

Full Length Research Paper

Designing a fuzzy model for decision support systems in the selection and recruitment process

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Today, most companies require skilled and experienced staff in their firms, but they encounter problems in identifying the necessary personnel to recruit. However, there is lack of a system that has the capability of integrating the needs of organizations in this field. A case study is Iran Khodro Company, Iran's largest car maker which has always been faced with these problems. Based on this study, the head of the department of Human Resources of Iran Khodro Company Affairs was implemented as the deputy leader in their recruitment and selection plan. Acceptable performance results from this research are considered the most important achievement due to the study and its application in other parts of the company by the deputy for recruitment and selection. The goal of this study is to introduce a model of fuzzy decision support systems that is in compliance with it; as such, Iran Khodro Company can improve their selection and hiring process. In this context, the absence of a model capable of compliance with specific restrictions on hiring decisions will be felt. The model can be developed to become a Decision Support System in the field of personnel selection. Therefore, the findings of this study can be used in making good decisions and senior managers can also assist in making comprehensive and scientific decisions. Also, according to environmental uncertainty, the research phase space can be near the amount of models to more realistic situations and can cause more aspects of the situation to decide on the actual model that gives the best expression.

Key words: Decision support system, fuzzy model, TOPSIS method, selection, recruitment.

INTRODUCTION

This pattern is suggested from widely used employment tests in the company that its overall framework includes five factors: medical, functional characteristics, behavioral and appearance characteristics, personality and psychological factors, and science and knowledge characteristics. Sub domain of each related factor has been extracted from employment tests, interviews with experts and selected documents studies.

Employed Applicants in Iran Khodro Company have been constantly evaluated by these criteria, but this assessment has never been integrated and systemic. Therefore, in this study, we intend to use existing models and experiences in organizations and offer a Decision Support Model for selection and employment. However,

considering the need and importance of human resource systems, each day, the last sub systems, particularly the recruitment and selection subsystem, need to develop human resources. Given that the importance of the organizations under the human resource systems have been realized (Boxall and Purcell, 2000). The importance of topic selection, recruitment, and hidden costs in an organization is required for human resources management system and operation, before any other action such as: planning and building subsystems and selection of personnel selection. The correct strategies for decisions are taken; nature of the modeling process to reduce the complexity of decision making can be a major role.

The criteria for this study were obtained from the

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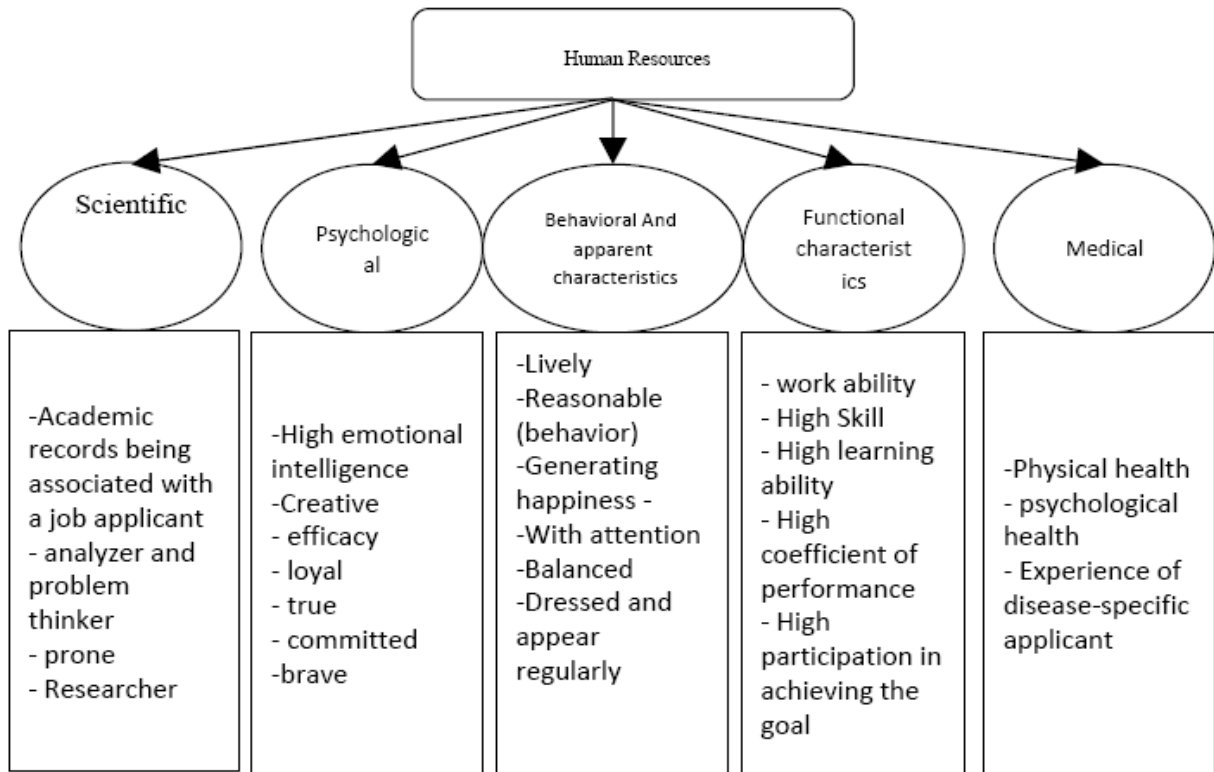


Figure 1. Part of total number of benchmark research of experts.

resources, experiences of Iran Khodro in selection and selection of field studies (observations of a researcher in the Department of resources and human cycles of selection and recruitment). Number of collected sub domain of factors is 34 criterions in the initial research phase that were classified into five key factors. The ultimate goal of this study is to provide appropriate and practical models to help identify risk factors in the recruitment and selection process (Figure 1).

The Fuzzy-TOPSIS method

Most researches on vendor selection problem consider crisp and exact data which are usually far from real-world situations. In the real-world, the rating values of alternatives as well as important weights of criteria usually have various types of vagueness, and we cannot always apply the classical decision-making techniques for these problems. Therefore, the fuzzy sets theory provides a precious tool for taking these realities into account. In a fuzzy multiple criteria decision making (FMCDM), linguistic variables were used to express the subjective and/or careless qualitative of a decision maker's assessments. A linguistic variable is a variable whose values are of linguistic terms (Kristof-Brown et al., 2005). Just a few researchers have applied the fuzzy sets theory into supplier selection problem. Cascio and Aguinis (2008) The TOPSIS method was first proposed by Hwang and Yoon (1981). The basic concept of this method is that the chosen alternative should have the shortest distance from the positive ideal solution and the farthest distance from a negative ideal solution (Feredrik, 2010).

For Fuzzy TOPSIS method, Feredrik (2010) introduced fuzzy

SMART approach for supplier selection. On the other hand, Kumar et al. (2006a) applied fuzzy programming approach for vendor selection, but they did not incorporate intangible criteria in the decision making process. In recent years, TOPSIS has been a favorable technique for solving MCDM problems. This is mainly for two reasons: Its concept is reasonable and easy to understand, and in comparison with other MCDM methods, like AHP, it requires less computational efforts, and therefore, can be easily applied. TOPSIS is based on the concept that the optimal alternative should have the shortest distance from the positive ideal solution (PIS) and the farthest distance from the negative ideal solution (NIS).

However, due to the advantages of TOPSIS method in this paper, a new fuzzy TOPSIS approach for vendor (supplier) selection problem was proposed. Cascio and Aguinis (2008) introduced fuzzy sets theory to supplier selection problem, but they only investigated a three-level hierarchy problem, that is, goal, criteria and alternatives. In this paper, to make a more detailed decision, we considered a four-level hierarchy problem- goal, criteria, sub-criteria and alternatives; furthermore, we used the canonical representation of multiplication operation on three trapezoidal fuzzy numbers (Ajzen and Fishbein, 1990) to evaluate and rank alternative suppliers and to select the most promising one.

A positive ideal solution is a solution that maximizes the benefit criteria and minimizes cost criteria; whereas, a negative ideal solution maximizes the cost criteria and minimizes the benefit criteria (Bennis, 1999). In the classical TOPSIS method, the weights of the criteria and the ratings of alternatives are precisely known and crisp values are applied for the evaluation process. However, under many conditions, crisp data are inadequate to model real-life decision problems. Therefore, the fuzzy TOPSIS method was proposed, in which the weights of criteria and ratings of alternatives were evaluated by linguistic variables represented by fuzzy numbers to deal with the deficiency in the traditional TOPSIS

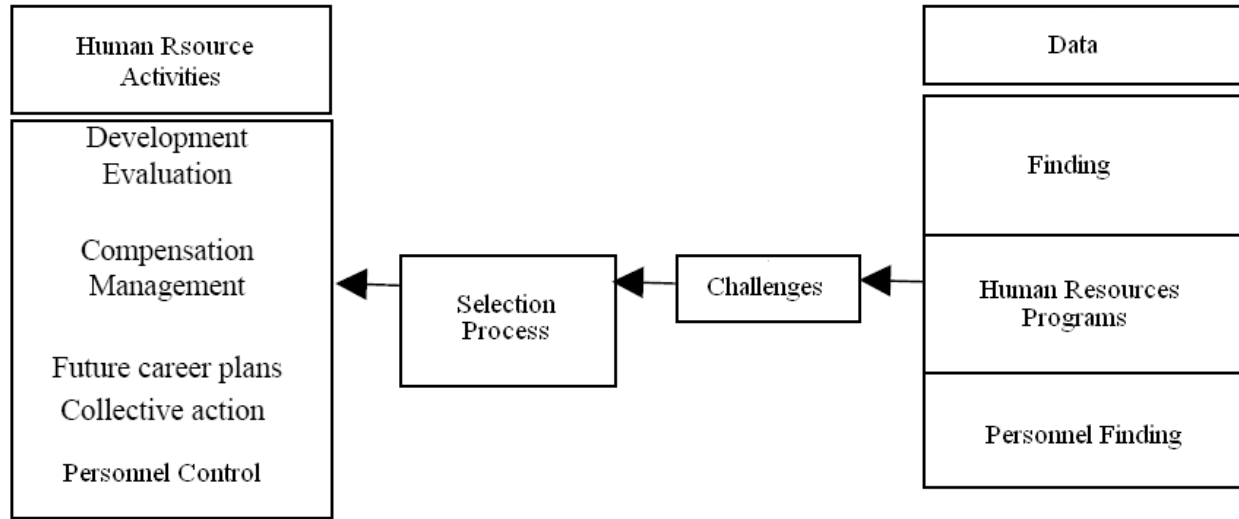


Figure 2. The selection operation.

(Pascal and Athos, 2001). The related algorithm can be described as follows (Guest, 2010; Waterman and Peters, 2002):

- Step 1: A committee of the decision-makers is formed (Fuzzy rating of each decision maker).
- Step 2: Criteria evaluation is determined.
- Step 3: After that, appropriate linguistic variables are chosen for evaluating criteria and alternatives.
- Step 4: The weight of criteria are aggregated.
- Step 5: The fuzzy decision matrix is constructed.
- Step 6: The above matrix is normalized.
- Step 7: Considering the different weight of each criterion, the weighted normalized decision matrix is computed by multiplying the important weights of evaluation criteria and the values in the normalized fuzzy decision matrix.

Selection process

The selection process includes clear steps of decision about the selection process and hiring the best applicants from available applicants. This process provides job opening process that starts and ends with the hiring decision. However, in many cases, the final decision is with the selection and recruitment of a relevant supervisor or manager, but the role of the human resource units is to confirm applicants according to their potential merit. This process includes steps that require careful evaluation that adds time and complexity to the hiring process. At different steps, managers and human resources personnel employment units aligned the needs of the organization with each other. In many organizations, units combine finding and selection process and it is called employment operation. In large organizations, employment is one of the responsibilities of employment management, while in small organizations; it is the personnel management's task. Since the selection process is an important function in the department of human resources, therefore, employment is often a main focus of firms, and it would not be exaggerating to say that the selection process is considered on the basis of the organizations' successes or even a single organization's successes.

As seen in Figure 2, the selection operation is assisted by three factors that includes, job analysis information, which contains job description, person specification and performance standards in every job, the human resources' programs that identify empty jobs

and possible improvements to the selection in an effective way, and finding that creates a set of the applicants troubleshooting force and employees are selected from them. The employment is known as a source of other human resource management activities. Without employment process, the nature of human resource management as well as other activities will be at risk.

Population research and information provider

Population study of all managers and professionals in the Department of Human Resources is composed of Iran Khodro Company. Study population represents information including experts; managers are active in the field of human resources.

Data collection methods and tools

Human resource issues have different methods for gathering information, but the most important method of data collection methods, is interviews with experts and experienced people in this area. Also in this study, these tools and group interviews have been used to collect basic data. For completing the literature, we have tried to use library, related sites and areas of human resources-related magazines in systems that use appropriate recruitment and selection for its operation. Furthermore, using a field study (direct observation systems in the current selection and recruitment of human resources) we tried to know the influence of elements within the recruitment selection and employment tests.

Steps in problem solving based on fuzzy TOPSIS method

In this article, the priority of applicant is determined. Accordingly, in the main model, factors affecting recruitment and selection are in the first level; in the second level, criteria of research and in third level, applicants' research. In this model, weights and measures of factors is calculated by the geometric mean method that is one of the approximate methods in weight computing of hierarchical analysis.

Describing the Fuzzy- TOPSIS method, we require knowing some basic definitions of fuzzy sets, fuzzy numbers and linguistic

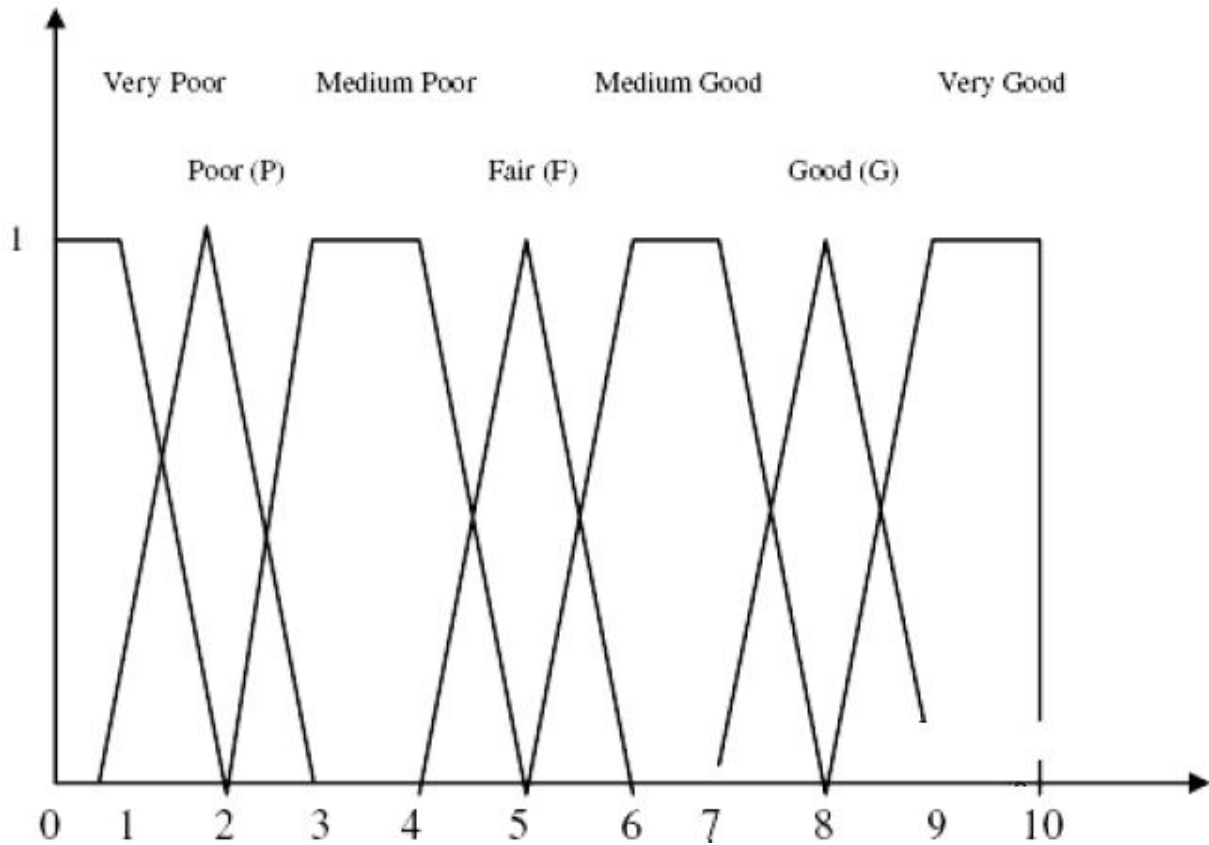


Figure 3. Fuzzy variables graph.

variables were checked. A fuzzy sets show that every x of X is in the numerical range of $[0, 1]$ when compared to a fuzzy subset of X . In Function (x) , closing to 1 shows more belonging to x set. Therefore, fuzzy sets and membership functions are indicator functions and generalized definite set (Buckley, 1985):

relation 1:

$$\mu_{\tilde{A}}(x) = \begin{cases} 0, & \\ \frac{x-n_1}{n_2-n_1}, & \\ 1, & \\ \frac{x-n_4}{n_3-n_4}, & \\ 0, & \end{cases}$$

In this study, each of the seven linguistic variables that have been used to convert linguistic variables to fuzzy numbers of the form as shown in Figure 3 and Table 1 is used.

RESULTS

In this study, we have applied only points of the Department of Human Resources' because it is the most important in the completion of paired comparisons questionnaire being experts to prevent diversion of results. Thus, for the first questionnaire, a sample of 40 experts in Human Resources Department of Iran Khodro Company and for the second questionnaire, sample size

is for very certified individuals of Human Resources Department. As mentioned earlier, three job applicants of the Department of Human Resources who had priority were evaluated by the four experts. Finally, with the help of the MATLAB program, software were prepared and run for determining priorities of different individuals that showed that both of their results are the same.

Weight of different criterions in Research shows that in order of personality, psychological, medical and scientific knowledge are functional and the appearance and behavior has been in priorities of Human Resources Department for Employment and selection (Table 2).

Although, weight of different criterions in each factor does not have a significant difference, but the relative priority of each criterion in each factor is caused by more attention of experts.

In medical factor, psychological criterion is in priority to physical health, whereas in the functional characteristics, high-skill has high-priority to physical health. In the behavior and appearance factor, being polite has a priority on balance in behavior. In psychological personality factors, criterions of creativity, integrity, emotional intelligence and being practical have a priority on order. In the science and knowledge factor, relevant education to the job has a priority for researcher.

As was explained previously, the final results of Topsis

Table 1. Corresponding values of trapezoidal fuzzy linguistic variables.

| Row | Linguistic variable | A trapezoidal fuzzy number |
|-----|---------------------|----------------------------|
| 1 | Very good | (8, 9, 9, 10) |
| 2 | Good | (7, 8, 8, 9) |
| 3 | Somewhat good | (5, 6, 7, 8) |
| 4 | Average | (4, 5, 5, 6) |
| 5 | Somewhat weak | (2, 3, 4, 5) |
| 6 | Weak | (1, 2, 2, 3) |
| 7 | Very poor | (0, 1, 1, 2) |

Table 2. Calculated weights.

| Factor | Criterion | Factor weight | Criterion weight |
|--|---|---------------|------------------|
| Medical | Physical health | 0.31 | 0.35 |
| | Psychological health | | 0.65 |
| Functional characteristics | Top skills | 0.1 | 0.63 |
| | High learning ability | | 0.37 |
| Behavioral and morphological characteristics | With attention | 0.08 | 0.53 |
| | Balanced | | 0.47 |
| Psychological character | Creative | 0.4 | 0.32 |
| | High emotional intelligence | | 0.22 |
| | Honest | | 0.26 |
| | Practical | | 0.2 |
| Scientific knowledge | Researcher | 0.11 | 0.46 |
| | Academic records and relation between them and work | | 0.54 |

for fuzzy persons C, A and B, respectively were employed in preferences based on these results. Also, the output contents of C, A and B were the priorities that indicate equality in the TOPSIS programs.

SUGGESTIONS

Suggestions of research are from the results of this study, we hope that these suggestions will be used in Iran Khodro and other organizations. The suggestions are as follows:

1. More and more attention to employment testing and screening applicants, and determining minimum necessary for entry on the next steps of assessment.
2. Using linguistic variables and fuzzy logic in qualitative evaluation of individuals.
3. Enter values in the designed model in the MATLAB software.

4. Compare the results obtained by different people, and selection, and hiring the best of them

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