix is equal to $(M_{gi}^{j})^{-1} = \left(\frac{1}{u_{ij}}, \frac{1}{m_{ij}}, \frac{1}{l_{ij}}\right)$. (Table 2) In this step, each of the coefficients of the paired comparisons of matrix can be calculated from equation 2 using Fuzzy Analytical Hierarchy Process definition.

S_1 = (7.74,12.20,18.33) *(23.24,38.19,51.62)$^{-1}$ = (0.035,0.078,0.192)

Step 2: Calculating the degree of preference (degree of feasibility) using equations 6 and 7 S_i on S_k (Table 3).

Step 3: Using equation 9 to calculate the relative weights of the criteria (Table 3).

Step 4: Calculating the weight options. The final weight of the combination of options relative weights are derived using equation 10 (Table 3).

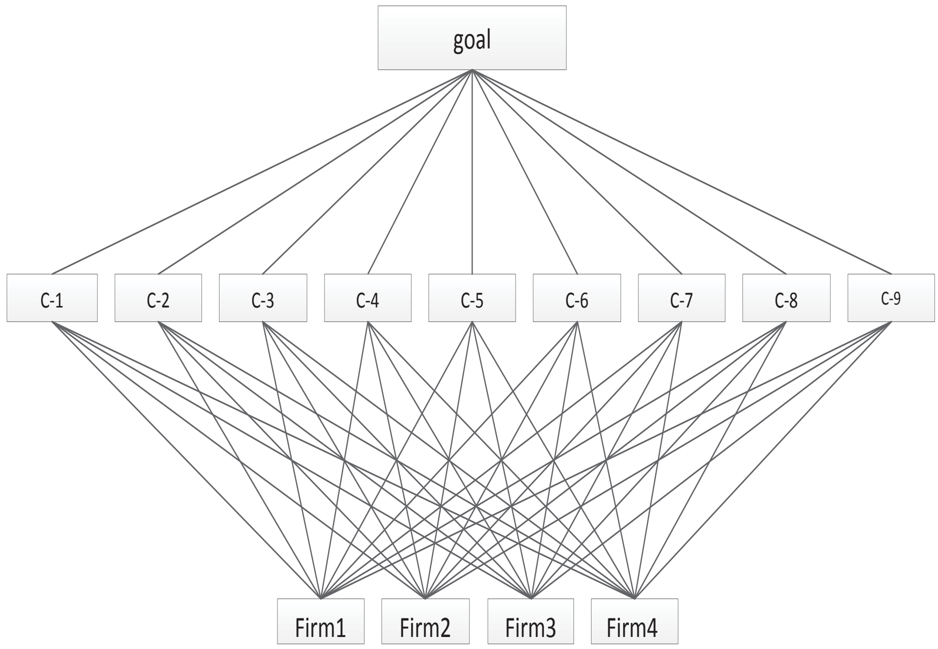

Figure 2. Research conceptual model

Table 2.Criteria Paired Comparisons

Shifter	C1			C2			C3			C4			C5			C6			C7			C8			C9		
	l	m	u	l	m	u	l	m	u	l	m	u	l	m	u	l	m	u	l	m	u	l	m	u	l	m	u
C1	1	1	1	1	1	1	1	3	5	3	5	7	1/5	1/3	1	1	1	1	1/5	1/3	1	1/7	1/5	1/3	1/5	1/3	1
C2	1	1	1	1	1	1	1	3	5	3	5	7	1/5	1/3	1	1	1	1	1	3	5	1/7	1/5	1/3	1/9	1/7	1/5
C3	1/5	1/3	1	1/5	1/3	1	1	1	1	3	5	7	1/5	1/3	1	1	1	1	1/7	1/5	1/3	1/5	1/3	1	1/7	1/5	1/3
C4	1/3	1	1	1/3	1	1	1	1	3	1	1	1	1/3	1	1	1/3	1	1	1	1	1	1/5	1/3	1	1/5	1/3	1
C5	1	3	5	1	3	5	1	3	5	1	3	5	1	1	1	1	1	1	3	5	7	1/5	1/3	1	1/7	1/5	1/3
C6	1	1	1	1	1	1	1	1	1	1	3	5	1	1	1	1	1	1	3	5	7	1	1	1	1/5	1/3	1
C7	1	3	5	1/5	1/3	1	3	5	7	1	1	1	1/7	1/5	1/3	1/7	1/5	1/3	1	1	1	1/7	1/5	1/3	1/7	1/5	1/3
C8	3	5	7	3	5	7	1	3	5	5	7	9	1	3	5	1	1	1	3	5	7	1	1	1	1	1	1
C9	1	3	5	5	7	9	3	5	7	5	7	9	3	5	7	1	3	5	3	5	7	1	1	1	1	1	1

Step 1 - Forming a decision matrix, and converting the decision matrix to an amorphous matrix without scale using equation 11:

Step 2 – Creating a scale less weighty matrix assuming that vector is given as input to the algorithm. Using equation 12: (Table 5)

Table 3. Calculation of Wi and W' amount

$V(S \geq S_1, S_2, \ldots, S_k)$	W′	W_i
$V(S_1, \geq S_2, S_3, S_4, S_5, S_6, S_7, S_8, S_9)$	0.36119	0.08
$V(S_2, \geq S_1, S_3, S_4, S_5, S_6, S_7, S_8, S_9)$	0.463265	0.11
$V(S_3, \geq S_1, S_2, S_4, S_5, S_6, S_7, S_8, S_9)$	0.183958	0.04
$V(S_4, \geq S_1, S_2, S_3, S_5, S_6, S_7, S_8, S_9)$	0.063847	0.02
$V(S_5, \geq S_1, S_2, S_3, S_4, S_6, S_7, S_8, S_9)$	0.658592	0.15
$V(S_6, \geq S_1, S_2, S_3, S_4, S_5, S_7, S_8, S_9)$	0.400063	0.09
$V(S_7, \geq S_1, S_2, S_3, S_4, S_5, S_6, S_8, S_9)$	0.293458	0.07
$V(S_8, \geq S_1, S_2, S_3, S_4, S_5, S_6, S_7, S_9)$	0.900759	0.21
$V(S_9, \geq S_1, S_2, S_3, S_4, S_5, S_6, S_7, S_8)$	1	0.23

Step 3 - Determining the ideal solution and negative ideal solution. For an ideal option and for negative ideal are defined (Using equations 13 and 14). Here we consider the fuzzy positive ideal solution is equal to (1,1,1) and fuzzy negative ideal solution is equal to (0,0,0). It should be noted that because all the criteria are made of the profits, outlined options are true for all criteria.

Step 4 - Calculating the size of the separation (distance): Distance between option i and the ideals will take place using 15 and 16 and 17 relations (Table 6).

Step 5 - Calculating the relative closeness of Ai to the ideal solution. (Using equation 18)

Step 6- Option ranking. Options from the available issue can be ranked according to the maximum value of the corresponding CC_j^*

Table 4.Decision Matrix

	Contractor 1			Contractor 2			Contractor 3			Contractor 4		
	l	m	u	l	M	u	l	m	u	l	m	u
C1	2	3	4	1	2	3	4	5	6	2	3	4
C2	3	4	5	2	3	4	4	5	6	2	3	4
C3	2	3	4	2	3	4	3	4	5	1	2	3
C4	6	7	8	6	7	8	7	8	9	6	7	8
C5	3	4	5	4	5	6	5	6	7	6	7	8
C6	2	3	4	2	3	4	4	5	6	3	4	5
C7	2	3	4	2	3	4	2	3	4	2	3	4
C8	4	5	6	2	3	4	6	7	8	3	4	5
C9	4	5	6	2	3	4	6	7	8	5	6	7

Table 5.Massy Non-scale Matrix

	Contractor 1			Contractor 2			Contractor 3			Contractor 4		
	l	m	u	l	m	u	l	m	u	l	m	u
accuracy in estimation	0.028	0.042	0.056	0.014	0.028	0.042	0.056	0.070	0.084	0.028	0.042	0.056
Good experience in	0.054	0.071	0.089	0.036	0.054	0.071	0.071	0.089	0.107	0.036	0.054	0.071
Machines Power	0.017	0.026	0.034	0.017	0.026	0.034	0.026	0.034	0.043	0.009	0.017	0.026
Geographical location	0.010	0.011	0.013	0.010	0.011	0.013	0.011	0.013	0.015	0.010	0.011	0.013
Financial power	0.057	0.076	0.095	0.076	0.095	0.114	0.095	0.114	0.133	0.114	0.133	0.152
safety Instructions	0.031	0.046	0.062	0.031	0.046	0.062	0.062	0.077	0.092	0.046	0.062	0.077
Contractors blank	0.034	0.051	0.068	0.034	0.051	0.068	0.034	0.051	0.068	0.034	0.051	0.068
Management and	0.104	0.130	0.156	0.052	0.078	0.104	0.156	0.182	0.208	0.078	0.104	0.130
Manpower specialties	0.116	0.145	0.173	0.058	0.087	0.116	0.173	0.202	0.231	0.145	0.173	0.202

Table 6. Calculation of D-, D* and CCJ amounts

	D^-	D^*	CC_j
Contractor 1	0.61	8.40	0.068
Contractor 2	0.49	8.53	0.055
Contractor 3	0.84	8.17	0.093
Contractor 4	0.66	8.35	0.073

Conclusions

Because of civil infrastructures in the oil company's execution activities, financial resources loss, and the projects implementation in time intervals more than the planned interval, not only they cause defeat and damage in the projects, but also they are a means of cost increase in future activities and also these structures' maintenance cost. In this research, it was attempted to find a suitable way for contractors' selection and ranking with fuzzy AHPand TOPSIS methods, according to which, the subject literature, organization politics, and appropriate decisions were studied in the first stage, to select the efficient criteria for assessing the competence of contractors in oil companies construction projects. Then, the defined criteria evaluation was done, using fuzzy AHP method and finally contractors assessment and their ranking, Classification and selection was performed using fuzzy TOPSIS method. According to the results of the study (Table 6) Contractor 3 was chosen as the best option. Also, the critical criteria based on the results obtained were as follows : {23 % staff specialty , 21 % management and organization , 15 % financial power }.

Some of the research objectives in this study that were met are as follows:

1. Providing a systematic model to build a good structure for decision-making process.
2. Recognizing the critical factors in construction companies selection.
3. To help decision-makers to reflect and express their valuable judgments that will lead to recommendations on options.
4. Helping people to be more consistent and rational in their assessments and lessening risks and lack of certainty.
5. Facilitating negotiations (bargaining power increases.

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