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SELECTING AN EFFECTIVE LEADER- A COMPETENCY BASED FUZZY VIKOR ANALYSIS MODEL

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Zagross Hadadian
University of Applied Science and Technology, Zar center, Karaj, Iran
Zagrossfuture@gmail.com

Kimiya Mesbah
Mazandaran University of Science and Technology, Babol, Iran
Mkimiya.2000@gmail.com

Abstract: The accurate and targeted process of selecting the most appropriate human resources can be a key factor in organizational success. The increasing attention to the leadership factor in making organizational developments across the world and the key role of effective leader show the need to use effective methods to recruit effective leaders. In this paper the fuzzy VIKOR method has been developed to solve fuzzy multicriteria problem to select effective leader. This method solves problem in a fuzzy environment where both criteria and weights are fuzzy sets. The fuzzy operations and procedures for ranking fuzzy numbers are used in developing the Fuzzy VIKOR algorithm. A numerical example illustrates an application to select effective leaders.

Keywords: Effective leaders, Fuzzy VIKOR Analysis.

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1. INTRODUCTION

There has been long-standing debate on the effectiveness, efficiency, productivity and excellence of organizations among organizational theorists, management philosophers, financial and economic analysts, and executives. The scientists, theorists and experts investigating the organization have generally started their works with the issue of effectiveness. The effectiveness efforts are a common aspect of all organizations, and effectiveness is a concept that has received special attention in the new management so that the majority of research in the field of organization and management has addressed it consciously or unconsciously and directly and indirectly.

One of the most important issues related to organizational effectiveness is leadership effectiveness, as Hersey, Blanchard and Johnson argue that one clear point that flows in the whole leadership literature is that successful organizations have a major feature that distinguishes them from unsuccessful ones, which is dynamic and effective leadership (Herbest, 2003). Peter Drucker also points out that leaders and managers are the most scarce, basic resources of all organization. For this reason, organizations are continually looking for effective leaders (Cunningham, 2003). According to Parolini (2004), research on the competitiveness values empirically show that effective leaders first value people, and then context and systems, and finally production goals. These priorities are empirically related to maximizing the commercial and financial performance as well as organizational effectiveness. Therefore, we can say that leadership effectiveness will lead to organizational effectiveness.

According to Stevenson and Warn (2004) effective leadership is a person's ability to effectively influence others when the leader uses a combination of his knowledge, skills and attitude. Effective leadership in the organization is the essential factor in creating sympathy and empathy, and effective leaders are those who can bring together different people under a single intellectual structure and view and create the perception that individual differences are trivial, and it is the collective spirit that matters (Alvani, 1998). Moreover, according to Stogdill (1974), unlike ineffective leaders, effective leaders inform their subordinates on what is expected of them, let them know the process of changes, explain the reasons for decisions and ask their opinions before adopting a new plan. The most effective leaders show higher adaptation degrees, which enables them to adapt their behavior with ever-changing and contradictory demands. Overall, it seems that each of the different management movements has tried to realize leadership effectiveness or organizational effectiveness through debate on effective leadership in the form of practical, transformational, servant, etc.

The implications of management theories that emphasize efficiency and effectiveness and focus on traditional leadership methods are that to achieve efficiency and effectiveness, it is necessary to apply traditional leadership methods, such as the traits theory, behavioral theories, contingency and conditional theories and even the transformational leadership theory, because these leadership methods are consistent with these management approaches and will lead to efficiency and effectiveness (Haseen, 2001). Although over the last decades, studies have been done on behaviors related to leadership effectiveness, they have mostly examined broad categories of task-oriented and relationship-oriented behaviors (such as structure development and attention to employees) that cannot be easily related to the requirements and challenges that managers are faced with in different situations (Farahi, 1996).

Since the hiring, training and firing poor and inappropriate staff are often costly, and realizing the inappropriateness of some employees is time-consuming (Golec & Kahya, 2007), the correct selection of candidates for the organization is vital. One of the basic steps of staff selection process and one of the most important and complex issues in employee selection is to present the features and indicators required for a candidate and how to weight them (Jessop, 2004; Lin, 2010). Many researchers have examined staff selection using different techniques and indicators. The literature review found that the indicators used as staff selection criteria are very broad and often different. However, there are some common indicators in the studies (Golec & Kahya, 2007; Kelemenis & Askounis, 2010; Dursun & Karsak, 2010; Kelemenis & Askounis, 2010); But when it comes to select a leader, the decision dimensions will be different, and the selection parameters will be different.

Researchers defined and explained leadership in various ways. Bennis and Nanus (1985) claimed that there were more than 350 different definitions for leadership prior to 1985. This diversity in definition can be clarified by Conger (1992) indicating that “leadership is largely an intuitive concept for which there can never be a single agreed-upon definition”. Just as there are different definitions for leadership, there are different leadership theories. To start with, the leader traits theory, which was among the first leadership theories, described leadership effectiveness by the natural characteristics and abilities (such as superior intelligence, good memory, and bountiful energy etc.) of the leader (Steers, Porter, & Bigley, 1996). However, this theory had a weakness. It could not predict the linkage between leadership traits and performance (Stogdill, 1948); therefore, new theories were proposed. For instance, leader behavior theories which explained leadership effectiveness by leader behaviors were introduced. These theories instead of leaders’ traits, concentrated on behaviors of leaders to understand leadership effectiveness (Steers et al., 1996).

Scholars (for example, Schellhardt, 1996; Smith, Hornsby, & Shirmeyer, 1996) attain that measuring leadership effectiveness in meaningful and useful ways is a difficult exercise, and mostly leads to failure. Researchers have tried to determine factors which should be asses, for example, according to Hughes et al. (1999), many organizations apply competence model. These models introduce behaviors that are translated into skills and behaviors that a leader must excel in (Guinn, 1996). The major benefit of the competence model is that it keeps alignment between needed behaviors and skills of effective leaders and what is assessed (Hughes et al., 1999).

There are so many competence items which can be assessed to select an effective leadership. For instance, they should be a good listener, have ability to solve conflicts, have knowledge of the law, and be able to establish directions for others (Spencer & Spencer, 1993; Conger, 1992; Kotter, 1990). Moreover, they should be strategic opportunist, a good data analyst, sensitive to diversified issues, and have good communication skills (Conger & Benjamin, 1999). Additionally, in their researches, Oyinlade (2003) and Oyinlade and Gellhaus (2005) counted a number of essential behavioral leadership qualities as follows: Good listening skills, Good presentation skills, Participative decision-making style, Motivator, Honest and Ethical, Organizational knowledge, Good interpersonal skills, Fiscal efficiency, Knowledge of policies, Vision for the future, Delegating authority, Providing support, Fairness, Creativity, Hardworking, Good prioritizing skills, Problem-solving skills.

2.THE PROPOSED METHOD AND EXPERIMENTAL RESULT

Since the most fundamental feature of human resources is their fuzziness, some researchers (For example, Capaldo & Zollo, 2001; Dursun & Karsak, 2010; Golec & Kahya, 2007; Gungor, 2009; Zhang & Liu, 2011; Alguliyev et al., 2015) have chosen multi-criteria decision-making methods in fuzzy environments for employee selection. One of these approaches to do decision-making is using Fuzzy VIKOR. The VIKOR was developed to determine a solution for a problem with conflicting criteria, which can help decision makers reach a final decision (Yücenur et al., 2012; Wan et al., 2013). In the VIKOR, the solution combines a maximum group utility and a minimum individual regret of the opponent (Wan et al., 2013). An extension of VIKOR to determine fuzzy compromise solution for multicriteria is presented by Opricovic (2007). Fuzzy VIKOR is based on the aggregating fuzzy merit that represents distance of an alternative to the ideal solution (Yücenur et al., 2012; Wan et al., 2013; Chang, 2014). In this study we planed to select leaders based on their effectiveness. Based on the literature review we assumed that there are six main important creteria to assess leaders for effectiveness:

C1= Honest and Ethical

C2= Motivator

C3= Vision for the future

C4= Participative decision making style

C5= Good interpersonal skills

C6= Problem-solving skills

Moreover, we planed to assess 5 leaders (A1,A2,A3,A4,A5) based on this technique.

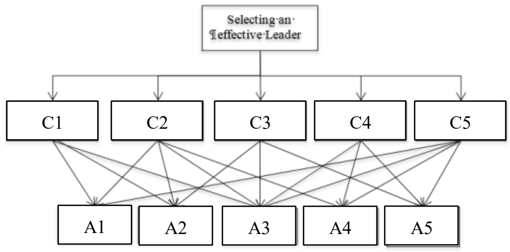


Figure1. Creteria and available options to select

Based on the indices identified, we prioritized the available options using the fuzzy VIKOR technique. The VIKOR technique is one of the multi-criteria decision-making techniques to select the best option. The normalized value in the VIKOR technique does not depend on criterion measurement unit, while the values normalized by other methods such as TOPSIS might depend on the measurement unit (Huang et al, 2009). Decision matrix is first formed like other methods to select the best option based on multi-criteria decision-making techniques. The decision matrix with n criteria and m option, represented by X, will be calculated as follows:

$$\tilde{\mathrm{X}} = \begin{bmatrix} x_{11} & x_{12} \cdots & x_{1n} \\ x_{21} & x_{22} \cdots & x_{2n} \\ \vdots & \vdots & \vdots \\ x_{m1} & x_{m2} & x_{mn} \end{bmatrix} \quad (1)$$

If the relations of n criteria are investigated by k expert, the initial matrix to investigate the relations of n criteria relations from the k^{th} assessor perspective will be as follows

$$\begin{bmatrix} 0 & \tilde{X}_{12}^{(k)} & \cdots & \tilde{X}_{1n}^{(k)} \\ \tilde{X}_{21}^{(k)} & 0 & \cdots & \tilde{X}_{2n}^{(k)} \\ \vdots & \vdots & \ddots & \vdots \\ \tilde{X}_{n1}^{(k)} & \tilde{X}_{n2}^{(k)} & \cdots & 0 \end{bmatrix} \quad (2)$$

So that each element of this initial triangular fuzzy matrix will be as follows:

$$\tilde{X}_{ij}^{(k)} = \left(\tilde{l}_{ij}^{(k)}, \widetilde{m}_{ij}^{(k)}, \tilde{u}_{ij}^{(k)}\right) \quad (3)$$

So that $\tilde{X}_{ij}^{(k)}$ is the k^{th} expert assessment value from the i^{th} proposed distance based on the J^{th} criterion

In the current research, 5 options were assessed based on 6 criteria from the 8 experts' perspective. Thus, the decision matrix is$\tilde{\mathrm{X}}_{5\times6}$. The fuzzy decision matrix will be as Table 1

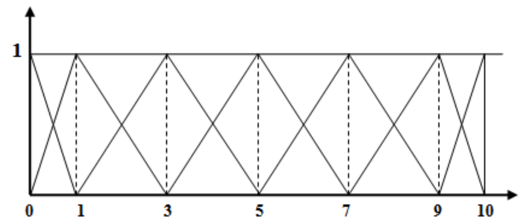
Table 1 Decision matrix based on verbal phrases of the experts

X		C1	C2	C3	C4	C5	C6
Expert 1	A1	H	L	H	VH	VH	VH
	A2	H	H	VH	H	VH	M
	A3	VH	H	VH	H	VH	M
	A4	H	H	H	M	M	M
	A5	VH	M	H	H	M	H
Expert 2	A1	M	M	H	VH	VH	VH
	A2	VH	H	H	H	M	H
	A3	H	H	H	H	M	H
	A4	H	M	M	H	H	H
	A5	H	L	H	VH	L	H
Expert 3	A1	VH	M	H	H	M	H
	A2	VH	H	H	VH	VH	VH
	A3	VH	H	VH	H	VH	M
	A4	H	H	H	M	M	M
	A5	VH	M	H	H	M	H
Expert 4	A1	M	M	H	VH	VH	VH
	A2	VH	H	H	H	M	H
	A3	H	H	H	H	M	H
	A4	H	M	M	H	H	H
	A5	H	L	H	VH	L	H
Expert 5	A1	H	L	H	VH	L	H
	A2	VH	M	H	H	M	H
	A3	VH	H	H	VH	VH	VH
	A4	VH	H	VH	H	VH	M
	A5	M	M	H	VH	VH	VH
Expert 6	A1	VH	H	H	H	M	H
	A2	H	H	H	H	M	H
	A3	H	M	M	H	H	H
	A4	VH	H	VH	H	VH	M
	A5	H	H	H	M	M	M
Expert 7	A1	VH	M	H	H	M	H
	A2	M	M	H	VH	VH	VH
	A3	VH	M	H	H	M	H
	A4	VH	H	H	VH	VH	VH
	A5	VH	H	VH	H	VH	M
Expert 8	A1	M	M	H	VH	VH	VH
	A2	M	M	H	VH	VH	VH
	A3	VH	H	H	H	M	H
	A4	H	H	H	H	M	H
	A5	H	M	M	H	H	H

Seven-point scale, inserted in table 2, was used for fuzzification of expert views.

Table 2Fuzzy triangular numbers of 7-degree scale to assess the options (Chen, 2000)

fuzzy numbers equivalent	**sign**	**Verbal Phrase**
(0, 0, 1)	VL	Very Low
(0, 1, 3)	L	Low
(1, 3, 5)	ML	Medium Low
(3, 5, 7)	M	Medium
(5, 7, 9)	MH	Medium High
(7, 9, 10)	H	High
(9, 10, 10)	VH	Very High



Figur 2.Triangular fuzzy numbers equivalent to the 7-point scale to rank the importance of the criteria

The verbal phrases, inserted in Table 1, based on the Table 2 scale, have been presented in Table 3 in the form of fuzzy decision matrix.

To aggregate the experts' views, the fuzzy mean of the views needs to be calculated. The aggregation methods are in fact experimental methods presented by various researchers. In our research, we used the fuzzy mean method. The fuzzy mean of n triangular fuzzy number will be calculated as follows (Bojadziev& Bojadziev, 2007)

$$\tilde{F}_{AVE} = (\mathrm{L.M.U}) = \frac{\sum l_i^k}{n}.\frac{\sum m_i^k}{n}.\frac{\sum u_k^i}{n} \quad (4)$$

Where, triangular fuzzy number $\tilde{f}_i = (l_i^k.m_i^k.u_i^k)$ is equivalent to fuzzy k^{th} expert view on the i^{th} criterion. The mean fuzzy of experts' panel view for each of the research indices is presented in Table 4.

Table 3 Decision matrix (assessment) obtained from the fuzzy mean of the experts' view

X	C1	C2	C3	C4	C5	C6
A1	(7, 9, 10)	(0, 1, 3)	(7, 9, 10)	(9, 10, 10)	(9, 10, 10)	(9, 10, 10)
A2	(7, 9, 10)	(7, 9, 10)	(9, 10, 10)	(7, 9, 10)	(9, 10, 10)	(3, 5, 7)
A3	(9, 10, 10)	(7, 9, 10)	(9, 10, 10)	(7, 9, 10)	(9, 10, 10)	(3, 5, 7)
A4	(7, 9, 10)	(7, 9, 10)	(7, 9, 10)	(3, 5, 7)	(3, 5, 7)	(3, 5, 7)
A5	(9, 10, 10)	(3, 5, 7)	(7, 9, 10)	(7, 9, 10)	(3, 5, 7)	(7, 9, 10)
A1	(3, 5, 7)	(3, 5, 7)	(7, 9, 10)	(9, 10, 10)	(9, 10, 10)	(9, 10, 10)
A2	(9, 10, 10)	(7, 9, 10)	(7, 9, 10)	(7, 9, 10)	(3, 5, 7)	(7, 9, 10)
A3	(7, 9, 10)	(7, 9, 10)	(7, 9, 10)	(7, 9, 10)	(3, 5, 7)	(7, 9, 10)
A4	(7, 9, 10)	(3, 5, 7)	(3, 5, 7)	(7, 9, 10)	(7, 9, 10)	(7, 9, 10)
A5	(7, 9, 10)	(0, 1, 3)	(7, 9, 10)	(9, 10, 10)	(0, 1, 3)	(7, 9, 10)
A1	(9, 10, 10)	(3, 5, 7)	(7, 9, 10)	(7, 9, 10)	(3, 5, 7)	(7, 9, 10)
A2	(9, 10, 10)	(7, 9, 10)	(7, 9, 10)	(9, 10, 10)	(9, 10, 10)	(9, 10, 10)
A3	(9, 10, 10)	(7, 9, 10)	(9, 10, 10)	(7, 9, 10)	(9, 10, 10)	(3, 5, 7)
A4	(7, 9, 10)	(7, 9, 10)	(7, 9, 10)	(3, 5, 7)	(3, 5, 7)	(3, 5, 7)
A5	(9, 10, 10)	(3, 5, 7)	(7, 9, 10)	(7, 9, 10)	(3, 5, 7)	(7, 9, 10)
A1	(3, 5, 7)	(3, 5, 7)	(7, 9, 10)	(9, 10, 10)	(9, 10, 10)	(9, 10, 10)
A2	(9, 10, 10)	(7, 9, 10)	(7, 9, 10)	(7, 9, 10)	(3, 5, 7)	(7, 9, 10)
A3	(7, 9, 10)	(7, 9, 10)	(7, 9, 10)	(7, 9, 10)	(3, 5, 7)	(7, 9, 10)
A4	(7, 9, 10)	(3, 5, 7)	(3, 5, 7)	(7, 9, 10)	(7, 9, 10)	(7, 9, 10)
A5	(7, 9, 10)	(0, 1, 3)	(7, 9, 10)	(9, 10, 10)	(0, 1, 3)	(7, 9, 10)
A1	(7, 9, 10)	(0, 1, 3)	(7, 9, 10)	(9, 10, 10)	(0, 1, 3)	(7, 9, 10)
A2	(9, 10, 10)	(3, 5, 7)	(7, 9, 10)	(7, 9, 10)	(3, 5, 7)	(7, 9, 10)
A3	(9, 10, 10)	(7, 9, 10)	(7, 9, 10)	(9, 10, 10)	(9, 10, 10)	(9, 10, 10)
A4	(9, 10, 10)	(7, 9, 10)	(9, 10, 10)	(7, 9, 10)	(9, 10, 10)	(3, 5, 7)
A5	(3, 5, 7)	(3, 5, 7)	(7, 9, 10)	(9, 10, 10)	(9, 10, 10)	(9, 10, 10)
A1	(9, 10, 10)	(7, 9, 10)	(7, 9, 10)	(7, 9, 10)	(3, 5, 7)	(7, 9, 10)
A2	(7, 9, 10)	(7, 9, 10)	(7, 9, 10)	(7, 9, 10)	(3, 5, 7)	(7, 9, 10)
A3	(7, 9, 10)	(3, 5, 7)	(3, 5, 7)	(7, 9, 10)	(7, 9, 10)	(7, 9, 10)
A4	(9, 10, 10)	(7, 9, 10)	(9, 10, 10)	(7, 9, 10)	(9, 10, 10)	(3, 5, 7)
A5	(7, 9, 10)	(7, 9, 10)	(7, 9, 10)	(3, 5, 7)	(3, 5, 7)	(3, 5, 7)
A1	(9, 10, 10)	(3, 5, 7)	(7, 9, 10)	(7, 9, 10)	(3, 5, 7)	(7, 9, 10)
A2	(3, 5, 7)	(3, 5, 7)	(7, 9, 10)	(9, 10, 10)	(9, 10, 10)	(9, 10, 10)
A3	(9, 10, 10)	(3, 5, 7)	(7, 9, 10)	(7, 9, 10)	(3, 5, 7)	(7, 9, 10)
A4	(9, 10, 10)	(7, 9, 10)	(7, 9, 10)	(9, 10, 10)	(9, 10, 10)	(9, 10, 10)
A5	(9, 10, 10)	(7, 9, 10)	(9, 10, 10)	(7, 9, 10)	(9, 10, 10)	(3, 5, 7)
A1	(3, 5, 7)	(3, 5, 7)	(7, 9, 10)	(9, 10, 10)	(9, 10, 10)	(9, 10, 10)
A2	(3, 5, 7)	(3, 5, 7)	(7, 9, 10)	(9, 10, 10)	(9, 10, 10)	(9, 10, 10)
A3	(9, 10, 10)	(7, 9, 10)	(7, 9, 10)	(7, 9, 10)	(3, 5, 7)	(7, 9, 10)
A4	(7, 9, 10)	(7, 9, 10)	(7, 9, 10)	(7, 9, 10)	(3, 5, 7)	(7, 9, 10)
A5	(7, 9, 10)	(3, 5, 7)	(3, 5, 7)	(7, 9, 10)	(7, 9, 10)	(7, 9, 10)

Table 4. The mean fuzzy of experts' panel view and formation of final decision matrix

X	C1	C2	C3	C4	C5	C6
A1	(6.25, 7.88, 8.88)	(2.75, 4.5, 6.38)	(7, 9, 10)	(8.25, 9.63, 10)	(5.63, 7, 8)	(8, 9.5, 10)
A2	(7, 8.5, 9.25)	(5.5, 7.5, 8.88)	(7.25, 9.13, 10)	(7.75, 9.38, 10)	(6, 7.5, 8.5)	(7.25, 8.88, 9.63)
A3	(8.25, 9.63, 10)	(6, 8, 9.25)	(7, 8.75, 9.63)	(7.25, 9.13, 10)	(5.75, 7.38, 8.5)	(6.25, 8.13, 9.25)
A4	(7.75, 9.38, 10)	(6, 8, 9.25)	(6.5, 8.25, 9.25)	(6.25, 8.13, 9.25)	(6.25, 7.88, 8.88)	(5.25, 7.13, 8.5)
A5	(7.25, 8.88, 9.63)	(3.25, 5, 6.75)	(6.75, 8.63, 9.63)	(7.25, 8.88, 9.63)	(4.25, 5.75, 7.13)	(6.25, 8.13, 9.25)

Decision matrix non-scaling

The fuzzy normal matrix is represented by the symbol Ñ and each element of the normal matrix is represented by $\tilde{n}_{ij}.For$ normalizing, the following equation is used:

$$\tilde{N} = \left[\tilde{n}_{ij}\right]_{m\times n} \quad (5)$$

If the criterion has the positive load, the following equation will be used:

$$\tilde{n}_{ij} = \left(\frac{l_{ij}}{c_j^*}, \frac{m_{ij}}{c_j^*}, \frac{u_{ij}}{c_j^*}\right) \quad (6)$$

$$c_j^* = max c_{ij}$$

If the criterion has the negative load, the following equation will be used:

$$\tilde{n}_{ij} = \left(\frac{l_j^-}{u_{ij}}, \frac{l_j^-}{m_{ij}}, \frac{l_j^-}{l_{ij}}\right) \quad (7)$$

$$l_j^- = min\ l_{ij}$$

The normal matrix is represented by the symbol Ñ and each element of the normal matrix is represented by $\tilde{n}_{ij}.N$ormalizing results are as follows:

Table 5. fuzzy normalized decision matrix

N	C1	C2	C3	C4	C5	C6
A1	(0.63, 0.79, 0.89)	(0.3, 0.49, 0.69)	(0.7, 0.9, 1)	(0.83, 0.96, 1)	(0.63, 0.79, 0.9)	(0.8, 0.95, 1)
A2	(0.7, 0.85, 0.93)	(0.59, 0.81, 0.96)	(0.73, 0.91, 1)	(0.78, 0.94, 1)	(0.68, 0.85, 0.96)	(0.73, 0.89, 0.96)
A3	(0.83, 0.96, 1)	(0.65, 0.86, 1)	(0.7, 0.88, 0.96)	(0.73, 0.91, 1)	(0.65, 0.83, 0.96)	(0.63, 0.81, 0.93)
A4	(0.78, 0.94, 1)	(0.65, 0.86, 1)	(0.65, 0.83, 0.93)	(0.63, 0.81, 0.93)	(0.7, 0.89, 1)	(0.53, 0.71, 0.85)
A5	(0.73, 0.89, 0.96)	(0.35, 0.54, 0.73)	(0.68, 0.86, 0.96)	(0.73, 0.89, 0.96)	(0.48, 0.65, 0.8)	(0.63, 0.81, 0.93)

3.NORMAL MATRIX DE-FUZZIFICATION

In his proposed algorithm, Opricovic (2003) used the center of gravity method for defuzzification of $\tilde{S}_j$ ،$\tilde{R}_j$ ،$\tilde{Q}_j$ ،j=1,…,J

$$\mathrm{Crisp}(\tilde{N}) = (2m + l + u)/4 \quad (8)$$

In order to transform one fuzzy number to definitive number, the second de-fuzzification method of the balanced mean, recommended by Bojarziz, was used. By de-fuzzification of the values, the definitive decision matrix is as presented in Table 6.

Table 6. decision matrix (assessment)

Df	C1	C2	C3	C4	C5	C6
A1	0.77	0.49	0.88	0.94	0.78	0.93
A2	0.83	0.79	0.89	0.91	0.83	0.87
A3	0.94	0.84	0.85	0.89	0.82	0.79
A4	0.91	0.84	0.81	0.79	0.87	0.70
A5	0.87	0.54	0.84	0.87	0.64	0.79

4.DETERMINING THE POSITIVE IDEAL AND NEGATIVE IDEAL POINT

The best and the worst option among all options are determined fir each criterion and name them f_j^* and f_j^- , respectively. If the criterion is positive, f_j^* will be the maximum column value and f_j^- will be the minimum column value. If we link all f_j^*s together, an optimal combination of the highest score will be the positive ideal point, and in the case of f_j^- , the worst score will be the ideal negative point. In this matrix, all criteria are positive. Thus, we will have:

$f_j^* =$ {0.938; 0.845; 0.888; 0.938; 0.870; 0.925}

$f_j^- =$ {0.772; 0.490; 0.806; 0.794; 0.778; 0.700}

5.DETERMINING THE WEIGHT OF THE DECISION CRITERIA

After determining the positive ideal and negative ideal values and before entering to the stage of calculating the utility and regret of the options, it is required that the weight of the criteria and sub-criteria of decision-making to be determined (Chen, 2000). The scale inserted in Table 7 is proposed for determining the weight of the criteria.

Table 7.Triangular fuzzy numbers equivalent to the 7-point scale to rank the criteria (Chen, 2000)

Verbal Phrase	Fuzzy numbers equivalent
Very low (VL)	(0, 0, 0.1)
Low (L)	(0, 0.1, 0.3)
Medium low (ML)	(0.1, 0.3, 0.5)
Medium (M)	(0.3, 0.5, 0.7)
Medium high (MH)	(0.5, 0.7, 0.9)
High (H)	(0.7, 0.9, 1.0)
Very high (VH)	(0.9, 1.0, 1.0)

The verbal phrases of the experts to express the importance of the research criteria are presented in Table 8.

Table 8. The Importance level of research criteria based on verbal phrases of experts

X	E01	E02	E03	E04	E05	E06	E07	E08
C1	H	VH	VH	H	H	VH	H	M
C2	VH	VH	VH	H	VH	VH	H	H
C3	VH	VH	VH	VH	VH	VH	VH	H
C4	H	H	VH	H	VH	M	VH	H
C5	L	H	VH	H	M	M	H	H
C6	H	VH	VH	H	H	H	H	H

(Each criterion is represented by the symbol Ci and each expert is represented by symbol Ei symbol)

Using the scale shown in Table 7, these values become fuzzy.

Table 9. Fuzzification of the experts' view in expressing the importance of research criteria

X	E01	E02	E03	E04	E05	E06	E07	E08
C1	(0.7, 0.9, 1)	(0.9, 1, 1)	(0.9, 1, 1)	(0.7, 0.9, 1)	(0.7, 0.9, 1)	(0.9, 1, 1)	(0.7, 0.9, 1)	(0.3, 0.5, 0.7)
C2	(0.9, 1, 1)	(0.9, 1, 1)	(0.9, 1, 1)	(0.7, 0.9, 1)	(0.9, 1, 1)	(0.9, 1, 1)	(0.7, 0.9, 1)	(0.7, 0.9, 1)
C3	(0.9, 1, 1)	(0.9, 1, 1)	(0.9, 1, 1)	(0.9, 1, 1)	(0.9, 1, 1)	(0.9, 1, 1)	(0.9, 1, 1)	(0.7, 0.9, 1)
S11	(0.7, 0.9, 1)	(0.7, 0.9, 1)	(0.9, 1, 1)	(0.7, 0.9, 1)	(0.9, 1, 1)	(0.3, 0.5, 0.7)	(0.9, 1, 1)	(0.7, 0.9, 1)
S12	(0, 0.1, 0.3)	(0.7, 0.9, 1)	(0.9, 1, 1)	(0.7, 0.9, 1)	(0.3, 0.5, 0.7)	(0.3, 0.5, 0.7)	(0.7, 0.9, 1)	(0.7, 0.9, 1)
S13	(0.7, 0.9, 1)	(0.9, 1, 1)	(0.9, 1, 1)	(0.7, 0.9, 1)	(0.7, 0.9, 1)	(0.7, 0.9, 1)	(0.7, 0.9, 1)	(0.7, 0.9, 1)

By calculating the fuzzy mean of experts' view (equation 4) and fuzzification of the values (equation 8), the final weight of decision-making criteria is presented in Table 10.

Table 10. Final weight of decision-making criteria

	S	R	Q
A1	0.507	0.179	0.382
A2	0.263	0.106	0.013
A3	0.313	0.100	0.043
A4	0.546	0.184	0.427
A5	0.844	0.330	1.000

6.CALCULATING THE UTILITY VALUE (S) AND REGRET VALUE (R) FOR EACH OPTION

The utility value (S) represents the relative distance of i^th option from positive ideal solution (the best combination) and the regret value (R) represents the maximum discomfort of i^th option of being distant from the positive ideal solution (Opricovic, S., & Tzeng, G. H., 2003)

$$S_j = \sum_{i=1}^{n} W_i \cdot \frac{f_i^* - f_{ij}}{f_i^* - f_i^-} \quad (9)$$

$$R_j = max\left[w_i \cdot \frac{f_i^* - f_{ij}}{f_i^* - f_i^-}\right] \quad (10)$$

7.CALCULATING THE VIKOR INDEX

Thus, the next step is calculating the VIKOR index (Q) for each option.

$$Q_i = v\left[\frac{S_i - S^*}{S^- - S^*}\right] + (1 - v)\left[\frac{R_i - R^*}{R^- - R^*}\right] \quad (11)$$

$S^- = maxS_i$, $S^* = minS_i$

$R^- = maxR_i$, $R^* = minR_i$

Thus, we will have

Table 11.Ranking the utility and regret values of each option

X	C1	Crisp	Normal
C1	(0.725, 0.888, 0.963)	0.866	0.165
C2	(0.825, 0.963, 1)	0.938	0.179
C3	(0.875, 0.988, 1)	0.963	0.184
C4	(0.725, 0.888, 0.963)	0.866	0.165
C5	(0.538, 0.713, 0.838)	0.701	0.134
C6	(0.75, 0.925, 1)	0.9	0.172

8.ARRANGING THE OPTIONS BASED ON THE Q, R, AND S

In this step, all options are arranged in three groups from small to great based on the values the Q, R, and S(Opricovic, S., & Tzeng, G. H., 2003).

The first condition: the option A_1 should be known at least in one of the groups R and S as the top rank.

The second condition: if the option A1 and A2 have the first and the second ranks among the m option, the following equation is applied:

$$Q(A_2) - Q(A_1) \geq \frac{1}{m-1} \quad (12)$$

If one of these conditions is not hold, the compromise solution will be achieved, meaning that both options of A1 and A2 would be selected as the top option.

Based on the calculations of VIKOR, options A2 and A3 are in the first and second rank, respectively, and Q value has been calculated 0.013 and 0.043 for A2 and A3, respectively, which they are smaller than other values.

The first condition that suggests the top option should be recognized a top rank in at least one of the R and S groups is hold.

Now, the second condition should be examined:

N=4

$$0.043 - 0.013 \geq \frac{1}{5-1} ; \rightarrow 0.030 \leq 0.25 \qquad (13)$$

The second condition is not hold, so both options A1 and A3 are selected as the top option.

9. CONCLUSION

Selection of appropriate human resources in any organization can be a key success factor in that organization. On the other hand, changes in the world and intense competition between organizations have made the use of effective leadership crucial more than ever. Thus, organizations attract and appoint effective leaders in order to make organizational developments and gain competitive power. In this regard, the importance of methods to recruit effective leaders becomes more apparent. In this paper the fuzzy VIKOR method focuses on ranking and selecting from a set of alternatives in a fuzzy environment. A numerical example illustrates an application of the fuzzy VIKOR method to select effective leaders.

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