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THE WEIGHTED SUM PREFERRED LEVELS OF PERFORMANCES APPROACH TO SOLVING PROBLEMS IN HUMAN RESOURCES MANAGEMENT

Darjan Karabasevic[a*], Dragisa Stanujkic[b], Bojan Djordjevic[c] and Ana Stanujkic[b]

[a]University Business Academy in Novi Sad, Faculty of Applied Management, Economics and Finance, Jevrejska 24, 11000, Belgrade

[b]University of Belgrade, Technical faculty in Bor, Vojske Jugoslavije 12, 19210 Bor, Serbia

[c]John Naisbitt University, Faculty of Management Zajecar, Park suma "Kraljevica"bb, 19000 Zajecar, Serbia

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Abstract

In the modern market and in competitive business conditions, human resources are the basis of achieving a long-term success and the key resource of competitive advantage. Therefore, employees represent one of the main strategic resources of an organization. The process of the recruitment and selection of personnel plays an extremely important role in human resources management, which tends to provide an organization with motivated and competent personnel. Therefore, the main objective of the paper is to present an approach to solving problems in human resource management, i.e. personnel selection, based on a recently developed multiple-criteria decision making method. The methodology used in the paper is based on the Weighted Sum Preferred Levels of Performances (WS PLP) method adapted for the purpose of an analysis based on decision-makers' preferred levels of performances. The weights of the criteria are determined by using the Step-wise Weight Assessment Ratio Analysis method (the SWARA method). The final ranking order is established by using the weighted averaging operator. Usefulness and efficiency of the proposed approach are considered in the numerical example for the selection of the HR manager. As a result, WS PLP approach can be used for solving personnel selection problems. The proposed multiple-criteria decision-making based approach is easy to use, effective, applicable and adaptable, depending on the goal we want to achieve. In order to solve problems in other areas, the proposed approach can be easily modified.

Keywords: human resources, human resources management, personnel selection, WS PLP, Weighted Sum, MCDM

* *Corresponding author: darjankarabasevic@gmail.com*

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1. INTRODUCTION

Today, organizations are increasingly recognizing the importance of human capital that has the ability to create other forms of intellectual capital and its employees, for which reason enormous resources are particularly invested in people, who become an important factor in achieving and maintaining competitiveness (Bánociová & Martinková, 2017).

The human resources of an organization are its employees with their knowledge, skills and experience. Bearing in mind the fact that human resources are those who create all other types of resources (material and non-material), it can be said that human resources are considered as the most important resource that must be paid attention to and shown an interest in at the highest level (Figar, 2007). Human resources are the most creative and the driving force of an organization because they play a decisive role in increasing the efficiency of business operations, achieving goals, the mission and vision of the organization.

Competent and motivated employees, committed to the organization significantly determine the performance and market position the organization. In their research studies, many authors, such as Wright et al.(1994), Alfalla-Luque et al. (2012), DeCenzo et al. (2015), Albrecht et al. (2015), Mayfield et al. (2016) and Karabasevic et al. (2016), emphasize the importance of human resources as a prerequisite factor for long-term and sustainable competitive advantage.

The modern world is affected by rapid changes, in which industrial technology gives place to information technology and the traditional ways of organizing are greatly transformed and adapted to the demands of the 21st century. New trends and new circumstances have a direct impact on human resources management (HRM). Growing competition, the management of international affairs, technological innovation, doing business in line with valid regulations, trade union activities, ethical issues and the best practice versus the best fitting are considered to be such trends or circumstances (Torrington et al., 2002).

The HRM is based on the fact that all organizations are characterized by people as the common denominator on the basis of which personnel and organizational policies and strategies of an organization are created. In this sense, the authors Wright & Nishii (2007), Boxall & Purcell (2011) and Đurović (2012) point out the fact that the HRM in modern organizations is becoming a significant strategic component.

One of the main challenges organizations are being faced with today is finding adequate ways for the evaluation and selection of personnel, in accordance with the defined set of competencies for a certain position. Afshari et al. (2010) emphasize the importance of personnel selection for an organization in a way that personnel selection directly and significantly affects the quality of employees; various approaches have also been developed in order to help organizations to place the right people in the right working places.

Griffin (2011) highlights the fact that the process of recruitment and selection of personnel is an extremely important activity of the HRM. Prior to the selection process, there is the recruitment process, aimed at attracting applicants and creating a pool of applicants. After the recruitment process is finished, the logical continuation is that towards the selection process involving the gathering of information from the applicants, where it is necessary to predict their success at work and their future work engagement, after which those candidates who prove to be the most successful are selected, i.e. recruited.

Taking into account the importance of having quality personnel at an organization and the fact that in the hiring process decision makers make decisions regarding personnel selection for the most part basing them on traditional approaches, such as analyzing the results of the conducted tests (the IQ tests, cognitive tests, personality tests and so forth), one of the main aims of this paper is to provide a new, simple and easy to use MCDM-based approach, for which reason the SWARA method is selected for determining the weights of the criteria, whereas the WS PLP approach is utilized for the purpose of ranking the evaluated alternatives.

Therefore, the manuscript is organized as follows: Section 1 is the Introduction; The Literature Review is presented in Section 2. The Methodology is accounted for in Section 3. The Numerical Example is presented in Section 4, finally, the Conclusions are given in Section 5.

2. LITERATURE REVIEW

In the business environment today, organizations are faced with the adoption of a large number of decisions on a daily basis. Decisions can be adopted through intuition and previous experience derived from operating activities; however, a question arises whether in that case the decisions that have been made are the right ones or not and whether they will enable the realization of the desired effect or not.

The business operations of organizations are often performed in an unpredictable and turbulent environment; in the same way, the decision making process is conducted, followed by specific uncertainties. While making decisions, decision makers are often faced with the problem of selecting the optimal alternative from a set of available alternatives, sometimes with the presence of possible limitations.

Relevant approach to making decisions and the adoption of sustainable solutions is provided by the Multiple-criteria Decision Making Methods (MCDM). The MCDM is one of the fastest growing and the most dynamic interdisciplinary fields of operations research.

Stanujkic et al. (2013a) describe multiple-criteria decision making as the process of selecting one from a set of available alternatives, or ranking alternatives, based on a set of criteria of usually different significance. Whereas, Belton and Stewart (2002) point out the fact that the “consideration of different choices or a course of action becomes an MCDM problem when there exist a number of such standards which conflict to a substantial extent”. However, in general, it is important to distinguish two types of MCDM problems: the one type is that related to having a finite number of alternative solutions, and the other is related to having an infinite number of solutions (Xu & Yang, 2001).

As previously stated, rapid development in the field of operations research has caused the emergence of many MCDM methods, some of the prominent being as follows: the Weighted Sum method (Fishburn, 1967; Lin et al., 2017), the Compromise Programming, (Zeleny, 1973; Raju et al., 2017), the AHP method (Saaty, 1980; Azizkhani et al., 2017), the TOPSIS method (Hwang & Yoon, 1981; Raj & Prabhu, 2017), the PROMETHEE method (Brans & Vincke, 1985; Živković et al., 2017), the ELECTRE method (Roy, 1991; Mousavi et al., 2017), the COPRAS method (Zavadskas et al., 1994; Valipour et al., 2017) and the VIKOR method (Opricović, 1998; Hafezalkotob & Hafezalkotob, 2017).

In addition to the above-mentioned methods, newer MCDM methods, such as the MOORA method (Brauers & Zavadskas, 2006), the MULTIMOORA method (Brauers & Zavadskas, 2010), the ARAS method (Zavadskas & Turskis, 2010), the SWARA method (Keršulienė et al., 2010), the WASPAS method (Zavadskas et al., 2012), the EDAS method (Ghorabaee et al., 2015) and the CODAS method (Ghorabaee et al., 2016) have recently been developed.

The foregoing methods have been applied so far to solving various problems. In order to cope with the problems that are followed by uncertainty, ambiguity and vagueness, some of these methods have their appropriate extensions in terms of using fuzzy numbers, intuitionistic fuzzy numbers and grey numbers.

Selecting candidates in the recruitment and selection process is a complex problem. To evaluate and select the best candidate among several candidates is a problem that could be solved by applying MCDM methods.

Traditional approaches in the process of recruitment and selection of personnel, i.e. the selection of human resources, is in the majority of cases based on the application of statistical analysis and test results (Kulik et al., 2007). However, some authors successfully approach the problem of personnel selection by using MCDM methods, such as the fuzzy MCDM approach to personnel selection proposed by (Dursun & Karsak, 2010), the application of the SAW method to the personnel selection problem (Afshari et al., 2010), the application of the VIKOR method to solving the personnel training selection problem (El-Santawy, 2012), the Fuzzy DEMATEL-ANP MCDM approach to personnel selection (Kabak, 2013), the Hamming distance with subjective and objective weights for personnel selection (Md Saad et al., 2014), personnel selection by using the interval 2-tuple linguistic VIKOR method (Liu et al., 2015), the application of the hybrid MCDM model to PR personnel selection (Chang, 2015), the selection of candidates in the mining industry based on the use of the SWARA and the MULTIMOORA methods (Karabasevic et al., 2015), the application of the fuzzy AHP and the fuzzy VIKOR approaches to personnel selection (Salehi, 2016), a framework for personnel selection based on the SWARA and the fuzzy ARAS methods (Karabasevic et al., 2016) and so on.

The review of the literature in the field of the application of the MCDM methods to personnel selection shows that the MCDM methods can be successfully applied to the selection of personnel in organizations.

3. METHODOLOGY

The Weighted Sum or SAW method is one of the most widely used MCDM methods (Triantaphyllou & Mann, 1989). Taking into account the fact that the Weighted Sum method can be used with a different normalization procedures, the Weighted Sum Preferred Levels of Performances approach proposed by Stanujkic and Zavadskas (2015) is based on the use of the well-known Weighted Sum method with the application of the new normalization procedure proposed by Stanujkic et al. (2013b).

The application of the proposed WS PLP approach adapted for the purpose of an analysis based on decision-makers' preferred levels of performances with the introduction of the new compensation coefficient can be described through the following steps (Stanujkic & Zavadskas, 2015):

Step 1. Create a decision matrix and determine the weights of the criteria. Firstly, it is necessary to form a decision matrix and determine the weights of the criteria. In our case, the weights of the criteria were determined by applying the SWARA method proposed by Keršulienė et al. (2010).

Step 2. Define the preferred performance ratings for each criterion. In this step, it is necessary to establish a virtual alternative $A_0=\{x_{01},x_{02},...,x_{0n}\}$, whose elements represent the preferences of the decision maker. If the preferred performance rating of any criterion is not defined by the decision maker, then it is defined as follows:

$$x_{0j} = \begin{cases} \max\limits_i x_{ij} \mid j \in \Omega_{\max} \\ \min\limits_i x_{ij} \mid j \in \Omega_{\min} \end{cases}, \tag{1}$$

where x_{0j} denotes the optimal preference rating of the criterion j.

Step 3. Create a normalized decision matrix. In this step, normalized performance ratings can be calculated as follows:

$$r_{ij} = \frac{x_{ij} - x_{0j}}{x_j^+ - x_j^-}, \tag{2}$$

where r_{ij} denotes the normalized performance rating of the alternative i with respect to the criterion j, x_{ij} denotes the performance rating of the alternative i with respect to the criterion j, x_j^+ and x_j^- denotes the largest and the smallest performance ratings of the criterion j.

Step 4. Calculate the overall performance rating for each alternative. In this step, the overall performance ratings are calculated in the following manner:

$$S_i = \sum_{j=1}^{n} w_j \cdot r_{ij}, \tag{3}$$

where S_i denotes the overall performance rating of the alternative i, and w_j is the weight of the criterion j.

In the case of two or more alternatives being higher than 0 (S_i>0), the procedure for determining the overall performance rating continues through the following steps. Otherwise, the optimal alternative is the one with the highest S_i, and such alternatives are ranked in ascending order.

Step 5. Calculate the compensation coefficient. The compensation coefficient should provide adequate ratios. So, in this step, it is necessary to calculate the compensation coefficient for all the alternatives in which S_i>0, in the following manner:

$$c_i = \lambda d_i^{\max} + (1-\lambda)\bar{S}_i^+, \tag{4}$$

where:

$$d_i^{\max} = \max_i d_i = \max_i r_{ij} w_j, \tag{5}$$

$$\bar{S}_i^+ = \frac{S_i^+}{n_i^+}, \tag{6}$$

where d_i^{max} denotes the maximum weighted normalized distance of the alternative i in relation to the preferred performance ratings of all the criteria, so that r_{ij}>0, $\bar{S}_i^*$ denotes the average performance ratings obtained on the basis of the criteria, so that r_{ij}>0, n_i^* denotes the number of the criteria of the alternative i, so that r_{ij}>0, λ is the coefficient (λ =[0,1]) and is usually set at 0.5.

Step 6. Determine the adjusted performance rating. The adjusted performance rating should be calculated for all the alternatives in which S_i>0 by using Eq. (7), where, if necessary, the decision maker can reduce, or even totally eliminate, the impact of the compensation coefficient by varying the values of the coefficient γ:

$$S_i' = \sum_{j=1}^{n} w_j r_{ij} - \gamma c_i, \tag{7}$$

where $S_i^{'}$ represents the adjusted overall performance rating of the alternative i, c_i is the compensation coefficient (c_i>0), and γ represents the coefficient (γ=[0,1]).

Step 7. Do the final ranking of the alternatives and select the most efficient one. Taking into account the fact that the alternatives are ranked in ascending $S_i^{'}$, the alternative with the highest $S_i^{'}$ is the most appropriate.

When several DMs are involved in the evaluation process, the final ranking order can be established by using the weighted averaging operator.

The weighted averaging (WA) operator, defined by (Harsanyi, 1955), allows the mapping of the k dimensions in a single overall score WA:$R^k \rightarrow R$, as follows:

$$WA(a_1, a_2, \ldots, a_k) = \sum_{l=1}^{k} \omega_j a_j, \tag{8}$$

where a_j denotes the performance of the criterion j and ω_j denotes the weight of the dimension j; $\omega_j \in [0,1]$ and $\sum_{j=1}^{n} \omega_j = 1$.

Based on the use of the WA operator, the final ranking order of the considered alternatives can be determined as follows:

$$S_i'' = \sum_{l=1}^{k} \omega_k S_i, \tag{9}$$

where ω_k denotes the significance of the decision maker k.

In the cases when the steps 5 and 6 of the WS PLP approach are used, the final ranking orders are determined as follows:

$$S_i'' = \sum_{l=1}^{k} \omega_k S_i'. \tag{10}$$

4. A NUMERICAL EXAMPLE

In order to show the applicability and usability of the proposed approach, a numerical example is presented in this section.

Telecommunication Company is looking for the HR manager. Only four shortlisted candidates have entered the final round of the selection process. The final decision on candidates is based on the opinions of three decision makers (DMs) –the HR director and two HR partners, respectively. Also, it is important to accentuate that the decision makers do not have the same significance/weight in the decision-making process. The weight of 0.50 has been attributed to the HR director, whereas the two HR partners have the equal weights of 0.25 in the decision-making process. The candidates have been evaluated according to the six criteria, namely the following: C_1 – Relevant work experience; C_2 – Education; C_3 – Communication and presentation skills; C_4 – People management skills, C_5 – Organizational and planning skills and C_6 – Foreign languages. The weights of the criteria defined in such a manner were determined by applying the SWARA method. The weights of the criteria for all the three DMs are shown in Table 1.

The performance ratings of the alternatives, the weights of the criteria and the preferred performance ratings (PPR) for all the three DMs are presented in Table 2, Table 3 and Table 4.

Table 1. The evaluation criteria for the HR manager with the corresponding weights of the three DMs

	Criteria	DM1 - w_j	DM2 - w_j	DM3 - w_j
C_1	Relevant work experience	0.27	0.27	0.27
C_2	Education	0.21	0.20	0.24
C_3	Communication and presentation skills	0.16	0.17	0.16
C_4	People management skills	0.14	0.14	0.12
C_5	Organizational and planning skills	0.11	0.12	0.10
C_6	Foreign languages	0.10	0.09	0.08
		1	1	1

Table 2. The initial decision matrix for the first DM of the three DMs

Criteria	C_1	C_2	C_3	C_4	C_5	C_6
Optimization	max	max	max	max	max	max
w_j	0.27	0.21	0.16	0.14	0.11	0.10
PPR	4	4	3	4	4	4
A_1	4	3	4	4	3	4
A_2	5	4	3	5	4	4
A_3	5	5	4	5	5	5
A_4	5	4	3	3	4	4

Table 3. The initial decision matrix for the second DM of the three DMs

Criteria	C_1	C_2	C_3	C_4	C_5	C_6
Optimization	max	max	max	max	max	max
w_j	0.27	0.20	0.17	0.14	0.12	0.09
PPR	3	4	3	4	4	3
A_1	5	4	3	3	3	3
A_2	3	3	3	3	4	2
A_3	5	4	4	4	4	5
A_4	4	4	3	4	4	3

Table 4. The initial decision matrix for the third DM of the three DMs

Criteria	C_1	C_2	C_3	C_4	C_5	C_6
Optimization	max	max	max	max	max	max
w_j	0,27	0,24	0,16	0,12	0,10	0,08
PPR	4	4	3	3	4	3
A_1	3	4	3	4	3	3
A_2	3	4	3	3	2	3
A_3	5	4	5	4	3	4
A_4	4	3	3	4	3	3

Table 5. The normalized decision matrix for the first DM of the three DMs

Criteria	C_1	C_2	C_3	C_4	C_5	C_6
w_j	0.27	0.21	0.16	0.14	0.11	0.10
A_1	0	-1	1	0	-1	0
A_2	1	0	0	1	0	0
A_3	1	1	1	1	1	1
A_4	1	0	0	-1	0	0

Table 6. The weighted normalized decision matrix for the first DM of the three DMs

Criteria	C_1	C_2	C_3	C_4	C_5	C_6
A_1	0.00	-0.21	0.16	0.00	-0.11	0.00
A_2	0.27	0.00	0.00	0.14	0.00	0.00
A_3	0.27	0.21	0.16	0.14	0.11	0.10
A_4	0.27	0.00	0.00	-0.14	0.00	0.00

The normalized and the weighted normalized decision matrices obtained from the first DM of the three DMs are accounted for in Table 5 and Table 6.

The ranking orders of the candidates for all the three DMs are displayed in Table 7.

Taking into account the fact that in the evaluation and selection of candidates three decision makers have participated, the ranking order of the considered alternatives is determined by applying the WA operator by applying Eq. (8). The final ranking results are shown in Table 8.

Based on the data from Table 8, the ranking order of the alternatives, i.e. the candidates, is as follows: $A_1 \prec A_2 \prec A_4 \prec A_3$. Therefore, the candidate designated as A_3 has the highest total importance and the best results in terms of the evaluated criteria.

Table 7. The ranking results obtained from all the three DMs

	DM1		DM2		DM3	
	S_i	Rank	S_i	Rank	S_i	Rank
A_1	-0.16	4	0.27	3	-0.25	3
A_2	0.41	2	-0.43	4	-0.47	4
A_3	1.00	1	0.89	1	0.69	1
A_4	0.12	3	0.27	2	-0.22	2

Table 8. Final ranking results determined by WA operator for all the three DMs

	S_i	Rank
A_1	-0.08	4
A_2	-0.02	3
A_3	0.90	1
A_4	0.07	2

5. CONCLUSION

In the modern market and in competitive business conditions, human resources are the basis of achieving a long-term success and the key resource of competitive advantage. Therefore, employees represent one of the main strategic resources of an organization. Competent and motivated employees are of the key importance for any modern organization that strives to achieve success. An organization's success and market position largely depend on the people who work for the organization, for which reason organizations invest quite a lot of efforts and resources in finding ideal employees. This is the reason why the process of recruitment and selection is a significant function of human resource management. Therefore, the approach for personnel selection based on the use of the WS PLP is presented in this paper. More precisely, the proposed approach integrates the SWARA and WS PLP methods for decision-making in a group environment, whereby the SWARA method is used to determine the weight of the criteria, and the WS PLP approach is used to determine the overall performance rating for each alternative. The presented numerical example has shown that the proposed approach is easy to use, effective, applicable and adaptable, depending on the goal we want to achieve. In order to solve problems in other areas, the proposed approach can be easily modified by using another set of evaluation criteria.

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ПРИСТУП ПОНДЕРИСАНЕ СУМЕ ПРЕФЕРИРАНИХ НИВОА ПЕРФОРМАНСИ У РЕШАВАЊУ ПРОБЛЕМА У МЕНАЏМЕНТУ ЉУДСКИХ РЕСУРСА

Дарјан Карабашевић, Драгиша Станујкић, Бојан Ђорђевић и Ана Станујкић

Извод

На савременом тржишту и конкурентним условима пословања, људски ресурси представљају основу за остваривање дугорочног успеха и кључни ресурс за постизање конкурентске предности. Стога, запослени представљају један од основних стратешких ресурса организације. Процес регрутације и селекције кадрова има веома значајну улогу у менаџменту људских ресурса, који тежи да обезбеди организацији мотивисано и компетентне кадрове. Стога, главни циљ рада је да представи приступ решавању проблема у менаџменту људских ресурса, тј. селекције кадрова базиран на примени недавно предложене методе вишекритеријумског одлучивања. Методологија примењена у овом раду се базира на методи пондерисаних нивоа перформанси (WS PLP) прилагођене у циљу анализа базираних на преференцијама доносиоца одлука. Тежине критеријума се одређују коришћењем *Step-wise Weight Assessment Ratio Analysis* (SWARA) методе. Коначан редослед рангираних алтернатива је успостављен коришћењем пондерисаног оператора агрегације. Примењивост и ефикасност предложеног приступа су разматрани у нумеричком примеру избора менаџера људских ресурса. Као резултат тога, утврђено је да се WS PLP приступ може успешно применити за решавање проблема избора кадрова. Предложени вишекритеријумски приступ је једноставан за коришћење, ефективан и адаптиван, у зависности од циља који се жели постићи. Осим тога, предложени приступ се лако може модификовати у циљу решавања других проблема.

Кључне речи: људски ресурси, менаџмент људских ресурса, избор кадрова,”WS PLP”, пондерисана сума, МКДО

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