Grading of Universities by Group of Experts using Fuzzy AHP and Fuzzy TOPSIS

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Abstract - **Our country has one of the largest higher education system in the world, comprising of more than 500 universities situated in different states. Many Indian universities are well named and more popular, so often people get confused to select best one for their better qualification. In this paper efforts were made to provide solution for ranking of higher educational institutions using MCDM techniques though customized software in which different experts gives their weighted values to attributes of ranking software and ranking of different universities are derived based on the different weighted values assigned by different experts namely expert1, expert 2 and expert3 to select best university among the given universities. ranks obtained through experts are compared and found to be satisfactory. The attributes of performance & criterion are always having human decision making element which are sometimes contrary, confusing and ambiguous. To deal this ambiguity of attribute & criterion the approach of AHP, Fuzzy AHP and Fuzzy TOPSIS techniques applied to obtain refined and more realistic rankings.**

keywords - **Multi criteria decision making (MCDM),Analytic hierarchy process(AHP),Fuzzy analytic hierarchy process (FAHP), Fuzzy technique for order preference by similarity to ideal solution (FTOPSIS)**

I. INTRODUCTION

Every human need a better qualification degree in hand to select a best university because a university allows you to choose your preferred choice of line or career and also provide a rich cultural and social environment in the life. A university helps you to learn the tricks and skills of learning essay writing research, group discussion and so on. Nowadays having maximum best university in each country so selection of best university is difficult for student & parents, that's why deciding ranking of university is more important.

Ranking of universities is aMulti criteria decision making problem. It refers to making decisions in the presence of multiple, usually conflicting criteria. Several authors have reviewed MCDM techniques previously. Knezevic et al. [1] have applied a hybrid model which is based on a combination of classical and fuzzy MCDM methods to analyze the problem of employee productivity in electrical power supply companies of Serbia. Dooki et al. [2] have presented a hybrid method of FAHP and FTOPSIS to select the best chief inspector of banks based on some various qualitative and quantitative criteria with different priorities. Soloukdar and Parpanchi [3] have identify the most important criteria and indicators inselection of business intelligence vendors, and ranking the vendors of such tools using FAHP and FTOPSIS. Awasthi and Chauhan [4] have proposed a hybrid approach integrating affinity diagram, AHP and fuzzy TOPSIS for city logistics planning. Kutlu and Ekmekcioglu [5] have also used fuzzy TOPSIS and fuzzy AHP for fuzzy failure modes and effects analysis. Agirgun [6] has presented ranking B2C(business to consumer) web sites with AHP and TOPSIS under fuzzy environment. Ghosh [7] has proposed model for ranking of the faculty members for evaluating their performances through AHP and TOPSIS methods. Comparative analysis of AHP and FAHP for multi criteria inventory classification model has been presented by Kabir and Hasin [8]. Buyukozkan and Cifci [9] have focused on hybridization of fuzzy AHP and fuzzy TOPSIS based strategic analysis in healthcare industry. Dagdeviren et al.[10] have used AHP and TOPSIS methods for weapon selection. Amiri [11] has applied AHP and fuzzy TOPSIS method for project selection.

In this paper we have used MCDM techniques though customized software [12] in which different experts areto select the best criteria for university then apply to MCDM method based fuzzy AHP and fuzzy TOPSIS techniques to evaluate the ranking of universities.

II. MULTICRITERIA DECISION MAKING (MCDM) METHOD

Multi criteria decision makingis measured as a complex decision making tool to deal with the process of making decision among number of alternatives with conflicting criteria on them. FAHP and TOPSIS methods are the most commonly used MCDM methods. AHP is one of the very popular MCDM method deals with complex problems and FAHP is an extension of original AHP method suggested by saaty(1980)(2000) to deal with qualitative and quantitative data. TOPSIS method is a method of support decision that is based on the concept with the best alternative that is, the closest to the ideal solution and farthest from negative ideal solution. The steps for implementing the FAHP and FTOPSIS[14] processes areillustrated as follows:-

STEP-I: Analytic hierarchy process is the one of the most popular analytical techniques for complex decision making problems. T.L.Saaty (1980, 2000) [15][16],developed AHP, which decomposes a decision-making problem in to a system of hierarchies of objectives, attributes and alternatives. It helps the decision makers to set priorities and make the best decision. So the AHP is most highly regarded and widely used decision making method. It can efficiently deal with tangible (i.e. objective) as well as non-tangible (i.e. subjective) attributes.

The steps for implementing the AHP process are illustrated as follows:-

- Define the Objectives.
- Identify the Criteria/Attributes.
- Choose the Alternatives.
- Construct the pair wise comparison matrices using Satty's 9-point scale shown in Table 1.

TABLE 1: Saaty's Nine Point Scale

Compared to 2nd alternative,the 1st alternative is	Numericalrating
Extremely preferred	9
Very strongly preferred	7
Strongly preferred	5
Moderately preferred	3
Intermediate judgment betweentwo adjacent judgment	2, 4,6,8

- Calculating the geo metric mean
- Determine the maximum Eigen value
- Calculating the Consistency index
- Obtain the random index (RI) for the number of attributes used in decision making.
- Calculating the consistency ratio CR
- Compare the pair wise alternatives.
- Calculate final ranking.

Fuzzy AHP is Fuzzification of the AHP method.In some situations, experts want to use the uncertainty while performing the comparisons of the alternatives. For taking uncertainties into consideration fuzzy numbers are used instead of crisp numbers.The method proposed by Chen and Hwang (1992) first converts linguistic terms into fuzzy numbers and then the fuzzy numbers into crisp scores [13].
Hierarchy of University ranking process is depicted in Figure 1 as there are three layers where upper layer represents goal and second layer represents university five criteria. Whereas last layer (leaf) represent alternatives available i.e. groupof university to be ranked.

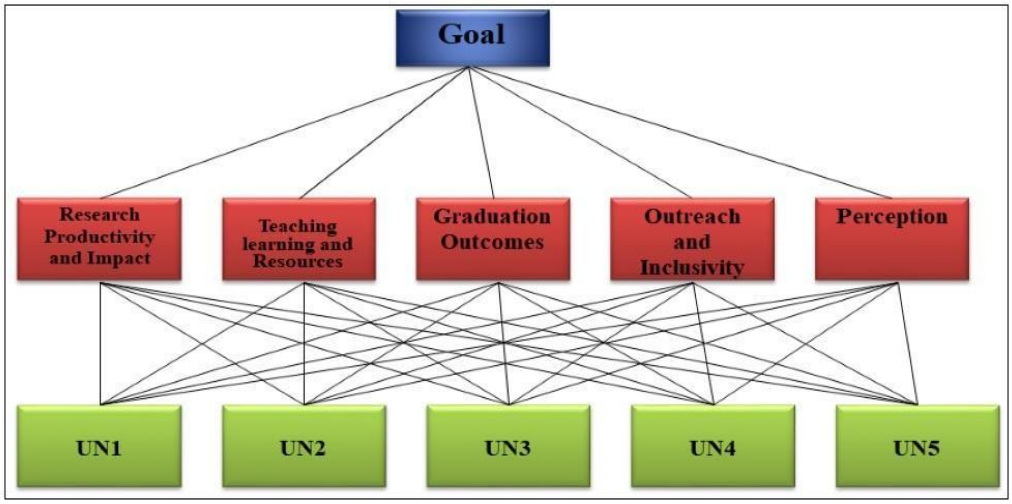

Figure 1: Hierarchy of University Ranking

STEP-II: TOPSIS thus gives a solution that is not only closest to the hypothetically best, that is also the farthest from the hypothetically worst. The main procedure of the TOPSIS method for the selection of the best alternative from among those available is described below:
Step 1: Determine the objective, and to identify the attributes.
Step 2: This step represents a matrix based on all the information available on attributes.

Step 3: Obtain the normalized decision matrix.Step 4:Obtain the weighted normalized matrix.
Step 5: Derivesthe ideal and complimentaryideal solutionsStep 6:Obtain the separation measure for each alternative.
Step 7: The relative closeness to the ideal solution and the corresponding rank of the candidate.That is a overall steps of TOPSIS through we can decide the rank.

III. MCDM BASED CUSTORMIZED SOFTWARE

A user login screen of the software can be seen in Figure 2 through which a valid user can enter his/her user Id and password toutilize the software.

Figure 2: User login page

With the use of different MCDM methods, conclusions can be derived and solved for decision making problems by the user. For application and processing of MCDM techniques and methods, different criterion and alternatives are to be enlisted and tested fortheir suitability to analyse and derive a particular alternative for decision making.There are two ways for selecting criteria and alternatives: First is to directly input number of alternative and criteria and second is to load the input file consisting number of criteria and alternative along with data. The entire process of calculation of MCDM methods may be stored in file by providing file name in test name text box as shown in Figure 3.

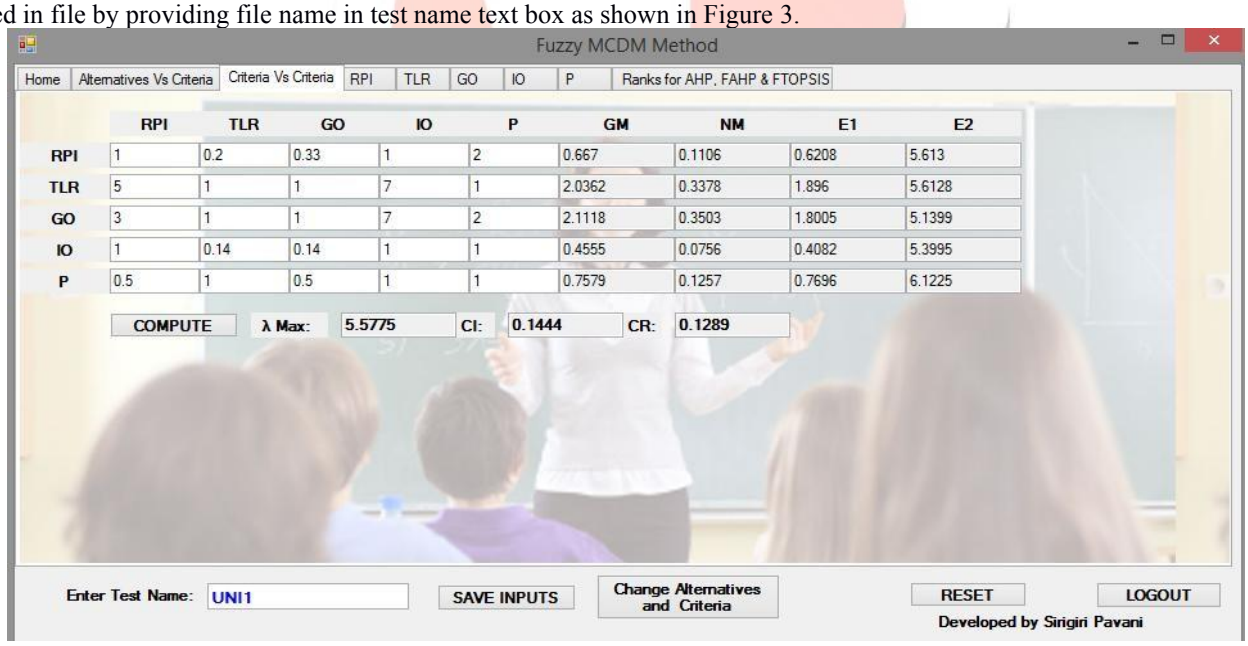

Figure 3: Weighted values of criteria to criteria for expert 1

For the simplicity five alternatives are considered and one of the criteria is compare to reaming four criteria's here we observe the CR value is less than or equal to 0.1. It means the given values are consistent.

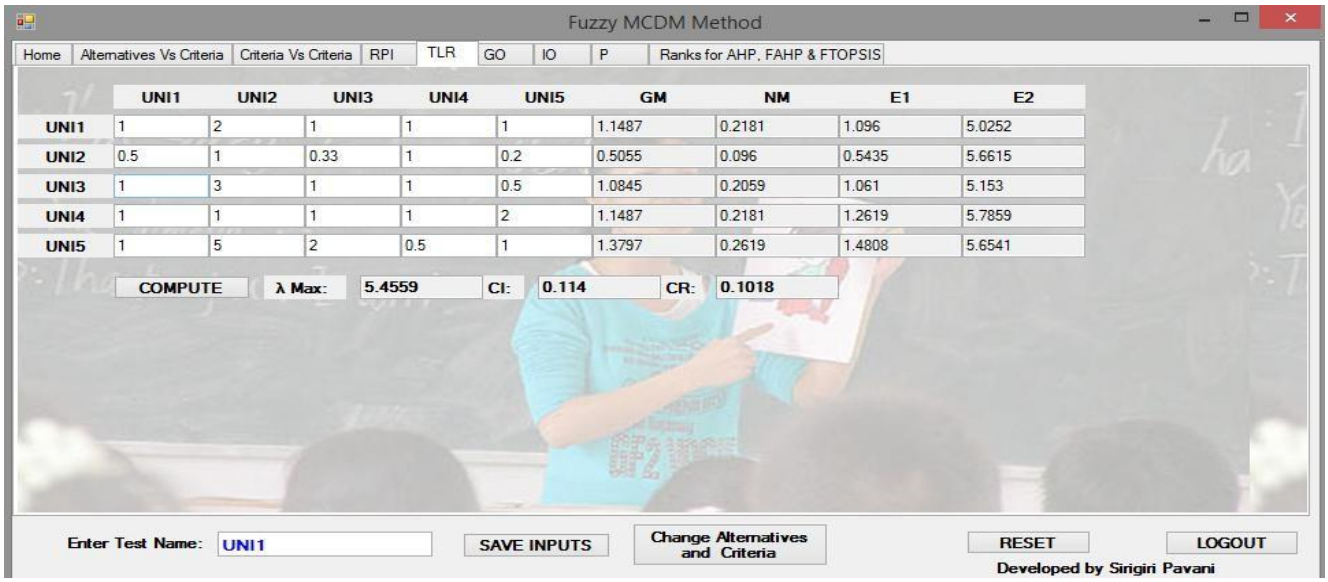

Figure 4: Comparison of Alternative to alternative for criteria TLR

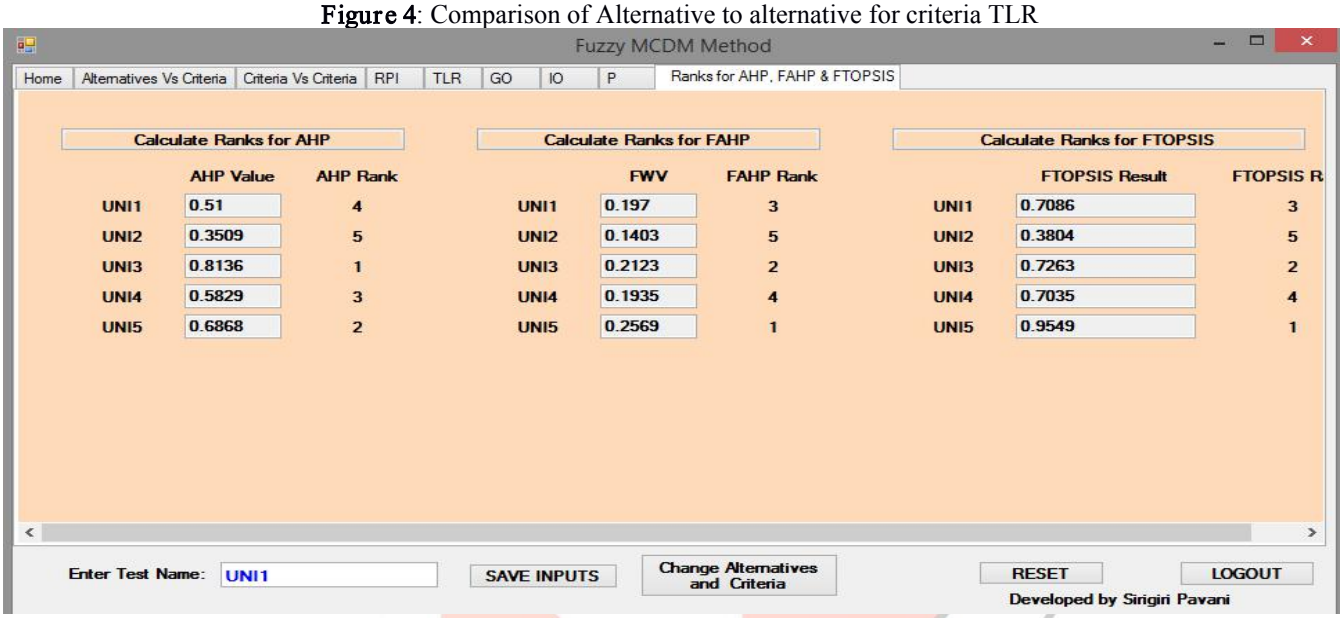

Figure 5: University ranking of expert1

The above Figure 5 shows a comparative ranking of the alternatives using AHP, FAHP and FTOPSIS, as it is clear the rank of thedifferent alternatives are different in case of different MCDM methods. If we consider first alternative (University 1) the rank is 3, university 5 rank is 1 respectively in case of AHP, FAHP and FTOPSIS, which is quite obvious. Before obtaining rank consistency is also checked and found under the limit which proves that the assigned weights are appropriate.

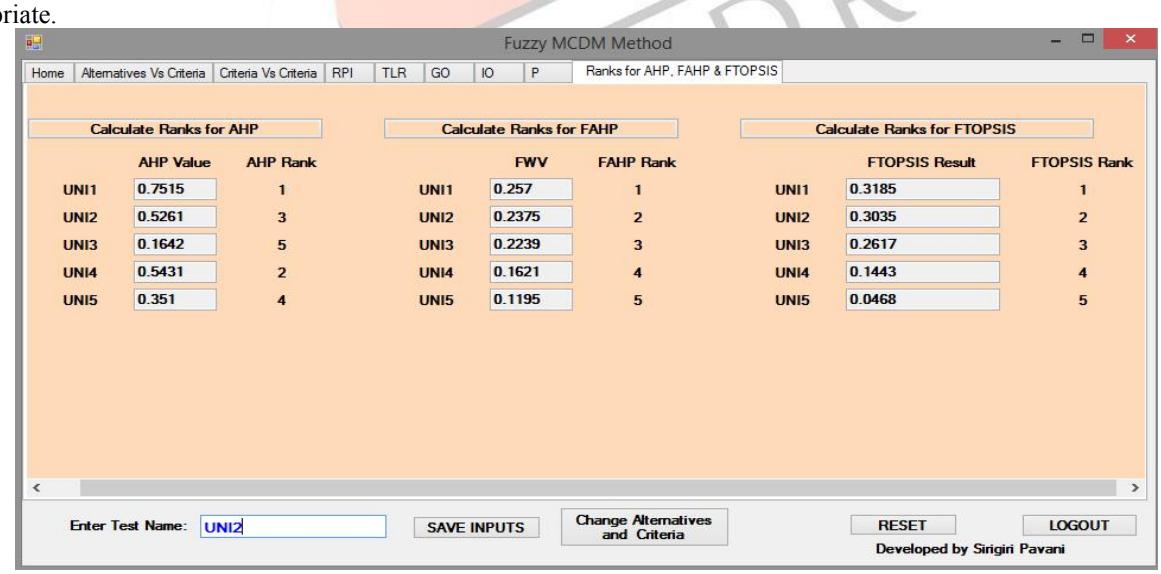

Figure 6: University ranking of expert2

The above Figure 6 shows to first alternative (University 1) the rank is 1, university5 rank is 5, respectively in case of AHP, FAHP and FTOPSIS, which is quite obvious. Before obtaining rank consistency is also checked and found under the limit which proves that the assigned weights are appropriate.

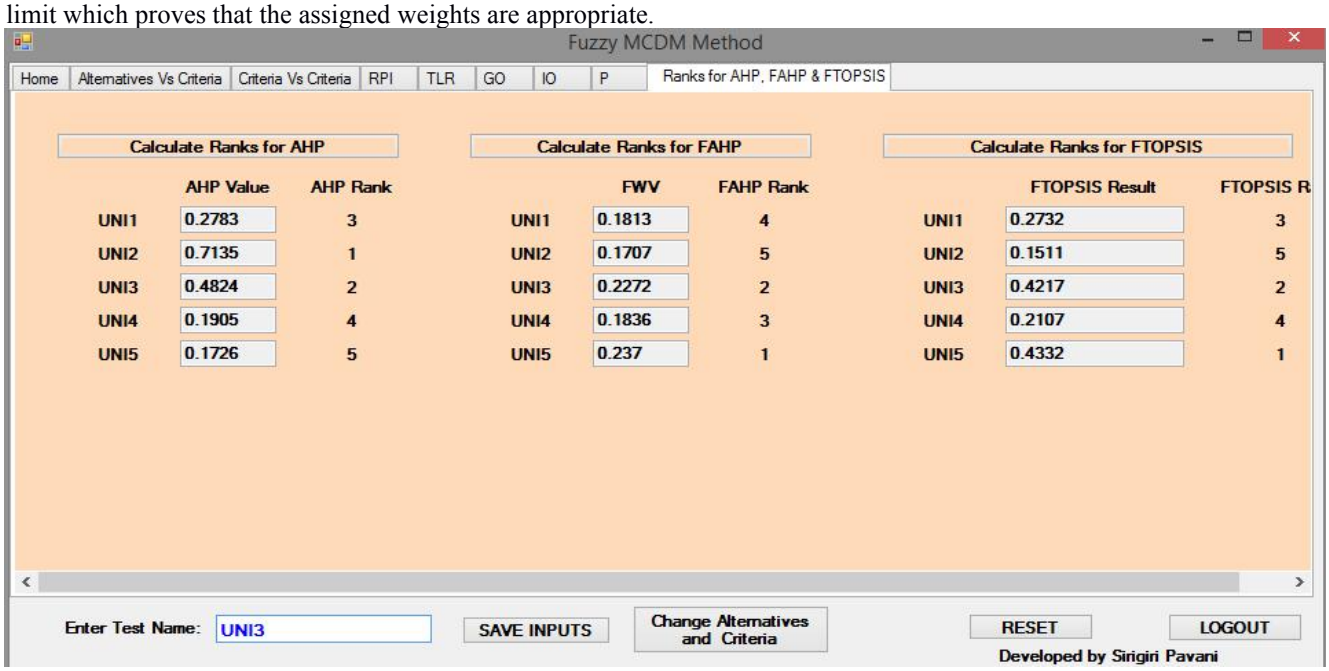

Figure7: University ranking of expert 3

The above figure shows to first alternative (University 1) the rank is 3, university 5 rank is 1 respectively in case of AHP, FAHP and FTOPSIS, which is quite obvious. Before obtaining rank consistency is also checked and found under the limit which proves that the assigned weights are appropriate.

IV. CONCLUSION

For complex decision making problems, MCDM methods are widely used in various domains. Selecting ranking of universities performance based on various conflicting criteria may also be treated as one of the complex decision making optimization problems. The customized software may help to do the experimental work and to compare the results. Three different experts aregiven their weighted values to each criteria of alternatives then customized software provides ranks for alternatives and out of the three experts, the weighted values of expert1 and expert 3 indicates the University 5 as best one. Byusing this software one can easily choose best university.

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