

Selection of a Candidate Using Fuzzy Approach

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Abstract: This paper proposes a new approach for the evaluation of the candidates on the basis of their suitability for job. It tries to help out the decision-makers minimize subjective value judgments and make more effective selection from the pool of applicants, under the various evaluation criteria. It has the potential to be an effective tool to be employed by those involved in personnel selection.[9]

Keywords: Personnel Evaluation Fuzzy Sets; Decision Making And Fuzzy Suitability Table.

I. INTRODUCTION

Human Resource Management (HRM) in a organization is a department which looks after the process of managing people through personnel selection, performance appraisal, reward systems, training and development. A common agenda followed by the business academics and practitioners is that HRM should be based on justice principles, particularly when it comes to hiring individuals for the organization, performance appraisal and rewarding. The justice principles are understood as the process of decision making to be carried out with the minimal influence of subjective judgments. The hiring procedure is the first contact of a future employee with an organization[2][10][11][12]

During the hiring process the candidates are to be evaluated through certain rounds of selection process which are based on aptitude tests, group discussions, personnel interview and other processes depending on the needs of an organization. The exact evaluation of job applicants is a difficult process because of the complexity and multi-valences of their skills. However, the fuzzy theory can be applied to improve the efficiency of assessments and reduce the subjective judgment.

According to Carlson and Fuller, the application of fuzzy set theory in the decision making process under multiple criteria, when only incomplete or vague information is available, has been the subject of much research over the last two decades. The basic postulate behind this work is that many real world problems have more to do with fuzziness than randomness. In such situations, it is more appropriate to handle uncertainty by fuzzy set theory than by probability theory.

This paper is organized as follows. The first section, provides a review of the background of fuzzy set theory. In Section two, application of fuzzy ideas to human resources staff selection is forwarded, where the candidates are given scores according to their respective performance in the criteria which is defined by the organization. [10][11][12].

II. BACKGROUND OF THE FUZZY SET THEORY

The theory of fuzzy sets was proposed by Lotfi Zadeh in his seminal paper 1965 as an approach to handling uncertainty and vagueness in decision making processes[7]. Zadeh elaborated on such ideas in a 1975 article and introduced the concept of

linguistic variables. The classical (so-called crisp) theory allows an element either to be a member of a set or excluded from a set. In fuzzy sets, however, an element can be a partial member of a set; hence a fuzzy set is a class whose boundaries are not sharply defined. With consideration a discrete universe of discourse X with cardinality n , $X = \{x_1, x_2, \dots, x_n\}$. A fuzzy set A in X can be represented as a set of ordered pairs of a generic elements x belongs to X and its grade of membership

$$A = \{(x_1, \mu_A(x_1)), (x_2, \mu_A(x_2)), \dots, (x_n, \mu_A(x_n))\}$$

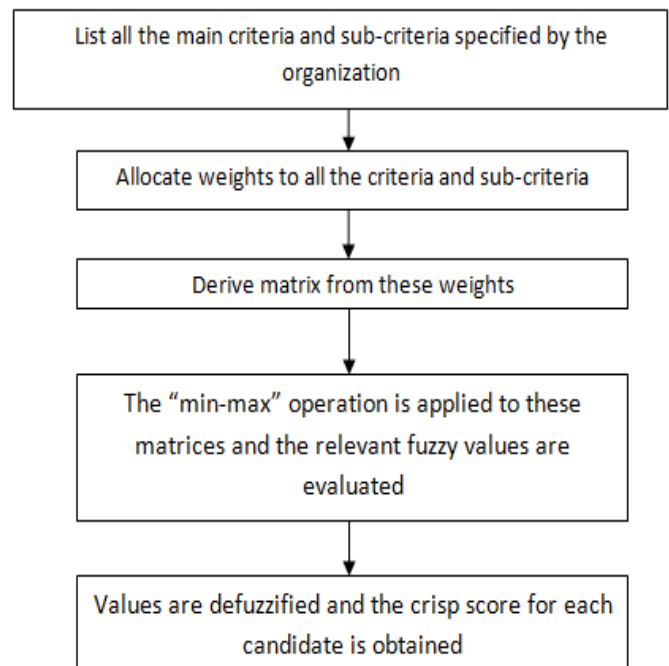
Where μ_A is the membership (characteristic) function of the fuzzy set A . It maps the elements of X to the unit interval, $\mu_A: X \rightarrow [0, 1]$ and therefore denotes a degree of membership of x in A .

Clearly, a fuzzy set is a generalization of a crisp set whose membership function takes on only two values $\{0, 1\}$.

III. A NEW APPROACH FOR CANDIDATE SELECTION USING FUZZY SETS

Here, the use fuzzy ideas to develop a rational and objective selection procedure considering all relevant criteria along with their importance is discussed. Suppose that the job analysis has identified main tasks entailed in a job and determined the essential and desirable skills that are required to be performed. The decision-makers are responsible for assessing the suitability of L candidates under each of the N criteria.

The stepwise flow of the proposed method depicted in figure is presented as follows:



IV. IMPLEMENTATION AND CALCULATION OF WEIGHTS

A sample of questionnaire with the criteria and sub-criteria is used here and the candidates are given score on their performance by the recruiters score between 0 and 100 for each of the criteria which should make up a total of 100. The criteria and their corresponding sub-criteria items and their respective mean scores are denoted as follows in the below table:

Criteria	Criteria mean score	Sub-criteria	Sub-criteria mean score
Human skills and Qualifications	45	Communication skills	22
		Creativity and originality perspective	25
		Leadership skills and team spirit	23
		Motivational capability	30
		TOTAL	100
General skills	35	Qualification	28
		Work Experience	22
		Knowledge in technical and post related affair	25
		Organizational knowledge	25
		TOTAL	100
Personnel Information	20	Age	24
		Financial Background	26
		Intelligence and extroversion	23
		Learning ability	27
TOTAL	100	TOTAL	100

For each of the sub-criteria like “Human skills and Qualifications”, “General skills” and “Personnel Information”; their respective weight matrices $A1$, $A2$, $A3$ could be derived by using the sub-criteria mean scores in Table above. These weight matrices are denoted as:

$A1=(0,22\ 0,25\ 0,23\ 0,30)$
 $A2=(0,28\ 0,22\ 0,25\ 0,25)$
 $A3=(0,24\ 0,26\ 0,23\ 0,27)$

Similarly, the generalized weight matrix A is obtained from the criteria mean scores as follows:

$A=(0,45\ 0,35\ 0,20)$

In order to obtain the results for the implementation phase, it was assumed that there is a party committee with five members. It was supposed that the members would give scores to candidates’ features among a scale of 1 to 5 (Very High=5, High=4, Medium=3, Low=2, Very Low=1). By this way, the

matrices are derived from these candidate interview assessment and the results are evaluated by calculating the union of these matrices. It should be noted that the member set size used in this implementation is not a mandatory value or limit. This is a discretionary value chosen for this study and it can be changed to different alternative values in similar studies in the future.

Scores given by the decision-makers for the candidates are as follows:[6][7][8]

Criteria	Sub-criteria	Scores given to the candidates		
		M1	M2	M3
Human skills and Qualifications	Communication skills	5	4	4
	Creativity and originality perspective	4	3	5
	Leadership skills and team spirit	1	5	2
	Motivational capability	4	3	2
General skills	Qualification	5	3	5
	Work Experience	4	1	3
	Knowledge in technical and post related affair	2	1	3
	Organizational knowledge	5	2	4
Personnel Information	Age	5	5	4
	Financial Background	3	5	5
	Intelligence and extroversion	1	2	5
	Learning ability	3	4	2

Fuzzy methodology and results:

In this section, fuzzification and defuzzification process which provide the quantitative modeling and derivation of the respective results are explained. For explanation purpose we will take into account the Human skills and Qualifications section of the table:[6][7][8]

Human skills and Qualifications	Communication skills	5	4	4
	Creativity and originality perspective	4	3	5
	Leadership skills and team spirit	1	5	2
	Motivational capability	4	3	2

Fuzzification of human skills and qualifications:

$$C_1 = A_1 \cdot B_1$$

		Excellent	Good	Average	Low
Human skills and Qualifications	Communication skills	(0,4)	(0,6)	(0,0)	(0,0)
	Creativity and originality perspective	(0,2)	(0,2)	(0,2)	(0,4)
	Leadership skills and team spirit	(0,2)	(0,2)	(0,2)	(0,2)
	Motivational capability	(0,4)	(0,2)	(0,2)	(0,4)

Thus, using this definition, the necessary quantitative evaluations could be established. For instance, the fuzzy union operation for “Human Skills and Qualifications” criteria could be implemented as follows;

$$C_1 = (0,22 \ 0,25 \ 0,23 \ 0,30) \cup \begin{pmatrix} 0,4 & 0,0 & 0,0 & 0,0 \\ 0,2 & 0,2 & 0,2 & 0,4 \\ 0,2 & 0,2 & 0,2 & 0,2 \\ 0,4 & 0,2 & 0,2 & 0,4 \end{pmatrix}$$

For “Human Skills and Qualifications”, the membership degrees C_1 are obtained as

$$C_1 = (0,28 \ 0,28 \ 0,2 \ 0,27)$$

Thus, the matrix for “Human Skills and Qualifications” could be written as;

$$B_1 = \begin{pmatrix} 0,4 & 0,0 & 0,0 & 0,0 \\ 0,2 & 0,2 & 0,2 & 0,4 \\ 0,2 & 0,2 & 0,2 & 0,2 \\ 0,4 & 0,2 & 0,2 & 0,4 \end{pmatrix}$$

Using the same methodology, the other two matrices are developed and they are denoted one by one as follows;

General skills:

$$B_2 = \begin{pmatrix} 0,4 & 0,0 & 0,2 & 0,0 \\ 0,2 & 0,4 & 0,2 & 0,4 \\ 0,0 & 0,2 & 0,4 & 0,2 \\ 0,4 & 0,0 & 0,2 & 0,4 \end{pmatrix}$$

Personnel information:

$$B_3 = \begin{pmatrix} 0,4 & 0,4 & 0,0 & 0,2 \\ 0,4 & 0,2 & 0,2 & 0,4 \\ 0,2 & 0,0 & 0,0 & 0,2 \\ 0,2 & 0,2 & 0,0 & 0,4 \end{pmatrix}$$

After this step, each of these matrices is to be processed using the union operation and the weight matrices that were defined in section[6].

All the other criteria are evaluated in the same manner as below:

General skills: (0,2 0,24 0,2 0,2)

Personnel information: (0,26 0,33 0,2 0,33)

Hence, the matrix obtained from these criteria can be denoted as follows;

$$C = \begin{pmatrix} 0,28 & 0,28 & 0,2 & 0,27 \\ 0,2 & 0,24 & 0,2 & 0,2 \\ 0,26 & 0,33 & 0,2 & 0,33 \end{pmatrix}$$

In order to obtain a final fuzzy score for the candidate, union operation will be applied on general weight matrix A and matrix C . After this operation, Final Fuzzy Score (FFS) is determined.

$$FFS = A \cdot C$$

$$FFS = (0,45 \ 0,35 \ 0,20) \cup$$

$$FFS = (0,22 \ 0,23 \ 0,21 \ 0,22)$$

In the final step, this final fuzzy score matrix will be operated through defuzzification process through union operation. Thus, a final score will be determined for the candidate. It should be noted that, after defuzzification, the final score for any candidate can be any quantitative value ranging between 0 and 100. The formula and the calculations are denoted in

$$P = \frac{\sum_{i=1}^3 (FFS_i) \cdot \bar{Z}}{\sum_{i=1}^3 (FFS_i)}$$

$$= \frac{(0,22) \cdot 20 + (0,23) \cdot 40 + (0,21) \cdot 60 + (0,22) \cdot 80}{0,22 + 0,23 + 0,21 + 0,22}$$

$$= 49.77$$

After these calculations, the final score of the candidate is found out as 49.77 and this score will be compared with other candidates’ scores.[6][7][8].

CONCLUSION

A new method has been proposed for evaluating the overall suitability of job applicants, using fuzzy logic. By expertly choosing weights for skills and tasks in advance of evaluation of applications, the fuzzy method achieves a rational basis for assessment. Subjective value judgments in the recruitment and selection processes are avoided using the HRM fuzzy logic model. The method could be further developed including other factors than those that strictly influence the HRM decision making process.

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