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Evaluation of Individual Performance Based on the Integrated Approach of Combined Fuzzy Process of Design and Engineering Companies in the Oil, Gas and Petrochemical Industry

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Abstract
One of the main and spiritual assets of any organization is the human resources of that organization. Individual performance appraisal system is an important area of human resource management that can significantly affect the performance of the organization and competitive advantage. Since it cannot be controlled without control, management and without evaluation, so evaluation is one of the most important issues in increasing productivity and quality of work and because of examining the behaviors and capabilities of employees and their growth and prosperity to achieve the goals of the organization is very important. Is. This research is a descriptive-applied study and its purpose is to provide a method to prioritize effective indicators in evaluating the individual performance of design and engineering companies in the oil, gas and petrochemical industry based on fuzzy hybrid process (ANP and fuzzy Topsis). In general, this model includes 5 criteria. The results obtained by ANP method and fuzzy TOPSIS show that factors such as organizational empowerment, individual skills and personality are the most important main criteria. According to the results, more attention is paid to the factors that are most considered by employees, including; It is recommended to pay attention to job security, establish mutual trust between the employee and the manager, train problem solving skills, cooperation and partnership, observe ethical and social principles in order to influence and intervene in the evaluation of employees.
Keywords: Individual performance evaluation, fuzzy network analysis process, fuzzy TOPSIS

1. Preface

According to the study and review of research on individual performance appraisal, as it is evident, few studies have examined the criteria and factors under consideration in evaluating individual performance using applied decision-making techniques. On the other hand, due to the importance of evaluating individual performance in service centers, including design and engineering companies in the oil, gas and petrochemical industry, the need to provide an integrated methodology that can examine this issue in one of these companies and provide an approach that in those criteria, the performance of employees in these centers is felt to be relevant. Also, the necessity of evaluating individual performance with regard to considering and using a combination of multi-criteria decision making techniques (ANP and TOPSIS) in the fuzzy environment in our country is important. To achieve this goal, we intend to first review all articles related to individual performance appraisal, especially the factors affecting appraisal, as well as the methods used in it (preferably using TOPSIS and ENP techniques) and then review the appropriate criteria with Pay attention to the opinions of experts, and university professors and experts related to the mentioned topics, extracted so that if a criterion is not relevant, it is removed and if a criterion is not included, it is added to the list of criteria for evaluating individual performance. After reviewing and determining the final criteria, we first prioritize the criteria using fuzzy network analysis process technique and then determine the ranking of available options using fuzzy TOPSIS technique. Therefore, in this study, in general, to determine the effective factors in evaluating individual performance at the expert level and their ranking (using two approaches of fuzzy ENP and fuzzy TOPSIS) in one of the design and engineering companies in the oil, gas and petrochemical industry (Nardis We will pay, areas of activity of this company including: development of oil and gas fields, offshore facilities, oil and gas refineries, utility systems and off

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sites, petrochemical complexes and related industries, pumping stations, booster pressure and pipelines and tanks It is a reserve

Performance appraisal is a continuous and constructive process of evaluating the quality and quantity of work performance and employee career advancement to measure and express employee performance about the job or task in question over a period of time (Pigot[1], 2006), organizations to evaluate the performance of employees and members They pursue different goals. The main purpose of performance appraisal is to provide accurate and accurate information about the job performance of members of the organization. The more accurate and reliable this information is, the greater its potential value to the organization (Arnold and Feldman[2], 4). The purpose of performance appraisal is to identify the effectiveness and efficiency of the organization's employees by providing and developing vital human resource information.

The selection of performance indicators has a significant impact on the performance of each organization and its future orientations. Therefore, having proper knowledge of the factors that reflect organizational behavior and affect its performance is very important (Zidana and Kalpanab,[3] 2009). In the performance appraisal pyramid model, decision makers should identify performance appraisal factors based on the level of the organization. The important point is that apart from the level of education and work experience of employees, other factors such as job characteristics and working conditions affect employee performance (Wu and Jiang[4], 2009).

Figure 1 shows the importance of performance and its evaluation in the path of growth and success of the organization. Every organization sets its own strategic plans for success. These strategic plans pursue needs and goals. After determining the goals and strategies of the organization, it is the performance of employees that determines the growth and success of the organization. Periodic and annual performance appraisal of employees determines the amount of their performance outputs.

Depending on the level of output, managers can help employees improve performance. These guidelines directly affect employee performance. The results of performance appraisal are documented by managers and decisions are made accordingly (Delpo[5], 2007).

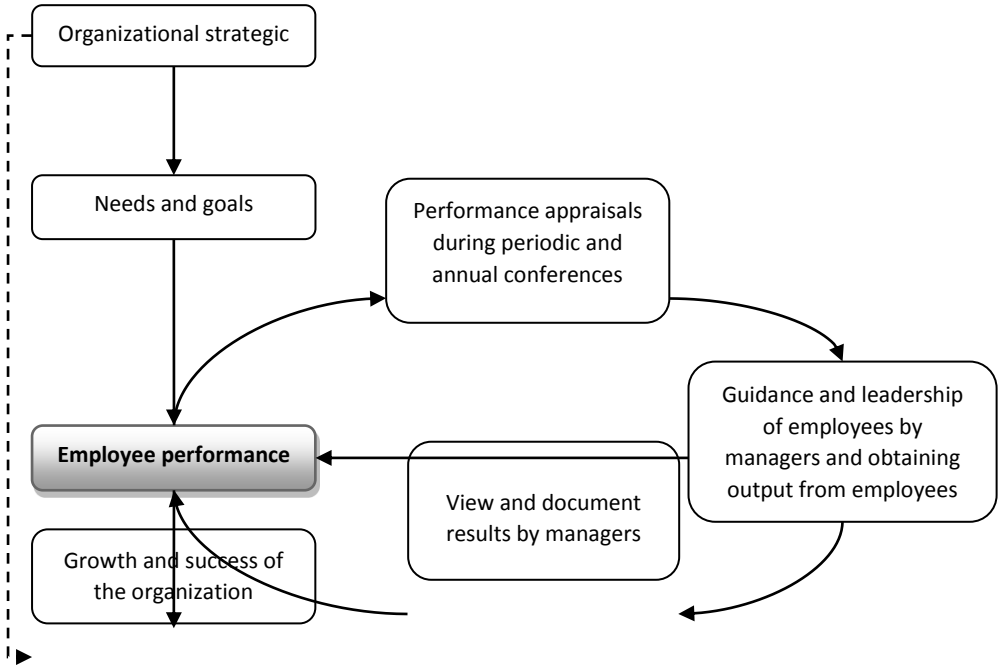

Figure 1: Evaluating the performance and growth of the organization (Wu and Jiang, 2009)

Today, effective evaluation of human resource performance is an issue that has attracted the attention of many managers. Most of them are looking for a practical approach or solution through which they can improve the performance of their employees and provide opportunities for growth and excellence and increase their

1 Piggot
2 Arnold & Feldman
3 Zeydana and Colpanb
4 Wu and Jiang
5 Delpo

competitive advantages. But it should be noted that the final decision can not be made by optimizing a variable. It is natural that solving such problems is complex and not easily possible, especially since most of these variables are in conflict with each other and increasing one can reduce the desirability of the other. Therefore, the application of integrated multi-criteria decision-making approaches can help to solve these problems.
The issue and subject of the research became important for the researcher because of his work experience related to human resources in the field of design and engineering companies in the oil, gas and petrochemical industry and on the other hand conducting studies related to the subject due to being a student and relevant field of study. In the field of oil and gas management and contracts, finally curiosity, personal experiences, study of written works and oral sources and most importantly the feeling of personal need of the researcher to understand the relevant concepts and process, led to the choice of research topic.
On the other hand, believing in the effectiveness of performance appraisal in the shadow of knowledge and understanding of different evaluation methods and more importantly choosing a method appropriate to the characteristics of the organization and also knowing the cognitive weakness of managers and lack of up-to-date models, especially in design and engineering companies of gas and petrochemicals necessitated research in this field.

2. 2- Research Precedent:

Appropriate quantitative research has been done in the field of performance appraisal using different methods. For example, Bazaz Jazayeri (2006) in an article introduces TEAM approach in evaluating the performance of human resources. According to him, program development Performance appraisal is done through the following four distinct steps. These four steps are:

- Technical stage: The technical stage requires working with employees in order to develop a clear job description, job performance standards and work goals appropriate to recording employee performance.

- Expansion stage: This stage is the longest and most sensitive stage of the performance appraisal process. The success and effectiveness of a performance appraisal program depends on the successful implementation of this step. This is the stage where supervisors really do the job of supervisor. They observe, monitor, provide feedback, and direct employee performance.

- Evaluation phase: If the evaluation period is one year, the manager should formally discuss work performance with his staff once a year. The annual evaluation should include a summary of the informal evaluations conducted during the year.

- Maintenance phase[6]: This phase is performed to ensure the implementation of the evaluation program, and is one of the most critical parts of the performance evaluation process. Having an open and effective communication atmosphere helps to implement this step effectively.

Using this approach requires a positive attitude and full knowledge of the objectives and policies of the evaluation, knowledge and understanding of the evaluation process, accurate knowledge of the cultural situation and organizational climate, creating a stress-free environment during the evaluation, knowledge of the situation Other systems of the organization (such as salaries, promotions, appointments, etc.) and the application of ongoing management support. Also, the correct and conscious implementation of the four steps of this approach can minimize or control common errors in performance appraisal. Eghbal, Yarmohammadian and Siadat (2009) in a study aimed at applying the EFQM excellence model with Proforma information system approach in evaluating the performance of human resources management of Isfahan University of Medical Sciences state that the human resources management of Isfahan University of Medical Sciences scored 516 points in this evaluation. The field of enablers gained 294 and the field of results 222 points. Also, the highest percentage of points were nine factors. Leadership is 61%, Policy and Strategy 75%, Employees 58%, Resources and Partners 52%, Processes 53%, Customer Results 43%, Employee Results 29%, Community Results 55% and Key Performance Results 52%. Surayai et al. (2006) during a research have prioritized the indicators for evaluating the performance of human resources using fuzzy AHP. Their model includes 5 main criteria of intelligence and talent, leadership, perseverance and seriousness in work, initiative and creativity, flexibility and related sub-criteria and 20 options. The results obtained from the numerical example show that the rate of application of individual knowledge in creating optimal results, the level of staff skills, information transfer and the rate of success in training programs are among the most important indicators of human resource evaluation. Islam and Rasad[7] (2006) also examined the evaluation of individual performance using the AHP method.

6 Maintenance Phase

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They consider quality / quantity of work, planning / organization, creativity / commitment, teamwork / collaboration, communication, and external factors to evaluate individual performance. Each of these criteria is divided into three sub-criteria. Employees were evaluated using this method and the overall ranking of employees was obtained using the AHP method. Nahan and Jiang [8](2009) also evaluated the performance of employees using fuzzy AHP method to evaluate individual performance. In this study, they presented an effective combination of AHP and fuzzy methods and they believe that this method provides better results in evaluating individual performance. In this regard, Gongor et al.[9] (2009) state that quantitative and qualitative factors should be used simultaneously to obtain accurate and systematic information. For this reason, they consider the AHP method as a kind of decision-making method that is a combination of quantitative and qualitative methods. Taylor et al.[10] (1998) believe that for a routine evaluation, several activities must be performed. First, demand must be collected, then employees must be evaluated using different criteria, and finally, the average of each criterion for each employee must be weighed. To be given. In this process, two main problems arise. These two problems are: a) how to rank employees based on each of the criteria b) to compile a set of logical weights for each of the criteria. To overcome these problems, they suggest the AHP method as a way to solve these problems. The AHP method is known as a method for evaluations and decision making in complex situations. (Taylor et al., 1998) On the other hand, regardless of the importance of performance management, most organizations do not have a systematic approach to evaluating or using a system that aligns with the organizational culture and strategic goals of the organization. Practical studies show that half of the industrial organizations do not have a performance appraisal system or do not value employee performance appraisal. Effective evaluation of human resource performance is an issue that has attracted the attention of many managers. Most of them are looking for a practical approach or solution through which they can improve the performance of their employees and provide opportunities for growth and excellence and increase their competitive advantages. However, it should be noted that the final decision cannot be made by optimizing a variable. It is natural that solving such problems is complex and not easily possible, especially since most of the mentioned variables are in conflict with each other and increasing one can reduce the desirability of the other. Therefore, the application of integrated multi-criteria decision-making approaches can help to solve these problems.

Reviewing the literature, it can be concluded that so far few studies have been conducted to identify and determine the factors of evaluation of individual performance using the multi-objective decision approach, especially TOPSIS and ENP, and therefore, lack of resources and lack of The right model increases the possibility of making mistakes in conducting research. Finally, the researcher has tried to reduce the error rate as much as possible by using all available tools and facilities.

2-1- Fuzzy Hybrid Multiprocessor Decision Making

Multidisciplinary decision-making methods are one of the most widely used decision-making methods and many researchers in various fields use these methods (Taghizadeh et al., 2015). According to what was stated, in this study, in order to evaluate individual performance, a combination of ANP and TOPSIS techniques was used in a fuzzy environment.

2-2- Fuzzy ANP Metho

ANP is the general form of AHP first proposed by Saati (1996). The AHP employs only a one-way hierarchical relationship between decision levels, while the ANP is able to consider the internal relationships between decision levels and indicators. The ANP-based system is a network that shows direct relationships with dependency and feedback and differs from the hierarchical structure (Saaty, 1996).

The ANP method is able to consider the internal relationships between elements by obtaining compound weights through the development of a supermatrix. In the ANP structure, each node represents a cluster with elements inside it; A straight line shows the interactions between the two clusters; And a loop indicates the internal dependence of the elements within a cluster (Saaty, 2004).

Since previous research has shown that estimating human judgments about preferences using precise numerical values is often difficult and opaque, the use of fuzzy logic to solve ambiguous and inaccurate problems becomes necessary. Since the issue of employee evaluation involves human judgment and these judgments are also vague and opaque, the combination of fuzzy set theory and ANP should be used to solve such a problem (Hasan et al., 2016). In the literature, many researchers such as (Tuzkaya and ünüt, 2008; Mohanty et al., 2005; Liu and Lin, 2009; Dag˘deviren and Yüksel, 2010; Luo et al., 2010; Liu and Wang, 2010; Vinodh, et al., 2011) have used fuzzy ANP in various fields of research.

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2-3 Fuzzy TOPSIS Methods

The TOPSIS method is a multi-criteria method for identifying the answer from a limited set of options. This method was first proposed by Chen and Huang (1992). The main logic of TOPSIS is to determine the ideal positive and negative answer (Hwang and Yoon, 1981). According to this logic, the optimal answer should have the shortest distance from the positive ideal answer and the maximum distance from the negative ideal answer. As stated earlier, human judgments often imply inaccuracy, subjectivity, and ambiguity. Therefore, fuzzy logic should be used in this regard (Opricovic and Tzeng, 2004). Therefore, in this research, an attempt has been made to use fuzzy logic in the TOPSIS method in order to evaluate people.

The fuzzy TOPSIS method first requires information about the relative importance of the criteria. There are several ways to determine these weights. In this research, fuzzy ANP method has been used to determine them. In previous studies, many researchers such as, (Aiello, 2009; Amiri et al., 2009; Cavallaro, 2010; Iç and Yurdakul, 2010; Kelemenis and Askounis, 2010; Roghanian et al., 2010; Sadi-Nezhad and Damghani, 2010 ; Sun and Lin; 2009; Ye, 2010) have used the fuzzy TOPSIS method in various fields.

3- Research Questions

- What is the ranking of individual performance evaluation factors at the expert level of design and engineering companies in the oil, gas and petrochemical industry using the fuzzy ANP method?

- What is the priority of individual performance appraisal factors at the expert level of design and engineering companies in the oil, gas and petrochemical industries using a combined approach (ANP and fuzzy Topsis)?

- Which of the main criteria identified in evaluating the individual performance of design and engineering companies in the oil, gas and petrochemical industry using the fuzzy ANP method is more important?

- Which of the identified options is more important in evaluating the individual performance of design and engineering companies in the oil, gas and petrochemical industry using the combined method (ANP) and Topsis)?

4- Research Method

This research is an applied research in terms of purpose. In the research literature section, the library method has been surveyed to collect materials, and in the section for determining the weight of criteria, experts in the field of oil and gas have been surveyed, using the field method and a questionnaire. On the other hand, considering that this research is not based on statistical analysis, there is no need to determine the population and statistical sample in a specific sense. We were forced to pre-test only to determine the reliability of the questions (performance appraisal factors) in the questionnaire. Different methods and tools have been used to collect and analyze the data and information required for this research. The method of data collection includes library methods and field methods and the tool for collecting this information is the library method of articles; In field methods, depending on the method used, the collection tools include questionnaires, interviews and observations. In this research, both library and field methods have been used and the collection tools have been library studies and designing and compiling a questionnaire.

In this study, purposeful sampling (judgmental type has been used) in order to select experts. In this method, people are selected as a sample who can provide the information intended for research (Danaei-Fard et al., 2013). Therefore, 10 specialists of design and engineering companies in the oil, gas and petrochemical industries who had valuable experience and experience in the field of executive and scientific, were selected as a sample.

- ✓ The general framework of the research can be shown based on the following figure:

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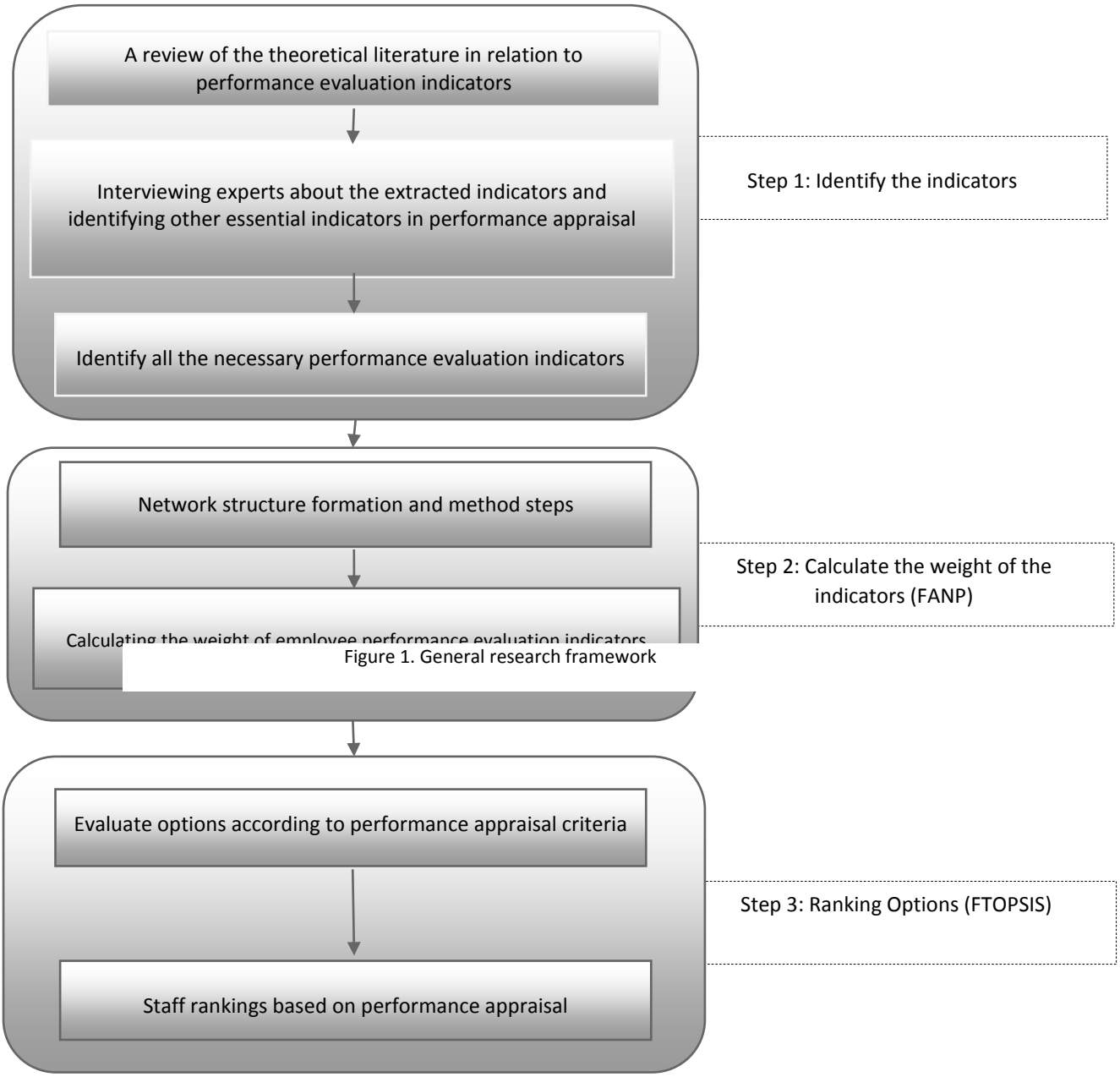


Figure 1. General research framework

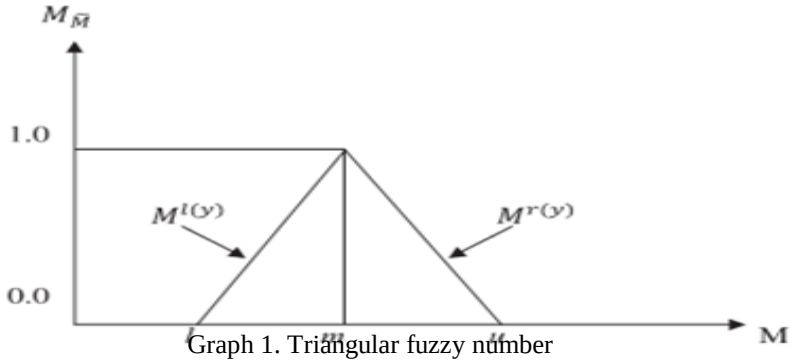
- ✓ In this research, fuzzy ANP method is used to calculate the weight of indicators and fuzzy TOPSIS method is used to rank and prioritize employees. Therefore, in the following, the steps of this method will be described along with the obtained results.

5- Information Analysis:

5-1- Application of FMADM Hybrid Approach in Evaluating Employee Performanc

The theory of fuzzy logic provides a powerful mathematical tool for dealing with uncertainties related to human cognitive processes, such as thinking and reasoning. It also provides a broader framework than classical set theory that aids in the ability to reflect the real world. A fuzzy set is a class of goals with a continuum of membership degrees. As a set is defined by a membership function, each membership is assigned a membership degree in the range [0,1]. Figure 1 shows a triangular fuzzy number. In this figure, l (y) and r (y) represent the right and left sides of a triangular fuzzy number, respectively. Each triangular fuzzy number is simply denoted by (l, m, u). The parameters l, m and u represent "smallest possible value", "most probable value" and "largest possible value",

respectively. Fuzzy numbers can also be represented using membership functions. The membership function of a triangular fuzzy number is in the form of relation (1) (Rostamzadeh and Sofian, 2011).



Graph 1. Triangular fuzzy number

$$\mu_{\tilde{M}}(x) = \begin{cases} 0 & x < l \\ \dfrac{x-l}{m-l} & l \le x \le m \\ \dfrac{u-x}{u-m} & m \le x \le u \\ 0 & x > u \end{cases}$$

5-2- Chang Development Analysis Method

The steps of Chang's development analysis method are as follows (Zhu, Jing, and Chang, 1999).

1- Calculating the normalized value of the total line: In order to calculate this value, the following equation is used:

$$[\sum_{i=1}^{n}\sum_{j=1}^{m} M_{gi}^{j}]^{-1} S_i = \sum_{j=1}^{m} M_{gi}^{j} \otimes$$

- ✓ In this relation, M is a triangular fuzzy number. ⊗ Shows the product of two fuzzy numbers. In order to obtain $\sum_{j=1}^{m} M_{gi}^{j}$, we use the following equation:

$$\sum_{j=1}^{m} M_{gi}^{j} = \left(\sum_{j=1}^{m} l_j \text{،} \sum_{j=1}^{m} m_j \text{،} \sum_{j=1}^{m} u_j\right) \text{،} \; i = 1\text{،}2\text{،} \dots \text{،} n$$

- ✓ To calculate this $[\sum_{i=1}^{n}\sum_{j=1}^{m} M_{gi}^{j}]^{-1}$, we can first calculate $\sum_{i=1}^{n}\sum_{j=1}^{m} M_{gi}^{j}$ using the following equation:

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

- ✓ Then by inverting the answer obtained as follows, $[\sum_{i=1}^{n}\sum_{j=1}^{m} M_{gi}^{j}]^{-1}$ is calculated.

$$[\sum_{i=1}^{n}\sum_{j=1}^{m} M_{gi}^{j}]^{-1} = ((\sum_{j=1}^{m} u_i)^{-1} \text{ ، } (\sum_{j=1}^{m} m_i)^{-1} \text{ ، } (\sum_{j=1}^{m} l_i)^{-1})$$

2- Calculating the degree of magnitude of the sum of rows relative to each other: In order to calculate the magnitude of two sums of rows, $\tilde{S}_i \geq \tilde{S}_j$, the following equation can be used:

$$V(\tilde{S}_i \geq \tilde{S}_j) = \sup[\min(\tilde{S}_i(x)، \tilde{S}_j(y))]$$

$$V(\tilde{S}_i \geq \tilde{S}_j) = \begin{cases} 1 & m_i \geq m_i \\ \dfrac{u_i - l_j}{(u_i - m_i) + (m_j - l_j)} & l_j \geq u_i \quad i، j = 1، \dots، n; j \neq i \\ 0 & otherwise \end{cases}$$

- ✓ Similarly, if we want to compare each $\tilde{S}_i$with the others, we use the following equation.

$$V(\tilde{S}_i \leq \tilde{S}_j \,|\, j = 1، 2، \dots، n، \ i \neq j) = \min[V(\tilde{S}_i \geq \tilde{S}_j)]$$

3- Calculating the weight vector of indices: The weight vector of indices is denoted by W = (w1,w2,...,wn) . This vector is obtained from the pairwise comparison matrix as follows:

$$W_i = \frac{V(\tilde{S}_i \geq \tilde{S}_j \,|\, j = 1، 2، \dots، n، \ i \neq j)}{\sum_{k=1}^{n} V(\tilde{S}_i \geq \tilde{S}_j \,|\, j = 1، 2، \dots، n، \ k \neq j)}$$

5-3- Fuzzy ANP Method

The steps of the fuzzy ANP method are as follows (Bhattacharya et al., 2014; Tadić et al., 2014; Büyüközkan and Çifçi, 2012):

- ✓ Step 1- Selecting and defining evaluation indicators and creating a network structure: In this step, first the indicators should be identified and then by defining the relationships between the indicators, the network structure between them should be drawn. The network structure of factors affecting employee performance appraisal is described in Figure 2.

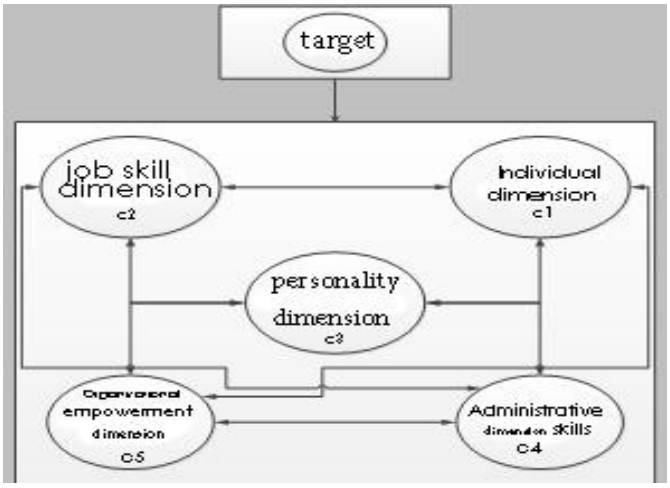


Figure 2. Network structure of the research model

- ✓ Step 2 - Select the appropriate language variables to determine the weight of the indicators: In fuzzy ANP, it should be noted that language terms will be used to perform paired comparisons. For this purpose, in this study, the triangular fuzzy numbers of Table 1 have been used.

Table 1. Definition of linguistic terms and their corresponding linguistic values in order to compare the indicators

Linguistic terms	Linguistic values	Conversely linguistic values
Exactly equal	(1,1,1)	(1,1,1)
Same preference	(1,1,3)	(1/3,1,1)
Relatively important	(1,3,5)	(1/5,1/3,1)
More importantly	(3,5,7)	(1/7,1/5,1/3)
Much more important	(5,7,9)	(1/9,1/7,1/5)
Extremely important	(7,9,9)	(1/9,1/9,1/9)

- ✓ Step 3: Formation of the initial supersatrix: In this step, according to the network structure of the model, the initial supermatrix is formed. The supersatrix of the present research model is as follows:

Table 2. Primary supermatrix

Indicators	Target	
0	0	Target
W_{22}	W_{21}	Indicators

- ✓ Step 4 - Determine the relative weights in the initial supermatrix and the formation of the rhythmic supernatant: In this step, W_21 and W_22 must be calculated. By placing these values in the initial supermatrix, a rhythmic supramatrix is obtained. It should be noted that Chang (1996) developed a developmental analysis method for fuzzy AHP. Therefore, the present study uses Chang's developmental analysis method to compare pairs of elements. The weight vector W_21, which is related to the pairwise comparison of indicators with respect to the target, was obtained by combining the opinions of experts as described in the table below.

Table 3. Parallel comparison of indicators according to purpose

	C1	C2	C3	C4	C5	W21
C1	(1,1,1)	(0.53,0.65,0.77)	(0.66,0.83,1.03)	(0.88,1.11,1.39)	(0.59,0.73,0.91)	0.140
C2	(1.30,1.57,1.89)	(1,1,1)	(1.02,1.26,1.52)	(1.04,1.33,1.69)	(1.04,1.33,1.69)	0.235
C3	(0.98,1.21,1.52)	(0.66,0.80,0.98)	(1,1,1)	(1.57,1.98,2.45)	(0.88,1.11,1.39)	0.235
C4	(1.35,1.67,2.07)	(0.59,0.75,0.96)	(0.41,0.51,0.64)	(1,1,1)	(0.49,0.60,0.74)	0.159
C5	(1.25,1.57,1.96)	(0.59,0.75,0.96)	(0.72,0.90,1.13)	(1.35,1.67,2.07)	(1,1,1)	0.231

- ✓ Also, the vector W_22, which is related to the internal relations of the indices, is obtained according to the results of Tables 4 to 8.

Table 4. Parallel comparison of indicators with respect to index C1

	C2	C3	C4	C5	W22
C2	(1,1,1)	(1.02,1.26,1.52)	(1.10,1.40,1.74)	(1.64,2.46,3.20)	0.362
C3	(0.66,0.80,0.98)	(1,1,1)	(1.10,1.40,1.74)	(0.82,1.02,1.35)	0.300
C4	(0.58,0.71,0.91)	(0.58,0.71,0.91)	(1,1,1)	(0.49,0.60,0.74)	0.112
C5	(0.31,0.41,0.61)	(0.74,0.98,1.22)	(1.35,1.67,2.07)	(1,1,1)	0.225

Table 5. Parallel comparison of indicators with respect to index C2

	C1	C3	C4	C5	W22
C1	(1,1,1)	(1.64,2.12,2.58)	(4.57,5.50,6.35)	(0.78,0.98,1.22)	0.303
C3	(0.39,0.47,0.61)	(1,1,1)	(1.37,1.74,2.21)	(0.47,0.60,0.77)	0.216
C4	(0.17,0.18,0.22)	(0.45,0.57,0.73)	(1,1,1)	(0.23,0.28,0.36)	0.177
C5	(0.82,1.03,1.29)	(1.29,1.66,2.12)	(2.78,3.56,4.42)	(1,1,1)	0.303

Table 6. Parallel comparison of indicators according to C3 index

	C1	C2	C4	C5	W22
C1	(1,1,1)	(0.79,1.04,1.43)	(0.39,0.47,0.61)	(1.35,1.72,2.21)	0.220
C2	(0.70,0.96,1.27)	(1,1,1)	(0.28,0.37,0.50)	(1.81,2.36,2.58)	0.275
C4	(1.64,2.12,2.58)	(2.00,2.73,3.54)	(1,1,1)	(3.60,4.60,5.52)	0.350
C5	(0.45,0.58,0.74)	(0.35,0.42,0.55)	(0.18,0.22,0.28)	(1,1,1)	0.155

Table 7. Parallel comparison of indicators with respect to index C4

	C1	C2	C3	C5	W22
C1	(1,1,1)	(0.35,0.42,0.55)	(0.29,0.38,0.52)	(0.31,0.37,0.46)	0.099
C2	(1.81,2.39,2.90)	(1,1,1)	(0.40,0.50,0.65)	(0.33,0.41,0.52)	0.200
C3	(1.92,2.66,3.48)	(1.55,2.02,2.48)	(1,1,1)	(0.82,1.04,1.27)	0.345
C5	(2.16,2.69,3.28)	(1.92,2.45,3.02)	(0.79,0.96,1.22)	(1,1,1)	0.356

Table 8. Parallel comparison of indicators according to C5 index

	C1	C2	C3	C4	W22
C1	(1,1,1)	(1.74,2.25,2.90)	(1.58,1.94,2.34)	(1.35,1.76,2.34)	0.370
C2	(0.35,0.45,0.58)	(1,1,1)	(0.58,0.79,1.10)	(0.60,0.80,1.10)	0.130
C3	(0.43,0.51,0.64)	(0.91,1.26,1.74)	(1,1,1)	(0.81,1.06,1.35)	0.228
C4	(0.45,0.57,0.74)	(0.91,1.25,1.67)	(0.74,0.94,1.24)	(1,1,1)	0.222

- ✓ By placing the calculated values (W) in the initial super matrix, the rhythmic supramatrix is obtained as described in Table 9. In this super matrix, the sum of each column is 1.

Table 9. Rhythmic supermatrix

	Target	Indicators			
Target	0	0	0	0	0
Indicators		0	0.303	0.22	0.099	0.37
		0.362	0	0.275	0.2	0.13
		0.3	0.216	0	0.345	0.228
		0.112	0.177	0.35	0	0.222
		0.22	0.303	0.155	0.356	0

- ✓ Step 5 - Limit Supermatrix Formation: This is similar to the Markov chain process by enabling a rhythmic supermatrix to a large number. By increasing the weighted supernatant to 80, the ultimate matrix was obtained as Table 10.

Table 10. Limit Supermatrix

	Target	Indicators				
Target	0	0	0	0	0	0
Indicators	0.204	0.204	0.204	0.204	0.204	0.204
	0.190	0.190	0.190	0.190	0.190	0.190
	0.207	0.207	0.207	0.207	0.207	0.207

	0.181 0.198	0.181 0.198	0.181 0.198	0.181 0.198	0.181 0.198	0.181 0.198

- ✓ Step 6- Determining the weight of the indicators: In this step, the results of the supra matrix are used to determine the weight of the indicators. According to the limit sup matrix, the weight of the indicators is as shown in Table 11.

Table 11. Final weight of indicators

Indicator	Individual dimension	Job skills dimension	Personality dimension	Administrative skills dimension	The dimension of organizational empowerment
Weight	0.204	0.190	0.207	0.181	0.198

5-4 FTOPSIS Method:

- ✓ The steps of this method are as follows (Chen, 2000):

  - Step 1- Determine the appropriate language variables to rank the options: In this step, the language variables of Table 12 are used to convert verbal words into fuzzy numbers.

Table 12. Definition of language terms and their corresponding language values for evaluating options (Chen, 2000)

Linguistic terms	**Linguistic values**
very little	(0,0,1)
Low	(0,1,3)
Somewhat low	(1,3,5)
medium	(3,5,7)
Somewhat much	(5,7,9)
Much	(7,9,10)
very much	(9,10,10)

- Step 2 - Determining fuzzy numbers: In this step, according to the evaluation done by decision makers, and based on the table of language variables, fuzzy numbers corresponding to the evaluation of decision makers are determined. In general, if the decision makers are more than one person, there is one fuzzy number for each decision maker. Now, for further calculations, the fuzzy numbers obtained by different decision makers are combined to evaluate the options and the weight of the indicators, respectively, in the following relations, respectively.

$$\tilde{x}_{ij} = \frac{1}{k}\left[\tilde{x}_{ij}^{1} \bigoplus \tilde{x}_{ij}^{2} \bigoplus \ldots \oplus \tilde{x}_{ij}^{k}\right]$$

$$\tilde{w}_{j} = \frac{1}{k}\left[\tilde{w}_{j}^{1} \bigoplus \tilde{w}_{j}^{2} \bigoplus \ldots \oplus \tilde{w}_{j}^{k}\right]$$

- Step 3- Formation of fuzzy decision matrix:

$$\tilde{D} = \begin{bmatrix} \tilde{x}_{11} & \tilde{x}_{12} & \cdots & \tilde{x}_{1n} \\ \tilde{x}_{21} & \tilde{x}_{22} & & \tilde{x}_{2n} \\ \vdots & & \ddots & \vdots \\ \tilde{x}_{m1} & \tilde{x}_{m2} & \cdots & \tilde{x}_{mn} \end{bmatrix}$$

- ✓ The fuzzy decision matrix in this study, which is the sum of the opinions of all 10 experts, is shown in Table 13.

Table 13. Fuzzy decision matrix

	C1	C2	C3	C4	C5
W	0.204	0.190	0.207	0.181	0.198
A1	(5,7.5,9)	(2,4.5,6)	(5,7.5,9)	(4,6,8)	(7,8,9)
A2	(2,5,8)	(4,7,9)	(2,4.5,6)	(7,8.7,10)	(5,7.2,10)
A3	(7,8.7,10)	(2,3.5,5)	(5,7.5,9)	(4,6.5,9)	(6,8.5,10)
A4	(2,4.5,6)	(6.5,7.2,9)	(4,6,8)	(5.5,7.5,10)	(4,6,8)
A5	(3,4.7,6)	(5,7.2,8.5)	(7,8.5,10)	(2,3.5,4.5)	(7,8,9.5)

- Step 4 - Formation of fuzzy normalized decision matrix: In this step, the decision matrix obtained from the previous step is normalized by linear normalization method. The normalized decision matrix is $\widetilde{R} = [\tilde{r}_{ij}]_{m\times n}$. The components of this matrix for revenue indices and cost indices are calculated as follows:

$$u_j^* = \max_i u_{ij} \qquad \tilde{r}_{ij} = \left(\frac{l_{ij}}{u_j^*}, \frac{m_{ij}}{u_j^*}, \frac{u_{ij}}{u_j^*}\right)$$

$$, l_j^- = \min_i l_{ij} \qquad \tilde{r}_{ij} = \left(\frac{l_j^-}{u_{ij}}, \frac{l_j^-}{m_{ij}}, \frac{l_j^-}{l_{ij}}\right)$$

- Step 5 - Formation of a balanced fuzzy normalized matrix: In this step, by multiplying the fuzzy normalized decision matrix in the index weight matrix, a balanced normalized fuzzy matrix will be obtained.

$$\widetilde{V} = [\tilde{v}_{ij}]_{m\times n}, \quad i = 1, 2, \dots, m, \ j = 1, 2, \dots, n$$

$$\tilde{v}_{ij} = \tilde{r}_{ij} \otimes \tilde{w}_{ij}$$

- Step 6 - Determine the positive ideal answer and the negative ideal answer: According to the data obtained from the previous step, determine the positive ideal answer (A^*) and the negative ideal answer (A^-) using the following equations.

$$A^\star = (\tilde{V}_1^\star, \tilde{V}_2^\star, \dots, \tilde{V}_n^\star), \qquad \tilde{V}_j^\star = (1, 1, 1)$$

$$A^- = (\tilde{V}_1^-, \tilde{V}_2^-, \dots, \tilde{V}_n^-), \qquad V_j^- = (0, 0, 0)$$

- Step 7- Calculate the distance between each of the options to the positive ideal answer and the negative ideal answer: Using the following equations, so that d_i^* indicator shows the distance between option i and the positive ideal answer and d_i^- sign If the distance between option i and the ideal answer is negative, these values are calculated.

$$d_i^\star = \sum_{j=1}^{n} d(\tilde{v}_{ij}, v_j^\star), \qquad i = 1, 2, \dots, m$$

$$d_i^- = \sum_{j=1}^{n} d(\tilde{v}_{ij}, v_j^-), \qquad i = 1, 2, \dots, m$$

- ✓ In order to calculate the distance between two triangular fuzzy numbers $\tilde{m}$, n., The following equation is used.

$$d(\tilde{m}, \tilde{n}) = \sqrt{\frac{1}{3}[(m_1 - n_1)^2 + (m_2 - n_2)^2 + (m_3 - n_3)^2]}$$

- Step 8- Determining the proximity coefficient for each option and ranking the options: To calculate the proximity coefficient for each of the options, the following equation is used. And then the target markets will be ranked based on the largest coefficient of proximity.

$$CC_i = \frac{d_i^-}{d_i^* + d_i^-}, \qquad i = 1, 2, \ldots, n$$

- ✓ It should be noted that the use of the FTOPSIS method provided results as shown in Table 14 for the options. The results in this table are normalized. Therefore, prioritizing the options will be A3> A2> A4> A1> A5, respectively.

Table 14. Prioritize each option

The weight of each option	Options
0.191	A1
0.211	A2
0.224	A3
0.193	A4
0.182	A5

6- Conclusions and Suggestions:

In the literature, few fuzzy concept-based methods have been used to evaluate performance. This research tried to introduce a new integrated approach for evaluating individual performance in design and engineering companies in the oil, gas and petrochemical industries based on the concept of fuzzy and the application of a combined model (two approaches of network analysis process and TOPSIS in fuzzy environment). The fuzzy network analysis approach is used to weight individual performance evaluation criteria and options. The fuzzy TOPSIS approach is used to rank individual performance appraisal factors. Finally, based on the output obtained - the index of proximity to the ideal - employee performance can be evaluated.

The concern of the present study was obtained for the researcher because the competition in the field of oil and gas centers has been overshadowed by the emphasis on contracts in this field, and they somehow try to overtake other competitors by identifying their strengths and improvements. Engineering in the oil, gas and petrochemical industries are no exception to this rule and in competitive market conditions try to promote their image and brand.

As mentioned in the literature, the success and profitability of any economic and service resource is possible in the shadow of the strategic factors of human resources of that organization, paying attention to their needs and wants and establishing a sincere and emotional relationship with them is the determining factor of success or failure. It is considered an organization and this law governs and can be generalized in any enterprise connected to oil and gas. Obviously, the human resources of any organization are part of the assets of that organization and the correctness of the processes related to employees can encourage and motivate staff and ultimately help to improve other processes, including promotion and productivity, this important regardless of the process. It will not be achieved with human resource management, including the individual performance appraisal system. Many studies show the importance of the evaluation process and its effect on staff performance.

In a study conducted by Islam and Rasad to evaluate individual performance using the HP method, the criteria of quality / quantity of work, creativity, teamwork and cooperation were used as the main criteria, and in the present study, as sub-criteria in ranking by combined method. Have been noticed.

In another study by Bazar Jazayeri, in an article introducing the TEAM approach, he discusses the development of a performance appraisal program through four distinct stages. Which includes the technical stage, development stage, evaluation stage and maintenance stage. In his opinion, the second stage of development is one of the longest and

most sensitive stages of the performance evaluation process and the success and effectiveness of the performance evaluation program depends on the successful implementation of this stage. According to him, this step is done by supervisors and they observe and monitor, provide feedback and direct the performance of employees. Therefore, according to the results of the present study, organizational capabilities are the first priority in ranking the main factors by the HP method, which indicates the close alignment of this study with other studies.

In the study of Surayai et al. During a study that prioritized performance appraisal indicators using fuzzy AHP, the main criteria of intelligence and talent, leadership, perseverance and seriousness in work, initiative, creativity and flexibility and the results obtained include the amount of The use of individual knowledge in creating optimal results, staff skills, information transfer and success rates in training programs are the most important indicators of human resource evaluation. Is assigned to the fifth.

According to the obtained results, more attention to the main factors of organizational empowerment and job skills at the expert level is necessary and can increase competitiveness and motivation resulting from the correct system of individual performance appraisal as an effective factor in service delivery.

It is also suggested to pay more attention to the effective options in performance appraisal that have been ranked first to third based on the combined model. These factors are: quality and accuracy of work, responsibility and perseverance in performing tasks.

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