SELECTION OF CANDIDATES IN THE PROCESS OF RECRUITMENT AND SELECTION OF PERSONNEL BASED ON THE SWARA AND ARAS METHODS

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Abstract: *At the time when employees nowdays represent an important resource in achieving business success, there is an increasing focus on the process of recruitment and selection of personnel, because every company seeks to fill a vacant position with the best candidates, ie. those who best meet the requirements of the job. Therefore, this paper will propose an MCDM approach to the recruitment and selection of personnel by applying methods for decision making, in this case, by applying SWARA and ARAS methods. In order to determine the effectiveness of the proposed model, in the paper will also be presented a numerical example.*
Keywords: *recruitment, selection of personnel, MCDM, SWARA, ARAS.*

INTRODUCTION

In contemporary business conditions, which are characterized by rapid and unpredictable changes in both environment, as well as in the organization. The organization must be and must remain flexible as to track changes in environment and to remain competitive, also to maintain a competitive advantage.

Organizations increasingly manage human resources strategically, i.e. define the strategy for the development of human potential of the organization. Human Resources undeniably becomes part of strategic management over time at the company.

Recruitment is the process of attracting qualified candidates in numbers that will allow organization to choose the best candidates for filling vacancies. Selection of candidates represent a process in which is performed selection between the available candidate for the job and where afterwards a decision is made on his future employment. (Petkovic *et al*, 2005; Bogicevic Milikic, 2006).

The process of recruitment and selection means that firstly is needed to determine the characteristics necessary for the effective work performance of the job i.e. job analysis. Upon completion of the work analysis, then is carried out an evaluation of the extent to which each candidate meets or does not meet the requirements of a particular job.

Should bear in mind that there are also cases in modern organizations which often for filling vacancies performed internally recruitment which implies finding candidates within the organization, i.e. among employees.

This manuscript aims to establish an effective MCDM model for personnel selection, in this case for the position of Sales Manager in the hospitality industry. MCDM model will be based on the SWARA method for determining weights of evaluation criteria, and on the ARAS method for ranking alternatives in this case ranking of candidates in the selection process.

Therfore, this manuscript is organized as follows: in section 1 criteria for the selection of personnel are presented, in section 2 SWARA method is shown, in section 3 ARAS method is shown, in section 4 numerical example is presented, finaly in section 5 conlusions are given.

1. CRITERIA FOR THE SELECTION OF PERSONNEL

When the company have a vacant position, or there is a need to create a new position, the company always strives to find a candidate who will best and successfully perform the tasks in that vacant position i.e. future job position. However, before the company starts with the hiring process, it is necessary to define the criteria for the position, ie. consider the job requirements, which will be the basis of the entire future hiring process, and candidates will be selected in accordance with the defined criteria and requirements of the job. So, job analysis as the process involves gathering relevant information for the position and specifying the knowledge, abilities, skills and other requirements necessary for the performance of concrete job.

The evaluation criteria in the recruitment and selection process is obtained on the basis of the process of job analysis and based on them it is necessary to choose a predictor or a test that will measure the qualities or characteristics necessary to perform for the specific job.

In the recruitment and selection process for the evaluation of candidates can be applied different types of tests and the interviews such as structured interviews, intelligence tests, psycho tests, personality tests, cognitive tests and so forth, and all that with aim to evaluate the candidates in the best possible way (Miller & Gordon, 2014; Cook & Cripps, 2005).

One part of the literature is devoted to the use of MCDM or MADM methods for the selection of personnel such as a GRA-based intuitionistic fuzzy multi-criteria group decision making method for personnel selection (Zhang & Liu, 2011), personnel selection fuzzy model (Petrovic-Lazarevic, 2001), personnel selection using analytic network process and fuzzy data envelopment analysis approaches (Lin, 2010), a fuzzy AHP approach to personnel selection problem (Güngör *et al*., 2009), extension of TOPSIS method for R&D personnel selection problem with interval grey number (Wang, 2009), a fuzzy multi-criteria decision making approach for solving a bi-objective personnel assignment problem (Huang *et al*., 2009), and a rough-set based approach to design an expert system for personnel selection (Akhlaghi, 2011).

So based on the studied literature, authors of the manuscript proposes the following evaluating criteria in the proces of recruitment and selection of Sales Manager in hospitality industry. Evaluation criteria for the mentioned position are shown in table 1.

Table 1. The set of evaluation criteria

	Criteria	Designation
C_1	Work experience	*We*
C_2	Education	*Ed*
C_3	Organizational skills	*Os*
C_4	Communication and problem solving skills	*Cp*
C_5	Computer skills	*Cs*
C_6	Foreign languages	*Fl*

2. THE COMPUTATIONAL PROCEDURE OF THE SWARA METHOD

The Step-wise Weight Assessment Ratio Analysis (SWARA) technique was proposed by Kersuliene *et al*. (2010). Similarly to the ARAS method, the SWARA is also a newly proposed method, however it is also used for solving many problems such as: a rational dispute resolution (Kersuliene *et al*. 2010), an architect selection (Kersuliene & Turskis 2011), the design of products (Zolfani *et al*. 2013), a machine tool selection (Aghdaie *et al*. 2013), the prioritizing of the sustainability assessment indicators of the energy system (Zolfani & Saparauskas 2013), personnel selection (Zolfani & Banihashemi 2014)), investment prioritizing in high tech industries based on SWARA-COPRAS approach (Hashemkhani Zolfani & Bahrami, 2014) and developing a new hybrid MCDM method for selection of the optimal alternative of mechanical longitudinal ventilation of tunnel pollutants during automobile accidents (Hashemkhani Zolfani *et al*, 2013)

The process of determining the relative weights of criteria using SWARA method, based Kersuliene *et al*. (2010) and Stanujkic *et al*. (In press), can accurately be shown by using the following steps:

***Step* 1**. The criteria are sorted in descending order based on their expected significances.

***Step* 2**. Starting from the second criterion, the respondent expresses the relative importance of criterion *j* in relation to the previous (*j*-1) criterion, for each particular criterion. According to Kersuliene *et al*. (2010), this ratio is called the Comparative importance of average value, s_j.

***Step* 3**. Determine the coefficient k_j as follows

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

***Step* 4**. Determine the recalculated weight q_j as follows

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

***Step* 5**. The relative weights of the evaluation criteria are determined as follows

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

where w_j denotes the relative weight of *j*-th criterion, *n* denotes number of criteria.

3. THE COMPUTATIONAL PROCEDURE OF THE ARAS METHOD

A new additive ratio assessment (ARAS) method was proposed by Zavadskas and Turskis (2010). Therefore the ARAS method can be classified as a newly formed, but effective and easy to use, MCDM method. The ARAS method has been applied to solve various decision-making problems, and also have been formed its fuzzy and grey extension, named ARAS-F (Turskis, Zavadskas 2010b) and ARAS-G (Turskis, Zavadskas 2010a). From many papers, here we mention only a few, such as: Zavadskas *et al*. (2010, 2012), Bakshi and Sarkar (2011), and Stanujkic *et al*. (2013).

Based on Stanujkic and Jovanovic (2012), the procedure of solving problems by using ARAS methods, in cases when MCDM problem incude only benefit criteria, can be precisely described by using the following steps:

***Step* 1**: **Determine optimal performance rating for each criterion**. After creating a decision matrix, the next step in the ARAS method is to determine the optimal performance rating for each criterion. If decision makers do not have preferences, the optimal performance ratings are calculated as:

$$x_{0j} = \max_i x_{ij} , \tag{4}$$

where x_{0j} is optimal performance rating in relation to the *j*-th criterion.

***Step* 2**: **Calculate the normalized decision matrix** $R = [r_{ij}]$. The normalized performance ratings are calculated by using the following formula:

$$r_{ij} = \frac{x_{ij}}{\sum_{i=0}^{m} x_{ij}} , \tag{5}$$

where r_{ij} is normalized performance rating of ***i***-th alternative in relation to the ***j***-th criterion.

***Step* 3: Calculate the weighted normalized decision matrix** $V = [v_{ij}]$. The weighted normalized performance ratings are calculated by using the following formula:

$$v_{ij} = w_j \cdot r_{ij} , \tag{6}$$

where v_{ij} is weighted normalized performance rating of ***i***-th alternative in relation to the ***j***-th criterion.

***Step* 4: Calculate the overall performance index for each alternative.** The overall performance index S_i, for each alternative, can be calculated as the sum of weighted normalized performance ratings, using the following formula:

$$S_i = \sum_{j=1}^{n} v_{ij} \,. \tag{7}$$

***Step* 5: Calculate the degree of utility for each alternative.** In the case of evaluating faculty websites, it is not only important to determine the best ranked website. There is also important to determine relative quality of considered websites, in relation to the best ranked website. For this we use degree of utility, which can be calculated using the following formula:

$$Q_i = \frac{S_i}{S_0} \,, \tag{8}$$

where Q_i is degree of utility of *i*-th alternative, and S_0 is overall performance index of optimal alternative, and it is usually 1.

***Step* 6: Rank alternatives and/or select the most efficient one.** The considered alternatives are ranked by ascending Q_i, i.e. the alternatives with greater values of Q_i have a higher priority (rank) and the alternative with the largest value of Q_i is the best placed.

4. A NUMERICAL EXAMPLE

In order to demonstrate the efficiency and simplicity of the proposed apprach in this section, a numerical example is presented. To determine the weight of the criteria the team of three experts was formed. The attitudes of the first expert, as well as the calculated weight of criteria, are shown in Table 2.

Table 2. The responses obtained from the first of the three experts and calculated weights of criteria

	Criteria	s_j	k_j	q_j	w_j
C_1	Work experience		1	1	0.25
C_2	Education	0.11	1.11	0.90	0.23
C_3	Organizational skills	0.05	1.05	0.86	0.22
C_4	Communication and problem solving skills	0.25	1.25	0.69	0.17
C_5	Computer skills	0.9	1.9	0.36	0.09
C_6	Foreign languages	1.15	2.15	0.17	0.04
				3.97	1.00

The values in the column s_j represent the attitudes of expert, i.e. values given by experts. The values in columns k_j, q_j and w_j obtained using Eqs. (1), (2) and (3).

The attitudes of second and third expert are shown in tables 3 and 4, as well as the corresponding weights of criteria.

Table 1a. The responses obtained from the second of the three experts and calculated weights of criteria

	Criteria	s_j	k_j	q_j	w_j
C_1	Work experience		1	1	0.26
C_2	Education	0.11	1.11	0.90	0.23
C_3	Organizational skills	0.15	1.15	0.78	0.20
C_4	Communication and problem solving skills	0.2	1.2	0.65	0.17
C_5	Computer skills	0.9	1.9	0.34	0.09
C_6	Foreign languages	1	2	0.17	0.04
				3.85	1.00

Table 3. The responses obtained from the third of the three experts and calculated weights of criteria

	Criteria	s_j	k_j	q_j	w_j
C_1	Work experience		1	1	0.34
C_2	Education	0.11	1.11	0.90	0.30
C_3	Organizational skills	1	2	0.45	0.15
C_4	Communication and problem solving skills	0.25	1.25	0.36	0.12
C_5	Computer skills	1	2	0.18	0.06
C_6	Foreign languages	1	2	0.09	0.03
				2.98	1.00

After that, the overall weight of criteria are determined as geometric mean of weights obtained from experts. Table 4 shows the weights of evaluation criteria.

Table 4. The weights of the criteria

	Criteria	w_j
C_1	Work experience	0.28
C_2	Education	0.25
C_3	Organizational skills	0.19
C_4	Communication and problem solving skills	0.15
C_5	Computer skills	0.08
C_6	Foreign languages	0.04

The ratings of four candidates, obtained from three experts are shown in Tables 5, 6 and 7.

Table 5. The data obtained from the first expers

	We	*Ed*	*Os*	*Cp*	*Cs*	*Fl*
A_1	5	3	3	3	2	4
A_2	4	4	5	5	3	5
A_3	4	5	4	4	4	4
A_4	2	5	5	5	5	5

Table 6. The data obtained from the second expert

	We	*Ed*	*Os*	*Cp*	*Cs*	*Fl*
A_1	5	3	3	3	3	4
A_2	4	4	5	3	4	5
A_3	3	4	3	4	3	4
A_4	3	5	5	4	5	5

Table 7. The data obtained from the third expert

	We	*Ed*	*Os*	*Cp*	*Cs*	*Fl*
A_1	4	3	3	3	4	3
A_2	4	4	4	3	4	5
A_3	3	4	3	4	3	4
A_4	3	5	3	4	5	5

The overall ratings of evaluated candidates are determined as geometric mean of ratings obtained from experts. Table 8 shows the weights of evaluation criteria.

Table 8. The average ratings of candidates

	We	*Ed*	*Os*	*Cp*	*Cs*	*Fl*
A_0	4.64	5.00	4.64	4.31	5.00	5.00
A_1	4.64	3.00	3.00	3.00	2.88	3.63
A_2	4.00	4.00	4.64	3.56	3.63	5.00
A_3	3.30	4.31	3.30	4.00	3.30	4.00
A_4	2.62	5.00	4.22	4.31	5.00	5.00

In Table 8 are also shown optimal performance ratings, in row A_0, obtaided using Eq. (1). Normalized ratings, determined using the Formula (3), are shown in Table 9.

Table 9. The normalized decision-making matrix

	We	*Ed*	*Os*	*Cp*	*Cs*	*Fl*
w_i	0.28	0.25	0.19	0.15	0.08	0.04
A_0	4.64	5.00	4.64	4.31	5.00	5.00
A_1	4.64	3.00	3.00	3.00	2.88	3.63
A_2	4.00	4.00	4.64	3.56	3.63	5.00
A_3	3.30	4.31	3.30	4.00	3.30	4.00
A_4	2.62	5.00	4.22	4.31	5.00	5.00

In Table 9 are also shown weights of criteria. The overall performance indexes and is degrees' of utility, obtained by using the formulae (7) and (8), are shown in Table 10.

Table 10. The overall performance indexes and degrees' of utility

	S_i	Q_i	Rank
A_0	0.23		
A_1	0.17	0.74	4
A_2	0.20	0.86	1
A_3	0.18	0.78	3
A_4	0.20	0.86	2

Data from Table 10 indicate that the Candidate labeled as A_2 has the highest total importance, and therefore has best results in terms of evaluated criteria.

5. CONCLUSION

From the above shown numerical example it can be concluded that proposed and applied MCDM model based on SWARA-ARAS methods can successfully resolve problems in terms of personnel selection. The proposed model is easy to use and for the better evaluation of candidates in recruitment and selection process additional criteria can be supplemented. As a direction for future research, other MCDM methods can be used to solve similar problems such as WASPAS, VIKOR and MULTIMOORA.

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