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An Approach to Criteria Weights Determination by Integrating the DELPHI and the Adapted SWARA Methods

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Abstract: The process of evaluation and selection of personnel is characterized by defining a specific set of criteria. The process of defining and determining the weights of the criteria is a significant, because the evaluation and the final selection of personnel are carried out on the basis of the defined set of criteria. Therefore, this manuscript is aimed at creating a set of the sales managers' evaluation criteria as well as defining the weights of such criteria. The survey sample was 79 domain experts in the field of the recruitment and selection of personnel. The proposed approach based on the integration of the Delphi technique and the adapted SWARA methods was successfully applied for the purpose of defining the weights of the criteria and completely responded to the requirements in terms of defining the criteria and determining the weights of the criteria.

Keywords: Evaluation criteria, sales manager, weights determination, SWARA, Delphi technique, MCDM.

JEL Classification: D81, O15, C02

1. Introduction

A rapid development of the field of multiple-criteria decision making (MCDM), as an important part of operational research, has caused the creation of many methods for decision making. Bana e Costa and Pirlot (1997) point out that a significant development in the area of multiple-criteria decision-making started in 1972, when the international scientific community interested in the multi-criteria domain emerged in an organized form. As a significant subfield of operational research, MCDM deals with the evaluating and choosing/selecting of the best alternative based on several criteria (Hajiagha et al., 2016). Also, MCDM may be considered as a complex and dynamic process, inclusive of one managerial level and one engineering level (Duckstein & Opricovic, 1980), where the managerial level defines the goals and chooses the optimal alternative (Opricovic & Tzeng, 2004).

Every problem of multiple-criteria decision-making is always associated with multiple criteria. Cupic et al. (2003) state that criteria represent different dimensions from which alternatives can be observed. In situations when there is a large number of criteria, the criteria can be arranged in a hierarchical sense, which means that one criterion is more important than another, i.e., the main criterion. Also, each main criterion can be associated with several sub-criteria; each sub-criterion can be associated with slightly lower sub-criteria. Diakoulaki et al. (1995) emphasize the association of the weights of criteria in MCDM problems and state that it is the critical stage of the whole decision-making process. Also, Zavadskas and Podvezko (2016) point out the fact that the weights of criteria are of great importance in MCDM. Therefore, the significance of evaluation criteria, i.e., the weights of criteria, is important because it has an impact on the ranking of the results obtained by applying MCMD methods. Srdjevic et al. (2004) also confirm the importance of criteria for solving multi-criteria problems and emphasize the fact that, in the process of the evaluation of alternatives, criteria are crucial for the final decision.

The effectiveness of the personnel selection process largely depends on the defined set of criteria by which the evaluation and the final selection of candidates are conducted. The significance of criteria during the process of personnel selection is specially highlighted in a research study carried out by Kelemenis and Askounis (2010), where they state that criteria should be defined in order to cover the decision-maker's requirements and that they should be related to the specific job description and requirements. A set of the

necessary evaluation criteria and the required skills that candidates should possess are significant from the company's standpoint because, during the process of recruitment and selection, recruiters always strive to fill the vacant position with the personnel who best meet the evaluation criteria (Karabašević et al., 2015a).

Over time, many approaches that can be used for the defining of criteria weights have been proposed, such as: the AHP method, proposed by Saaty (1977; 1980); the Delphi technique, proposed by Hwang and Lin (1987); the MACBETH method, proposed by Bana e Costa (1992) and Bana e Costa and Vansnick (1993); the SWARA method, proposed by Keršulienė et al. (2010); the FARE method, proposed by Ginevicius (2011); the KEMIRA method, proposed by Krylovas et al. (2014) and so on. Also, some of the existing methods are used in the fuzzy environment in order to determine the relative weights of evaluation criteria, such as Fuzzy AHP (Torfi et al., 2010).

The work is aimed at creating a set of the evaluation criteria for the position of the Sales Manager, as well as at defining the weights of such criteria. Therefore, the paper is organized as follows: in Section 1, the introductory considerations are given; in Section 2, the SWARA method is presented. Section 3 is dedicated to the selection of the evaluation criteria, whereas, finally, the conclusions are presented in Section 4.

2. Step-wise Weight Assessment Ratio Analysis

The new Step-wise Weight Assessment Ratio Analysis (SWARA) method was proposed by Kersulienė et al. (2010). According to Kersulienė et al. (2010), one of the main features the SWARA method brings is a possibility of engaging experts in appraising the significance ratio of the criteria in the process of the determination of their weights. In their research, Stanujkic et al. (2015) also especially emphasize the advantages of the SWARA method in comparison with the well-known AHP method, this being so primarily due to a lower number of pairwise comparisons, for which reason it is much easier to apply. Hashemkhani Zolfani et al. (2015) further state that the SWARA method can successfully be used instead of the AHP, the ANP or the FARE methods.

The SWARA method has so far been applied in solving various problems, primarily in determining the weights of criteria, such as: the rational dispute resolution (Kersulienė et al. 2010), the architect selection (Kersulienė & Turskis, 2011), the design of products (Hashemkhani Zolfani et al., 2013), the machine tool selection (Aghdaie et al., 2013), a supplier selection (Alimardani et al., 2013), wall insulation (Ruzgys et al., 2014), the selection of a packaging design (Stanujkic et al. 2015) and the personnel selection (Kersulienė & Turskis, 2014; Hashemkhani Zolfani & Banihashemi, 2014; Karabašević et al., 2015a; 2015b; 2016), the evaluation of strategies (Hashemkhani Zolfani et al., 2015), the ERP system selection (Shukla et al., 2016) and so on.

The procedure for expressing the relative importance between criteria and for the determination of the weights of criteria can be shown in **Figure 1**.

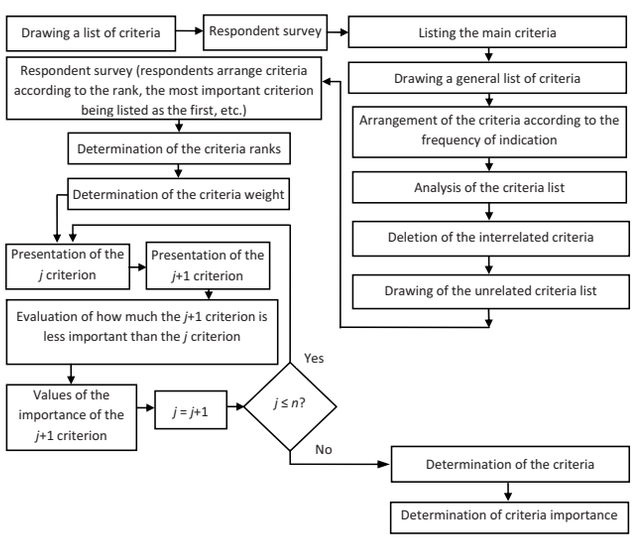

Figure 1: The determination of the weights of criteria based on the application of the SWARA method (Kersulienė et al., 2010)

The process of the determination of the relative weights of criteria by using the SWARA method based on Kersulienë et al. (2010) is further simplified by Stanujkic et al. (2015) and can be shown through the following steps:

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

***Step* 2**. Starting from the second criterion, the respondent expresses the relative importance of the criterion *j* in relation to the previous (*j*-1) criterion, and does so for each particular criterion. According to Kersulienë et al. (2010), this ratio is called the Comparative Importance of the 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 (Karabašević et al., 2015a):

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

***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 the *j*-th criterion, and *n* denotes the number of the criteria.

3. An Approach to the Selection of the Sales Manager's Evaluation Criteria, based on the SWARA Method and the Delphi Technique

The selection of the key criteria, together with associated weights for the position of the sales manager, was conducted through the two cycles of the survey on the total of 79 research participants, out of whom 21 were surveyed in the first round and 58 in the second. The participants in the study were HR managers, HR experts, HR partners, HR experts in recruitment and selection and the sales directors who participated in the selection of sales managers.

For the purpose of determining the weights, the adapted SWARA method (Kersulienë et al., 2010) combined with the Delphi technique (Bowels, 1999) was used. In the proposed integrated approach, some benefits that the Delphi technology permits are used to replace some initial steps of the original SWARA method, or more precisely said, to replace the steps related to the determination of the list of the evaluation criteria. Such an approach should provide an opportunity for the systematic refinement of experts' opinions in order to reach a consensual position. The proposed approach can be shown through the two rounds of the conducted survey, namely as follows:

Round 1 of the survey. The first round, performed in two steps, was conducted in order to identify the most important criteria.

***Step* 1. The creating of the initial set of the alternatives**. The first step involves the creation of the initial set of the general evaluation criteria for the position of the sales manager. The initial set of 10 proposed criteria was obtained on the basis of the studied literature and the interviews with experts in this domain and the representative references are displayed in **Table 1**.

Table 1: The initial set of the proposed evaluation criteria

The proposed evaluation criteria	Representative references
Interview preparedness (CV and personal presentation)	Ruetzler et al. (2010); Popovic et al. (2012).
Relevant work experience	Ruetzler et al. (2010); Popovic et al. (2012); Boran et al. (2011); Hill and Birdseye (1989); Bogdanovic and Miletic (2014).
Education	Popovic et al. (2012); Hill and Birdseye (1989).
Interpersonal skills	Ruetzler et al. (2010).
Communication and presentation skills	Biesma et al. (2007); Popovic et al. (2012); Boran et al. (2011); Bogdanovic and Miletic (2014).
Commitment and aptitude for working with others (team work)	Ruetzler et al. (2010); Biesma et al. (2007); Popovic et al. (2012).
Organizational, leadership and analytical skills	Popovic et al. (2012).
Problem solving and strategic thinking	Biesma et al. (2007); Bogdanovic and Miletic (2014).
Computer skills	Popovic et al. (2012); Bogdanovic and Miletic (2014).
Knowledge of foreign languages	Popovic et al. (2012); Bogdanovic and Miletic (2014).

Source: Authors' calculations

The respondents were given an opportunity to make a free choice of the criteria from the proposed initial set or, if they believed they could propose their own set of the evaluation criteria, they were free to do so. It was necessary that the criteria should be entered according to their importance, starting from the most significant and ending with the less significant ones.

***Step* 2. The creating of the final list of the evaluation criteria upon completion of the first round of the survey.** The respondents interviewed in the first round of the survey took the advantage of the possibility of entering their evaluation criteria that differed from the initial set of the proposed criteria. Accordingly, additional 29 criteria were added apart from those criteria, for which reason the set of the criteria at the end of the first round of the survey consisted of a total of 39 criteria shown in **Table 2**.

Table 2: The list of the evaluation criteria obtained after the completion of the first round of the survey

Evaluation criteria	
Interview preparedness (CV and personal presentation)	The appropriate qualifications
Relevant work experience	Advanced sales skills and knowledge
Education	Self-motivation
Interpersonal skills	Leadership skills and their potential
Communication and presentation skills	The ability to analyze problems, reasoning and decision-making
Commitment and aptitude for working with others (team work)	Relevant work experience and references
Organizational, leadership and analytical skills	Leadership and mentoring
Problem solving and strategic thinking	Negotiation skills and communication
Computer skills	Knowledge of psychology of sales skills
Knowledge of foreign languages	Special education (training)
Proactivity	Presentation skills
Creativity	Problem-solving skills
Motivation and dedication to work	Understanding the needs of potential customers
Organizational, analytical and problem-solving skills	Communication and presentation skills, cultural expression, the ability to establish contact
Presentation skills and leadership abilities	Individual competencies (self-initiative, ability to adapt, ability to harmonize personal goals in the organization)
References	Organizational and leadership skills
Appearance	Creative competences (creative motivation, initiative to improve and discover new opportunities, searching for information)
Willingness to learn	Analytical thinking ability, expert opinion
Impression at the interview (personal presentation)	Ability to lead teamwork
Confirmed recommendations of former employers (work experience)	

Source: Authors' calculations

Round 2 of the survey: The second round, which is presented through the three steps further in the text, was conducted with the aim of creating the final set of the evaluation criteria together with the corresponding weights.

***Step* 1**. **The criteria reduction in the evaluation criteria list derived from the first round of the survey**. The reduction in the number of the selection criteria was made and the 20 evaluation criteria that would be used in the second round of the survey were selected in the following two stages:

- according to the number of the occurrences and
- according to the importance assigned to them in the questionnaire.

The final list of the 20 evaluation criteria obtained after making the reduction is accounted for in **Table 3**.

Table 3: The final list of 20 evaluation criteria after completing the reduction

Evaluation criteria	
Interview preparedness (CV and personal presentation)	Motivation and dedication to work
Relevant work experience	Leadership and mentoring
Education	Advanced sales skills and knowledge
Interpersonal skills	Negotiation skills and communication
Communication and presentation skills	Knowledge of psychology of sales skills
Commitment and aptitude for working with others (team work)	Communication and presentation skills, cultural expression, the ability to establish contact
Organizational, leadership and analytical skills	Analytical thinking ability, expert opinion
Problem solving and strategic thinking	References
Computer skills	The ability to analyze problems, reasoning and decision-making
Knowledge of foreign languages	Special education (training)

Source: Authors' calculations

***Step* 2**. **The evaluation of the criteria and the creation of the final list of the evaluation criteria together with the corresponding weights during the second round of the survey**. During the second round of the survey, the respondents were given the opportunity to choose as many as 7 criteria stated in the list of the criteria shown in **Table 3**. Then, it was necessary to carry out the comparison of the criteria on the basis of the expected significance, i.e., from the highest to the lowest ones.

***Step* 3. The modification of the SWARA method for determining the group weights**. The normal SWARA approach implies that the selected alternatives have previously been ranked according to the expected importance in a descending order, after which the activity of assigning significance in relation to the *n*-1 alternative is carried out. In order to collect the respondents' more realistic attitudes, the adapted SWARA approach was applied for the purpose of weights assignment at the group level. Accordingly, the respondents were allowed to make a choice of the criteria at their own discretion, after which it was necessary that the criteria should be assigned relative importance, i.e., their corresponding weights. In order to facilitate the evaluation of the criteria, i.e., the assignment of importance, it was recommended that the respondents should (and could) also express relative importance in percentages. Due to the above said, prior to the application of the computational procedure of the SWARA method, it was necessary that the following formula should be applied in order to determine $s_{i.}$:

$$s_i = 1 - \frac{p_i}{100}, \tag{4}$$

Where p_i denotes the significance of the criteria (how much the criterion is less significant in relation to the *j* criterion), while *i,* is expressed in percentages.

***Step* 3.1. The choice of the evaluation criteria and the determination of the weights on the basis of the second round of the survey**. The respondents expressed their relative importance in such a way as explained in the previous step. When the ranking of the criteria according to the mean value of the weights is concerned, an anomaly was noted, namely, that the criteria chosen by a smaller number of the respondents, and with greater importance/weight assigned to them, were given higher rankings. For the purpose of solving the above problem, the following approach was proposed for the purpose of achieving

a more equitable ranking of the criteria that assigns equal importance to the medium value of the weights and to the sum of the weights in the following manner:

$$l_i = \lambda o_i' + (1-\lambda) o_i'' \tag{5}$$

where represents the coefficient, [0,1], o_i' denotes the rank achieved on the basis of the mean weights of the criteria, *i*, and o_i'' denote the rank achieved on the basis of the sum of the weight of the criteria *i*.

Thereafter, the discussed criteria were ranked in relation to l_i, after which the selection of the *n* of the highest-ranked criteria was performed.

In order to meet the requirement $\sum_{j=1}^{n} w_j = 1$, the weights of the selected criteria were determined as follows:

$$w_j = \frac{\overline{w}_j}{\overline{w}_t} \tag{6}$$

where $\overline{w}_j$ denotes the mean weight of the criteria *j*, achieved on the basis of the respondents' attitudes, $\overline{w}_t$ denotes the sum of mean weights of all selected criteria $\sum_{j=1}^{n} \overline{w}_j$, and *n* denotes the number of the selected criteria.

Table 4 is the list showing the total of 20 criteria, together with the corresponding weights. The value of the coefficient is 0.5.

Table 4: The final ranking of the 20 evaluation criteria after the completion of the second round of the survey

Criteria	Mean weights of criteria *i*	Rank to the mean weights O_i' -	Sum of the weights of criteria *i*	Rank to the sum of weights – O_i''	Coefficient λ for O_i' is 0.5	Coefficient λ for O_i'' is 0.5	Aggregated rank l_i	Final rank
	max	min	max	min	0.5	0.5	1	
Communication and presentation skills	0.231	1	6.464	3	0.5	1.5	1	**1**
Interpersonal skills	0.122	11	3.905	10	5.5	5	5.25	11
Relevant work experience	0.191	3	8.776	1	1.5	0.5	1	**1**
Commitment and aptitude for working with others (team work)	0.127	10	4.564	7	5	3.5	4.25	8
Education	0.149	6	5.073	5	3	2.5	2.75	**4**
Organizational, leadership and analytical skills	0.129	9	5.165	4	4.5	2	3.25	**6**
Problem solving and strategic thinking	0.111	12	4.001	8	6	4	5	10
Interview preparedness (CV and personal presentation)	0.195	2	7.021	2	1	1	1	**1**
Computer skills	0.129	8	0.259	18	4	9	6.5	13
Knowledge of foreign languages	0.059	16	0.473	14	8	7	7.5	15

Criteria	Mean weights of criteria *i*	Rank to the mean weights O_i' -	Sum of the weights of criteria *i*	Rank to the sum of weights – O_i''	Coefficient λ for O_i' is 0.5	Coefficient λ for O_i'' is 0.5	Aggregated rank l_i	Final rank
	max	min	max	min	0.5	0.5	1	
Motivation and dedication to work	0.156	5	4.668	6	2.5	3	2.75	**4**
Leadership and mentoring	0.075	14	0.895	12	7	6	6.5	13
Advanced sales skills and knowledge	0.141	7	3.940	9	3.5	4.5	4	**7**
Negotiation skills and communication	0.108	13	1.075	11	6.5	5.5	6	12
Knowledge of psychology of sales skills	0.072	15	0.289	17	7.5	8.5	8	16
Communication and presentation skills, cultural expression, the ability to establish contact	0.170	4	0.678	13	2	6.5	4.25	8
Analytical thinking ability, expert opinion	0.051	17	0.308	15	8.5	7.5	8	16
References	0.031	19	0.306	16	9.5	8	8.75	18
The ability to analyze problems, reasoning and decision-making	0.047	18	0.094	19	9	9.5	9.25	19
Special education (trainings)	0.020	20	0.039	20	10	10	10	20

Source: Authors' calculations

Table 5 shows the final selection and the final ranking of the best-placed criteria. The table also shows the original weights of the criteria and the adjusted weights of the criteria in order to satisfy the requirement that the sum of the weights results in the value 1.

Table 5: The 7 top-ranked criteria together with the corresponding weights and the corrected weights

Rank	Criteria	Weights	Corrected weights
1	Communication and presentation skills	0.231	0.194
1	Relevant work experience	0.191	0.160
1	Interview preparedness (CV and personal presentation)	0.195	0.164
4	Motivation and dedication to work	0.156	0.131
4	Education	0.149	0.125
6	Organizational, leadership and analytical skills	0.129	0.108
7	Advanced sales skills and knowledge	0.141	0.118
		1.191	1.000

Source: Authors' calculations

At the beginning of the research study, the initial set of 10 criteria belonging to the criteria displayed in **Table 1** was created. If we compare the final list of the criteria after conducting the survey from **Table 5** with the criteria initially proposed in **Table 1**, we can notice that the five of these criteria (Communication and presentation skills; Relevant work experience; Interview preparedness (CV and personal presentation); Education and Organizational, leadership and analytical skills) come from the initial list of the proposed criteria, which suggests that, at the start of the research study, the criteria were well-selected, based on the thoroughly investigated literature and interviews with the experts in this domain.

On the basis of the research and the opinions of the experts in the field of human resources, we can notice that, in the process of the recruitment and selection of sales managers, decision-makers pay special attention to the above criteria. Thus, it is necessary for a sales manager to be communicative and to have good presentation skills, a relevant work experience qualifying him/her for election, to be well-prepared for the interview, motivated for and dedicated to his/her work, i.e., to strive to achieve the company goals, to be so educated that he or she has organizational, analytical and sales skills, and ultimately – to be a leader.

Conslusion

As an expert-oriented method, the SWARA method has proved to be extremely suitable for testing respondents', i.e., experts' attitudes. The adapted SWARA method is successfully applied in the work in order to determine the weights of the criteria. The set of the criteria for the selection of sales managers, together with their corresponding weights, is successfully defined by applying this approach. The adapted SWARA method has proved to be very suitable for problem solving from the very beginning of the research study. Initially, the planned approach was solely based on the application of the SWARA method; in order to make the study closer to the respondents, however, the above method was also modified to a certain extent. The proposed approach has successfully responded to the requirements in terms of defining the criteria and determining the weights of the criteria. The applicability and ease of use of the proposed approach has proved to be useful and can be applied in order to determine the weights, differently from the traditional approaches based, for example, on the AHP method, and the same can be used for the examination of the attitudes of experts in other areas as well, depending on the problem that is being considered.

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