RESEARCH ARTICLE OPEN ACCESS

Positive Ideal Solution in The Topcis Method

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Abstract:

Decision-making can be regarded as the cognitive process resulting in the selection of a belief or a course of action among several alternative possibilities. It is the study of identifying and choosing alternatives based on the values and preferences of the decision maker. Multi-criteria decision making (MCDM) is the process of finding the best alternative from all of the feasible alternatives where all the alternatives can be evaluated according to a number of criteria or attribute (Tan & Chen, 2010). It refers to screening, prioritizing, ranking, or selecting a set of alternatives under usually independent, incommensurate or conflicting attributes (Hwang & Yoon, 1981) . In this research, TOPSIS and Fuzzy TOPSIShas been applied to find the better laptop. Today different kinds of laptops are available. Identification of difference between this laptop is very difficult. In this research Cost, Warranty, Size, Battery life, Specification (RAM, Processor, graphics card, speed), genuine operating system, weight of the laptop, Wi-Fi and Touch pad are considered as criteria to find the better laptop. It is difficult to select better laptop because relatively all laptops are seems to be similar. By applying TOPSIS and Fuzzy TOPSIS method to the alternatives based on the criteria the laptops can be differentiated. MCDM evaluation metrics are applied to evaluate the laptop selection problem. A comparative analysis of TOPSIS and Fuzzy TOPSIS methods are illustrated.

Keywords — **MCDM, TOPSIS, Fuzzy numbers, Fuzzy positive ideal solution, Fuzzy negative ideal solution**

Introduction:

TOPSIS METHOD:

TOPSIS is one of the useful Multi Attribute Decision Making techniques that are very simple and easy to implement, so that it is used when the user prefers a simpler weighting approach. On the other hand, the AHP approach provides a decision hierarchy and requires pairwise comparison among criteria (Lee et al., 2001). TOPSIS method was firstly proposed by Hwang & Yoon (1981). According to this technique, the best alternative would be the one that is nearest to the positive ideal solution and farthest from the negative ideal solution (Benitez et al., 2007). The positive ideal solution is a solution that maximizes the benefit criteria and minimizes the cost criteria, whereas the negative ideal solution maximizes the cost criteria and minimizes the benefit criteria (Wang & Chang, 2007; Wang &Elhag, 2006; Wang & Lee, 2007; Lin et al., 2008). In other words, the positive ideal solution is composed of all best values attainable of criteria, whereas the negative ideal solution consists of all worst values attainable of criteria (Ertuğrul&Karakasoğlu, 2009).

Decision making problem is the process of finding the best option from all of the feasible alternatives. In this paper, from among multicriteria models in making complex decisions and multiple attribute models for the most preferable choice, technique for order preference by similarity to ideal solution (TOPSIS) approach has been dealt with. In real-word situation, because of incomplete or non-obtainable

information, the data (attributes) are often not so deterministic, there for they usually are fuzzy/imprecise. Therefore, the aim of this paper is to extend the TOPSIS method to decision-making problems with fuzzy data. In this paper, the rating of each alternative and the weight of each criterion are expressed in triangular fuzzy numbers. The normalized fuzzy numbers is calculated by using the concept of *α-cuts*. Finally, a numerical experiment is used to illustrate the procedure of the proposed approach at the end of this paper.Decision making problem is the process of finding the best option from all of the feasible alternatives. In this paper, from among multicriteria models in making complex decisions and multiple attribute models for the most preferable choice, technique for order preference by similarity to ideal solution (TOPSIS) approach has been dealt with. In real-word situation, because of incomplete or non-obtainable information, the data (attributes) are often not so deterministic, there for they usually are fuzzy/imprecise. Therefore, the aim of this paper is to extend the TOPSIS method to decision-making problems with fuzzy data. In this paper, the rating of each alternative and the weight of each criterion are expressed in triangular fuzzy numbers. The normalized fuzzy numbers is calculated by using the concept of *α-cuts*. Finally, a numerical experiment is used to illustrate the procedure of the proposed approach at the end of this paper.

The **Technique for Order of Preference by Similarity to Ideal Solution** (**TOPSIS**) is a multi-criteria decision analysis method, which was originally developed by Hwang and Yoon in 1981[1] with further developments by Yoon in 1987,[2] and Hwang, Lai and Liu in 1993.[3]TOPSIS is based on the concept that the chosen alternative should have the shortest geometric distance from the positive ideal solution (PIS)[4] and the longest geometric distance from the negative ideal solution (NIS).[4] It is a method of compensatory aggregation that compares a set of alternatives by identifying weights for each criterion, normalising scores for each criterion and calculating the geometric distance between each alternative and the ideal alternative, which is the best score in each criterion. An assumption of TOPSIS is that the criteria are monotonically increasing or decreasing. Normalisation is usually required as the parameters or criteria are often of incongruous dimensions in multi-criteria problems.[5][6] Compensatory methods such as TOPSIS allow trade-offs between criteria, where a poor result in one criterion can be negated by a good result in another criterion. This provides a more realistic form of modelling than non-compensatory methods, which include or exclude alternative solutions based on hard cut-offs.[7] An example of application on nuclear power plants is provided in.[8]

Normalisation:

Two methods of normalisation that have been used to deal with incongruous criteria dimensions are linear normalisation and vector normalisation.Linear normalisation can be calculated as in Step 2 of the TOPSIS process above. Vector normalisation was incorporated with the original development of the TOPSIS method,[1] and is calculated using the

Following Formula:

In using vector normalisation, the non-linear distances between single dimension scores and ratios should produce smoother trade-offs.[9]he*TOPSIS* method is a technique for establishing order preference by similarity to the ideal solution, and was primarily developed for dealing with real-valued data. This technique is currently one

of most popular methods for Multiple Criteria Decision Making (*MCDM*). In many cases, it is hard to present precisely exact ratings of alternatives with respect to local criteria and as a result these ratings are seen as fuzzy values. A number of papers have been devoted to fuzzy extensions of the *TOPSIS* method in the literature, but these extensions are not complete since the ideal solutions are usually presented as real values (not by fuzzy values) or as fuzzy values which are not attainable in the decision matrix. In most of these papers, a defuzzification of elements of the fuzzy decision matrix is used, which leads inevitably to a loss of important information and may even produce the wrong results. In this paper, we propose a new direct approach to the fuzzy extension of the *TOPSIS* method which is free of the limitations of other known approaches. We show that the distances of the alternatives from the ideal solutions may be treated (in some sense) as modified weighted sums of local criteria. It is known that using weighted sums is not the best approach to the aggregation of local criteria in many real-world situations. Therefore, here, we propose the use, in addition to weighted sums, some other types of local criteria aggregation in the *TOPSIS* method and we develop a method for the generalization of different aggregation modes, providing compromised final results.

Supplier selection has become a very critical activity to the performance of organizations and supply chains. Studies presented in the literature propose the use of the methods Fuzzy TOPSIS (Fuzzy Technique for Order of Preference by Similarity to Ideal Solution) and Fuzzy AHP (Fuzzy Analytic Hierarchy Process) to aid the supplier selection decision process. However, there are no comparative studies of these two methods when applied to the problem of supplier selection. Thus, this paper presents a comparative analysis of these two methods in the context of supplier selection decision making. The comparison was made based on the factors: adequacy to changes of alternatives or criteria; agility in the decision process; computational complexity; adequacy to support group decision making; the number of alternative suppliers and criteria; and modeling of uncertainty. As an illustrative example, both methods were applied to the selection of suppliers of a company in the automotive production chain. In addition, computational tests were performed considering several scenarios of supplier selection. The results have shown that both methods are suitable for the problem of supplier selection, particularly to supporting group decision making and modeling of uncertainty. However, the comparative analysis has shown that the Fuzzy TOPSIS method is better suited to the problem of supplier selection in regard to changes of alternatives and criteria, agility and number of criteria and alternative suppliers. Thus, this comparative study contributes to helping researchers and practitioners to choose more effective approaches for supplier selection. Suggestions of further work are also proposed so as to make these methods more adequate to the problem of supplier selection.Decision making is the process of finding the best option among the feasible alternatives. In classical multiple criteria decision-making (MCDM) methods, the ratings and the weights of the criteria are known precisely. Owning to vagueness of the decision data, the crisp data are inadequate for real-life situations. Since human judgments including preferences are often vague and cannot be expressed by exact numerical values, the application of fuzzy concepts in decision making is deemed to be relevant. In this paper, we

proposed the application of a fuzzy distance formula in order to compute a crisp value for the standard deviation of fuzzy data. Then, we use this crisp value of the standard deviation to normalize the fuzzy data using the distance formula again. In our normalization approach, we have enough flexibility to consider various types of fuzzy numbers (such as triangular, trapezoidal, and interval). Finally, we use the technique for order preference by similarity to an ideal solution to determine the ranking order of the alternatives. A numerical example from the literature is solved to demonstrate this applicability of the proposed model. We also compare our proposed approach with similar methods in the literature using some examples with known results and a number of randomly generated test problems. The results point to the applicability of our method and signify its effectiveness in identifying solutions.

Conclusion:

The present study explored the use of TOPSIS and fuzzy TOPSIS in solving a Laptop selection problem. The aim was to investigate the dimensions of Laptop quality, by adapting and extending the TOPSIS and fuzzy TOPSIS models. Moreover, the methods and experiences learned from the study can be valuable to the company's future strategic planning. Empirical results showed that the proposed methods are viable approaches in solving the proposed Laptop selection problem. TOPSIS is a viable method for the proposed problem and is suitable for the use of precise performance ratings. When the performance ratings are vague and inaccurate, then the fuzzy TOPSIS is the preferred technique. In addition, there exists other worth investigating MCDM methods for a Laptop selection problem. This becomes one of the future research opportunities in this classical yet important research area.Sampling is a major limitation in this study. Since the survey was conducted based on a sample in Toshiba, Sony, LG, Acer,Samsung,Apple,HP,Dell, Lenovo,HCL comparison based on isprocessor.

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