Часопис из области економије, менаџмента и информатике
БизИнфо (БЛАЦЕ)
www.bizinfo.edu.rs
Journal of Economics, Management and Informatics
BizInfo (BLACE)

Approach to the personnel selection in a group decision-making environment based on the use of the MULTIMOORA and PIPRECIA-S methods

Pristup izboru zaposlenih zasnovan na MULTIMOORA i PIPRECIA-S metodama u grupnom okruženju

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Article info

Original scientific paper/ Originalan naučni rad

Received/ Rukopis je primljen:
6 December, 2023
Revised/ Korigovan:
12 May, 2024
Accepted/ Prihvaćen:
13 June, 2024

DOI:
https://doi.org/10.5937/bizinfo2401019S

UDC/ UDK:
005.96:004.738

Abstract

The selection of suitable personnel is of great importance for the successful operation of companies. Therefore, this article investigates the application of the Multi-Objective Optimization by Ratio Analysis plus Full Multiplicative Form (MULTIMOORA) and Simplified PIvot Pairwise RElative Criteria Importance Assessment (PIPRECIA-S) methods to evaluate candidates under the conditions of group decision-making. The MULTIMOORA method is used for ranking candidates while PIPRECIA-S method is used for determining criteria weights. As main objective of this article can be identified proposing and checking the usability of an easy-to-use and at the same time easy-to-understand framework for personnel evaluation that supports group decision-making and negotiation among human resource managers in the evaluation process. Additionally, the objective is to propose a framework that can be used for solving similar decision-making problems, as well as to propose a framework that can serve as a basis for the development of appropriate software.
Keywords: *human resources management, personnel selection, recruitment, PIPRECIA-S, MULTIMOORA*

Sažetak

Izbor odgovarajućeg zaposlenog je od izuzetnog značaja za uspešno funkcionisanje kompanije. Zbog toga je istraživanje u ovom radu usmereno na primenu Multi-Objective Optimization by Ratio Analysis plus Full Multiplicative Form (MULTIMOORA) i Simplified PIvot Pairwise RElative Criteria Importance Assessment (PIPRECIA-S) metoda za evaluaciju kandidata u uslovima grupnog odlučivanja. MULTIMOORA metoda upotrebljena je za rangiranje kandidata, dok je PIPRECIA-S iskorišćena za definisanje težine kriterijuma. Kao glavni cilj ovog članka može se navesti predlaganje jednostavnog i istovremeno lako razumljivog okvira za evaluaciju kadrova koji podržava grupno odlučivanje i pregovaranje između menadžera ljudskih resursa u procesu evaluacije. Osim toga, dodatni cilj je predlaganje modela koji se može koristiti i za rešavanje sličnih problema, a takođe i poslužiti kao osnova za razvoj odgovarajućeg softvera.
Ključne reči: *menadžment ljudskih resursa, izbor zaposlenih, PIPRECIA-S, MULTIMOORA*

1. Introduction

The recruitment and selection of suitable personnel is essential for the efficient functioning and further development of the company in a competitive environment. For this reason, almost every modern company has a specialized department, the Human Resources (HR) department, which deals with the recruitment and selection of the personnel required for the efficient functioning of the company.

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Among numerous other approaches, using multiple criteria decision-making (MCDM) methods in the recruitment and selection process can be identified as one of the actual approaches. As a result, numerous articles have been published in the scientific and professional literature, such as Liang and Wang (1994), Dursun and Karsak (2010), Karabašević et al. (2015a; 2015b, 2016), Ulutaş et al. (2020), Popović (2021), Uslu et al. (2021), and so on.

Different MCDM approaches have been applied in these researches, such as TOPSIS (Kelemenis & Askounis, 2010; Matin et al., 2011; Samanlioglu et al., 2018; Nabeeh et al. 2019), VIKOR (Liu et al., 2015; Krishankumar et al., 2020), PROMETHEE (Luo & Xing, 2019), EDAS (Karabasevic et al., 2018), COPRAS (Zolfani et al., 2012; Ighravwe & Oke, 2019), and MULTIMOORA (Baležentis et al., 2012a; Baležentis et al., 2012b; Uslu et al., 2021).

In MCDM methods, as the characteristic phases can usually be identified the normalization phase and the aggregation phase. In the normalization phase, the ratings of the alternatives concerning criteria are transformed into dimensionless values, while in the aggregation phase overall utility, i.e., performance, of each alternative, based on which the alternatives are ranked, is calculated. The above-mentioned MCDM methods, as well as numerous other MCDM methods, differ significantly in the approach used for normalization, as well as the approach used for aggregation, i.e., the approach used for calculating the overall utility of considered alternatives. For example, the TOPSIS method uses the square root normalization procedure and the distances from ideal and anti-ideal solutions in Euclidean space for ranking alternatives, while the VIKOR method is based on the Minkowski metric and a specific linear normalization procedure. The PROMETHEE method uses pairwise comparisons for ranking alternatives. The EDAS method use two distance measures, the positive and the negative distance from average for ranking alternatives. Similarly, to the TOPSIS method, in this method alternatives with higher values of positive distances and lower values of negative distances are more preferable. The COPRAS method is also specific and it is based on the application of a sum normalization procedure and a specific aggregation procedure.

The MULTIMOORA (Multi-Objective Optimization by Ratio Analysis plus Full Multiplicative Form) method was proposed by Brauers and Zavadskas (2010). The MULTIMOORA method is characterized by the fact that it integrates three approaches to determine the most suitable alternative, whereby the most suitable alternative is determined using the theory of dominance. The MULTIMOORA method was formed by extending the MOORA (Multi-Objective Optimization by Ratio Analysis) method, which was also proposed by Brauers and Zavadskas (2006).

Apart from personnel selection, the MULTIMOORA method has been successfully applied to solve a number of different problems in various fields, e.g., in economy (Brauers and Zavadskas 2010, 2011; Brauers et al. 2011; Brauers, 2010), construction (Kracka et al., 2015), risk management (Liu et al., 2014a) and waste treatment (Liu et al., 2014b), material selection (Hafezalkotob and Hafezalkotob, 2016; Hafezalkotob et al., 2016) and the CNC machine tool evaluation (Sahu et al., 2016), and so on.

The PIPRECIS-S (Simplified PIvot Pairwise RElative Criteria Importance Assessment) method was proposed by Stanujkic et al. (2021) as a simplified version of the PIPRECIA (PIvot Pairwise RElative Criteria Importance Assessment) method, which also proposed by Stanujkic et al. (2017). The main purpose of the PIPRECIA-S and PIPRECIA methods is to determine the importance (weights) of the criteria. However, they can also be used to fully solve MCDM problems. PIPRECIA and PIPRECIA-S have been used to determine the criteria weights in several articles, such as: Jauković-Jocić et al. (2020), Đalić et al. (2020), Ulutaş et al. (2020), Ulutaş and Topal (2022), Setiawansyah and Saputra (2023).

Based on the above, in this article an approach for personnel selection in a group decision-making environment based on the use of the MULTIMOORA and PIPRECIA-S is presented. In the proposed approach, PIPRECIA-S is used to determine the criteria weights, while the MULTIMOORA method is used to rank the candidates.

Therefore, the rest of article is organized as follows: In Section 2 the MULTIMOORA and PIPRECIA-S methods are presented in details, while in Section 3, an empirical illustration of candidate evaluation is considered, with the aim to explain in detail the proposed methodology. Finally, the conclusions are presented at the end of the article.

2. Methodology

2.1. The MULTIMOORA method

The MULTIMOORA method integrates three approaches to evaluate alternatives and select the most suitable one. As a result of the three approaches, three ranking lists are formed and the final ranking of the alternatives is determined by applying the theory of dominance.

The three approaches used in the MULTIMOORA method are: the Ratio System (RS) approach, Full Multiplicative Form (FMF) approach and the Reference Point (RP) approach.

The ratio system approach. In the RS approach, alternatives are ranked in descending order according to the values of their overall importance. In other words, the alternative with the higher overall importance value is considered the most suitable. In this approach the overall importance y_i of alternative i is determined through the following equation:

$$y_i = \sum_{j\in\Omega_{max}} r_{ij}\, w_j - \sum_{j\in\Omega_{min}} r_{ij}\, w_j. \qquad (1)$$

Here, Ω_{max} and Ω_{min} represent the set of beneficial and set of non-beneficial criteria, respectively.

The full multiplicative form approach. In the FMF approach, the alternatives are ranked in descending order according to the value of their overall utility, i.e., the alternative with the higher value of overall utility is the most suitable alternative. In this approach the overall utility u_i of alternative i is determined through the following equation:

$$u_i = \frac{\prod_{j\in\Omega_{max}} r_{ij}\, w_j}{\prod_{j\in\Omega_{min}} r_{ij}\, w_j}. \quad (2)$$

The reference point approach. In the RP approach, the alternatives are ranked in ascending order based on the value of their maximum distance from the reference point, i.e. the alternative with the smaller value of the maximum distance is the most suitable alternative. In this approach the maximum distance d_i^{max} of alternative i is determined through the following equation:

$$d_i^{max} = max_j\left(w_j\left|r_j^* - r_{ij}\right|\right), \quad (3)$$

where d_i^{max} denotes the maximum distance of the alternative i to the reference point r_j^*, determined through the following equation:

$$r_j^* = max_i\, r_{ij}. \quad (4)$$

2.1.1. Adaption of the MULTIMOORA method for solving MCDM problems with only beneficial criteria

MCDM problems typically involve both beneficial and non-beneficial criteria. Beneficial criteria are those where higher values of performance ratings are more preferable, whereas non-beneficial criteria are those where lower values of performance ratings are more preferable. However, there are also MCDM problems that do not include non-beneficial criteria, such as personnel evaluation. In such cases, i.e., for solving such type of MCDM problem, the ordinary MULTIMOORA method must be adapted. One form of the MULTIMOORA method adapted for solving MCDM problems in which alternatives are evaluated on the basis of only beneficial criteria can be expressed by applying the following steps:

Step 1. Evaluate the alternatives concerning the chosen criteria and create the initial decision-making matrix D, as follows:

$$D = \left[x_{ij}\right]_{m\,x\,n}, \quad (5)$$

where x_{ij} denote performance rating of alternative i in relation to the criterion j.

Step 2. Calculate the normalized ratings r_{ij} of alternatives, as follows:

$$r_{ij} = \frac{x_{ij}}{\sqrt{\sum_{i=1}^{n}(x_{ij})^2}} \quad (6)$$

where x_{ij} denotes the performance of the alternative i to the criterion j, and n denote number of criteria.

Step 3. Calculate the overall importance y_i of the alternative i using the RS approach, as follows:

$$y_i = \sum_{j=1}^{n} r_{ij}\, w_j \quad (7)$$

Step 4. Calculate the overall utility u_i of the alternative i using the FMF approach, as follows:

$$u_i = \prod_{j=1}^{n} r_{ij}\, w_j. \quad (8)$$

Step 5. Calculate the maximum distance d_i^{max} of the alternative i using the RP approach, as follows:

$$d_i^{max} = max_j\left(w_j\left|r_j^* - r_{ij}\right|\right). \quad (9)$$

Step 6. Rank the alternatives and determine the most appropriate one. As a result of applying RS, RP and FMF approaches, there are three lists of values: y_i, d_i^{max}, and u_i. For using theory of dominance, the values in the lists y_i and u_i must be lined up in descending order and the values in the list d_i^{max} in ascending order.

The final decision is made based on the theory of dominance. In other words, the alternative with the highest number of appearances in the first positions on all ranking lists is the best-ranked alternative.

2.1.2. The MULTIMOORA method in a group decision-making environment

The application of the MULTIMOORA method in a group decision-making environment is discussed in Baležentis et al. (2012a) and Baležentis et al. (2012b). In the mentioned articles, at the very beginning of the evaluation of alternatives using the MULTIMOORA method in a group environment, a group decision matrix is formed based on the decision matrices of the decision-makers (DMs) involved in the evaluation. In such an approach, the attitudes of the DMs involved in the evaluation are very quickly transformed into the group attitudes.

However, in this article is considered the possibility of evaluating the alternative using the MULTIMOORA method for each DM involved in the evaluation and making the final decision about the ranking of the alternatives by using the theory of dominance or negotiation of the DMs.

2.2. The PIPRECIA-S method

As already mentioned, the PIPRECIA-S method is proposed by Stanujkic et al. (2021), with the aim of making it easier for decision-makers to determine the criteria weights. The calculation procedure of the PIPRECIA-S method can be illustrated as follows:

Step 1. Determine the set of evaluation criteria.

Step 2. Set the relative significance s_j of each criterion, except the first, as follows:

$$s_j = \begin{cases} > 1 & if\ C_j \succ C_1 \\ 1 & if\ C_j = C_1, \\ < 1 & if\ C_j \prec C_1 \end{cases} \quad (10)$$

where $j \neq 1$.

Similar to the PIPRECIA method, the value of s_1 is set to 1, while values of s_j belong to the interval (1, 1.9] when $C_j \succ C_1$, that is to the interval [0.1, 1) when $C_j \prec C_1$.

Step 3. Calculate the value of coefficient k_j as follows:

$$k_j = \begin{cases} 1 & if\ j = 1 \\ 2 - s_j & if\ j > 1 \end{cases}. \quad (11)$$

Step 4. Calculate the recalculated weight q_j as follows:

$$q_j = \begin{cases} 1 & if\ j = 1 \\ \frac{1}{k_j} & if\ j > 1 \end{cases}. \quad (12)$$

Step 5. Determine the relative weights of the evaluation criteria as follows:

$$w_j = \frac{q_j}{\sum_{k=1}^{n} q_k}. \quad (13)$$

3. A framework for evaluating candidates based on MULTIMOORA and PIPRECIA-S methods

The approach based on the use of the MULTIMOORA and PIPRECIA-S methods is based on determining the importance of the evaluation criteria (criteria weights), for each decision-maker (DM) involved in evaluation, and determining ranking orders of the candidates based on the opinions of each DMa, involved in evaluation, using the MULTIMOORA method.

As a result of using such approach *K* ranking lists of candidates could be formed in case when *K* DMs evaluates candidates. In this approach, similarly as in the MULTIMOORA method, the final ranking list is formed and the most suitable candidate is selected based on theory of dominance or based on the negotiations of the DMs involved in the evaluation.

At any moment of the evaluation, one or more decision-makers can come back to re-determine the criteria weights, re-evaluate the candidates in relation to the criteria, or perform calculations using the MULTIMOORA method. In this approach, it is recommended to create appropriate Excel sheets in which DMs enter their attitudes about the relative importance of the criteria and the candidate's performances in relation to the selected set of criteria, based on which criteria weights and candidate ranks are automatically calculated.

4. Illustrative example

In order to present the usability of the proposed approach based on the use of MULTIMOORA and PIPRECIA-S methods for ranking and selecting candidates, an example of evaluating candidates for a software development engineer position in an IT company is used. The evaluation is based on the case of real company which details we are not allowed to reveal. In this case four Human Resources Manager (HRMs) evaluates five candidates based on the following criteria: C_1 – Education, C_2 – Relevant work experience, C_3 – Relevant certificates, C_4 – Communication and presentation skills, C_5 – People management skills, C_6 – Organizational and planning skills and C_7 – Foreign language skills.

The attitudes of four DMs regarding the weights of the criteria are illustrated in Tables 1 to 4. In these tables, the calculation details and weights of the evaluation criteria are presented, as calculated through the PIPRECIA-S method.

Table 1. The criteria weight obtained based on the attitudes of the first HRM

Criteria	s_j	k_j	q_j	w_j
C_1		1	1	0.11
C_2	1.2	0.80	1.25	0.13
C_3	1.2	0.80	1.25	0.13
C_4	1.3	0.70	1.43	0.15
C_5	1.3	0.70	1.43	0.15
C_6	1.3	0.70	1.43	0.15
C_7	1.35	0.65	1.54	0.16
			9.32	1.00

Source: Author′s calculation

Data in column s_j represent HRM preferences, while values in columns k_j, s_j and w_j are calculated using Eqs. (11) to (13). The weights for the remaining three HRMs were calculated in a similar way.

Table 2. The criteria weight obtained based on the attitudes of the second HRM

Criteria	s_j	k_j	q_j	w_j
C_1		1	1	0.11
C_2	1.2	0.80	1.25	0.14
C_3	1.2	0.80	1.25	0.14
C_4	1.3	0.70	1.43	0.16
C_5	1.3	0.70	1.43	0.16
C_6	1.3	0.70	1.43	0.16
C_7	1.25	0.75	1.33	0.15
			9.12	1.00

Source: Author′s calculation

Table 3. The criteria weight obtained based on the attitudes of the third HRM

Criteria	s_j	k_j	q_j	w_j
C_1		1	1	0.11
C_2	1.2	0.80	1.25	0.14
C_3	1	1.00	1.00	0.11
C_4	1.2	0.80	1.25	0.14
C_5	1.3	0.70	1.43	0.16
C_6	1.3	0.70	1.43	0.16
C_7	1.3	0.70	1.43	0.16
			8.79	1.00

Source: Author′s calculation

Table 4. The criteria weight obtained based on the attitude of the fourth HRM

Criteria	s_j	k_j	q_j	w_j
C_1		1	1	0.12
C_2	1.2	0.80	1.25	0.15
C_3	1.1	0.90	1.11	0.13
C_4	1.2	0.80	1.25	0.15
C_5	1.25	0.75	1.33	0.16
C_6	1.25	0.75	1.33	0.16
C_7	1.1	0.90	1.11	0.13
			8.39	1.00

Source: Author′s calculation

The weights of the criteria obtained from the four decision-makers are summarized in Table 5.

Table 5. The criteria weight obtained based on the attitudes of all HRMs

C*	HMR_1 w_j	HMR_2 w_j	HMR_3 w_j	HMR_4 w_j	*min*	*max*	Δ
C1	0.11	0.11	0.11	0.12	0.11	0.12	0.01
C2	0.13	0.14	0.14	0.15	0.13	0.15	0.02
C3	0.13	0.14	0.11	0.13	0.11	0.14	0.03
C4	0.15	0.16	0.14	0.15	0.14	0.16	0.02
C5	0.15	0.16	0.16	0.16	0.15	0.16	0.01
C6	0.15	0.16	0.16	0.16	0.15	0.16	0.01
C7	0.16	0.15	0.16	0.13	0.13	0.16	0.03

*C-criteria

Source: Author′s calculation

As can be concluded from Table 5, there is no great difference in the importance of the criteria obtained from the four HRMs. The ratings of the candidates obtained from the four HRMs in relation to the criteria are shown in Tables 6 to 9.

Table 6. The ratings of candidates obtained from the first HRM

	C_1	C_2	C_3	C_4	C_5	C_6
A_1	4	3	3	3	4	3
A_2	4	3	4	4	3	4
A_3	5	5	4	3	3	4
A_4	4	5	3	4	4	5
A_5	5	4	3	3	4	4

Source: Author′s calculation

Table 7. The ratings of candidates obtained from the second HRM

	C_1	C_2	C_3	C_4	C_5	C_6
A_1	4	4	4	4	4	3
A_2	4	4	3	3	4	4
A_3	5	5	4	3	4	5
A_4	4	4	3	5	3	5
A_5	4	5	4	4	3	4

Source: Author′s calculation

Table 8. The ratings of candidates obtained from the third HRM

	C_1	C_2	C_3	C_4	C_5	C_6
A_1	4	4	4	4	4	3
A_2	4	4	3	3	4	4
A_3	5	5	4	3	4	5
A_4	4	4	3	5	3	5
A_5	4	5	4	4	3	4

Source: Author′s calculation

Table 9. The ratings of candidates obtained from the fourth HRM

	C_1	C_2	C_3	C_4	C_5	C_6
A_1	3	4	4	4	4	3
A_2	3	4	3	4	3	3
A_3	5	4	3	4	4	4
A_4	4	3	4	4	3	5
A_5	4	4	4	4	3	4

Source: Author′s calculation

The overall importance's y_i, the overall utilities u_i, and the maximum distances d_i^{max} of evaluated candidates, calculated using Eqs. (7), (8), and (9), as well as appropriate ranking orders, sum of ranks and final rank of candidates, determined by using MULTIMOORA method and ratings obtained from four HRMs are presented in Tables 10 to 13.

Table 10. The ratings of candidates obtained from the first HRM

				Ranks				
	y_i	u_i	d_i^{max}	y_i	u_i	d_i^{max}	**Σ**	The final rank
A_1	0.41	0.0000000020	0.034	5	5	5	15	5
A_2	0.45	0.0000000035	0.029	2	3	4	9	3
A_3	0.45	0.0000000041	0.021	3	2	1	6	2
A_4	0.47	0.0000000054	0.021	1	1	1	3	1
A_5	0.43	0.0000000033	0.021	4	4	1	9	3

Source: Author′s calculation

Based on y_i, u_i, and d_i^{max}, appropriate ranking orders of evaluated candidates were determined based on the attitudes of the first HRM. As it can be seen from the previous table, the ranking orders in this case do not differ significantly, and the most suitable candidate is the candidate denoted as A_4. The final ranking order, determined based on dominance theory, is also shown in Table 10.

In a similar way, the three ranking orders based on the three approaches used in the MULTIMOORA method, as well as the final ranking orders of the ranked candidates, are determined for remaining three HRMs.

Table 11. The ratings of candidates obtained from the second HRM

				Ranks			Σ	The final rank
	y_i	u_i	d_i^{max}	y_i	u_i	d_i^{max}		
A_1	0.45	0.0000000039	0.033	2	3	3	8	3
A_2	0.41	0.0000000023	0.036	5	5	4	14	5
A_3	0.47	0.0000000060	0.036	1	1	4	6	1
A_4	0.43	0.0000000027	0.032	4	4	2	10	4
A_5	0.44	0.0000000039	0.019	3	2	1	6	1

Source: Author′s calculation

Table 12. The ratings of candidates obtained from the third HRM

				Ranks			Σ	The final rank
	y_i	u_i	d_i^{max}	y_i	u_i	d_i^{max}		
A_1	0.45	0.0000000038	0.034	2	3	4	9	3
A_2	0.42	0.0000000023	0.033	5	5	2	12	4
A_3	0.47	0.0000000059	0.033	1	1	2	4	1
A_4	0.43	0.0000000026	0.036	4	4	5	13	5
A_5	0.44	0.0000000038	0.020	3	2	1	6	2

Source: Author′s calculation

Table 13. The ratings of candidates obtained from the fourth HRM

				Ranks			Σ	The final rank
	y_i	u_i	d_i^{max}	y_i	u_i	d_i^{max}		
A_1	0.46	0.0000000046	0.037	1	3	4	8	3
A_2	0.39	0.0000000015	0.037	5	5	4	14	4
A_3	0.46	0.0000000046	0.032	2	2	2	6	1
A_4	0.44	0.0000000034	0.032	4	4	2	10	5
A_5	0.46	0.0000000049	0.021	3	1	1	5	2

Source: Author′s calculation

The final ranking orders of candidates obtained from four HRMs are presented in Table 14.

Table 14. The final ranking orders of candidates obtained from all HRM

	HRMs $_1$	HRMs $_2$	HRMs $_3$	HRMs $_4$
A_1	5	3	3	3
A_2	3	5	4	4
A_3	2	1	1	1
A_4	1	4	5	5
A_5	3	1	2	2

Source: Author′s calculation

As can be seen from Table 14, the candidate denotes as alternative A_3 is the most appropriate according to the attitudes of the three HRMs and he can be chosen as the most suitable. In other cases, when there is a significant difference in the attitudes of the HRMs involved in the evaluation, the calculation procedure can be sent back to one of the earlier stages, as determination of the importance of the criteria or re-evaluating the candidate in relation to the criteria, until a consensus is reached between the HRMs involved in the evaluation**.**

5. Conclusion

Effective personnel selection plays a crucial role in ensuring the smooth functioning of businesses. Therefore, this article observed the application of the Multi-Objective Optimization by Ratio Analysis plus Full Multiplicative Form (MULTIMOORA) and Simplified PIvot Pairwise RElative Criteria Importance Assessment (PIPRECIA-S) methods for evaluating personnel in the conditions of group decision-making. In this approach the PIPRECIA-S is used for determining the criteria weights while the MULTIMOORA method is used for ranking alternatives. The main objective of this article is to propose an easy-to-use framework for evaluating candidates in the recruitment process that supports group decision-making and negotiation during evaluation.

It is known that the MULTIMOORA method does not use one integral parameter for determining the overall importance of an alternative, on the basis of which the final ranking of the alternative is determined. In contrast, the MULTIMOORA method uses three alternative ranking approaches, based on which three ranking lists are formed, and the final ranking order of alternatives is determined by applying the theory of dominance. This approach can be useful for decision-makers when evaluating candidates because based on the three ranking lists, they can observe whether a candidate is a dominant candidate or not.

Therefore, in this case, the evaluation procedure was chosen, in which the calculation of the significance of the criteria and the evaluation of the alternative is done separately for each decision-maker, and the final choice of the most suitable candidate is made by applying the theory of dominance, or in case of major discrepancies, the calculation procedure is repeated with new values until reaching of the final consensus.

One limitation of the proposed approach is that it does not support different importance levels (weights) for HRMs involved in the evaluation. Unfortunately, this is a direct consequence of the intention to use the proposed approach

in negotiation processes, in order to select the most suitable candidate, that is, the selection of the most suitable alternative in similar decision-making cases. As previously stated, the model is based on the integrated use of two easy-to-use MCDM methods and can be easily incorporated into some spreadsheet programs. The applied methods are also easy to understand, which is why the HRMs can easily correct their preferences regarding the criteria weights or ratings of the candidates concerning the criteria, during negotiations. In addition, the three approaches used in the MULTIMOORA method, as well as the procedure of selecting the most suitable alternative using the dominance theory, allow the HRMs to determine whether theirs favored candidates are ranked first based on all three approaches, and in case of need, i.e., differences of opinion with other HRMs, correct their preferences.

Finally, as directions for future research, the intention for developing appropriate software adapted for using in a group decision-making environment, based on the proposed framework, which would enable easier negotiation during the candidate evaluation, as well as in the case of solving similar decision-making problems. The mentioned software should enable all HRMs involved in evaluation to see the ranking orders of alternatives of all HRMs and enable each HRM to correct their preferences regarding the criteria weights or ratings, when necessary.

Acknowledgement

The research presented in this article was partly financially supported by of the Ministry of Science, Technological Development and Innovation of the Republic of Serbia, within the funding of the scientific research work at the University of Belgrade, Technical Faculty in Bor, according to the contract with registration number 451-03-47/2023-01/200131.

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