

MCDM and Its Role in Personnel Selection- A Review

Aarushi Singh, Sanjay Kumar Malik

Abstract— The task of personnel selection has always showed vagueness in its process. It is not only based on ones qualitative parameters, rather it also involves manipulative and cognitive attributes of the decision maker (DM). Multiple Criteria has evolved as a powerful tool in many complex decision making tasks. This paper has discussed the effect of MCDM on the process of personnel selection, highlighting the enhanced results obtained. Personnel selection when implemented in conjunction with MCDM methodology provides the results that are more rationale and logical, hence efficient prioritization of the alternatives. The paper has summarized the features of the problem domain and emphasized how and why MCDM can be an ideal choice for carrying out this task.

Index Terms— Multiple Criteria Decision Making (MCDM), Decision Maker (DM), Analytic Hierarchy Process (AHP), Technique for Ordered Preference by Similarity to Ideal Solution (TOPSIS), Promethee, Simple Additive Weighting (SAW), Simple Additive Weighting (SAW)

I. INTRODUCTION

Human Resource is an indispensable resource of any working organization/ institute or social group. It is a prerequisite to any activity that an organization performs. It is actually the smart work of a team (group of individuals) in an organization that takes it to the zenith of success. Therefore, the selection of these individuals has to be done with acute insight and profound analysis.

Personnel Selection is the task of choosing the individuals whose features or attributes match to the requirement of the profile they are being chosen for or vice-versa. This task if done in a systematic and planned manner, can help the organization to harness the best talent from among the present alternatives, with respect to particular profile.

There are so many ways like- meetings, telephonic or direct interviews, job knowledge tests etc which help in carrying out this task. But, the decision makers in the selection process are humans, so natural errors, intentional/ unintentional biasness, manipulative and judgmental decisions can lead to inconsistent selections which will ultimately hamper the growth of the organization. Therefore, the task of personnel selection urges for a systematic approach to be followed.

MCDM is widely accepted methodology which exists in many different areas of research from past 50 years. The major strength of this approach is the well structured formulization of the problem domain. Beginning with the

initial set of alternatives (options to be prioritized) and attributes (parameters used for analyzing alternatives), at every step we go on reducing the ambiguities among the alternatives. This paper summarizes the usefulness of MCDM in personnel selection, thus making the best choice of the candidate for a particular profile of the job.

II. LITERATURE REVIEW

The practice of making the decisions is as old as man. Knowingly or unknowingly, a person starts doing this task at very initial stages with small choices and finally leading to the important decisions including those of scientific research or daily life complexities.

A. Short History- MCDM

The earliest known references related to MCDM, takes us down to 1706-1790 when Benjamin Franklin, used a simple paper system approach for decision making. He took a sheet of paper, on one side he wrote the points in the favour of the argument while the other side had the points against the arguments [1]. The arguments with somewhat equal importance on both the sides were struck out. Repeating this process , the points on one of the side are striked away completely and the points left on the other side should be supported. This was his way, which formed the basis of MCDM and later gave the way for researchers to develop new techniques.

Thereafter, the work on goal programming by Charles and Cooper came into picture in 1955. The work was carried to new heights by the efforts of Stan Zionts & Bruno Contivi by making a Multiple Criteria Negotiating Model in 1968. The year 1972, marked the first conference on MCDM in Columbia which was attended by several contributors of this field. The proceedings of the conference was the first major volume on MCDM and is still heavily cited.

The outstanding work by Thomas L. Satty[17] in 1970 was a major breakthrough in the field of MCDM. Satty introduced a new technique AHP, based on MCDM. This technique is drag them to the first column. Make the graphic wider to push out any text that may try to fill in next to the graphic.

widely used in many varied and original forms. In 1975, first organization 'Special Interest Group' was established on MCDM which later evolved into International Society on MCDM and has an active membership worldwide [2].

The current trends in MCDM, have led to the evolution of many techniques. Following are eleven MCDM approaches which are quite popular in the recent times- (1) AHP, (2) FST, (3) MAUT, (4) Case Based Reasoning, (5) ELECTRE, (6) PROMTHEE (7) SAW, (8) TOPSIS, (9) SMART, (10) Data Envelopment Analysis and (11) Goal Programming. Each of these has its own respective advantages and disadvantages, as summarized by Velasquez and Hester, 2013 [3].

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Aarushi Singh, M. Tech. Student, Hindu College of Engineering, Sonapat, Deptt. of CSE, Hindu College of Engineering, Sonapat

Sanjay Kumar Malik, M. Tech. Student, Hindu College of Engineering, Sonapat, Deptt. of CSE, Hindu College of Engineering, Sonapat

B. Problem of Personnel Selection

Personnel Selection is one of the important tasks of the Human Resource Department of any organization. It is the selection of appropriate person for a particular profile of the job, be it a software developer, or a marketing analyst or any teaching job. Therefore, it is a mapping of a set of candidates to the set of the job profile they match. In other words, personnel selection is an association between the eligible candidates and the requirements of the job profile, done with the assistance of human resource department of the organization. This association can be either positive or negative. The association is positive if the features of the job/task are completely satisfied by the qualities possessed by the candidate. On the contrary the association turns out to be negative if there is a mismatch between the requirements of the job profile and the qualities possessed by an individual.

Human resource is the most crucial resource for growth and success, hence, positive association is extremely important to trace out the best in all the spheres.

The selection process is usually carried out using written tests and interviews and is basically based on the personal beliefs, ideas and judgment power of the selector. The results given by the selection team without using any common platform or a mathematical and organized approach, are expected to be biased or inconsistent. Sometimes, personal relations between the interviewer and the candidate can result in inconsistency, since there can be the other one who is more deserving yet he/she is probable to be ignored. Therefore, the selection process is not only statistical based but also based on the psychology of the selecting team. With the time, the term 'Personnel Selection' has become broader, it doesn't merely sticks to the selection of academically eligible individuals rather it determines the input quality of the person and matches it with the needs of the task/ job [6].

To assure the selection of right person in the right job, a shift from the traditional technique to the modern mathematical and organized approach has been seen. Among the other decision making problems, the Personnel Selection Problem has been a part of research in the recent years [4].

A dynamic drift is being witnessed in the developing countries, that the job seekers doesn't merely need a job to earn money rather they need a job that could help them fulfill their talent and explore out their best in the area of the interest. This phenomenon was usual in the developed nations initially but with the advent of globalisation the mind set of the youth of developing nations is also changing.

The same phenomenon can be observed on the other side too, i.e. of hiring companies/ organizations. They need individuals who can lay their best in the job profile they are being selected for and promote healthy team environment. Hence, the traditional process of hiring has to be replaced with modern organized approaches that considers ones talents and personality traits [5].

III. ORGANIZED APPROACHES TO PERSONNEL SELECTION

Personnel Selection, always directly and significantly affect the quality of the output that the organization delivers. It has been a keen area of research in the 20th century, though the traces of such research are evident in 90th century too [8]. The research work by Hough & Oswald [8], elaborate the transition being taking place in this area. Various approaches have been developed to make the best choice from among the

eligible candidates. These techniques are based upon certain common principles or features, since the selection process is a complex task and involves a significant amount of vagueness and subjectivity [4].

The modern selection technique, avoids the judgment of the candidates on the voluntary psychological basis. These techniques have tried to minimize this effect and avoid the biased selection. The approach undertakes, the individual's attributes into account as the parameters for the judgment, thus giving a common platform to judge the potential of a person with respect to a particular job/ task. The attributes can be broadly classified into- Subjective Attributes and Objective Attributes [7].

Subjective Attributes:- These are the qualitative attributes or in other words, the attributes such as leadership quality, confidence, communications etc. which have qualitative definition are said to be Subjective Attributes. A definite value and voluntary perspective generally fail to consider them in the way they should be given importance.

Objective Attributes:- The attributes for which a quantified value is present can be categorized as Objective Attributes. Example, General aptitude, knowledge about the subject. There exists some ways to measure them and an approximately correct value is expected to be obtained without the interference of psychological perspective of the DM to some extent.

The newly developed techniques which are quite organized and systematic in nature, take into account the type of the job for which the candidate is being hired. These techniques have a profound analysis of all the features of the job which includes- the tasks to be performed, the qualities required to perform the task efficiently and constraints involved. Now, depending on the features of the job, the candidate possessing such features is/are to be selected. Despite, the eligibility fulfillment, both objective and subjective attributes with respect to the job/task must be present in the candidate(s) selected. For example- Selecting lecturers for a college/ institute should consider the following features in the candidate, since these are the demand of the profession:-

- 1) Knowledge of the subject matter
- 2) Pedagogical knowledge of teaching the subject in the appropriate manner
- 3) Ability to Access student's learning
- 4) Proper expression of speech
- 5) Good communication
- 6) Ability to foster student's responsibility for their own learning.

IV. ROLE OF MCDM IN PERSONNEL SELECTION

The problem under study, has attracted the interest of many researchers from the multi-criteria perspective. Though personnel selection can be done in several ways but most of the newly developed techniques treat personnel selection as a Multiple Criteria Decision Making Problem. Indeed, on observing closely it is a process of choosing the best among the present candidates (alternatives), on the basis of the criteria or attributes with respect to the particular job.

The recent developed techniques or approaches subtly, treat it as MCDM problem and finds the solution using the MCDM methodologies [7], [9], [10]. The researchers have tried the solution of this problem using the basic MCDM techniques and even the modified new techniques, in search of more accurate and quick results [11], [12], [13] for the growing real time problems.

In the following section, this paper has summarized the MCDM methodologies which are best suited for the problem like personnel selection [3]. The following Table 1, has enlisted MCDM techniques for this problem. In addition, it has illustrated the advantages associated with each of them in giving the best solution to the problem of Personnel Selection.

V. GENERIC MODEL FOR PERSONNEL SELECTION

This selection of the paper summarizes a Generic Model for the problem of personnel selection, using MCDM methodology, irrespective of MCDM technique used. Fig. 1. illustrates the basic series of the steps involved in choosing the best candidate from among the present alternatives on the basis of the attributes necessary to do the comparative analysis.

Step 1: Start the process by eliciting the problem domain.

Step 2: Identify the job: Study the task/ job to the profound depths. Here, we need to essentially find all necessary features needed to do the task in the best form.

Step 3: Elicit the Necessary Attributes of the job: This step involves the eliciting of all the attributes of the job and differentiating them as Objective and Subjective ones.

Step 4: Listing the eligible and interested candidates: Studying the job perspective completely, the candidates eligible, whose analysis has to be done should be selected.

Step 5: Apply the MCDM Methodology: There are 8 techniques enlisted in Table 1., it is the step to choose one of them and apply on the data set.

Step 6: Compute the value of each Candidate: After the application of the desired technique on the data set, some results are obtained, which help in ranking the alternatives. Upon the reception of the results either stop or repeat the process if results need to be refined.

VI. CONCLUSION AND FUTURE WORK

MCDM is increasingly becoming a solution to many of the selection problems. Personnel Selection is one of those complex selection problem where there is maximum probability of inconsistent results due to the interference of human judgmental and cognitive nature in the selection process. The best suited MCDM techniques for the solution of selection problems, have been enlisted in this paper, to facilitate for optimal selections. The paper has even presented a Generic Model, showing the step by step process of personnel selection in conjunction with MCDM. The

continues attention to this field has explored out different approaches to deal with such problems.

There is still a lot to discover in this area. MCDM has wide applicability throughout the areas of research. In addition to personnel selection, the other areas of MCDM application [14], [15], [16], includes economics, business, production planning, waste management, construction, teaching, profession etc. MCDM is used in these areas for selection, ranking and evaluation.

METHOD	ADVANTAGES/ FEATURES
Analytic Hierarchy Process (AHP)	Easy to use. Ability to handle complex problems where data set is large. Well structured representation helps in clear and accurate estimation.
METHOD	ADVANTAGES/ FEATURES
Data Envelopment Analysis (DEA)	Capability to handle multiple inputs and outputs. Efficiency can be analyzed and quantified.
Fuzzy Set Theory (FST)	Carefully handles linguistic variables. Analysis real world selection problem with insight. Takes into account insufficient information. The technique can be used in conjunction with other MCDM techniques like Fuzzy MCDM, Fuzzy TOPSIS.
Goal Programming (GP)	Capable to handle large scale problems. Can produce infinite alternatives.
ELECTRE	Takes uncertainty into account. Handles vague information efficiently. Simulates the real world problems efficiently.
PROMETHEE	Easy to use. Doesn't require any assumption that criteria are proportionate.
Simple Additive Weighting (SAW)	Takes into account the mutual importance of Criteria. Calculation is simple Easy implementation Best suited for simpler MCDM problem
Technique for Ordered Preference by Similarity to Ideal Solution (TOPSIS)	Logical approach for selection. Can be combined with the methodologies like fuzzy to handle uncertain information. Scalable, both to the perspective of attributes and alternatives

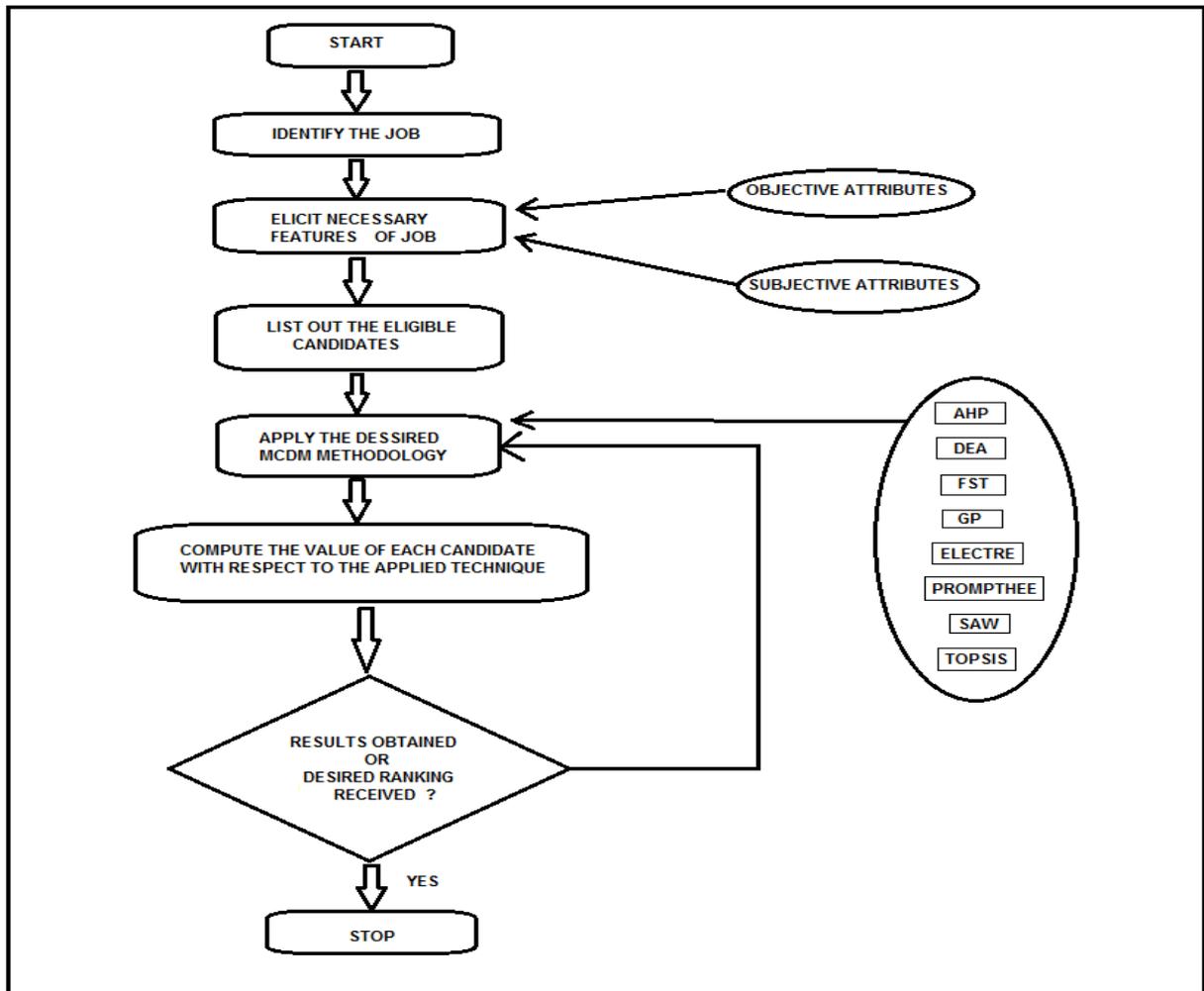


Fig. 1. Generic model for Personnel Selection

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