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OBJECTIVE APPROACH TO POLICE OFFICERS SELECTION

Milan Kankaraš, PhD[1]
University of Defence, Belgrade, Serbia

Neven Cvetićanin, PhD
Institute of Social Sciences, Belgrade, Serbia

Ivan Petrović, PhD
University of Defence, Belgrade, Serbia

Abstract: Protection and enhancement of people and property security is the police aim. To achieve this aim police officers carry out numerous activities. Bearing in mind the previously mentioned, the goal accomplishment directly depends on an employee's quality. Thus, hiring the best candidates is one of the most important activities of human resource management in the police organization. In order to employ the best candidates, the police leadership strives to increase objectivity through the process of police officers' selection. In that process, based on job description, human resource specialists set the criteria of choice. Concerning different importance of the criteria, it is necessary to determine weight for each criterion and, based on the criteria and individual characteristics of candidates choose the candidate who best fulfils job requirements. The objective of this paper is to describe an objective approach to police officers selection through the application of Analytic Hierarchy Process (AHP) and Multi-Attributive Ideal-Real Comparative Analysis (MAIRCA). This approach is equally applicable within police organization as well as in other organizations.

Keywords: human resources, selection, AHP, MAIRCA, method.

INTRODUCTION

Police performs numerous activities to ensure equal protection, rights and freedoms for everyone. Bearing in mind that police officers carry out these activities, police efficiency depends on their quality. To increase the efficiency and accomplish police goals, it is necessary to hire employees with adequate knowledge,

1 kankaras.milan@outlook.com

abilities and skills. Human resources selection is one of the basic processes that enable the choosing of the best candidate. One of the human resources selection characteristics is a certain level of subjectivity.

Concerning that, the responsible management strives to increase the objectivity as much as possible. In order to reduce bias, police management can apply predefined criteria. The criteria depend on job description and there are fundamental and additional criteria. Fundamental criteria are mandatory, i.e. all candidates have to fulfill these requirements. In contrast, auxiliary criteria are desirable, so candidates should meet demands as much as possible and the candidate choice hinges on the fulfillment level of the criteria.

Taking into account that additional criteria influence the selection differently, there are two main problems in the process of police officers selection: additional criteria significance and candidates ranking. There are various methods to determine the weights of criteria and rank candidates (ELECTRE, PROMETHEE, MENOR, VIKOR, AHP and cetera), but each of them has a certain level of subjectivity. It is necessary to combine several different methods to increase objectivity in the selection process. The goal of this paper is to check the applicability of amalgamating the AHP and MAIRCA methods in case of police officers selection. The AHP method enables determining criteria weights, and MAIRCA enables candidates ranking by their characteristic deviation from the ideal characteristic.

In addition to introduction and conclusion, the paper includes three chapters. The challenges of human resources selection is described in the first part of the paper. Besides the selection process description, AHP-MAIRCA hybrid method is explained in the second chapter. Finally, the model is applied on the case of police officers selection and its applicability is checked.

The challenges of human resources selection

Human resource management includes several activities. One of them is a selection that enables to hire the best candidates. There are a number of definitions of selection, but there are no essential differences among them. Human resources selection can be defined as a choice among eligible candidates by pre-set methods and hiring the best candidate or candidates (Dessler, 2014; Kulic, 2005; Lojić, 2011; Gusdorf, 2008; Mathis, et al., 2008). In effect, in the selection process, organizations compare job requirements and candidates' competences and hire a candidate who meets the demands most (Figure 1).

Based on job description, human resource specialists prepare job requirements (professional knowledge, experience and specific skills) which a management accepts or requests certain corrections. Practically, those requirements represent selection criteria. Essentially, there are two types of criteria: fundamental and additional (Kankaraš, et al., 2018). Fundamental criteria are compulsory and candidates have to meet all demands. However, those enable only the candidates' elimination. Objective ranking of eligible candidates based on the fundamental criteria is impossible. In contrast, additional criteria are desirable, so candidates

should meet demands as much as possible. Thus, candidates are different in the level of fulfillment of the additional criteria.

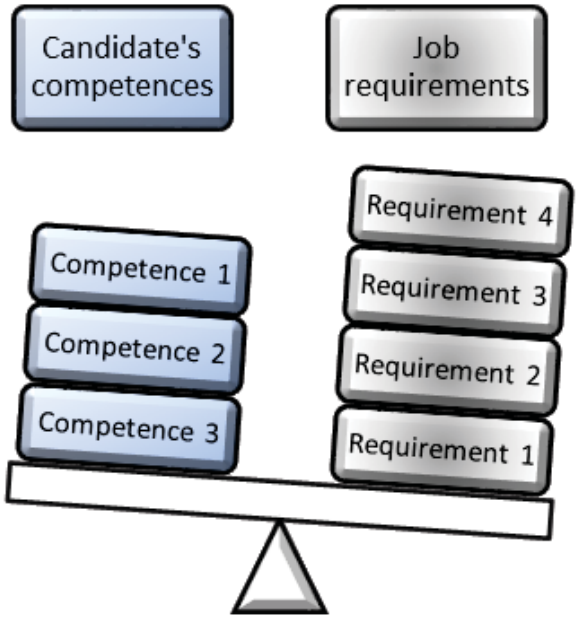


Figure 1: *Comparison between job requirements and candidate's competences*

Bearing in mind that an organization determines its fundamental criteria based on job description, there is no problem in defining them. Conversely, auxiliary demands are not directly related to job description but candidates with additional competencies would better do the job. Setting the additional criteria is one of challenges, which the management and human resource specialists should solve. Whereas additional criteria are desirable, their influence on the candidates' ranking is different. Due to these differences, organizations should determine the weights of criteria. Finally, based on the determined criteria, their weights and candidates' reference human resource specialists rank candidates and management can choose the best candidate.

In accordance whit the selection process analysis, there are three main issues: additional criteria determination, criteria weights setting, candidates ranking and the choice of the best candidate. Human resources selection is a serious process and its result has an effect on organizational success (poor employees, poor business). In order to increase the accomplishment, organizations should pay special attention to human resources selection process. To increase objectivity and quality of the selection process outcomes, organizations can use a wide range of scientific methods.

AHP-MAIRCA model

There are numerous methods to choose the best candidates, both in the theory and practice. The most applicable methods are AHP, ELECTRE, PROMETHEE, TOPSIS, MAIRCA, etc. Based on the approach, the methods are applied in two ways: individual or hybrid usage. Bearing in mind that each method has advantages and disadvantages, a hybrid approach is more suitable. It reduces the shortcomings of individual methods and its elements complement each other.

A choice of the hybrid model depends on the deficiencies that need to be vanquished. In the case of human resources selection process, it is necessary to determine the weights of additional criteria and to rank candidates by their competences. One of the suitable hybrid models is the AHP-MAIRCA model. This model enables weight setting using the AHP method, and candidates ranking according to the MAIRCA method (Figure 2).

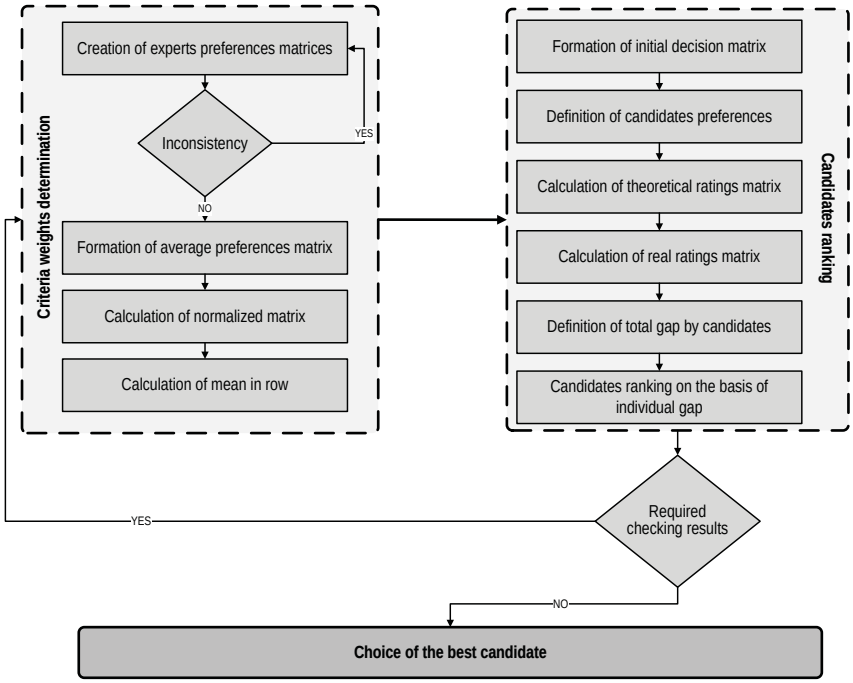


Figure 2: *AHP-MAIRCA model*

As shown in Figure 2, the model consists of two phases: criteria weights determination and candidates ranking. Bearing in mind that the list of candidates who fulfill both the fundamental and additional criteria are set, the first stage begins by determining expert preferences. Using Saaty rating scale, the experts compare the additional criteria, and, after consistency checking and based on individual experts matrices, average preferences matrix (X_p) is formed (equation 1).

$$X_p = \frac{1}{n}\sum_{i=1}^{n} x_{ij} \quad (1)$$

Where,

x_{ij} *– element of average preferences matrix;*

n – number of experts.

The next step includes a division of each column element whit the sum of column elements (Nikolić, et al., 1996). In this manner, normalized matrix (X_n) is calculated (equation 2).

$$X_n = \frac{x_{ij}}{\sum_1^n x_{ij}} \quad (2)$$

Criteria weights (w_i) are determined by a mean value of each normalized matrix row (equation 3).

$$w_i = \frac{1}{m}\sum_{i=1}^{m} x_{ni} \quad (3)$$

Where,

x_{ni} *– element of normalized matrix row;*

n – number of elements in the row.

The determination of criteria weights is one part of the model and it is performed by Analytic Hierarchy Process, as well as by software Expert Choice. Further, the first phase result is input to the second stage – candidates rating. A suitable method to rank candidates is Multi-Attributive Ideal-Real Comparative Analysis which is based on the comparison of theoretical and empirical solution (S) ratings by each criterion (C). The method determines a gap between ideal and observed ratings and, at the end of the process, ranks solutions by gap values (solution with the lowest gap value is the best ranked). In accordance with that, the second phase consists of six steps.

Based on MAIRCA procedure, the first step includes formulation of the initial decision-making matrix – *I* (Pamucar, et al., 2018; Tešić, et al., 2018). That matrix determines the candidates' characteristics – solutions values (S_i) by criteria – C_i (equation 4).

$$I = \begin{matrix} \\ S_1 \\ \vdots \\ S_m \end{matrix} \begin{matrix} \begin{matrix} C_1 & \cdots & C_n \end{matrix} \\ \begin{bmatrix} i_{11} & \cdots & i_{1n} \\ \vdots & \ddots & \vdots \\ i_{m1} & \cdots & i_{mn} \end{bmatrix} \end{matrix} \quad (4)$$

Depending on characteristics, solutions values can be quantitative and qualitative. To use descriptive (qualitative) values in the process directly is impossible. In that sense, it is necessary to transform these values applying an appropriate method (Nikolić, et al., 1996). The next step is preferences definition for the choice of solutions (P). Bearing in mind that employers should be neutral, in human resources selection process there are no the preferences of candidates. Thus, the preference of each candidate is the same, and depending on a number of candidates (equation 5).

$$P_{S_i} = \frac{1}{m};\ \sum_{i=1}^{m} P_{S_i} = 1, i = 1,2,\ldots,m \quad (5)$$

As shown, the solution preference is a ratio of one and total number of solutions – m. The next step includes the calculation of the theoretical (ideal) ratings matrix (T_p) as a product of solution preference and criterion weight – equation 6 (Pamucar, et al., 2018).

$$T_p = \begin{matrix} \\ P_{S_1} \\ \vdots \\ P_{S_m} \end{matrix} \begin{matrix} \begin{matrix} w_1 & \cdots & w_n \end{matrix} \\ \begin{bmatrix} t_{p_{11}} & \cdots & t_{p_{1n}} \\ \vdots & \ddots & \vdots \\ t_{p_{m1}} & \cdots & t_{p_{mn}} \end{bmatrix} \end{matrix} = \begin{matrix} \\ P_{S_1} \\ \vdots \\ P_{S_m} \end{matrix} \begin{matrix} \begin{matrix} w_1 & \cdots & w_n \end{matrix} \\ \begin{bmatrix} P_{S_1} * w_1 & \cdots & P_{S_1} * w_n \\ \vdots & \ddots & \vdots \\ P_{S_m} * w_1 & \cdots & P_{S_m} * w_n \end{bmatrix} \end{matrix} \quad (6)$$

Criteria weights are determined in the first stage. The fourth step enables the calculation of real ratings matrix (T_r). Based on MAIRCA procedure, the elements of real ratings matrix (t_r) represent a product of the theoretical ratings matrix elements (T_p) and the initial decision-making matrix elements (X) using the following formulas (Pamucar, et al., 2018):

higher is better (benefit type criteria):

$$t_{r_{ij}} = t_{p_{ij}} * \left(\frac{x_{ij} - x_j^-}{x_j^+ - x_j^-} \right) \quad (7)$$

lower is better (cost type criteria):

$$t_{r_{ij}} = t_{p_{ij}} * \left(\frac{x_{ij} - x_j^+}{x_j^- - x_j^+} \right) \quad (8)$$

Where:
x_j^+ – the maximum value of observed criterion by solutions;
x_j^- – the minimum value of observed criterion by solutions.

Based on a criteria type and its calculated elements, the real ratings matrix (T_r) is formed (equation 9).

$$T_r = \begin{matrix} \\ S_1 \\ \vdots \\ S_m \end{matrix} \begin{matrix} \begin{matrix} C_1 & \dots & C_n \end{matrix} \\ \begin{bmatrix} t_{r11} & \cdots & t_{r1n} \\ \vdots & \ddots & \vdots \\ t_{rm1} & \cdots & t_{rmn} \end{bmatrix} \end{matrix} \qquad 9$$

The next, fifth step, includes formatting a total gap matrix (G). The matrix elements (g_{ij}) are obtained as a difference between the theoretical and real rating matrix elements (Pamucar, et al., 2018). This difference represents the gap between ideal (theoretical) values and the observed (real) ratings (equation 10).

$$G = \begin{bmatrix} g_{11} & \cdots & g_{1n} \\ \vdots & \ddots & \vdots \\ g_{m1} & \cdots & g_{mn} \end{bmatrix} = \begin{bmatrix} t_{p_{11}} - t_{r_{11}} & \cdots & t_{p_{1n}} - t_{r_{1n}} \\ \vdots & \ddots & \vdots \\ t_{p_{m1}} - t_{r_{m1}} & \cdots & t_{p_{mn}} - t_{r_{mn}} \end{bmatrix} \qquad 10$$

Based on the gap value, the best option is the smallest gap, i.e. the element of gap matrix should be zero or gravitate towards zero. A higher gap represents a worse solution (farther than ideal value). In accordance with that, the final step is solutions rating based on the declination of real solutions value from the ideal. The final values (Q_i) are obtained by summing gaps by solutions – equation 11 (Pamucar, et al., 2018).

$$Q_i = \sum_{i=1}^{m} g_{ij} \qquad 11$$

In this manner, the candidates can be ranked by their individual characteristics and objectivity is increased. Further, the described AHP-MAIRCA model is applied to solve the practical problem of police officer selection.

Police officer selection

This paper discusses the problem of ranking five candidates for the service as a police officer (S_i). Due to the limited scope, only four criteria are considered in the paper (C_i):

- C_1 – education (school grades);
- C_2 – physical ability (the test of physical fitness);
- C_3 – intellectual ability (the psychological test);
- C_4 – work experience (the years of experience).

In order to determine the weights of criteria, five experts have compared criteria by Saaty rating scale, and average preferences matrix have been formed by equation 1. Also, to perform the next step (the calculation of normalized matrix) the sum of column has been calculated (table 1).

Table 1: *Average preferences matrix*

Criterion	C_1	C_2	C_3	C_4
C_1	1.000	0.333	0.333	0.333
C_2	3.000	1.000	0.333	2.000
C_3	3.000	3.000	1.000	4.000
C_4	3.000	0.500	0.250	1.000
Σ	10.000	4.833	1.917	7.333

Bearing in mind that consistency ratio is 0.09, the pairwise comparison results are acceptable. Based on the experts' opinion and equation 2, the normalized matrix has been calculated (table 2).

Table 2: Normalized matrix

Criterion	C_1	C_2	C_3	C_4
C_1	0.100	0.069	0.174	0.045
C_2	0.300	0.207	0.174	0.273
C_3	0.300	0.621	0.522	0.545
C_4	0.300	0.103	0.130	0.136

Finally, the criteria weights have been determined by equation 3:

- w_1 (the weight of education) 0.097
- w_2 (the weight of physical ability) 0.238
- w_3 (the weight of intellectual ability) 0.497
- w_4 (the weight of work experience) 0.168

The determination criteria weights are the end of the first phase. The second stage starts by forming the initial decision-making matrix. That matrix has been formed based on the individual characteristics of candidates and by equation 4 (Table 3).

Table 3: *The initial decision-making matrix*

Candidate	C_1	C_2	C_3	C_4
S_1	4.20	70.00	110.00	2.00
S_2	3.60	65.00	125.00	3.00
S_3	3.70	70.00	120.00	1.00
S_4	2.50	75.00	114.00	4.00
S_5	4.00	90.00	110.00	3.00

Bearing in mind that there are no preferences of candidates, and using equation 5, the preference of each candidate is 0.2. Based on the criteria weights, the preference for the choice and using equation 6, the theoretical rating matrix is formed (table 4).

Table 4: *The theoretical rating matrix*

Candidate	C_1	C_2	C_3	C_4
S_1	0.019	0.048	0.099	0.034
S_2	0.019	0.048	0.099	0.034
S_3	0.019	0.048	0.099	0.034
S_4	0.019	0.048	0.099	0.034
S_5	0.019	0.048	0.099	0.034

In the case of police officer selection, the best candidate is the one who fulfils criteria to the greatest extent possible. Taking into account that the type of each criterion is benefit, equation 6 is applied to calculate the elements of the real rating matrix (table 5).

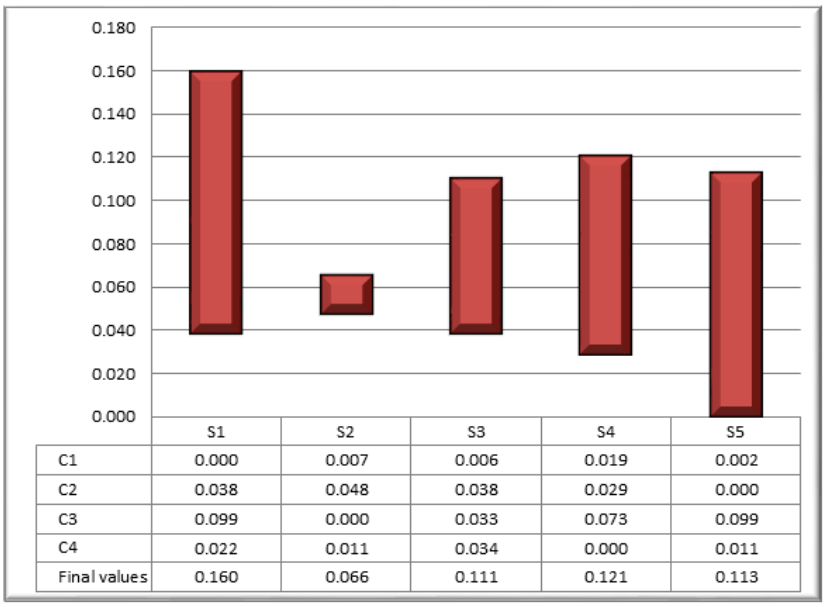
Table 5: *The real rating matrix*

Candidate	C_1	C_2	C_3	C_4
S_1	0.019	0.010	0.000	0.011
S_2	0.013	0.000	0.099	0.022
S_3	0.014	0.010	0.066	0.000
S_4	0.000	0.019	0.027	0.034
S_5	0.017	0.048	0.000	0.022

Finally, in accordance with the above and using equations 9 and 10, the total gap matrix is formed, the final values of each candidate, as well as candidates' rank (table 6).

Table 6: *The total gap matrix, the final values and candidates rank*

Candidate	C1	C2	C3	C4	Qi	Rank
S1	0.000	0.038	0.099	0.022	0.160	4
S2	0.007	0.048	0.000	0.011	0.066	1
S3	0.006	0.038	0.033	0.034	0.111	2
S4	0.019	0.029	0.073	0.000	0.121	4
S5	0.002	0.000	0.099	0.011	0.113	3



	S1	S2	S3	S4	S5
C1	0.000	0.007	0.006	0.019	0.002
C2	0.038	0.048	0.038	0.029	0.000
C3	0.099	0.000	0.033	0.073	0.099
C4	0.022	0.011	0.034	0.000	0.011
Final values	0.160	0.066	0.111	0.121	0.113

Figure 3: *Graphic presentation of the final values*

As shown in table 6, the smallest gap between ideal and observed ratings is 0.06, i.e. the characteristics of the second candidate (S2) are most in line with job requirements. Thus, the second candidate is the best choice for the organization in concrete circumstances. The final values can also be displayed graphically (Figure 3).

CONCLUSION

In the case of increasing objectivity in the police officer selection process, the specifics of police organization were taken into account, especially in the field of human resources management. The main goal of the paper was to provide a description of the proposed AHP-MAIRCA model, as well as its applicability in the process of selecting human resources, pointing to the importance of the selection of human resources in the police organization. By examining the possibility of applying AHP-MAIRCA model in the process of police officer selection, the practical applicability of this approach has been established. The proposed model has been presented in a specific case of admission of a police officer. Based on the research results, in addition to applicability of the model, it can be concluded that it allows for the following:

- the reduction of subjectivity;
- spotting the discrepancy between candidates' real characteristics and the ideal characteristics.

1. Based on the research results, the model's applicability is clearly noticed. Besides that, the complexity of choosing human resources also implies the complexity of using methods based on expertise as well as a certain level of subjectivity. Ditto, the human resource selection process includes the selection of adequate experts, as well as the calculation of their proposals using adequate techniques and methods. Therefore, the AHP-MAIRCA model can be supplemented by other methods of multi-criteria decision-making. Furthermore, in addition to "ordinary" (natural) numbers in the process of selection, it is recommended to apply methods on other types of numbers (fuzzy, fuzzy interval valued (fuzzy), neuro-fuzzy, rough with or without fuzzy or other types of numbers). The combination of different types of numbers and different methods significantly increases objectivity in the selection and validation of the research results. In addition, this can have a decisive influence in the selection of adequate employees.

2. Besides advantages of the method, there is a possibility of error due to the low-level process automation. In order to improve the human resource selection process, we should consider a creation of appropriate software. The importance of the paper is reflected in the practical application of the AHP-MAIRCA model, not just in the police organization, but also in other organizations. Illustration of the simplicity of the model usage is another contribution of this paper.

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