PROMETHEE USE IN PERSONNEL SELECTION

by

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ABSTRACT

Recruitment and selection of competent personnel are essential for the ongoing success of any project based organization (PBO). The key issue for decision making in personnel recruitment is selection of the right person to the right job. Although both are closely interrelated parts of a multistage decision process, recruiting activities generate applicants for jobs, and selection decisions must then be made that attempt to choose the subset of applicants, or the applicant, most likely to succeed. The main objective of this study is to develop a model based on PROMETHEE (Preference Ranking Organization Method for Enrichment Evaluation) method for ranking personnel selection criteria. In this study, a decision making methodology is designed that employs PROMETHEE in order to help the personnel selection process. In this respect, the aim of using the PROMETHEE technique is taken into account to assess and rank the importance of criteria.

Keywords: Personnel selection criteria; PROMETHEE, Decision making, Project Management.

INTRODUCTION

As in many decision problems, personnel selection problem is very complex in real life. Multicriteria decision making (MCDM) has been widely used to deal with decision-making problems involving multiple criteria selection of alternatives. To manage this personnel selection problem, the PROMETHEE method has been used in MCDM on personnel selection problems, in which qualitative information is traditionally transformed to numerical one using an ordinal scale. Chen et al. (P.-C. Chen, 2009) for personnel selection used fuzzy

linguistic PROMETHEE method. They used crisp value and linguistic value together for alternative evaluation. In a group decision making environment they show validity of their model with a numerical example for marketing manager selection. They considered English ability and experience as two quantity criteria, and market ability and communication ability as two quality criteria. Various methods have been proposed to decide on the selection of human resources. Liang and Wang (1992) presented a model by using concepts of fuzzy set theory assess personnel fitness and job vacation. On the other hand, fuzzy sets decision theory suggested with Miller and Feinzig (1993) for the personnel selection problem. Liang and Wang (1994) developed a fuzzy MCDM methodology to find the final ranking values for candidates in personnel selection problem. Yaakob and Kawata (1999) used fuzzy methodology for solving workers' placement problem. Lovrich (2000) used fuzzy linguistic model for personnel selection. Capaldo and Zollo (2001) presented a model based on a case study in FIAT Research Centre (CRF) that is a major Italian company. Butkiewicz (2002) used fuzzy numbers for staff selection. Chen and Cheng (2005) combined Group decision support system (GDSS) with MCDM in fuzzy environment to solve the personnel selection problem. Golec and Kahya (2007) developed a hierarchical structure and use a fuzzy model for personnel selection.

The PROMETHEE methodology seems to be completely adequate to personnel selection problems because it models preferences within its procedures in a simple and flexible manner. Also, it is perfectly intelligible for decision makers since it represents one of the most intuitive Multicriteria decision methods. Therefore, it is chosen for the enhancement towards the evaluation of criteria and weights. In this paper, a decision making methodology is designed that employs PROMETHEE in order to help the personnel selection process. In this respect, the aim of using the PROMETHEE technique is taken into account to assess and rank the importance of criteria. Finally, an application in a project based organization (PBO) demonstrates the effectiveness of the proposed methodology. This study discusses the personnel selection procedure and how determining criteria importance by using PROMETHEE. A case study used to validate this model and analyses the results of the validation. The case study is an in depth application of proposed methodology to assist in selecting project manager for an Iranian company. Results from case study will be presented as step by step.

MATERIAL AND METHOD

In a single-level analysis of pairwise fuzzy group decision making, each decision maker expresses his or her evaluation on each pair of alternatives based on whole criteria or based on each criterion when the criteria are considered explicitly. In the explicit criteria consideration, solutions based on each criterion are then aggregated into the final solution. The criteria may have the same or different weights. The weight for each criterion is determined separately based on the decision makers' consensus or by adjusting a decision parameter for the aggregation operator used. In most cases, the consensus is achieved by changing the weights of the decision makers (Lee, 2002). In the other type, the decision makers are encouraged to modify their opinion to reach a closer agreement in opinions (Hsu & Chen, 1996). Also, fuzzy sets are employed to recognize the selection criteria as linguistic variables rather than numerical ones. The AHP is used to determine the weights of the selection criteria, in accordance with their relative importance. By the importance roles of decision makers, there are heterogeneous and homogenous group decision making. Heterogeneous group decision making environment allows the opinions of individuals to have different weights, while homogenous not. Dubios and Prade (1979) pointed out that each individual is viewed as a subgroup, where the weight of an individual reflects the relative size of the subgroup, and reflect the relevance of the individual in the group.

The goal of this stage is the criteria evaluation based on PROMETHEE modeling for determining the weights of criteria. The basic elements of the PROMETHEE method have been first introduced by Professor Jean-Pierre Brans in 1982 (Figueira, Greco, & Ehrgott, 2005). This descriptive approach, allows the decision maker to visualize the main features of a decision problem: he/she is able to easily identify conflicts or synergies between criteria, to identify clusters of actions and to highlight remarkable performances. The prescriptive approach, named PROMETHEE (Mareschal, Brans, & Vincke, 1984), provides the decision maker with both complete and partial rankings of the actions. PROMETHEE has successfully been used in many decision making contexts worldwide. A non-exhaustive list of scientific publications about extensions, applications and discussions related to the PROMETHEE methods (Behzadian, Kazemzadeh, Albadvi, & Aghdasi, 2010) was published in 2010. This part of the study uses the PROMETHEE in the group decision making environment. Visual PROMETHEE is the software implementation of the PROMETHEE methods. Visual PROMETHEE is developed by VP Solutions under the supervision of Professor Bertrand from the Solvay Brussels School of Economics and Management. Professor Bertrand has

been developing and applying the PROMETHEE and GAIA methods for 30 years together with Professor Jean-Pierre Brans in Brussels. With Visual PROMETHEE you can share the expertise of a worldwide expert in the field of Multi criteria decision making and of one of the original authors of the PROMETHEE and GAIA methods. The purpose of this model is to enhance group agreement on the group decision making outcome by considering group decision making. Once the hierarchy is structured, the next stage is to establish the importance of each criterion and also to evaluate candidates based on the hierarchy.

CASE STUDY

By considering that MAPNA is a project based company, the selecting project manager is a critical task for this company. Usually this selection is not done by a single person and a group of persons participate in the process. Usually, the group of decision makers consists of decision makers from different organizational departments and high level managers. In order to determine which applicant is best for the job position from candidates, three decision makers are invited. For more convenience, $D=\{DM_1, DM_2, DM_3\}$ is considered as the decision maker set. The committee was formed for evaluation of candidates and consists of three persons, executive deputy of MAPNA Company (DM1), and procurement deputy (DM2) and the administrative and financial deputy (DM3). It is necessary that to define the importance for each criterion by each of decision makers. The proposed framework was applied to this project based organization to see the benefits of this method. They gave some values (between 1 and 10) as shown in Table 1. The most important criteria will have been the nearest value to ten. The status and effects of the experts were taken into account to determine the weights of each expert, which is shown in Table 2:

Table 2. The determined attribute weights for the Decision Lab software matrix

	DM 1	DM 2	DM 3
Foreign Language	9	8	7
Computer Knowledge	7	9	9
Experience	10	10	10
Age	10	9	10
Gender	3	1	2
Labor Shift	3	7	9
Non-Smoker	3	7	9
Education	9	8	8
Weights of the Experts	**0.55**	**0.40**	**0.35**

Therefore, three decision makers DM_1, DM_2 and DM_3 evaluate each candidate. Decision makers have weights 0.55, 0.40, and 0.35. Decision Lab 2000 software is used to get a PROMETHEE ranking. The given values to the criteria will be entered to the Decision Lab 2000 software and the same table as on Table 2 is made up as shown in the Figure 2.

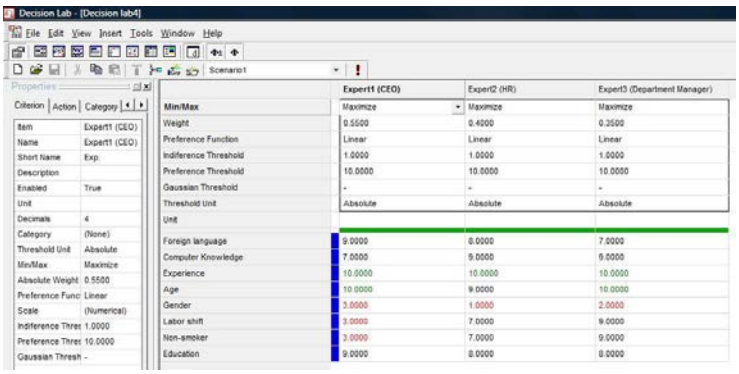
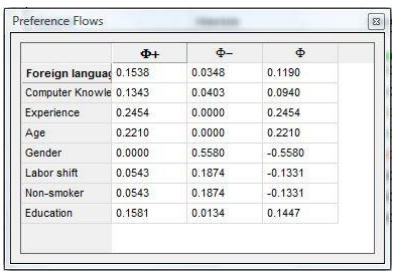


Figure 1: A screenshot from Decision Lab software

The criteria are then maximized since the highest number means the best value in this ranking. The criteria, defined functions, function parameters and the weights assigned to each expert is as seen in the Figure 2. All data entered into the program and calculated. As a result of calculations, the positive (Φ+), negative (Φ-) advantages and the net (Φ) advantages are streams of preferences are obtained as in Figure 3.



	Φ+	Φ−	Φ
Foreign languag	0.1538	0.0348	0.1190
Computer Knowle	0.1343	0.0403	0.0940
Experience	0.2454	0.0000	0.2454
Age	0.2210	0.0000	0.2210
Gender	0.0000	0.5580	-0.5580
Labor shift	0.0543	0.1874	-0.1331
Non-smoker	0.0543	0.1874	-0.1331
Education	0.1581	0.0134	0.1447

Figure 2: A screenshot of the preference flows from Decision Lab

After obtaining the preference flows, the partial ranking by using PROMETHEE I will be shown in Figure 4. It shows both positive (Φ+) and negative (Φ-) values and rankings for each criterion. However, it does not compare the conflicting actions.

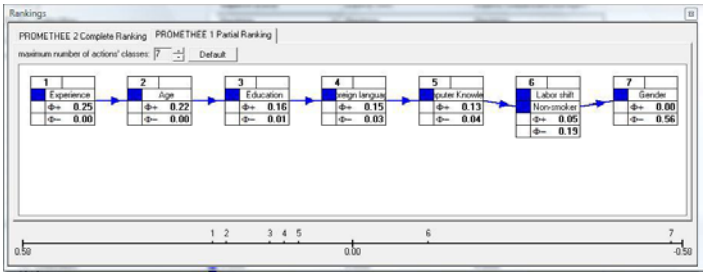


Figure 3: PROMETHEE I ranking

The PROMETHEE II (complete) ranking is shown in Figure 4. These are the net (Φ) values which positive values are subtracted from negative ones. (Φ= (Φ+)-(Φ-))

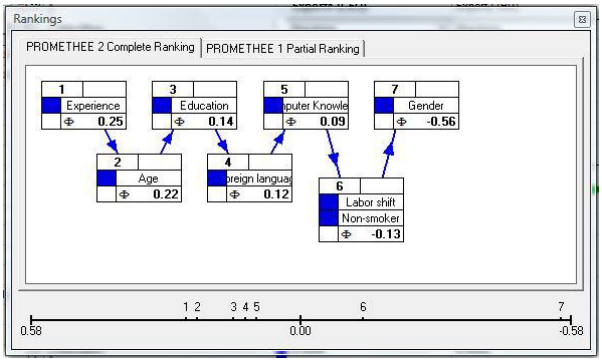


Figure 4: PROMETHEE II ranking

After all of these, the net flow values, from the preference flows table (Figure 5), are normalized and the important criteria are determined. The negative Φ- values (gender, labor shift, being non-smoker) are negligible and thereby they are ignored for calculation. The normalized attribute values are shown in Table 3.

Table 3. Normalized attribute weights

Foreign Language	**0.14**
Computer Knowledge	**0.11**
Experience	**0.30**
Age	**0.27**
Education	**0.18**

CONCLUSION

Personnel selection is a complex decision-making problem. It handles a large amount of data, which can come from quantitative and qualitative sources alike and so it would be useful to develop suitable decision-making methods to facilitate the personnel selection procedure. PROMETHEE method was used for multi criteria project manager selection procedure and a framework was presented. In the framework, some respected criteria were graded by 3

different authorized people in an PBO. The matching score of each criterion is determined, which is used as the evaluation for that selection, and ranked through PROMETHEE method. Finally, the framework is presented with a real-case study by the participation of a PBO and as a consequence positive feedbacks were taken from the firm.

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