

Milica Popović<sup>1</sup>

Gabrijela Popović<sup>2</sup>

Darjan Karabašević<sup>3</sup>

University Business Academy in Novi Sad

Faculty of Applied Management, Economics and Finance

ORIGINAL SCIENTIFIC ARTICLE

DOI: 10.5937/ekonomika2104001P

Received: September, 27. 2021.

Accepted: October, 14. 2021.

## DETERMINATION OF THE IMPORTANCE OF EVALUATION CRITERIA DURING THE PROCESS OF RECRUITMENT AND SELECTION OF PERSONNEL BASED ON THE APPLICATION OF THE SWARA METHOD

### Abstract

*Personnel selection for an organization is an extremely important process. Modern organizations strive to improve the process of recruitment and selection of personnel as much as possible, in order to provide the organization with quality personnel and thus long-term competitiveness. In addition, the evaluation criteria on which the recruitment and selection process is based is also important, as it has a large impact on the final selection of candidates. Therefore, the aim of this paper is to propose the application of multi-criteria decision-making methods for the process of determining the weighting coefficients of evaluation criteria. Accordingly, the SWARA (Step-Wise Weight Assessment Ratio Analysis) method for determining weights was applied in the paper. The SWARA method proved to be extremely reliable when it comes to defining the weights of evaluation criteria, primarily due to its simplicity and the fact that respondents and domain experts could easily express their views on the issue.*

**Keywords:** SWARA, MCDM, group decision-making, personnel selection, weights determination

**JEL classification:** C44, M12

## ОДРЕЂИВАЊЕ ЗНАЧАЈА ЕВАЛУАЦИОНИХ КРИТЕРИЈУМА ПРИЛИКОМ ПРОЦЕСА РЕГРУТАЦИЈЕ И СЕЛЕКЦИЈЕ КАДРОВА ЗАСНОВАН НА ПРИМЕНИ СЋАРА МЕТОДЕ

### Апстракт

*Избор кадрова за једну организацију представља изузетно важан процес. Савремене организације теже да процес регрутације и селекције кадрова што више унапреде, како би обезбедили организацији квалитетне кадрове и тиме дугорочну конкурентност. Поред тога, евалуациони критеријуми на којима се*

<sup>1</sup> milica.popovic.edu@gmail.com, ORCID ID 0000-0002-5783-671X

<sup>2</sup> darjan.karabasevic@mef.edu.rs, ORCID ID 0000-0001-5308-2503

<sup>3</sup> gabrijela.popovic@mef.edu.rs, ORCID ID 0000-0002-2652-4860

*заснива процес регрутације и селекције је такође значајан, јер у великој мери има утицаја на финални избор кандидата. Стога, циљ рада је да предложи примену метода вишекритеријумског одлучивања за процес одређивања тежинских коефицијената евалуационих критеријума. Сходно томе, у раду је примењена SWARA (Step-Wise Weight Assessment Ratio Analysis) метода за одређивање тежина. SWARA метода се показала изузетно поузданом када је у питању дефинисање тежина евалуационих критеријума, пре свега због своје једностасности и чињенице да су испитаници и доменски експери лако могли да изразе своје ставове по том питању.*

**Кључне речи:** SWARA, MCDM, групно одлучивање, избор кадрова, одређивање тежина

## Introduction

Employees are a valuable resource on which the success of a company depends and without which the company cannot be highly competitive (Ulutaş et al., 2020; Karabasevic et al., 2016). The selection of adequate personnel today is a great challenge primarily due to extremely variable and demanding business conditions (Ђорђевић, 2021; Wedajo & Chekole, 2020). Human resource management and personnel selection is an important part of business activity on which the success of the realization of tasks and set goals of an organization depends. Many factors affect the process of choosing the right person for a particular business position, such as, for example, changes in business behavior, job changes, social changes, changes in the law, improvement of information technology, and so forth (Robertson & Smith, 2001; Liao, 2003). The importance of quality personnel gained special importance during the current Covid-19 pandemic (Stošić-Mihajlović & Trajković, 2021). Therefore, it is very important to invest in intellectual capital in order to obtain quality personnel (Petković et al., 2021)

The selection of personnel directly affects the quality of the human resources base available to a particular organization, and therefore the selection of personnel is an important task for organizations, whether public or private. Different approaches have been developed to help and make it easier for organizations to choose the best candidate, more specifically to select the right people to do certain jobs (Karabasevic et al., 2018; 2015). Traditional methods for selecting candidates are mainly based on statistical analyses of test results that are considered to reflect reality. Modern approaches start from the thesis that selection is a complex process that characterizes uncertainty and subjectivity. As one of the ways to minimize or even avoid uncertainty and subjectivity, the authors suggest the application of multi-criteria decision-making methods (Afshari et al., 2010).

The application of multi-criteria decision-making (MCDM) in the process of evaluation and selection of personnel for a certain positions in an organization implies respect for all the criteria on which the selection is based (Jauković Jocić, 2020a, 2020b). MCDM methods enable the successful overcoming of the problem that arises in the case of the existence of conflicting criteria, because everyone is involved in the evaluation process and everyone influences the final decision and choice (Bakir &

Atalik, 2021; Stanujkic et al, 2018). In that way, the subjectivity of the obtained results is minimized and the reliability and relevance of the obtained results and decisions made is increased. Accordingly, the MCDM technique may be extremely suitable for determining the significance of evaluation criteria. It is important to note that the MCDM area has experienced intensive growth over time, accordingly, many methods have been proposed, some of which are used for the determination of weights, whereas some are used for ranking of the alternatives, such as (Zavadskas & Turskis, 2011):

- the SAW method,
- the AHP method,
- the TOPSIS method,
- the PROMETHEE method,
- the ELECTRE method,
- the VIKOR method, and so on.

In addition, newer generation of the MCDM methods have been proposed, such as (Ulutaş et al., 2021; Stanujkic et al., 2021):

- the SWARA method,
- the ARAS method,
- the WASPAS method,
- the MULTIMOORA method,
- the EDAS method,
- the CODAS method,
- the PIPRECIA method,
- the WISP method, and so forth.

Accordingly, the paper proposes the application of the SWARA method for determining the importance of evaluation criteria in the process of recruitment and selection of personnel (Keršulienė et al., 2010). Therefore, the remainder of the paper is as follows: In Section 1, the Introduction is presented, whereas, in Section 2, the SWARA method is presented. Determining the significance of the evaluation criteria is demonstrated in Section 3, finally, Conclusions are given at the end of the paper.

## The SWARA method

The SWARA method was developed by (Keršulienė et al., 2010). Over time, the method has been applied to solve a wide variety of problems, such as: evaluation of green suppliers (Akcan & Taş, 2019), risk management in supply chains (Ansari et al., 2020), project risk assessment (Valipur et al., 2017), selection of employees (Karabasevic et al., 2015; 2018), packaging design (Stanujkic et al., 2015) and so on.

The computational procedure of the SWARA method can be illustrated by applying the following steps (Stanujkic et al., 2015; Keršulienė et al., 2010)

Step 1. Defining the criteria on which the evaluation will be based and sorting of criteria in descending order. Sorting is done depending on the importance that the decision maker assigns to a certain criterion

Step 2. Expressing the relative importance of the criteria  $j$  in relation to the previous criterion ( $j-1$ ). The relative importance is expressed for each criterion separately, and it

starts with second criterion.

Stepn 3. Determining  $k_j$  by using following Eq.:

$$k_j = \begin{cases} 1 & j = 1 \\ s_j + 1 & j > 1 \end{cases} \quad (1)$$

whre  $s_j$  represents the ratio of comparative importance of the average value.

Step 4. Determination of recalculated weight  $q_j$  is performed as follows:

$$q_j = \begin{cases} 1 & j = 1 \\ \frac{q_{j-1}}{k_j} & j > 1 \end{cases} \quad (2)$$

Step 5. Determination of the relative weights of criteria by using the following Eq.:

$$w_j = \frac{q_j}{\sum_{k=1}^n q_k}, \quad (3)$$

where  $w_j$  represents the relative weight of the criteria  $j$ .

The ease of application of the SWARA method has contributed to its popularity and application for problem solving and determining the importance of evaluation criteria in various areas of life and business.

### **Determining the significance of evaluation criteria based on the application of the SWARA method**

In this part of the paper, the segment related to weight determination is presented, i.e. the significance of the evaluation criteria based on the application of the SWARA method. Interactive questionnaires are designed to graphically and numerically present the importance of the criteria after entering the attitudes of the respondents, with the possibility for the respondents to finally correct their views, if necessary. A total of 50 questionnaires were distributed by e-mail. Feedback was received from 42 respondents, however, 31 questionnaires were completed correctly.

The weights of the following evaluation criteria will be considered:

- $C_1$  – Relevant previous work experience,
- $C_2$  - Education,
- $C_3$  – Interview readiness,
- $C_4$  – Interpersonal skills,
- $C_5$  – Communication and presentation skills, and
- $C_6$  – Computer skills.

In the continuation of the paper, the obtained weights of evaluation criteria of all respondents for the stated criteria are presented. The relative meanings of the criteria obtained from the first respondent are shown in Table 1. Table 1 also shows the procedure for calculating weights using the SWARA method, as well as the calculated weights of the criteria.

*Table 1: Weights of the criteria obtained from the first respondent*

Criteria		$s_j$	$k_j$	$q_j$	$w_j$
$C_1$	Relevant previous work experience		1	1	0.21
$C_2$	Education	0.10	1.10	0.91	0.19
$C_3$	Interview readiness	0.20	1.20	0.76	0.16
$C_4$	Interpersonal skills	0.00	1.00	0.76	0.16
$C_5$	Communication and presentation skills	0.10	1.10	0.69	0.14
$C_6$	Computer skills	0.00	1.00	0.69	0.14

Values of variables shown in columns  $k_j$ ,  $q_j$  и  $w_j$  were calculated by using Eqs. (1), (2) and (3).

The relative meanings of the criteria obtained from the first five respondents are shown in Table 2, while the weights of the criteria obtained based on their responses are shown in Table 3.

*Table 2. Relative significance of the criteria obtained from the first 5 respondents*

Criteria	$I_1$	$I_2$	$I_3$	$I_4$	$I_5$
$C_1$	1	1	1	1	1
$C_2$	0.10	0.00	0.15	0.10	0.20
$C_3$	0.20	0.10	0.10	0.20	0.15
$C_4$	0.00	0.20	0.25	0.30	0.36
$C_5$	0.10	0.25	0.10	0.05	0.05
$C_6$	0.00	0.20	0.03	0.15	0.01

*Table 3. Weights of the criteria obtained from the first 5 respondents*

Criteria	$I_1$	$I_2$	$I_3$	$I_4$	$I_5$
$C_1$	0.21	0.21	0.23	0.23	0.24
$C_2$	0.19	0.21	0.20	0.21	0.20
$C_3$	0.16	0.19	0.18	0.18	0.18
$C_4$	0.16	0.16	0.14	0.14	0.13
$C_5$	0.14	0.13	0.13	0.13	0.12
$C_6$	0.14	0.11	0.13	0.11	0.12

The relative meanings of the criteria obtained from 31 respondents are shown in Tables 4a, 4b and 4c, due to the length of the table.

Table 4a. Relative significance of the criteria obtained by the first 10 of 31 respondents

Criteria	$I_1$	$I_2$	$I_3$	$I_4$	$I_5$	$I_6$	$I_7$	$I_8$	$I_9$	$I_{10}$
$C_1$	1	1	1	1	1	1	1	1	1	1
$C_2$	0.10	0.00	0.15	0.10	0.20	0.25	0.10	0.15	0.14	0.20
$C_3$	0.20	0.10	0.10	0.20	0.15	0.05	0.10	0.05	0.25	0.30
$C_4$	0.00	0.20	0.25	0.30	0.36	0.20	0.30	0.10	0.24	0.15
$C_5$	0.10	0.25	0.10	0.05	0.05	0.05	0.10	0.10	0.15	0.20
$C_6$	0.00	0.20	0.03	0.15	0.01	0.15	0.00	0.04	0.04	0.04

Table 4b. The relative significance of the criteria obtained by the following 10 respondents

Criteria	$I_{11}$	$I_{12}$	$I_{13}$	$I_{14}$	$I_{15}$	$I_{16}$	$I_{17}$	$I_{18}$	$I_{19}$	$I_{20}$
$C_1$	1	1	1	1	1	1	1	1	1	1
$C_2$	0.10	0.00	0.00	0.05	0.10	0.05	0.03	0.25	0.10	0.00
$C_3$	0.20	0.10	0.10	0.20	0.15	0.10	0.08	0.00	0.20	0.30
$C_4$	0.10	0.10	0.15	0.15	0.20	0.30	0.30	0.25	0.20	0.10
$C_5$	0.10	0.20	0.20	0.25	0.10	0.15	0.15	0.15	0.20	0.20
$C_6$	0.11	0.02	0.10	0.20	0.20	0.00	0.06	0.15	0.15	0.10

Table 4c. Relative significance of the criteria obtained by the remaining respondents

Criteria	$I_{21}$	$I_{22}$	$I_{23}$	$I_{24}$	$I_{25}$	$I_{26}$	$I_{27}$	$I_{28}$	$I_{29}$	$I_{30}$	$I_{31}$
$C_1$	0.10	0.00	0.00	0.10	0.05	0.25	0.00	0.00	0.10	0.00	0.10
$C_2$	0.09	0.20	0.25	0.15	0.30	0.03	0.02	0.20	0.30	0.25	0.20
$C_3$	0.30	0.25	0.25	0.15	0.30	0.30	0.10	0.20	0.15	0.30	0.30
$C_4$	0.15	0.05	0.05	0.25	0.15	0.10	0.10	0.15	0.20	0.00	0.25
$C_5$	0.15	0.00	0.15	0.15	0.00	0.07	0.15	0.10	0.00	0.00	0.00
$C_6$	0.10	0.00	0.00	0.10	0.05	0.25	0.00	0.00	0.10	0.00	0.10

The mean value of the relative significance of the criteria from Tables 4a, 4b and 4c, based on which the criteria weights were calculated, are shown in Table 5. Table 5 also shows the minimum and maximum values for each criterion, as well as the standard

deviation. The coefficient Cronbach alpha for the relative meanings of the criteria collected from the thirty-one respondents is as high as 0.999, which indicates a very high agreement in the attitudes of the respondents.

*Table 5: The average relative importance of the criteria based on the attitudes of all respondents*

Criteria	$s_j$	$min$	$max$	$stdev$
$C_1$	0.09	0.00	0.25	0.08
$C_2$	0.16	0.00	0.30	0.09
$C_3$	0.21	0.00	0.36	0.09
$C_4$	0.14	0.00	0.25	0.07
$C_5$	0.08	0.00	0.20	0.07
$C_6$	0.09	0.00	0.25	0.08

Table 6 summarizes the weights calculation procedure by using the SWARA method. The calculated criteria weights are also shown in Table 3.

*Table 6: Weights of criteria obtained based on the attitudes of all respondents*

	Criteria	$s_j$	$k_j$	$q_j$	$w_j$
$C_1$	Relevant previous work experience		1	1	0.22
$C_2$	Education	0.09	1.09	0.92	0.21
$C_3$	Interview readiness	0.16	1.16	0.79	0.18
$C_4$	Interpersonal skills	0.21	1.21	0.65	0.15
$C_5$	Communication and presentation skills	0.14	1.14	0.57	0.13
$C_6$	Computer skills	0.08	1.08	0.53	0.12

From Table 6 it can be noted that the criterion designated as  $C_1$  – Relevant previous work experience, based on the attitudes of the thirty-one respondents is the most significant and that its significance amounts to 22% of the overall importance of all criteria. According to the respondents, criterion  $C_6$  – Computer skills has the least importance for the selection of candidates, and its weight amounts to 0.13.

## Conclusion

Hiring competent people is crucial for an organization. Multi-criteria decision-making methods have been developed to support decision-makers during a single decision-making process. The process of recruitment and selection of personnel can also be seen as a problem that can be solved by applying the methods of multi-criteria decision-making.

Consequently, in this paper, the SWARA method was successfully applied to determine the importance of evaluation criteria in the process of recruitment and selection of personnel. The obtained group weights of the six evaluation criteria are based on the views of 31 respondents/domain experts. The reason for applying the SWARA method is its simplicity and convenience of application for examining the attitudes of decision-makers even if they are not well acquainted with multi-criteria decision-making. Therefore, the weights of the evaluation criteria are successfully determined. However, it should be noted that one of the limitations is the application of the crisp numbers in this process. So, it was not possible to include the vagueness of the environment. As a direction for future research, some extensions of the SWARA method could be used to get even more reliable results.

## References

- Afshari, A., Mojahed, M., & Yusuff, R. M. (2010). Simple additive weighting approach to personnel selection problem. *International Journal of Innovation, Management and Technology*, 1(5), 511.
- Akcan, S., & Taş, M. A. (2019). Green supplier evaluation with SWARA-TOPSIS integrated method to reduce ecological risk factors. *Environmental monitoring and assessment*, 191(12), 1-22.
- Ansari, Z. N., Kant, R., & Shankar, R. (2020). Evaluation and ranking of solutions to mitigate sustainable remanufacturing supply chain risks: a hybrid fuzzy SWARA-fuzzy COPRAS framework approach. *International Journal of Sustainable Engineering*, 13(6), 473-494.
- Bakır, M., & Atalık, Ö. (2021). Application of fuzzy AHP and fuzzy MARCOS approach for the evaluation of e-service quality in the airline industry. *Decision Making: Applications in Management and Engineering*, 4(1), 127-152.
- Đorđević, B. (2021). A process for assessing organization. *Journal of Process Management. New Technologies*, 9(1), 30-44.
- Jauković-Jocić, K., Karabašević, D., & Jocić, G. (2020a). The use of the PIPRECIA method for assessing the quality of e-learning materials. *Ekonomika*, 66(3), 37-45.
- Jauković-Jocić, K., Karabašević, D., & Popović, G. (2020b). An approach for e-learning courses evaluation based on the EDAS method. *Ekonomika*, 66(4), 47-59.
- Karabasevic, D., Stanujkic, D., Urosevic, S., & Maksimovic, M. (2015). Selection of candidates in the mining industry based on the application of the SWARA and the MULTIMOORA methods. *Acta Montanistica Slovaca*, 20(2), 116-124.
- Karabasevic, D., Zavadskas, E. K., Stanujkic, D., Popovic, G., & Brzakovic, M. (2018). An approach to personnel selection in the IT industry based on the EDAS method. *Transformations in Business & Economics*, 17(2), 54-65.
- Karabasevic, D., Zavadskas, E. K., Turskis, Z., & Stanujkic, D. (2016). The framework for the selection of personnel based on the SWARA and ARAS methods under uncertainties. *Informatica*, 27(1), 49-65.



- Keršulienė, V., Zavadskas, E. K., & Turskis, Z. (2010). Selection of rational dispute resolution method by applying new step-wise weight assessment ratio analysis (SWARA). *Journal of business economics and management*, 11(2), 243-258.
- Liao, S. H. (2003). Knowledge management technologies and applications – literature review from 1995 to 2002. *Expert Systems with Applications*, 25, 155–164.
- Petković, M., Krstić, B., & Rađenović, T. (2021). Intellectual capital investments as the driver of future company performance. *Ekonomika*, 67(2), 1-11.
- Robertson, I. T., & Smith, M. (2001). Personnel selection. *Journal of Occupational and Organizational Psychology*, 74, 441–472
- Stanujkić, D., & Karabašević, D. (2018). An extension of the WASPAS method for decision-making problems with intuitionistic fuzzy numbers: a case of website evaluation. *Operational Research in Engineering Sciences: Theory and Applications*, 1(1), 29-39.
- Stanujkić, D., Karabasevic, D., & Zavadskas, E. K. (2015). A framework for the selection of a packaging design based on the SWARA method. *Engineering Economics*, 26(2), 181-187.
- Stanujkić, D., Popović, G., Karabasevic, D., Meidute-Kavaliauskiene, I., & Ulutaš, A. (2021). An Integrated Simple Weighted Sum Product Method—WISP. *IEEE Transactions on Engineering Management*. doi: 10.1109/TEM.2021.3075783.
- Stošić-Mihajlović, L., & Trajković, S. (2021). Has the COVID 19 pandemic affected the world equally?. *Journal of Process Management. New Technologies*, 9(2), 54-63.
- Ulutaš, A., Popović, G., Stanujkić, D., Karabasevic, D., Zavadskas, E. K., & Turskis, Z. (2020). A new hybrid MCDM model for personnel selection based on a novel grey PIPRECIA and grey OCRA methods. *Mathematics*, 8(10), 1698.
- Ulutaš, A., Stanujkić, D., Karabasevic, D., Popović, G., Zavadskas, E. K., Smarandache, F., & Brauers, W. K. (2021). Developing of a Novel Integrated MCDM MULTIMOOSRAL Approach for Supplier Selection. *Informatica*, 32(1), 145-161.
- Valipour, A., Yahaya, N., Md Noor, N., Antuchevičienė, J., & Tamošaitienė, J. (2017). Hybrid SWARA-COPRAS method for risk assessment in deep foundation excavation project: An Iranian case study. *Journal of civil engineering and management*, 23(4), 524-532.
- Wedajo, M., & Chekole, B. (2020). Attitude of employees towards change Initiatives as influenced by commitment and job satisfaction: The case of selected higher education institutions in Ethiopia. *Journal of Process Management. New Technologies*, 8(3), 42-52.
- Zavadskas, E. K., & Turskis, Z. (2011). Multiple criteria decision making (MCDM) methods in economics: an overview. *Technological and economic development of economy*, 17(2), 397-427.

