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Multi-Criteria Decision-Making Technique for Personnel Selection: PSI Sample

Personel Seçimi İçin Çok Kriterli Karar Verme Tekniği Yaklaşımı: PSI Örneği

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ABSTRACT

Considering that it will not be easy to make an improvement in production factors without any cost, the most critical field for businesses to minimize costs is logistics and supply chain structures. Likewise, the most important production factor that provides competitive advantage for businesses is human resources, also known as intellectual capital. In this context, it is vital to assign the right personnel to the right job. In case of selection and assignment of personnel based on merit, efficient use of business resources will be ensured and the final efficiency of the business will be positively affected, thereby paving the way for competitive advantage. Today, a wide variety of applications and tests are carried out for personnel selection. These methods, most of which are based on intuitive and personal judgments, can sometimes lead to wrong selection. It is obvious that short job interviews and/or job trial periods will not be enough to get to know the individual with his/her personality. In this context, the importance of multi-criteria decision-making techniques, which are frequently used in choosing the most suitable one among different personnel alternatives, is mentioned in the study. Multi-criteria decision-making techniques are an important aid for decision makers in personnel selection, as in many different areas. Although a significant part of the methods still require intuitive approaches such as expert opinion, the PSI method used in the study allows for the impartial evaluation of the alternatives and to reach conclusions on the numerical values they have, with the application stages in a completely rational way. In the study, a personnel selection decision to be made under the influence of many criteria with different importance levels is solved with the PSI method, which is one of the multi-criteria decision-making techniques and has been frequently used in different fields recently, and the results are shared. In this context, one of them is cost-oriented (C1-Negative Personality Traits) and the others are benefit-oriented (C2-Foreign Language Grade, C3-Year of Experience, C4-Team Work Skill, C5-Empathy Ability, C6-Problem Solving Ability and C7-Appearance) considering a total of 7 criteria, the most suitable one among 6 candidates was determined.

Keywords: Multi-Criteria Decision-Making Techniques, Personnel Selection, PSI.

ÖZ

Belirli bir maliyete katlanmaksızın üretim faktörlerinde bir iyileştirme yapılmasının çok da kolay olmayacağı düşünülürse, işletmeler için maliyet minimizasyonu yapılabilecek en kritik faaliyet alanı lojistik ve tedarik zinciri yapılanmalarıdır. Aynı şekilde işletmeler için rekabet avantajı sağlayan en önemli üretim faktörü entelektüel sermaye olarak da bilinen insan kaynağıdır. Bu kapsamda doğru işe doğru personel görevlendirilmesi hayati önemi haizdir. Liyakate dayalı bir personel seçimi ve görevlendirilmesi halinde, işletme kaynaklarının verimli kullanımı sağlanacak ve işletmenin nihai etkinliği olumlu etkilenerek rekabet üstünlüğünün önü açılacaktır. Günümüzde personel seçimi için çok çeşitli uygulamalar ve testler yapılmaktadır. Büyük çoğunluğu sezgisel ve kişisel yargılara dayalı olan bu yöntemler zaman zaman hatalı seçimi beraberinde getirebilmektedir. Kısa iş görüşmelerinin ve/veya iş deneme sürelerinin, bireyi kişiliğiyle birlikte tanımaya yetmeyeceği aşikardır. Bu kapsamda çalışmada farklı personel alternatifleri arasından en uygun olanı seçmekte sıklıkla yararlanılan çok kriterli karar verme tekniklerinin önemine değinilmiştir. Çok kriterli karar verme teknikleri çok farklı alanlarda olduğu gibi personel seçiminde de karar vericiler için önemli bir yardımcı durumundadır. Yöntemlerin önemli bir bölümü yine uzman görüşü gibi sezgisel yaklaşımlara ihtiyaç duymakla birlikte, çalışmada kullanılan PSI yöntemi tamamen rasyonel bir şekilde uygulama aşamalarıyla, alternatiflerin tarafsız olarak değerlendirilmesine ve sahip oldukları sayısal değerler üzerinde sonuca gidilmesine olanak sağlamaktadır. Yapılan çalışmada birbirinden farklı önem seviyesindeki çok sayıda kriterin etkisi altında verilecek bir personel seçim kararı, çok kriterli karar verme tekniklerinden biri olan ve son zamanlarda farklı alanlarda sıklıkla kullanılan PSI yöntemiyle çözülmüş ve sonuçlar paylaşılmıştır. Bu kapsamda biri maliyet yönlü (K1-Olumsuz Kişilik Özellikleri) ve diğerleri fayda yönlü (K2-Yabancı Dil Notu, K3-Tecrübe Yılı, K4-Takım Çalışma Becerisi, K5-Empati Yeteneği, K6-Problem Çözme Yeteneği ve K7-Dış Görünüş) olmak üzere toplam 7 kriter dikkate alınarak 6 aday arasından en uygun olanı belirlenmiştir.

Anahtar Kelimeler: Çok Kriterli Karar Verme Teknikleri, Personel Seçimi, PSI.

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1. INTRODUCTION

Human resources, or intellectual capital as it is expressed today, is among the most important inputs of a business. It is often not possible to compensate for a mistake that can be made in assigning the right employee to the right job. In this context, all personnel who will take part in any organization, talent, competence, etc., it is vital that the criteria are chosen correctly and assigned to the right position under appropriate conditions. The importance of a personnel to be selected in accordance with the purpose of existence of the organization and/or the position within the organization is extremely important in terms of sustainability and competitiveness. Therefore, "recruitment of the right personnel will provide many benefits for the business, and the wrong selection will have many negative effects on the business by reducing productivity" (Yıldız and Aksoy, 2015).

The competitive environment accelerated by the development of technology necessitated the continuous renewal of enterprises. No matter how much a business invests in its brand, the value of that business determines the personnel it employs. One of the primary objectives of human resources is to select personnel who can best meet the requirements of the business, adapt to the corporate culture, and are open to change and development. It is not easy for businesses to identify the candidates who meet the criteria they are looking for and to choose the most suitable one among them, and it is an important cost item. For this reason, the solutions of decision-making problems, which are at the core of the selection process, should be carried out with scientific methods (Bedir & Eren, 2015).

Most of the decisions taken on extremely mundane issues in daily life are affected by more than one criterion. This situation causes the decisions made by different people to differ from each other on the same issue. The decision-making problem, which becomes more complex as the number of criteria increases, becomes more complex if these criteria affect each other (Demirci, 2020).

For this reason, Multi-Criteria Decision Making Techniques, which provide ease of solving the problem in parts and produce relatively more rational results, enable the optimization of more than one criterion by including all the criteria affecting the decision in the solution at the same time, and offer a single decision distribution to the decision maker in the selection of the best alternative (Yaralıoğlu, 2010; Turan, 2015).

In this context, the aim of the study is; It is to assist decision makers who are faced with the decision of personnel selection with methods based on scientific principles. For this, there are a wide variety of methods that have undergone significant developments in recent years and their numbers are increasing day by day. These methods, which are gathered under the title of multi-criteria decision making techniques (MCDM), can find application in many different areas in the literature today.

The PSI method used in the study was found to be important and preferred in that it does not require expert opinion due to the application stages and therefore produces completely rational results.

2. LITERATURE REVIEW

In the literature, MCDM applications are encountered in the solution of decision-making problems in many different fields. In accordance with the subject of the study, a literature review on personnel selection problems was made and the criteria in the existing studies were preferred during the application phase. In this context;

Ilgaz (2018) selected the personnel to work in the logistics sector by using AHP and TOPSIS methods in his study. As personnel selection criteria in his study; technical competence (reference, foreign language knowledge, active computer use), professional competence (year of experience, logistics information technology knowledge, reporting skills, vocational training), physical competence

(presentable appearance, physical endurance, being active) and social competence (team work) and harmony, effective communication skills, helpfulness) were used (Ilgaz, 2018).

Bedir and Eren (2015) in their study on the solution of a personnel selection problem for the retail sector; personal qualities (appearance, self-confidence, ability to cope with stress), interpersonal abilities (the ability to persuade, influence, empathize, teamwork and problem-solving), qualities necessary for the job (being active and dynamic, inclination to retail industry, knowledge about the product, taking initiative), experience (previously working time in the retail industry) and test result (personality inventory test result sent to the e-mail addresses of the candidates after the job application). They used AHP and PROMETHEE methods to select personnel for retail sector by usin these criteria (Bedir and Eren, 2015).

İbicioğlu and Ünal (2014) used the AHP method in their study. Accordingly, human resources managers were selected based on a total of 46 sub-criteria related to these, including corporate, demographic, professional, communication, managerial, mental and personality criteria (İbicioğlu and Ünal, 2014).

Doğan and Emre (2014) have brought a solution to the problem of human resources selection with the AHP and TOPSIS methods. 23 subjective and objective sub-criteria were used based on the main criteria of experience/work experience, education, professional requirements and individual characteristics, and external appearance, which were discussed in the study (Doğan and Emre, 2014).

Ünal (2011) presented examples of personnel selection belonging to different professions in his study. In his analysis with AHP, by using the main and sub-criteria required by the personnel to be selected; For the Engineering Department, it has brought solutions to the problems of selecting suitable personnel for the positions of manager candidate, Dean, Academic Staff, General Manager, Sales Representative and Marketing Manager, Nurse (Ünal, 2011).

3. METHOD

It is seen that methods that require expert opinion and depend on intuitive pre-assessment are generally used in personnel selection practices with MCDM in the literature. In this context, the PSI method applied in the study differs from the others in this respect.

The PSI (Preference Selection Index) method proposed by Maniya and Bhatt (2010) is a multi-criteria decision-making technique that produces solutions based on basic statistical information. Alternatives are ranked by taking into account a score value, known as the preference index, which is determined during the application process of the method.

In PSI method; there is no need to determine the relative importance of alternatives or criteria and to weight the criteria. Moreover, it does not require sensitivity analysis like some other multi-criteria decision making techniques. However, if the number of alternatives or criteria increases, the consistency of the results may become difficult (Attri & Grover, 2015). In this respect, criterion weights in PSI applications are determined using only the information provided in the decision matrix (Madic et al., 2017). Therefore, it also avoids possible disagreements about criterion weighting.

The application stages of the PSI method are as follows (Maniya & Bhatt, 2010; Vahdani et al., 2014; Chauhan et al., 2016);

Creation of Decision Matrix; At this stage, as in all other MCDM, an m x n-dimensional decision matrix is created with m decision alternatives and n decision criteria. The prepared decision matrix will be as seen in Equation 1.

$$X = \begin{matrix} x_{01} & x_{02} & \cdots & x_{0n} \\ x_{11} & x_{12} & \cdots & x_{1n} \\ \vdots & \vdots & \ddots & \vdots \\ x_{m1} & x_{m2} & \ldots & x_{mn} \end{matrix} \quad (1)$$

Normalizing Decision Matrix; At this stage, the decision matrix is normalized (x_{ij}^*), taking into account the benefit and cost orientation of the criteria. Equation 2 is used for the normalization of the benefit-oriented criteria and Equation 3 for the normalization of the cost-oriented criteria.

$$x_{ij}^* = \frac{x_{ij}}{maks.\, x_{ij}} \quad (2)$$

$$x_{ij}^* = \frac{min.\, x_{ij}}{x_{ij}} \quad (3)$$

Determination of Average Performance Value; At this stage, the average values of the normalized performance values ($\bar{x}_{ij}^*$) for each criterion are determined with the help of Equation 4.

$$\bar{x}_{ij}^* = \frac{\sum_{i=1}^{m} x_{ij}^*}{m} \quad (4)$$

Calculation of Preference Variability Value; At this stage, the preference variability value (PV_j) between the values of each criterion is calculated with the help of Equation 5.

$$PV_j = \sum_{i=1}^{m} \left(x_{ij}^* - \bar{x}_{ij}^*\right)^2 \quad (5)$$

Calculating the Deviation in Preference Value; At this stage, the deviation (ϕ_j) in the preference variability value of each criterion is calculated with the help of Equation 6.

$$\phi_j = \left(1 - PV_j\right) \quad (6)$$

Calculation of Total Preference Value; At this stage, the total preference value (ω_j) for each criterion is calculated with the help of Equation 7, with the total value equal to 1 ($\sum_{j=1}^{n} w_j = 1$).

$$\omega_j = \frac{\phi_j}{\sum_{j=1}^{n} \phi_j} \quad (7)$$

Determination of Preference Selection Index; In this last stage, the preference selection index (I_i) of each alternative is determined with the help of Equation 8. Accordingly, among the alternatives ranked from the largest to the smallest, it is decided that the alternative with the highest preference index is the best alternative.

$$I_i = \sum_{j=1}^{n} \left(x_{ij}^* * \omega_j\right) \quad (8)$$

4. RESULTS AND CONCLUSION

In the study, a selection was made among 6 candidates according to the applications made to the staff needed by a business with the PSI method, which is a MCDM which is frequently used in different fields in the literature recently. For this, first of all, the job description of the said staff was examined and the

criteria (7 criteria) that should be found in the candidates were determined bu literature. The criteria determined in this context are; C1-Negative Personality Traits (This criterion, which is considered as minimization-oriented, is expected to be low. Candidates are scored between 0-100 according to the results of the tests), C2-Foreign Language Grade (This criterion, which is maximization-oriented, is 0 in the form of a grade taken from the generally accepted foreign language exam. -100 were included in the analysis), C3-Year of Experience (This criterion, which is maximization-oriented, was determined as years according to the previous work experience of the candidate), C4-Team Work Skill, C5-Empathy Ability, C6-Problem Solving Ability and C7-Appearance (These criteria are maximization-oriented and included in the analysis by scoring between 1 and 9 according to the information obtained during the interview conducted by the Human Resources Department).

Then, the criteria values of the candidates were determined and the initial decision matrix was created and presented in Table 1.

Table 1. *Decision Matrix and Ranking of Alternatives*

Candidates	C1	C2	C3	C4	C5	C6	C7
	Min.	Maks.	Maks.	Maks.	Maks.	Maks.	Maks.
Candidate 1	25	80	13	7	6	7	5
Candidate 2	10	75	7	9	8	7	4
Candidate 3	20	60	9	8	5	6	4
Candidate 4	25	65	8	7	7	8	5
Candidate 5	50	95	9	8	6	8	3
Candidate 6	35	70	12	9	7	9	5

Then it is obtained the Normalized Decision Matrix by using the Equation 2 and Equation 3 and presented in Table 2.

Table 2. *Normalized Decision Matrix*

Candidates	C1	C2	C3	C4	C5	C6	C7
Candidate 1	0,4000	0,8421	1,0000	0,7778	0,7500	0,7778	1,0000
Candidate 2	1,0000	0,7895	0,5385	1,0000	1,0000	0,7778	0,8000
Candidate 3	0,5000	0,6316	0,6923	0,8889	0,6250	0,6667	0,8000
Candidate 4	0,4000	0,6842	0,6154	0,7778	0,8750	0,8889	1,0000
Candidate 5	0,2000	1,0000	0,6923	0,8889	0,7500	0,8889	0,6000
Candidate 6	0,2857	0,7368	0,9231	1,0000	0,8750	1,0000	1,0000
Mean	**0,4643**	**0,7807**	**0,7436**	**0,8889**	**0,8125**	**0,8333**	**0,8667**

After then by using the Normalized Decision Matrix and mean values of the column, it is obtained the Average Perfomance Value with the help of Equation 4.

***Table 3**. Average Performans Value*

Candidates	C1	C2	C3	C4	C5	C6	C7
Candidate 1	0,0041	0,0038	0,0657	0,0123	0,0039	0,0031	0,0178
Candidate 2	0,2870	0,0001	0,0421	0,0123	0,0352	0,0031	0,0044
Candidate 3	0,0013	0,0222	0,0026	0,0000	0,0352	0,0278	0,0044
Candidate 4	0,0041	0,0093	0,0164	0,0123	0,0039	0,0031	0,0178
Candidate 5	0,0698	0,0481	0,0026	0,0000	0,0039	0,0031	0,0711
Candidate 6	0,0319	0,0019	0,0322	0,0123	0,0039	0,0278	0,0178

Then it is calculated the Preference Variability Value, Deviation in Preference Value and Total Preference Value by using the Equation 5, Equation 6 and Equation 7, and presented in Table 4.

***Table 4.** Preference Variability Value, Deviation in Preference Value and Total Preference Value*

Parameters	C1	C2	C3	C4	C5	C6	C7	Total
PV_j	0,3983	0,0854	0,1617	0,0494	0,0859	0,0679	0,1333	
ϕ_j	0,6017	0,9146	0,8383	0,9506	0,9141	0,9321	0,8667	**6,0180**
ω_j	0,1000	0,1520	0,1393	0,1580	0,1519	0,1549	0,1440	**1,0000**

Finally it is determined the Preference Selection Index bu using the Equation 8, to rank all alternatives in order for selection decision. The Preference Selection Index values and rank values of alternatives presented in Table 5.

***Table 5**. Preference Selection Index and Rank Value of Alternatives*

Candidates	C1	C2	C3	C4	C5	C6	C7	Total	Rank
Candidate 1	0,04	0,13	0,14	0,12	0,11	0,12	0,14	0,8085	**3**
Candidate 2	0,10	0,12	0,08	0,16	0,15	0,12	0,12	0,8405	**2**
Candidate 3	0,05	0,10	0,10	0,14	0,09	0,10	0,12	0,6962	**6**
Candidate 4	0,04	0,10	0,09	0,12	0,13	0,14	0,14	0,7671	**4**
Candidate 5	0,02	0,15	0,10	0,14	0,11	0,14	0,09	0,7468	**5**
Candidate 6	**0,03**	**0,11**	**0,13**	**0,16**	**0,13**	**0,15**	**0,14**	**0,8589**	**1**

At the end of the prosess of PSI technique, it was determined that the most suitable candidate for the required staff of the enterprise was Candidate 6.

The issue of human resources procurement is considered to be an extremely complex and often subjective process by its nature. Keeping this process separate from personal approaches is extremely important for hiring the right staff for the right job. At this point, it would be appropriate to benefit from MCDMs, as in complex decisions to be made in many areas today. Because the decision to supply

human resources is too important to be left to subjective approaches.

MCDM has become the focus of attention in recent years and the number of methods has increased day by day. In this context, it is possible to come across a large number of MCDMs with different application stages in the literature. MCDM, which is used in the selection of the most suitable one among various alternatives, is an important helper for decision makers in matters under the influence of many criteria with different weights. Personal perception, emotion, attitude, manners, etc. It is considered that MCDM, which paves the way for objective decision-making in a completely rational way, will maintain its importance in the coming period as well.

Due to its structure, MCDM achieves results rationally and objectively according to the criteria values obtained for the alternatives, therefore it is not affected by the personal attitudes and behaviors of the decision makers. In this respect, the decision to procure human resources, which is extremely important for businesses, should be determined with objective approaches.

At this point, the MCDM to be chosen has a special importance. Some of the methods in the literature are criticized for their structures that require expert opinion and are partially based on subjective foundations. In this context, the PSI method was preferred in the study. The PSI method is seen as a completely objective approach, as it is a method that is based only on the criteria values and produces results with this information.

However, considering the differences in practice, another MCDM can be selected in future studies, and it is considered that the results may be healthier if the same data are applied together with two or more MCDMs for confirmation purposes.

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