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Survey on Multi Criteria Decision Making Methods

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ABSTRACT: This paper present an overview of various multi criteria decision making methods. This different methods has been useful to solve all problem related to decision making. Decision making is the process of identifying and selecting alternatives based on criteria of the decision maker. Over pas few decade, decision making increases popularity due to ability to solve complex real problem.

In this paper we going to explain introduction survey of five multi criteria decision making methods including Analytics Hierarchy process (AHP), TOPSIS, PROMETHEE, VIKORE, ELECTRE. It's consist of strength and weakness of five method and same time we explore method in of area of application.

KEYWORDS: Decision making, AHP, TOPSIS, PROMETHEE, VIKORE, ELECTRE.

I. INTRODUCTION

Multi-criteria Decision Making is the most useful branch of decision making. It is arm of a general class of Operations Research models that allow to make decision under the presence of a multiple, usually conflicting decision criteria. [1]

Depending upon the set of alternatives, Multi-criteria Decision Making problems are usually subdivided into two groups. MCDM problems have two types: Multiple Attribute Decision making (MADM) and Multiple Objective Decision making (MODM).

MODM methods are generally continuous or integer types, with a large number of alternative choices. MADM methods are generally discrete types [2].

MCDM is a useful tool in many domain like material selection, Recourse allocation, economical, Constructional, manufacturing, military, etc. So far various techniques have been proposed to solve MCDM problems. It is the study of identifying and selecting alternatives based on the calculated values and preferences given by decision maker. It consist of set of alternative choices to be considered and choose the one that best fits as per requirement [3]

II. SURVEY OF VARIOUS MCDM TECHNIQUES

Following are the some multi criteria decision making methods which will be used to identified the problem and provide best alternative.

1. AHP

The Analytic Hierarchy Process (AHP) is one of the best known Multi-criteria Decision Making approaches. The AHP, as a compensatory method [4]. It involves structuring various criteria into a hierarchy, evaluating the relative importance of criteria, finding alternative based on criteria and calculate overall ranking of the alternative based oncriteria. [5]. AHP is designed to mirror the way people actually think, it is most highly regarded and widely used method.

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Strengths

- The advantages of AHP is its flexibility and its ability to check inconsistencies.
- AHP helps to gather both subjective and objective evaluation measures.
- The AHP method assist group decision-making
- AHP is scalable method.

Weaknesses

- Large number of comparisons –
With AHP, the problem is decomposed into a number of sub part, within which and between which a number of pair wise comparisons need to be completed.
- Very difficult to distinguish scale
Sometimes, the decision-maker might find tough to distinguish while applying 9-point scale.

2. TOPSIS

TOPSIS method was initiated by Yoon and Hwang and (Benitez et al., 2007). This method consider the Euclidean distance from the best solution, longest distance from negative ideal solution. In this method, alternatives are ranked based on ideal solution similarity, If alternative are more similar to ideal solution then it has higher grade. The Ideal solution is a one which does not exist practically and we try to achieve it. In TOPSIS, the decision matrix examine both subjective and objective factors [6].

Strengths

- We can used any numbers of attribute and criteria.
- Less number of comparison required as compared to AHP.
- Easy to implement.

Weakness

- Unreliable result
- TOPSIS does not consider uncertainty in weightings.

3. VIKOR

It was developed by Serafim Opricovic to solve decision making problems with conflicting and no commensurable criteria. It assume that compromise is admissible for conflict resolution. Decision maker wants a solution nearest to ideal and the alternatives are assess to all criteria [3].

Strengths

- The best alternatives is find out based on maximizing utility group and minimizing regret group.
- This method is based on positive and negative ideal solution, thus it is proposes a compromise solution with high rate.

Weaknesses

- The performance rating is calculated as crisp values.
- In case of conflicting situations, a decision maker must also take imprecise or ambiguous data.

4. PROMETHEE

PROMETHEE method is proposed by Brans and it is based on ranking comparison relation between pair of alternative. First, it's compare rank of alternatives on each criteria. The PROMETHEE make the preferential function to relate the preference difference between set of alternative on each criterion [7].

To implementation of PROMETHEE needed two additional types of information,

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- Information on the Weight of criteria.
- Information on the decision makers preferences, which uses when differentiate the contribution of alternatives in terms of each criteria.

This method is mostly useful when group of people are working on complicated problem. It has unique advantages when important attribute of decision are difficult to compare.

Strengths

- PROMETHEE can simultaneously deal with quantitative criteria and score can be shown in their own units.
- It's require less number of inputs.
- It is very easy to use.

Weaknesses

- PROMETHEE suffers when new alternative is introduced
- PROMETHEE does not provide chance to structure a decision problem. It is very difficult when many criteria and options are available.
- PROMETHEE does not provide a clear method.

5. ELECTRE

The ELECTRE method was to select the best action from a given set of alternative.

There are two main segment to an ELECTRE application

First, the build of one or several outranking connections which aims at comparing each pair of actions. Second, Use procedure that elaborates on the recommendations acquire in the first phase.

The types of the recommendation depends on the issue being addressed: sorting, choosing or ranking [8].

Strengths

- We can apply fuzzy analysis.
- Its major strength is that it takes into consideration of uncertainty.
- ELECTRE take qualitative and quantitative criteria.

Weaknesses

- It is very hard to understand, because of the idea used in finding the concordance and discordance matrices.
- In ELECTRE, Thresholds can be calculated based on metrics, thus it is very hard to translate subjectivity opinion into thresholds value.
- ELECTRE process and result can be hard to explain in layman's terms

III. AREA OF APPLICATION

Sr no	Method	Areas of Application
1	AHP	Product development, Measuring object oriented software, develop estimate model , Performance-type problems, resource management, corporate policy
2	TOPSIS	Machine tool selection , Supplier Selection, Supply chain management , human resources management, business and marketing management ,resource management , engineering, manufacturingsystems
3	VIKOR	Identification of location,
4	PROMETHEE	Environmental, hydrology, logistics and transportation, energy, Agriculture.
5	ELECTRE	environmental ,energy, economics, water management, and transportation problems

TABLE I AREA OF APPLICATION

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IV. CONCLUSION

In this paper we review and analyse various multi criteria decision making methods. Also, Paper highlights different area of application where multi criteria decision making method are applicable. Table 1. Although the finding the best MCDM method for solving problem may never end. MCDM method is critical and valuable area as research point of view.

As a future scope for research, we suggest combination of AHP and TOPSIS as new method for multi criteria decision making method.

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