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SELECTION OF ACADEMIC STAFF USING THE FUZZY ANALYTIC HIERARCHY PROCESS (FAHP): A PILOT STUDY

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Original scientific paper

Evaluating candidates' suitability for a selection of academic staff is an important tool for Human Resources Management (HRM) to select the most suitable candidates for required posts. There are various methods regarding the selection of staff in the field. As there are increasing improvements in the field of education, universities around the world demand high quality and professional academic staffs. The present paper examines a fuzzy Analytic Hierarchy Process (FAHP) for selecting the most suitable academic staff, where five candidates under ten different sub-criteria are evaluated and prioritised. The FAHP method adopted here uses Triangular Fuzzy Numbers (TFN). The inability of AHP to deal with the impression and subjectiveness in the pair-wise comparison process has been improved in the FAHP. Instead of a crisp value, the FAHP generates a range of values to incorporate the decision-makers uncertainty. Also, a real case study is presented.

Keywords: *Academic Staff Selection, Multi-Criteria Decision-Making (MCDM), Fuzzy Analytic Hierarchy Process (FAHP), Human Resources Management (HRM)*

Izbor akademskog osoblja primjenom neizrazitog analitičkog hijerarhijskog postupka (FAHP): Ogledno istraživanje

Izvorni znanstveni članak

Procjena pogodnosti kandidata pri odabiru akademskog osoblja važan je alat u upravljanju ljudskim resursima (Human Resources Management – HRM) kod izbora odgovarajućih kandidata za tražena mjesta. Postoje različite metode za izbor osoblja u nekom području. Budući da područje obrazovanja postaje sve naprednije, univerziteti širom svijeta traže visoko kvalitetno i profesionalno akademsko osoblje. U ovom se radu ispituje neizraziti analitički hijerarhijski postupak (Fuzzy Analytic Hierarchy Process – FAHP) za izbor najprihvatljivijeg akademskog osoblja. Ocjenjuje se pet kandidata uz deset različitih podkriterija. Ovdje primijenjena FAHP metoda koristi trokutne neizrazite brojeve (Triangular Fuzzy Numbers – TFN). Nemogućnost AHP da bilježi utiske i subjektivno mišljenje u postupku uspoređivanja kandidata ispravljena je u FAHPu. Umjesto jedne definirane, gotove vrijednosti FAHP generira čitav niz vrijednosti kojima se obuhvaćaju nesigurni stavovi onih koji donose odluke. Prezentira se i analiza stvarnog slučaja.

Ključne riječi: *izbor akademskog osoblja, donošenje odluka uz više kriterija, neizraziti analitički hijerarhijski postupak (Fuzzy Analytic Hierarchy Process – FAHP), upravljanje ljudskim resursima*

1 Introduction

Personnel selection is a very important activity for Human Resources Management (HRM) that requires adequate selection criteria. In the wake of an increase in the number of universities in Turkey, the need for recruiting academic staff has become inevitable. When candidates apply for academic positions in a university, the basic purpose of selection operations is to determine those that have the necessary up-to-date knowledge, research performance, and language skills. Substantial research has been conducted on recruitment due to its critical role in bringing human capital into organizations [1].

There is an extended literature on personnel selection problem. For instance, Liang and Wang [2] provided an Multi-Criteria Decision-Making (MCDM) method for personnel selection that uses a fuzzy MCDM method. Gungor et al. [3] proposed a fuzzy AHP method for personnel selection problem based on quantitative and qualitative criteria. Kelemenis and Askounis [4] provided a new TOPSIS method to personnel selection. Dursun and Karsak presented a fuzzy MCDM algorithm for personnel selection. Rouyendegh and Erkan [5] provided an MCDM method for academic staff selection that uses a fuzzy ELECTRE algorithm. The fuzzy linguistic models allow the translation of verbal expressions into numerical ones, thereby dealing quantitatively with imprecision in the expression of the importance of each criterion. There are a number of multi-criteria methods used for this purpose and based on fuzzy relations. The fuzzy set theory has been proposed by Miller and Feinzing [6], Karsak [7], and Capaldo and Zollo [8] to address the issue of staff selection. In addition, the fuzzy analytical approach has been applied by Mikhailov [9] to the problem of selecting partnerships. Jessop [10] has applied the minimally-biased weight method in staff selection. Chen and Cheng [11] have proposed a Fuzzy Group Decision Support System (FGDSS) based on the metric distance method in order to solve the Information System (IS) problem in staff selection .

The MCDM was introduced in the early 1970's as a promising and important field of study. Since then, the number of contributions to the theories and models, which could be used as a basis for more systematic and rational decision-making with multi-criteria, has continued to grow at a steady rate [12]. In general, MCDM is a modelling and methodological tool for dealing with complex engineering problems [13]. Many mathematical programming models have been developed to address MCDM problems. However, in recent years, MCDM methods have gained considerable acceptance for judging different proposals.

When personnel selection that depends on the firm's specific targets, and the availiability of the individual preferences of Decision Maker(s) (DM), are combined, there becomes a highly complex situation [4]. It is not easy for the DM to select appropriate personnel who satisfy all the requirements among various criteria. Moreover, personnel selection is a MCDM problem which is affected by several conflicting factors and it consists of both qualitative and quantitative factors. In many MCDM models in the literature, quantitative criteria have been considered for staff selection. In recent years, the attention paid by researchers to the topic of skilled employee recruitment has increased considerably [14, 15]. As globalization intensifies, human capital becomes a critical element for the success of firms [16]. In addition, successful recruitment is also crucial for a nation's economic growth due to the shortage in labor force in many countries [17].

In the literature, the techniques applied in staff selection, assessment, and evaluation include written and oral exams [18]. Although evaluating applicants by means of written and oral exams is essential for a company when recruiting the needed staff, it is not sufficient all by itself; in this process, first of all, the criteria – or factors – that are to be the basis of assessment and evaluation have to be specified. Also, the weights of these criteria need to be determined for each criterion, which may possess a different degree of importance – or weight – in staff assessment and evaluation. Therefore, unsatisfactory selections may occur with assessment and evaluation tools, such as written or oral exams and tests, which may not be based upon any certain criteria and/or weight [19].

In this paper, Analytic Hierarchy Process (AHP) is suggested to solve academic staff selection based on Triangular Fuzzy Numbers (TFN) in the analysis. The AHP is a well-known method for solving decision-making problems. It is one of the most widely-used MCDM methods, in which the DM performs pair-wise comparisons and, then, the pair-wise comparison matrix and the eigenvector are derived to specify the weights of each parameter in the problem. The weights guide the DM in choosing the superior alternative.

This paper is divided into four sections. In section one, the problem is introduced. In section two, the FAHP is constructed and computations are carried out. How the proposed model is used in an example in the real world is explained in section three. Finally, in section four, conclusions and future study areas are discussed.

2 Preliminaries

2.1 Analytical hierarchy process (AHP)

The AHP, proposed by Saaty [20] is a flexible, quantitative method for selecting among alternatives based on their relative performance with respect to one or more criteria of interest [21, 22]. The AHP resolves complex decisions by structuring the alternatives into a hierarchical framework. The hierarchy is constructed through pair-wise comparisons of individual judgments rather than attempting to prioritize the entire list of decisions and criteria simultaneously. This process generally involves six steps [23]:

- Describing the unstructured problem,
- Detailed criteria and alternatives,
- Recruiting pair wise comparisons among decision elements,
- Using the eigenvalue method to predict the relative weights of the decision elements,
- Computing the consistency properties of the matrix, and
- Collecting the weighted decision elements.

The AHP techniques form a framework for decisions that use a one-way hierarchical relation with respect to the decision layers. The hierarchy is constructed in the middle level(s), with decision alternatives at the bottom, as shown in Fig. 1. The AHP method provides a structured framework for setting priorities on each level of the hierarchy using pair-wise comparisons that are quantified using a 1 ÷ 9 scale as demonstrated in Tab. 1.

Table 1 The 1 ÷ 9 Fundamental Scale

Importance intensity	Definition
1	Equal importance
3	Moderate importance of one over another
5	Strong importance of one over another
7	Very strong importance of one over another
9	Extreme importance of one over another
2, 4, 6, 8	Intermediate values

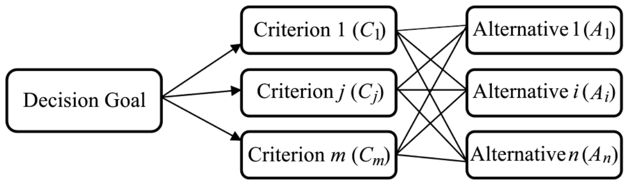

Figure 1 Hierarchy for a typical three-level MCDM problem

2.2 Fuzzy sets and fuzzy number

Zadeh (1965) introduced the Fuzzy Set Theory (FST) to deal with the uncertainty and vagueness. A major contribution of FST is the capability of representing uncertain data. FST also allows mathematical operators and programming to be performed to the fuzzy domain. A Fuzzy Set (FS) is a class of objects with a continuum of grades of membership. Such a set is characterized by a membership function, which assigns to each object a grade of membership ranging "between" zero and one [24, 25].

A tilde "~" will be placed above a symbol if the symbol shows a FST. A Triangular Fuzzy Number (TFN) $\tilde{M}$ is shown in Fig. 1. A TFN is denoted simply as (a, b, c). The parameters a, b and c $(a \le b \le c)$, respectively, denote the smallest possible value, the most promising value, and the largest possible value that describe a fuzzy event. The membership function of TFN is as follows:

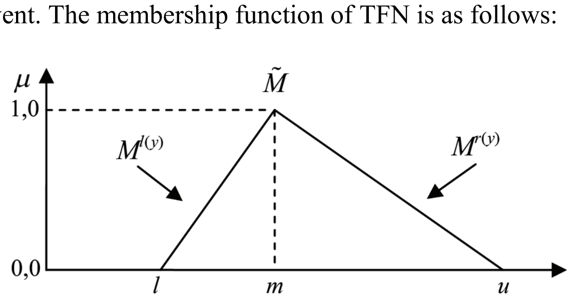

Figure 2 A TFNs $\tilde{M}$

Each TFN has linear representations on its left and right side, such that its membership function can be defined as:

$$\mu\left(\frac{x}{\widetilde{M}}\right)=\begin{cases}0, & x<l,\\ \dfrac{x-l}{m-l}, & l\le x\le m,\\ \dfrac{u-x}{u-m}, & m\le x\le u,\\ 0, & x>u.\end{cases} \tag{1}$$

A fuzzy number (FN) can always be given by its corresponding left and right representation of each degree of membership as in the following:

$$\widetilde{M}=M^{l(y)},M^{r(y)}=\left[l+(m-l)y,u+(m-u)y\right],\ y\in[0,1]. \tag{2}$$

Where $l(y)$ and $r(y)$ denote the left side representation and the right side representation of a fuzzy number (FN), respectively. Many ranking methods for FNs have been developed in the literature. These methods may provide different ranking results [26].

While there are various operations on TFNs, only the important operations used in this study are illustrated. Two positive TFNs (a_1, b_1, c_1) and (a_1, b_2, c_2) have been given as follows:

$$\begin{aligned}&(a_1,b_1,c_1)+(a_2,b_2,c_2)=(a_1+a_2,b_1+b_2,c_1+c_2),\\&(a_1,b_1,c_1)-(a_2,b_2,c_2)=(a_1-a_2,b_1-b_2,c_1-c_2),\\&(a_1,b_1,c_1)\times(a_2,b_2,c_2)=(a_1\times a_2,b_1\times b_2,c_1\times c_2),\\&(a_1,b_1,c_1)/(a_2,b_2,c_2)=(a_1/c_2,b_1/b_2,c_1/a_2).\end{aligned} \tag{3}$$

2.3 Fuzzy AHP

The AHP has a special concern with departure from consistency and the measurement of this departure, and with dependence within, and between, the groups of elements of its structure; it has found its widest applications in MCDM in planning and resource allocation, and in conflict resolution. In its general form, the AHP is a non-linear framework for carrying out both deductive and inductive thinking without the use of syllogisms. This is made possible by taking several factors into consideration simultaneously, allowing for dependence and for feedback and making numerical trade-offs to arrive at a synthesis or conclusion [27].

3 A model for academic staff selection

In this section, the academic staff selection problem is modelled with the FAHP method, according to which, factors used in the selection process are weighted according to this method. We modify the selection process to a ten- step method procedure, as shown below:

Step 1: Selection of an Expert Group for Decision-Making

Step 2: Calculation of TFN's

We set up the Triangular Fuzzy Numbers (TFN's). Each expert makes a pair-wise comparison of the decision criteria and gives them relative scores. The inability of AHP to deal with the impression and subjectiveness in the pair-wise comparison process has been improved in the fuzzy AHP. Instead of a crisp value, the fuzzy AHP is a range of values to incorporate the decision-makers' uncertainty [28]. In this method, the fuzzy conversion scale is as in Tab. 2. This scale has been employed in Parkash's [29] fuzzy prioritization approach.

Table 2 The 1 ÷ 9 Fuzzy conversion scale

Importance intensity	Triangular fuzzy scale	Importance intensity	Triangular fuzzy scale
1	(1, 1, 1)	1/1	(1/1, 1/1, 1/1)
2	(1, 2, 4)	1/2	(1/4, 1/2, 1/1)
3	(1, 3, 5)	1/3	(1/5, 1/3, 1/1)
5	(3, 5, 7)	1/5	(1/7, 1/5, 1/3)
7	(5, 7, 9)	1/7	(1/9, 1/7, 1/5)
9	(7, 9, 11)	1/9	(1/11, 1/9, 1/7)

$$\widetilde{G}_1=(l_i,m_i,u_i). \tag{4}$$

Step 3: Calculation of $\widetilde{G}_1$

We set up the TFNs using the AHP method based on the fuzzy numbers. Each expert makes a pair-wise comparison of the decision criteria and gives them relative scores:

$$\widetilde{G}_1=(l_i,m_i,u_i) \tag{5}$$

$$l_i=(l_{i1}\otimes l_{i2}\otimes\ldots\otimes l_{ik})^{\frac{1}{k}},\ i=1,2,\ldots,k \tag{6}$$

$$m_i=(m_{i1}\otimes m_{i2}\otimes\ldots\otimes m_{ik})^{\frac{1}{k}},\ i=1,2,\ldots,k \tag{7}$$

$$u_i=(u_{i1}\otimes u_{i2}\otimes\ldots\otimes u_{ik})^{\frac{1}{k}},\ i=1,2,\ldots,k. \tag{8}$$

Step 4: Calculation of $\widetilde{G}_T$

We establish the geometric fuzzy mean of the total row, using:

$$\widetilde{G}_T=\left(\sum_{i=1}^{k}l_i,\sum_{i=1}^{k}m_i,\sum_{i=1}^{k}u_i\right). \tag{9}$$

Step 5: Determination of fuzzy priorities for each candidate

The global weights for each candidate is determined and the candidates fuzzy priorities are calculated based on sub-factors proposed by Chan [30] using Linguistic variables, which are defined for the triangular fuzzy numbers, as in Tab. 3.

Table 3 Fuzzy numbers

Importance intensity	Triangular fuzzy scale
Very good	(3, 5, 5)
Good	(1, 3, 5)
Moderate	(1, 1, 1)
Poor	(1/5, 1/3, 1)
Very poor	(1/5, 1/5, 1/3)

Step 6: Calculation of $\widetilde{w}$

The fuzzy geometric mean of the fuzzy priority value is calculated with normalization priorities for factors using:

$$\tilde{w} = \frac{\tilde{G}_i}{\tilde{G}_T} = \frac{(l_i, m_i, u_i)}{\left(\sum_{i=1}^{k} l_i, \sum_{i=1}^{k} m_i, \sum_{i=1}^{k} u_i\right)} = \left[\frac{l_i}{\sum_{i=1}^{k} u_i}, \frac{m_i}{\sum_{i=1}^{k} m_i}, \frac{u_i}{\sum_{i=1}^{k} l_i}\right]. \quad (10)$$

Step 7: Calculation of $wi_{\alpha l}$

Factors belonging to nine different α-cut values are determined for the calculated α. The fuzzy priorities will be applied for lower and upper limits for each α value:

$$wi_{\alpha l} = (wil_{\alpha l}, wiu_{\alpha l});\ i = 1, 2, ..., k;\ l = 1, 2, ..., L. \quad (11)$$

Step 8: Calculation of W_{il}, W_{in}

Combine the entire upper values and the lower values separately, and then divide them by the total sum of α value:

$$W_{il} = \frac{\sum_{i=1}^{L} \alpha (w_{il})_l}{\sum_{i=1}^{L} \alpha_l};\ i = 1, 2, ..., k;\ l = 1, 2, ..., L \quad (12)$$

$$W_{iu} = \frac{\sum_{i=1}^{L} \alpha (w_{iu})_l}{\sum_{i=1}^{L} \alpha_l};\ i = 1, 2, ..., k;\ l = 1, 2, ..., L. \quad (13)$$

Step 9: Calculation of w_{id}

The following formula is used in order to defuzzify by combining the upper limit value and the lower limit values using the optimism index (λ).

$$w_{id} = \lambda \cdot W_{iu} + (1 - \lambda) \cdot W_{il};\ \lambda \in [0,1];\ i = 1, 2, ..., k. \quad (14)$$

Step 10: Calculation of W_{in}

In this final stage the defuzzification values priorities are normalized using:

$$W_{in} = \frac{w_{id}}{\sum_{i=1}^{k} w_{id}};\ i = 1, 2, ..., k. \quad (15)$$

3.1 Determining the weights of the factors in staff selection model

After building the FAHP model which aims to solve the problem of selecting the most eligible academic staff, the optimal academic personnel alternative is determined, as shown in Fig. 3.

Table 4 Pair-wise comparison matrix and fuzzy weights for factors

DMU	Work factor	Individual factor	Academic factor
Work factor	(1, 1, 1)	(1, 3, 5)	(1, 2, 4)
Individual factor	(1/5, 1/3, 1)	(1, 1, 1)	(1/4, 1/2, 1)
Academic factor	(1/4, 1/2, 1)	(1, 2, 4)	(1, 1, 1)

Table 5 Pair-wise comparison matrix and fuzzy weights for the work factor related sub-factors

Work factor	GRE – Foreign language	Average (Bachelor degree)	Oral presentation
GRE – Foreign language	(1, 1, 1)	(1, 3, 5)	(1, 5, 7)
Average (Bachelor degree)	(1/5, 1/3, 1)	(1, 1, 1)	(1, 3, 5)
Oral presentation	(1/7, 1/5, 1/3)	(1/5, 1/3, 1)	(1, 1, 1)

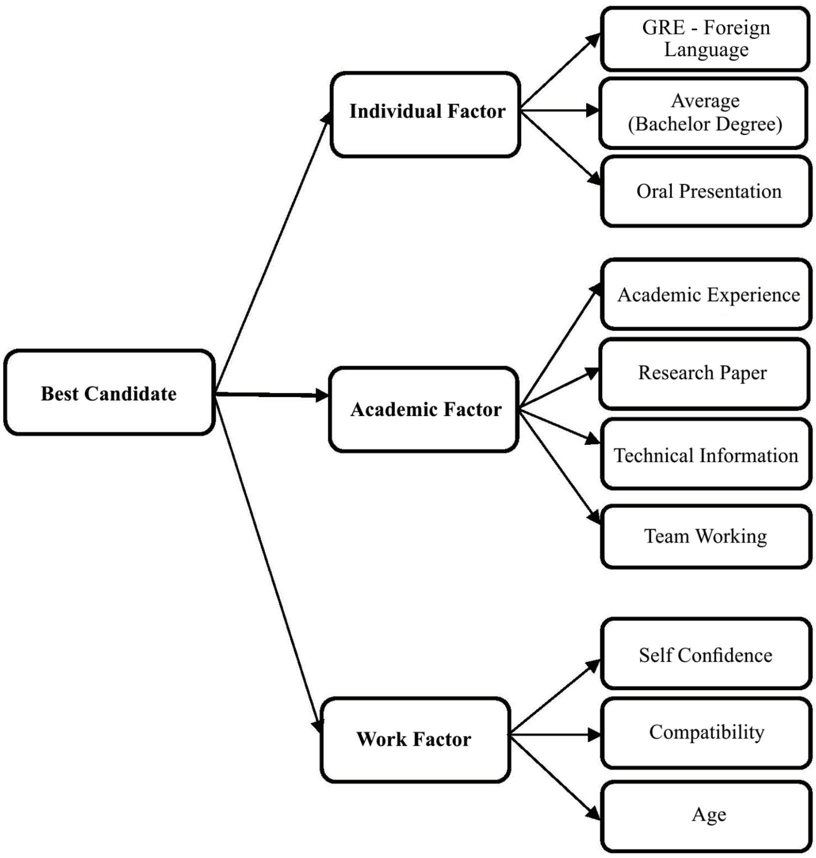

Figure 3 Hierarchy for staff selection problem

Table 6 Pair-wise comparison matrix and fuzzy weights for the academic factor related sub-factors

Academic factor	Self confidence	Compatibility	Age
Self confidence	(1, 1, 1)	(1, 2, 4)	(1, 3, 5)
Compatibility	(1/4, 1/2,1)	(1, 1, 1)	(1, 2, 4)
Age	(1/5, 1/3, 1)	(1/4, 1/2, 1)	(1, 1, 1)

Table 7 Pair-wise comparison matrix and fuzzy weights for the individual factor related sub-factors

Individual Factor	Academic experience	Research paper	Technical information	Team working
Academic experience	(1, 1, 1)	(1/4, 1/2, 1)	(1, 2, 4)	(1, 2, 4)
Research paper	(1, 2, 4)	(1, 1, 1)	(1, 3, 5)	(1, 3,5)
Technical information	(1/4, 1/2, 1)	(1/5, 1/3, 1)	(1, 1, 1)	(1, 1, 1)
Team working	(1/4, 1/2, 1)	(1/5, 1/3, 1)	(1, 1, 1)	(1, 1, 1)

Table 8 Global fuzzy factor for sub-factor

Individual factor	Fuzzy factor for sub factor	Global fuzzy factor for sub factor
Work Factor: (0,218; 0,613; 0,926)	(0.254,0.637,1.409) (0.102,0.259,0.732) (0.053,0.103,0.297)	(0.055,0.390,1.305) (0.022,0.159,0.678) (0.012,0.063,0.275)
Individual Factor (0,078; 0,137; 0,463)	(0.707,1.189,2) (1,2.060,3.163) (0.473,0.639,1) (0.473,0.507,1)	(0.055,0.163,0.926) (0.078,0.282,1.528) (0.0037,0.088,0.463) (0.037,0.069,0.463)
Individual Factor: (0,174; 0,249; 0,740)	(0.169,0.571,1.23) (0.106,0.286,1.23) (0.063,0.143,0.5)	(0.029,0.147,0.911) (0.018,0.071,0.911) (0.011,0036,0.371)

Table 9 Total fuzzy priority for the first candidate

Sub factor	Global fuzzy	Triangular fuzzy scale	Weight
First Candidate	(0,055; 0,390; 1,305)	(1, 1, 1)	(0,055; 0,390; 1,305)
	(0,022; 0,159; 0,678)	(1, 3, 5)	(0,022; 0,477; 3,390)
	(0,012; 0,063; 0,275)	(3, 5, 5)	(0,036; 0,315; 1,375)
	(0,055; 0,163; 0,926)	(3, 4, 5)	(0,165; 0,815; 4,630)
	(0,078; 0,282; 1,528)	(1, 1, 1)	(0,078; 0,282; 1,528)
	(0,037; 0,088; 0,463)	(1/5, 1/5, 1/3)	(0,0074; 0,0176; 0,154)
	(0,037; 0,069; 0,463)	(1/5, 1/5, 1/3)	(0,074; 0,0138; 0.154)
	(0,029; 0,147; 0,911)	(1, 3, 5)	(0,029; 0522; 4,555)
	(0,018; 0,071; 0,911)	(1, 3, 5)	(0,018; 0,213; 4,555)
	(0,011; 0,036; 0,371)	(1, 3, 5)	(0,011; 0,108; 1,855)
Second Candidate	(0,055; 0,390; 1,305)	(1, 3, 5)	(0,055; 1,170; 6,525)
	(0,022; 0,159; 0,678)	(1, 1, 1)	(0,022; 0,159; 0,678)
	(0,012; 0,063; 0,275)	(1, 1, 1)	(0,012; 0,063; 0,275)
	(0,055; 0,163; 0,926)	(1, 3, 5)	(0,055; 0,489; 4,630)
	(0,078; 0,282; 1,528)	(1, 1, 1)	(0,078; 0,282; 1,528)
	(0,037; 0,088; 0,463)	(1/5, 1/3, 1)	(0,0074; 0,0293; 0,463)
	(0,037; 0,069; 0,463)	(1/5, 1/3, 1)	(0,0074; 0,023; 0,463)
	(0,029; 0,147; 0,911)	(3, 5, 5)	(0,087; 0,735; 4,555)
	(0,018; 0,071; 0,911)	(1, 5, 5)	(0,054; 0,355; 4,555)
	(0,011; 0,036; 0,371)	(1, 3, 5)	(0,011; 0,108; 1,855)
Third Candidate	(0,055; 0,390; 1,305)	(1/5, 1/3, 1)	(0,011; 0,13; 1,305)
	(0,022; 0,159; 0,678)	(1/5, 1/3, 1)	(0,0044; 0,053; 0,678)
	(0,012; 0,063; 0,275)	(1/5, 1/3, 1)	(0,0024; 0,021; 0,275)
	(0,055; 0,163; 0,926)	(1, 1, 1)	(0,055; 0,163; 0,926)
	(0,078; 0,282; 1,528)	(1, 1, 1)	(0,078; 0,282; 1,528)
	(0,037; 0,088; 0,463)	(3, 5, 5)	(0,111; 0,440; 2,315)
	(0,037; 0,069; 0,463)	(3, 5, 5)	(0,111; 0,345; 2,315)
	(0,029; 0,147; 0,911)	(1, 1, 1)	(0,029; 0,147; 0,911)
	(0,018; 0,071; 0,911)	(1/5, 1/3, 1)	(0,0036; 0,024; 0,911)
	(0,011; 0,036; 0,371)	(1, 1, 1)	(0,011; 0,036; 0,371)
Fourth Candidate	(0,055; 0,390; 1,305)	(1/5, 1/3, 1)	(0,011; 0,13; 1,305)
	(0,022; 0,159; 0,678)	(1/5, 1/3, 1)	(0,0044; 0,053; 0,678)
	(0,012; 0,063; 0,275)	(1/5, 1/3, 1)	(0,0024; 0,021; 0,275)
	(0,055; 0,163; 0,926)	(1, 1, 1)	(0,055; 0,163; 0,926)
	(0,078; 0,282; 1,528)	(1, 1, 1)	(0,078; 0,282; 1,528)
	(0,037; 0,088; 0,463)	(3, 5, 5)	(0,111; 0,440; 2,315)
	(0,037; 0,069; 0,463)	(3, 5, 5)	(0,111; 0,345; 2,315)
	(0,029; 0,147; 0,911)	(1, 1, 1)	(0,029; 0,147; 0,911)
	(0,018; 0,071; 0,911)	(1/5, 1/3, 1)	(0,0036; 0,0142; 0,304)
	(0,011; 0,036; 0,371)	(1/5, 1/3, 1)	(0,0022; 0,0120; 0,371)
Fifth Candidate	(0,055; 0,390; 1,305)	(1, 1, 1)	(0,055; 0,390; 1,305)
	(0,022; 0,159; 0,678)	(1, 1, 1)	(0,022; 0,159; 0,678)
	(0,012; 0,063; 0,275)	(1, 3, 5)	(0,012; 0,189; 1,375)
	(0,055; 0,163; 0,926)	(1, 3, 5)	(0,055; 0,489; 4,630)
	(0,078; 0,282; 1,528)	(3, 5, 5)	(0,234; 1,410; 7,640)
	(0,037; 0,088; 0,463)	(1, 3, 5)	(0,037; 0264; 2,315)
	(0,037; 0,069; 0,463)	(1, 3, 5)	(0,037; 0207; 2,315)
	(0,029; 0,147; 0,911)	(1, 1, 1)	(0,029; 0,147; 0,911)
	(0,018; 0,071; 0,911)	(1/5, 1/3, 1)	(0,0036; 0,0142; 0,304)
	(0,011; 0,036; 0,371)	(1/5, 1/3, 1)	(0,0022; 0,0120; 0,371)

4 Results

As explained in Section 2.3, we aimed to select the most appropriate candidate for the position of academic staff. We have three criteria – namely, work, academic, and individual. The first, the second, and the third criterion are divided into three, four, and three sub-criteria, respectively. Tabs. 4÷9 demonstrate the relevant matrix related to the first step of the model.

The result score is always the-bigger-the-better. As shown in Tab. 10, candidate 2 has the largest score due to the most appropriate choice. Candidate 3 has the smallest score of the 5 candidates and is, therefore, ranked in the last place.

Finally, and upon the results of experiments, it is clear that – based on the FAHP approach - the candidate with the highest score is the most suitable choice for the job while the candidate with the smallest score among the five others is ranked in the last place.

Table 10 Normalization Priorities for Candidates

Candidates	Weight
First Candidate	6,518
Second Candidate	**7,101**
Third Candidate	**3,229**
Fourth Candidate	4,588
Fifth Candidate	6,289

5 Conclusion

The aim of the study was to provide an aduquate MCDM on academic staff selection. A MCDM algorithm based on the TFN is designed in the selection of academic staff selection. In order to achieve consensus among the decision-makers, all pair-wise comparisons were converted into triangular fuzzy numbers to adjust the fuzzy rating and the fuzzy attribute weight. The fuzzy set theory in the decision-making process implies that this practice is not absolute.

Academic staff selection is a process that also contains uncertainties. This problem can be overcome by using fuzzy numbers and linguistic variables to achieve accuracy and consistency. In short, our analysis suggests that recruitment within an academic environment is a complex issue and, thus, human resources and/or other authorities need to take appropriate measures when recruiting.

As for future work, it is suggested that other multi-criteria approaches may - such as, ANP and fuzzy outranking methods - be applied and compared in the process of staff selection and recruitment. The comparison of various methods in the selection of personnel may help in finding out the accuracy, appropriateness, suitability, fairness and practicality efficiently.

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