Use And Comparison of Topis And Electre Methods In Personnel Selection

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Abstract. One of the most important function of human resources is personnel selection process. This process should be done professionally, in a short time and with minimum cost. After personnel selection process, performance of the hired person is very important for the permanence and success of the company. From this point of view, the aim of this study is to select a personnel among the candidates efficiently, with minimum cost and within a short time in one of the leading companies of Turkey in automotive sector. In order to select the right personnel all criterias which has great impact on blue collar worker selection was decided and these criterias are weighted. From the candidate pool of automotive company, appropriate candidates were selected by using TOPSIS AND ELECTRE method which are multi-criteria decision making methods

1 Introduction

Personnel selection is an important part of human resources management policy in any enterprise. Personnel selection process is aimed at choosing the best candidate to fill the defined vacancy in a company. It determines the input quality of personnel and thus plays an important role in human resource management [2].

Especially today, with the rapid development of the increasing globalization processes, increasing competition environment necessitates development in personnel selection processes. What makes this compulsory is that with the diversity of candidates in the human resources market, the employer wants to know which candidates qualify which candidates are best suited to perform the defined job [6].

Many businesses that understand the importance of this are now allocating a lot of funding to be one step ahead of the competition. These funds are used by many scientists to develop new decision-making techniques to make the ideal choice [10]. The objective of a selection process depends mainly on assessing the differences among candidates and predicting future performance [3]. For the solution of the complexity inherent in the selection of personnel, many scientists have tried to achieve the result using multi-criteria decision making (MCDM) in methods. [1-2-5- 6-7-10-11].

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MCDM methods deal with problems of compromise selection of the best solutions from the set of available alternatives according to objectives. Usually neither of the alternatives satisfies all the objectives therefore satisfactory decision is made instead of optimal one [1].

In this study, an evaluation was conducted on the ideal staff selection in a pioneering company operating in the automotive sector in Turkey and in accordance with the wishes of the company's senior management, TOPSIS and ELECTRE methods, which are multi criteria decision making techniques, were used to determine which method gave better results.

2 Fundamental Properties of the Method

2.1 TOPSIS Method

Using the TOPSIS method, it is necessary to compare the alternative options according to certain criteria and between the maximum and minimum values that the criteria can take against the ideal situation. A multi-criteria decision problem with *n* alternatives and *m* criterions can be represented by *n* points in *m*-dimensional space. Yoon and Hwang (1980) have constructed the TOPSIS method based on the assumption that the solution alternative is the shortest distance to the ideal solution point and the farthest distance to the negative ideal solution point in some geometrical sense [9].The TOPSIS method consists of following steps [9]:

Step 1 Construct the decision matrix (A) :

The decision matrix is a matrix that must be created by the decision maker. This generated matrix will be a mxp dimensional matrix. Decision-making lines show decision points while columns contain factors.

$$A_{ij} = \begin{bmatrix} a_{11} & a_{12} & . & a_{1p} \\ a_{21} & a_{22} & . & a_{2p} \\ . & . & . & . \\ . & . & . & . \\ . & . & . & . \\ a_{m1} & a_{m2} & . & a_{mp} \end{bmatrix}$$

Step 2 Construct the normalized decision matrix (R):

After the decision matrix is formed, an element r_{ij} of the normalized decision matrix R is calculated as follows;

$$R_{ij} = \begin{bmatrix} r_{11} & r_{12} & . & r_{1n} \\ r_{21} & r_{22} & . & r_{2n} \\ . & . & . & . \\ . & . & . & . \\ . & . & . & . \\ r_{m1} & r & . & r_{mn} \end{bmatrix}$$

$$r_{ij=}\frac{a_{ij}}{\sqrt{\sum_{i=1}^{m} a_{ij}^2}} \quad (i = 1,2,\dots\dots m \;\; and \;\; j = 1,2,\dots\dots n) \qquad (1)$$

Step 3 Calculate the weighted normalized decision matrix (V_{ij}):

$$V_{ij} = \begin{vmatrix} w_1 r_{11} & w_2 r_{12} & . & w_n r_{1p} \\ w_1 r_{21} & w_2 r_{22} & . & w_n r_{2p} \\ . & . & . & . \\ . & . & . & . \\ . & . & . & . \\ w_1 r_{m1} & w_2 r_{m2} & . & w_n r_{mp} \end{vmatrix} \rightarrow V_{ij} = \begin{vmatrix} v_{11} & v_{12} & . & v_{1p} \\ v_{21} & v_{22} & . & v_{2p} \\ . & . & . & . \\ . & . & . & . \\ . & . & . & . \\ v_{m1} & v_{m2} & . & v_{mp} \end{vmatrix}$$

Each value of the normalized matrix is weighted with a value such as w_{ij}.

$$v_{ij} = r_{ij}.w_{ij} \qquad (2)$$

The weighted normalized value v_{ij} is calculated in the left way;

Where w_j is the weight of the j-th criterion, $\sum_{j=1}^{n} w_j = 1$

Step 4 Determine Ideal (A^+) and Negative ideal (A^-) solutions :

Once the weighted normalized matrix (V_{ij} matrix) is obtained, the maximal values of each column are determined, provided that our goal is maximization, provided that it depends on the structure of the problem. These maximum values are our ideal solution values. Then, minimum values for each column are obtained again. This is the negative ideal solution value. If our goal is minimization, the values obtained will be the exact opposite. The notation for obtaining ideal and negative ideal solution values is shown below.

$$\left\{ {}^{max}_{i}\ on\ condition\ that \right\} \rightarrow A^+ = \{v_1^+, v_2^+, \dots\dots\dots v_n^+\} max\ values\ for\ each\ column \quad (3)$$

$$\left\{ {}^{min}_{i}\ on\ condition\ that \right\} \rightarrow A^- = \{v_1^-, v_2^-, \dots\dots\dots v_n^-\} min\ values\ for\ each\ column \quad (4)$$

Step 5 Calculate the separation measures from the positive and the negative ideal solution :

The n-dimensional Euclidean distance method is applied to measure the separation distances of each alternative from the ideal solution and negative-ideal solution. In order to be able to calculate the distance of the ideal and negative ideal point, following formulas are used :

Ideal Distance

$$S_i^+ = \sqrt{\sum_{j=1}^{N} \left(V_{ij} - V_j^+\right)^2} \qquad (5)$$

Negative Ideal Distance

$$S_i^- = \sqrt{\sum_{j=1}^{N} \left(V_{ij} - V_j^-\right)^2} \qquad (6)$$

Step 6 Calculate the relative closeness to the positive ideal solution :

Ideal and negative ideal solution is used to calculate the ideal resolving relative closeness of each decision point. The ideal solution is symbolized by the relative closeness C_i^+. Where C_i^+ value takes a value in the range $0 \leq C_i^+ \leq 1$ and while $C_i^+ = 1$ represents the absolute solution closeness to the ideal solution of the corresponding decision point, C_i^-represents the absolute solution closeness to the negative ideal solution of the corresponding decision point.

$$C_i^+ = \frac{S_i^-}{S_i^- + S_i^-} \qquad (7)$$

Step 7 Rank the preference order or select the alternative closest to 1 :

A set of alternatives now can be ranked by descending order of value of C_i^+.

2.2 ELECTRE Method

ELECTRE (Elemination and Choice Expressing Reality) method is a multi-decision method first proposed by Benayoun and Roy in 1966. The method is based on binary superiority comparisons between alternative decision points for each rating factor [4]. In the ELECTRE Method concordance and discordance indexes are defined as measurements of satisfaction and dissatisfaction for decision maker in choosing one alternative over anothor. These indexes are then used to analyze the outranking relations among the alternatives [8]. The method is solved by the following steps [9]. The first three steps (Preparation of the decision matrix, the normalized decision matrix and weighted matrix) are not included here because they are the same as TOPSIS method.

Step 4 Ascertainment of Concordance C_{kl} to Discordance D_{kl} set :

In determining the concordance set, y matrix is used. The decision points for the evaluation factor are compared with another one and the sets are determined using the relationship shown in the following formula;

$$C_{kl} = \{J, y_{kj} \geq y_{lj}\} \qquad \text{j=1,2,3,…..n}$$

The formula is basically based on comparing the sizes of the line elements relative to each other. Each concordance set (C_{kl}) corresponds to an discordance set (D_{kl}). The elements of the discordance set consist of J values that do not belong to the concordance set. On complimentation of (C_{kl}), we obtain the discordance interval set (D_{kl}) using;

$$D_{kl} = \{J, y_{kj} < y_{lj}\} = J - C_{kl} \qquad \text{j=1,2,3,…..n}$$

Step 5 Calculation of The Concordance (C) and Discordance (D) Matrices

The relative value of the elements in the concordance matrix C is calculated by means of the concordance index. The concordance index C_{kl} is the sum of the weights associated with the criteria contained in the concordance set. That is;

$$C_{kl} = \sum_{J \in C_{kl}} W_j \qquad (8)$$

$$C = \begin{bmatrix} - & c_{12} & . & c_{1m} \\ c_{21} & - & . & c_{2m} \\ . & . & . & . \\ . & . & . & . \\ . & . & . & . \\ c_{m1} & c_{m2} & . & c_{mn} \end{bmatrix}$$

The concordance matrix is defined as left ;

The discordance matrix D_{kl} elements is defined by formula.

$$D_{kl} = \frac{\max\limits_{j \in D_{kl}} |y_{kj} - y_{lj}|}{\max\limits_{j} |y_{kj} - y_{lj}|} \qquad (9)$$

$$D = \begin{bmatrix} - & d_{12} & . & d_{1m} \\ d_{21} & - & . & d_{2m} \\ . & . & . & . \\ . & . & . & . \\ . & . & . & . \\ d_{m1} & d_{m2} & . & d_{mn} \end{bmatrix}$$

Then, using discordance index set, we can obtain discordance matrix as left;

Step 6 Determine The Concordance (F) and Discordance Dominance (G) Matrix :

For finding matrix (F), it is needed to compute threshold value $(\bar{c})$ as follow:

$$\bar{c} = \frac{1}{m(m-1)} \sum_{k=1}^{m} c_{kl} \qquad (m\ is\ dimension\ of\ matrix) \qquad (10)$$

$$\begin{cases} f_{kl} = 1, & if \ \ c_{kl} \geq \bar{c} \\ f_{kl} = 0 & if \ \ c_{kl} < \bar{c} \end{cases}$$

The left inequalities mean that if each element of matrix C_{kl}, is greater than or equal to $\bar{c}$, than 1 would be set in matrix (F). (corresponding element)

To determine discordance dominance matrix, we calculate matrix of (G).

$$\bar{d} = \frac{1}{m(m-1)} \sum_{k=1}^{m} \sum_{l}^{m} d_{kl} \qquad \left(\bar{d}: Discordance\ Threshold\ Value\right) \qquad (11)$$

$$\begin{cases} g_{kl} = 1 & if \quad d_{kl} \geq \bar{d} \\ g_{kl} = 0 & if \quad d_{kl} < \bar{d} \end{cases}$$

The elements of the matrix (G). take the value 0 or 1. There is no value on the diagonal of the matrix (G) as it shows the same decision points.

Step 7 Determine the aggregate dominance matrix (E):

Matrix E is performed by multiplying corresponding elements of F and G.

$$e_{kl} = f_{kl} . g_{kl} \qquad (12)$$

The matrix (E) is dimensioned according to the matrix (F) and (G) and consists of the values 0 and 1.

Step 8 Eliminate the less favourable alternative and rank them:

We must scan the line of matrix (E), line that has the highest score should be chosen as the best one.

3 Application

Since the first 3 steps of the TOPSIS and ELECTRE Methods to be used in practice are the same (a decision matrix, a normalized decision matrix and a weighted normalized

decision matrix) 3 steps for both methods were created in the same way. Afterwards, the analysis were carried out according to the steps of both methods.

3.1 TOPSIS

At this step, the first question is which criteria are important for recruitment. As a result of interviews with business managers, it has been determined that the following criteria are taken into account in recruitment. Then, a total of 65 applications were made and each candidate was asked to answer the previously determined criteria. A matrix was prepared based on the answers received.

In determining the weight of the factors, business managers, team leaders, and recruitment staff were asked which criteria weighted the recruitment process. The points awarded are distributed in such a way that the sum of the criterion values is 1 point. The weights of the criteria are shown in table 1.

Table 1. Criteria and Weights

CRITERIA	WEIGHTS	CRITERIA	WEIGHTS
C1. Education Status	0,099535124	C20. Task Responsibility	0,019917012
C2. Graduated Section	0,086828512	C21. Mobility	0,02127499
C3. Birthyear	0,01300578	C22. Anger	0,019917012
C4. Gender	0,011823437	C23. Uncontrolled Behavior	0,022632968
C5. Marital status	0,010641093	C24. Self-discipline	0,023990946
C6. Number of children	0,007094062	C25. Sociability	0,017201056
C7. Homeland	0,007882291	C26. Strength Resistance	0,022180309
C8. Smoking	0,016158696	C27. Harmony	0,023538287
C9. Driver's license	0,013399895	C28. Attention and Concentration	0,040685543
C10. Heavy and Dangerous Work Certificate	0,012217551	C29. Visual Comparison	0,037555886
C11. the work is registered	0,012217551	C30. Follow Visual Instruction	0,0383383
C12. Criminal record	0,016946926	C31. Mechanical-Technical Tendency	0,035991058
C13. Military Status for Male Candidates	0,014976353	C32. Verbal Instructions following	0,0383383
C14. Computer Skill	0,033849129	C33. General Image	0,026194145
C15. Course / Certificate Information	0,029819471	C34. General Attitude and Behavior	0,03077812
C16. Foreign Language Information	0,020148291	**35.** Willingness	0,032087827
C17. Work Experience Period (years)	0,029819471	C36. Listening and Understanding	0,033397535
C18. Experience Clarity	0,02127499	C37. Reliability	0,032087827
C19. Layout	0,023538287		

After the decision matrix formed by the data taken in the direction of the criterion has been put forward, Eq.(1) has been used to form the normalized decision (A) matrix. Then, the weighted normalized decision matrix was formed by Eq.(2). After the weighted normalized decision matrix is constructed, two solution sets have been established by using the Eq.(3) for the positive ideal solution and Eq.(4) for the negative ideal solution. In the next step, the deviations of the evaluation factor values for each decision point from the positive ideal and negative ideal solution sets were found. while the Eq.(5) formula is used to find positive ideal deviations, the Eq.(6) formula is used to find negative ideal deviations.

Positive ideal relative closeness values (S_i^+) and negative ideal relative closeness values (S_i^-) were obtained in the direction of the obtained results. By using the obtained differences in Eq.(7), the relative closeness to the ideal solution of each decision point was found and the results are given in Table 2.

Table 2. Relative closeness to the positive ideal solution

1	0,537037	**14**	0,408097	**27**	0,462341	**40**	0,454777	**53**	0,451602
2	0,509735	**15**	0,555171	**28**	0,477382	**41**	0,463658	**54**	0,305041
3	0,478116	**16**	0,082199	**29**	0,600987	**42**	0,526335	**55**	0,390352
4	0,553469	**17**	0,488091	**30**	0,454299	**43**	0,476687	**56**	0,354146
5	0,441776	**18**	0,519921	**31**	0,355324	**44**	0,494757	**57**	0,292422
6	0,402958	**19**	0,45544	**32**	0,445327	**45**	0,497137	**58**	0,542106
7	0,429644	**20**	0,465373	**33**	0,459771	**46**	0,428475	**59**	0,464441
8	0,495668	**21**	0,448104	**34**	0,458169	**47**	0,517146	**60**	0,498541
9	0,5489	**22**	0,528596	**35**	0,375747	**48**	0,548075	**61**	0,477263
10	0,433854	**23**	0,395076	**36**	0,097782	**49**	0,532101	**62**	0,528715
11	0,444864	**24**	0,492628	**37**	0,483895	**50**	0,45384	**63**	0,538521
12	0,524402	**25**	0,518692	**38**	0,557004	**51**	0,382064	**64**	0,323209
13	0,484628	**26**	0,381532	**39**	0,423482	**52**	0,216875	**65**	0,460184

As a result of Table 2, the most suitable candidates for the business were determined to be the ranking result from small value to the large value. Candidates with the highest score were candidates for 29, 38, 15 and 4 respectively, while 16th candidate is the lowest scored candidate.

3.2 ELECTRE

In this method, as in the TOPSIS method, 65 candidates were examined. We tried to make the best choice by using the Electre method in the direction of the data received from these candidates. While the first 3 steps of this method are performed as done in TOPSIS, the other steps will require different operations. Therefore, firstly, Concordance (C_{kl}) and Discordance (D_{kl}) sets were found by using the decision matrix, normalized decision matrix and weighted decision matrices obtained in the TOPSIS method.

Candidates for the same criteria as the values obtained from the weighted normalized matrix are compared with each other and the row number of the greatest value is determined as Concordance and the row number of the smallest name is determined as Discordance.

After this step, matrices of Concordance and Discordance were established. The Eq.(8) is used to construct the concordance matrices. On the other hand, the Eq.(9) is used to construct Discordance matrices. In this step, after the matrices of concordance and discordance are established, matrices of concordance and discordance dominance are established. When these two matrices are generated, the threshold values in Eq.(10)-Eq (11) for both matrices are first calculated.

After two calculated threshold values are obtained, the concordance matrix equal value is compared to each concordance matrix element. In this comparison, if a concordance matrix element is greater than the computed threshold value, it takes on the value 1, while if it is smaller, it takes on the value 0. In this way, a concordance dominance matrix is formed.

On the other hand, after the discordance threshold value is calculated with the Eq (11), it is compared with each element of the discordance matrix. In this comparison, if the value of each element of the discordance matrix is greater than the discordance threshold, it takes 1 and if it is smaller, the value of 0 is taken. Total dominance matrix consisting of 0 and 1 is formed as a result of mutual multiplication of elements of concordance and discordance dominance matrices as indicated by Eq (12).

Table 3. The Aggregate Dominance Matrix (E)

PID																																																									TOPLAM
29	0	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	0	1	1	1	1	1	1	1	1	1	1	1	1	0	1	1	1	1	1	1	1	1	1	1	1	1	1	0	1	1	1	1	1	1	1	1	1	1	1	1	60
22	0	1	0	0	1	1	1	1	0	1	1	0	1	1	0	1	1	1	1	1	0	1	0	1	1	1	1	1	0	1	1	1	1	1	1	1	1	1	0	1	1	1	1	0	1	0	0	1	0	1	1	1	0	0	1	1	44
9	0	0	1	0	1	1	1	1		1	1	0	1	0	0	1	1	0	1	0	1	0	0	1	1	1	1	1	0	1	1	1	0	0	1	1	1	1	0	1	0	1	1	0	1	1	1	1	0	1	0	1	1	0	1	1	43
15	0	1	1	0	1	1	1	1	0	1	1	0	1	0		1	1	1	1	0	1	0	0	1	1	1	1	1	0	0	1	1	0	0	1	1	1	1	0	1	0	0	1	0	1	1	1	1	1	1	0	1	1	0	1	1	43
53	0	1	1	0	1	1	1	1	1	1	1	1	0	0	0	1	0	1	1	0	1	0	0	1	1	1	1	1	0	1	0	0	1	1	1	1	1	0	1	0	0	1	1		1	1	1	1	1	0	0	1	1	0	1	1	42
25	0	1	0	0	1	1	1	0	0	1	1	0	1	1	0	1	1	0	1	0	1	0	1	1		1	0	1	0	0	1	1	0	1	1	1	1	1	0	0	1	1	1	0	1	0	0	1	0	1	0	1	0	0	1	1	39
48	0	0	1	0	1	1	0	1	1	1	1	0	1	0	0	1	0	0	1	0	1	0	0	1	0	1	1	1	0	0	1	1	0	1	1	1	1	0		0	0	0	1	0	1	1	1	1	1	1	0	1	1	0	0	1	37
38	0	0	0	0	1	1	1	0	0	1	1	1	0	1	0	1	0	0	1	1	1	0	1	1	0	1	0	1	0	1	1	0	0	1	0	0	1	0	0	0	0	1	1	0	1	0	1	1	0	1	0	1	1	0	1	1	35
42	0	0	0	0	1	1	0	0	0	1	1	0	1	0	0	1	1	0	1	0	1	0	0	1	0	1	0	1	0	1	0	1		1	1	1	1	1	0	0	0	1	1	0	1	0	0	1	0	1	0	1	0	0	1	1	33
49	0	0	0	0	1	1	1	0	0	1	1	0	0	1	0	1	0	0	1	1	1	0	1	1	0	0	0	1	0	0	1	0	0	0	0	0	1	0	0		0	1	1	0	1	0	1	1	0	1	0	1	0	0	1	1	31
4	0	0	1		1	1	1	1	0	1	1	0	1	0	0	1	0	0	1	0	1	0	1	1	0	1	1	1	0	1	0	0	0	0	1	0	1	0	0	0	0	0	1	0	0	1	1	1	0	1	0	0	0	0	1	0	30
18	0	0	0	0	1	1	1	0	0	1	1	0	0	1	0	0	0		1	1	1	0	1	1	0	0	0	1	0	0	1	1	0	1	0	0	1	0	0	0	0	1	1	0	1	0	0	1	0	1	0	1	0	0	1	1	30
60	0	0	0	0	1	1	1	0	0	1	1	0	0	1	0	0	1	1	1	1	1	0	1	1	0	1	0	1	0	0	0	1	0	0	1	0	1	0	0	0	0	0	1	0	0	0	0	0	0	1		0	0	0	1	1	30
13	0	0	0	0	1	1	0	0	0	1	1	0		1	0	1	0	0	1	0	1	0	0	1	0	1	0	1	0	1	0	1	0	0	1	0	1	0	0	0	1	1	1	0	1	0	0	1	0	1	0	1	0	0	1	1	29
2	0		0	0	1	1	0	0	0	1	1	0	1	0	0	1	0	0	1	0	1	0	1	1	0	1	0	1	0	1	1	1	0	1	0	1	1	0	0	0	0	0	1	0	1	0	0	1	0	1	0	1	0	0	1	1	28
17	0	0	0	0	1	1	1	0	0	1	1	0	0	1	0	0		0	1	0	1	0	1	1	0	1	0	1	0	0	0	0	0	0	1	0	1	0	0	0	0	0	1	0	0	0	0	0	1	0	0	0	0	0	1	1	25
47	0	0	0	0	1	1	0	0	0	0	1	0	0	1	0	1	1	0	0	0	1	0	0	1	0	1	0	1	0	0	0	1	0	0	1	0	1		0	0	1	0	0	0	1	0	0	1	0	1	0	1	0	0	1	1	25
12	0	0	0	0	1	1	1	0	0	1	1		0	1	0	0	0	0	1	1	1	0	1	0	0	1	0	1	0	1	0	0	0	1	0	0	0	0	0	0	0	0	1	0	1	0	1	0	0	0	0	0	0	0	1	1	24
45	0	0	0	0	1	1	0	0	0	1	0	0	1	0	0	0	0	0	1	0	1	0	0	1	0	1	0	1	0	0	0	1	0	0	1		1	0	0	0	0	0	1	0	0	0	0	0	0	1	1	0	0	0	0	1	24
30	0	0	0	0	1	1	1	0	0	1	1	0	0	1	0	1	0	0	1	0	1	0	1	1	0	1	0	1	0		0	0	0	0	0	0	0	0	0	0	0	0	1	0	1	0	0	1	0	0	0	0	0	0	1	1	23
51	0	0	0	0	0	1	1	0	0	1	1	0	0	1	0	1	0	0	1	0	1	0	0	1	0	0	0	0	0	0	0	1	0	0	0	0	1	0	0	1	0		1	0	1	0	1	0	0	1	0	0	0	0	1	1	23
58	0	0	0	0	1	1	0	1	0	1	0	0	1	0	0	1	0	0	1	0	1	0	0	1	1	1	0	1	0	0	1	0	0	0	0	0	1	0	0	0	0	0	1	0	1	0	0	1		0	0	1	0	0	0	1	21
43	0	0	0	0	0	1	1	0	0	1	1	0	0	1	0	0	0	0	1	0	1	0	1	0	0	0	0	0	0	0	0	1	0		0	0	1	0	0	0	0	0	1	0	0	0	0	1	0	1	0	0	0	0	1	1	20
55	0	0	0	0	1	1	0	0	0	1	1	0	0	0	0	1	0	0	1	0	1	0	0	1	0	0	0	1	0	0	1	1	0	0	0	0	1	0	0	0	0	0	1	0	1	0	0	0	0	1	0	0	0	0	0	1	20
63	0	0	1	1	1	1	1	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	1	0	0	1	1	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	0	0	0	0	0		1	0	19
20	0	0	0	0	1	0	1	0	0	0	1	0	0	1	0	0	0	0	1		0	0	1	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	1	0	0	0	0	1	0	16
27	0	0	0	0	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	1	0	1		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	1	1	1	1	0	0	0	0	1	0	0	0	15
16	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	1	0	0	0	0	0	1	0	0	0	0	1	0	0	0	0	0	0	1	1	13
8	0	0	1	0	0	1	1		0	0	0	0	0	0	0	1	0	0	0	0	1	0	0	0	0	1	0	1	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	12
41	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	1		0	0	0	0	1	0	0	0	0	0	1	0	0	0	0	1	0	0	0	0	0	0	1	1	12
50	0	0	0	0	0	0	1	0	0	0	1	0	0	1	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0		0	0	0	0	0	0	0	0	0	1	0	0	0	0	1	1	12
11	0	0	0	0	0	1	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	1	0	0	0	0	1	0	11
33	0	0	0	0	0	1	0	0	0	0	0	0	0	1	0	0	0	0	1	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	1	0	0	0	0	0	0	1	0	0	0	0	1	0	11
44	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0		0	1	0	0	0	0	0	1	0	0	0	1	1	1	1	0	0	0	0	0	1	11
37	0	0	0	0	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	1	0	10
62	0	0	0	0	1	1	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	1	0	0	0	0		0	0	0	10
24	0	0	0	0	0	1	0	0	0	0	1	0	0	0	0	0	0	0	0	0	1	0	0		0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	1	0	0	0	0	1	0	0	0	0	0	0	9
34	0	0	0	0	1	1	1	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	8
61	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	1	0	0	0	0	0	0	0	0		0	0	1	0	8
28	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0		0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	1	0	0	0	0	7
32	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	1	0	0	0	0	1	0	0	0	0	0	0	0	0	7
56	0	0	0	0	1	1	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0		0	0	0	0	0	0	0	0	0	7
5	0	0	0	0		1	0	0	0	0	0	0	0	1	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	6
7	0	0	0	0	0	1		0	0	0	0	0	0	1	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	6
65	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0		6

Table 3. shows the rows and columns of the aggregate dominance matrix generated. In the line of the matrix, the candidate with the highest sum of all criteria has become the most suitable candidate. The best candidate for the job is number 29.

Subsequently, candidates numbered 22, 9 and 15, respectively, are followed candidate number 29 in terms of their suitability for work. The candidate with the lowest suitability is 36.

4 CONCLUSION

As a result of this study, both methods applied were compared with each other and evaluations were made about which one would be the most correct result in terms of usage in the sector.

The Electre method compares the criterion values of the candidates and makes the conformity order. This method performs the evaluation by comparing whether the values are greater than or equal to the concordance threshold and whether the values is less than the discordance threshold. However, it does not take any action regarding how large the values are from each other, it also place candidates whose values are equal to each other in the same concordance set as the larger ones.

The Topsis method decides by looking at the Euclidean distance approach how far candidates are away from ideal. Even those values which are slightly different in magnitude among each other can be reflected in the order. Thus, the Topsis method gives the opportunity to analyze how close the candidates are to the ideal. For this reason, there are differences in the order of suitability of the candidates between the outputs of the two methods. When the results obtained in both methods are compared, the most suitable candidate is number 29 for business. However, since the methods calculate differently from each other, there is no similarity in the intermediate values.

Moving from here, it seems more appropriate to use the Topsis method in the problem of personnel selection. It is thought that the topsis method gives more reliable and precise results than Electre method and it is more accurate to use the Topsis method in the problem of personnel selection.

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