

A FUZZY METHOD ON DETERMINING OF JOB AND PERSONNEL EVALUATION RESULTS, AND MATCHING THEM WITH SUGGESTED MODEL

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Human resources departments are the most important parts of an organization. Various organizational and managerial regulations use information from human resources. At this respect, it is essential for an organization to determine its current jobs and workers. In this research, personnel evaluation and job evaluation processes examined together, and a newer fuzzy distance measure formula was developed. Outputs of model were discussed, and some suggestions were given for further researches. According to results, it has been argued that educational needing, personnel requirements and job requirements of a company could be easily and economically determined with using of this method. Quality and quantity of educations, current and future statue of workers and jobs could be determined in model successfully.

Key Words: Fuzzy Sets, Personnel Evaluation, Job Evaluation, Human Resources

(Received 1 Nov 2008; Accepted in revised form 9 Sept 2010)

1. INTRODUCTION

Nowadays, as competition and globalism effect markets efficiently, human capital becomes the most important component of an organization. To support the organization effectively, management information system (MIS) managers must manage their human resources effectively (Chen, L.S., & Cheng, C.H., 2005). Especially in case of poor operationalization of the concept in question, rating systems give people a false sense of security, protection and objectivity (Beatrice I. J. M. van der Heijden; André H. J. Nijhof, 2004). Human capital is managed by experts in human resources departments with various mathematical and statistical methods. In human resources, there are two major domains which managers must be deal with; job evaluation, and personnel evaluation. It has been seen that although there are so many researches on job evaluation and personnel evaluation separately, there is not any research in which these two concepts – personnel evaluation and job evaluation- were determined together based on fuzzy set theory.

Making the right decisions about human resources policies can determine success in companies (L. Cano' s, V. Liern, 2008). Accurate personnel selection, taking into account the company circumstances, allows managers to optimize production costs and achieve corporative goals (Butler, J.E., Ferris, G.R., & Napier, N.K. (1991). Like successful evaluation in an organization, the probability of a successful and timely completion of a project is also improved when decision makers choose employees with the skill and competency set that best matches the multi-criteria demands of the project (Shiple, M.F., & Johnson, M. (2009).

In a personnel selection problem involving many candidates an evaluation process performed by external experts would be too long and expensive. It has been shown that developed fuzzy set techniques can be used in other scenarios: hiring, training, promotion, etc., and can also be modeled by means of fuzzy sets. In this framework, fuzzy mathematical methods are a powerful tool for the decision-making process (L. Cano' s, V. Liern, 2008).

Fuzzy set theory considers some elements that are essential for dealing with economic, social and technological situations: the uncertainty in data, and the modeler or manager capacity to provide additional information (L. Cano' s, V. Liern, 2008). Human behavioral studies have also focused on understanding team members' problems and ensuring that team objectives are carefully formulated (Pillai, M., (2006).

Within the realm of project management, it has been demonstrated that a fuzzy logic model could help in the selection of new product introductions (Shiple, M.F., & Korvin, A. (1995) because it allows for subjective evaluation by the decision maker under conditions of uncertainty and ambiguity. The decision maker faces similar conditions when selecting project team members (Shiple, M.F., & Johnson, M. (2009).

In this research, personnel evaluation and job evaluation processes determined together based on fuzzy set theory, at the beginning of the research, personnel evaluation and job evaluation processes determined separately, current jobs and

personnel related to these jobs classified according to their fuzzy distances, grouped in a scale table which was generated in this research, afterwards they compared according to their fuzzy distances and group numbers, and results were discussed.

Results showed that fuzzy approach gave more detailed research opportunity within a job group. With using this method, it is possible to determine whether current personnel are able to work or not, even it is possible to determine position of a personnel in same job group. Thus, some further suggestions were made according to results like education needing of company or staff, amount and quality of educations according to personnel evaluation criteria and job evaluation factors, current position of jobs etc. Three possible personnel position were found and possible positions discussed.

2. MODEL

In the model of the research, fuzzy distance measures were used because of its linguistic nature and uncertainty degree properties. At the job grouping stage and personnel grouping stage, fuzzy distances of these components were determined according to linguistic statements. Current job factors were defined according to current job statues and personnel classification criteria were determined related to current job and personnel based on fuzzy triangular fuzzy numbers.

2.1 Fuzzy Job Evaluation

At this step of research, a general scale table that has some group numbers and was grouped according to some fuzzy intervals generated (see table below). This table was used for both personnel grouping and job grouping processes. Nine interval groups were defined with sub and top fuzzy distances, and distances of fuzzy distance values of job and personnel were compared with this scale. These intervals were numbered as group numbers from 1 to 9 (see table 1). Number of job groups could be increased based on organizational structure. Current jobs or personnel which have less value than top value of a group and higher value than sub value of a group were defined as a member of that group.

Table 1. Job groups, their sub and top values based on fuzzy intervals

Job Group	Sub fuzzy values	Top fuzzy values
1	(0 , 0 , 0)	(300 , 300 , 300)
2	(301 , 301 , 301)	(365 , 365 , 365)
3	(366 , 366 , 366)	(430 , 430 , 430)
4	(431 , 431 , 431)	(495 , 495 , 495)
5	(496 , 496 , 496)	(560 , 560 , 560)
6	(561 , 561 , 561)	(625 , 625 , 625)
7	(626 , 626 , 626)	(690 , 690 , 690)
8	(691 , 691 , 691)	(755 , 755 , 755)
9	(756 , 756 , 756)	(1000 , 1000 , 1000)

At job evaluation step, current job factors and their weight values were determined based on 4 main factors and 12 sub factors of current job as ability, responsibility, effort and job requirements. Table 2 illustrates weight values of job settlement.

Table 2. Job evaluation factor weights

Factors	Point of Factor Weight	Sub Factors	Sub Factor Weight Point
Ability	380	Education or Basic Information	114
		Experience	103
		Skills	89
		Initiative and Finding Remedies	74
Responsibility	280	Machine, Apparatus and Supplies Responsibility	60
		Equipment and Product Responsibility	78
		Production Responsibility	85
		Responsibility of Others' Job Security	57
Effort	150	Mental Effort	45
		Physical Effort	105
Job Requirements	190	Possible Dangers Caused by Job	75
		Labor Conditions	115

For each current job, experts of this job evaluated importance of their job factors as linguistic statements. These linguistic statements and their fuzzy values were given in Table 3.

Table 3. Linguistic and fuzzy values in job evaluation

Linguistic Value	Fuzzy Value
Very Low	(0 ; 0.2 ; 0.4)
Low	(0.2 ; 0.4 ; 0.6)
Medium	(0.4 ; 0.6 ; 0.8)
High	(0.6 ; 0.8 ; 1)
Very High	(0.8 ; 1 ; 1)

These statements converted to triangular fuzzy values, these values were combined, and multiplied by factor weights. Results were added and final fuzzy values of each current jobs were found. Afterwards, by looking top and sub values of current job, it was classified in scale table as group number.

2.2. Finding Of Job Groups of Current Jobs in Generated Scale According To Distances

Let A^+ and A^- be positive and negative ideal solution; d^+ and d^- defined as alternative's distance to positive and negative ideal solution (Jahanshahloo, G.R., et. al., 2006) than $f(A)$ fuzzy estimation is explained according to Hamming distance as following (Duin, C.W., Volgenant, A. (2006) ;

$$f(A) = \sum_{x \in E} |\mu_A(x) - \mu_C(x)| \quad \dots \quad (1)$$

In this case $M_i = (a_i, b_i, c_i)$ and $M_j = (a_j, b_j, c_j)$ including these two triangle fuzzy number, the distance between them was defined as below;

$$d(M_i, M_j) = \frac{1}{3} [|a_i - a_j| + |b_i - b_j| + |c_i - c_j|] \quad \dots \quad (2)$$

In this case, we have obtained only the distance of alternative solution to positive and negative ideal solutions depending on absolute values. In addition to this, it was required to find whether alternative solution is lower or higher than ideal solutions. Thus, it is possible to decide side situation in addition to distance measurement. For this reason, Formula (2) was developed as below:

$$d(M_i, M_j) = \frac{1}{3} [(a_i - a_j) + (b_i - b_j) + (c_i - c_j)] \quad \dots \quad (3)$$

With this equation, place and group number of a current job in scale table could be evaluated successfully. At the end of this step, current jobs within an organization could be easily grouped based on fuzzy distances.

2.3 Fuzzy Personnel Evaluation

A personnel is the one who has access to wide samples of behaviours under varying situations over periods of time (Jones, M. L. (2001). In personnel evaluation stage, some main and sub criteria related to organizational objectives, current job environment, personal skills, and other parameters mainly based on evaluated job class are determined and personnel are evaluated within this criteria. These criteria were determined based on job evaluation factors because of their relation with current jobs and using in matching stage. Other some factors could be added to these or neglected from these factors based on experts of human resources and other job specialists. Table 4 gives linguistic and fuzzy values in personnel evaluation, which could be used for conversion process.

Table 4. Linguistic and fuzzy values in personnel evaluation

Linguistic Value	Fuzzy Value
Insufficient	(0 ; 0.2 ; 0.4)
Open to Development	(0.2 ; 0.4 ; 0.6)
Successful	(0.4 ; 0.6 ; 0.8)
Very Successful	(0.6 ; 0.8 ; 1)
Excellent	(0.8 ; 1 ; 1)

According to defined criteria, linguistic stated values of personnel were determined and these values were converted to personnel fuzzy values based on table 4.

Linguistic statements again converted to triangular fuzzy values, these values were combined, and multiplied by criteria weights. Results were added and final fuzzy values of each current personnel were found. Same processes in finding of job groups of current jobs in generated scale according to distances were applied to fuzzy values of the personnel and they were grouped in same way. Afterwards, they were classified in scale table as group number.

2.4 Matching Evaluated Personnel Groups with Evaluated Current Job Groups

After determining job and personnel groups, these groups were compared. Group numbers of current jobs and personnel were matched and three possible situations were observed. Possible three situations were given below:

- Group number of current job is higher than group number of current personnel
- Group number of current job is lower than group number of current personnel
- Group number of current job is equal group number of current personnel

If group number of current job is higher than group number of current personnel, than there must be critic situation for both job and organizational success. At this situation, personnel who have lower group number must be observed and educational or other supplements –economical, social, job environment etc. - must be immediately supplied. This alert shows a weak bound in organizational chain and it must be defeated.

If group number of current job is lower than group number of current personnel, than there may be a promotion of personnel situation. At this situation, this alert means that these personnel may be used in higher levels of organization. As competition increases among the markets, an organization has to use its human resources efficiently. In this frame, it may be a useful and economical tool for both organizations and human resources experts.

If group number of current job is equal group number of current personnel, than there may be three sub situations. At this situation, fuzzy values of job and personnel were compared. These sub situations were based on fuzzy numbers. These sub situations were given below:

- Fuzzy number of job is higher than fuzzy number of personnel
- Fuzzy number of job is lower than fuzzy number of personnel
- Fuzzy number of job is equal fuzzy number of personnel

In the case of fuzzy number of job is higher than fuzzy number of personnel, again personnel must be supported effectively. Their needing like educational, economical, social etc. Must be satisfied to achieve objectives of current job. If fuzzy number of personnel is higher than fuzzy number of job, than this personnel may be used in higher positions of this job or any job which has same group number but higher fuzzy number. If there is an equilibrium point, there is an optimum situation for both personnel and current job.

In human resources processes, when examining these situations, same fuzzy distance measurement formula, which was used to find job groups, could be used to determine promotion levels, promotion gains, educational requirements and quantity of educations required for.

3. RESULTS

In this research, job evaluation and personnel evaluation processes examined together and findings showed that this process is so important to use human capital efficiently and to decide future behaviors of an organization. Waste of sources of an organization causes negative situations for an organization in competition area. To solve this problem, an organization must be deal with these problems. Human capital is the most important component of an organization, so these sources must be used efficiently in an organization.

Educational requirements are also important part of organizations, and more economical and useful education supplement requires some information about current statue of job and personnel. With our model, it could be more easy and economical to determine these requirements and information. For large companies, which have lots of job groups and workers, it is difficult to determine jobs and personnel together. Suggested model could be an easy solution to this problem with advantages of both time and personnel for evaluation. With matching of a personnel group that have optimum fuzzy sets and a personnel group that require education, an effective and cheaper education structure could be built, and application strategies and steps of education could be determined.

Although a current job group and current personnel have same group number, personnel within a job may be required for education according to its fuzzy distances determined with suggested model. In this frame, it could be said that suggested model also allows finding educational requirements within a group.

In human resources management, it is real that continued labors, up to now, will show themselves more intensely and studies done in this field are added with new ones by evolving of fuzzy logic's practice field (Chang, P.T. et. al., 2000; Storey, J. & Fenwick, N. 1989). In addition, if a group of personnel requires education and these educations are performed, efficiency of educations could be determined by looking fuzzy distance values of workers before and after educations. Two values of educated personnel, after and before education, could be matched according to suggested model outputs.

Model outputs also allow workers to evaluate themselves, and it allows drawing career maps of workers by reflecting workers. It also gives an advantage of information to organization about workers' career map, so organizations know their personnel skills in any case of empty positions. Thus, suggested model answers the requirements of organization by classifying its workers. Outputs of model also could be used for providing job environment satisfaction in an organization by using linguistic statements instead of mathematical statements.

Suggested model also could be used for small, middle or large companies, and for management strategies in service and production industries. Managers could use model outputs to determine their managerial concepts or overall behaviors of organizations.

Fuzzy set approaches can be used to derive a set of linguistic rules for the classifier (Tzoo-Hseng et. al., 2008). Thus, classifier could easily make effective communications with personnel, and suggested model also provides this useful tool for human resources experts.

Due to the importance of classification problems, many different methods, such as fuzzy logic (Subasi, A. 2006), neural network (Lee, E. W. M. et. al., 2006; Lin,C.-T. et. al., 2006; Mads, H.-M. et. al., 1996), GAs (Guo, N.R. et. al., 2002; Setness, M. and Roubos, H, 2000), and a statistical approach Chen, (Ta.-C. and Hsu, T.-C. (2006), have been developed to design classification systems (Tzoo-Hseng, S.L. et. al., 2008). Suggested model could help to solve this problem with high range of classification opportunities. By using the model, both job and personnel could be classified.

Finally, it could be said that this research has some additions to literature as a developed newer formula of fuzzy distance measurement, examining of personnel and job evaluation together, and suggested model also provides a clear view to extreme group differences in absolute logic method.

For further researches, it may be a literatural source and further researches could be performed according to personnel parameters, linguistic criteria or other specific details. Computer-based software was developed to perform calculations within this research, more general and effective computer software could be developed at this area.

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BIOGRAPHICAL SKETCH



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