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A FUZZY TOPSIS MULTIPLE-ATTRIBUTE DECISION MAKING SYSTEM

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ABSTRACT
The school fees in many universities have over the past years increased to cater for high cost of living especially in many state in the United States of America. With the rise in the number of applicants, some alternatives based on certain criteria need to be selected. To solve decision on fuzzy problem there is need to apply fuzzy multiple attribute decision-making.In this case fuzzy multiple attribute decision making with TOPSIS and weighted products is applied to generate a system that is used to select bursary applicants for academic and other co-curriculum activities. In this case, crisp and fuzzy data are keenly selected in a manner that can create a defining factor and aspect that can utilize the parameters that the system employs (Ramadan, 2011). To ensure that all the elements work with consistency and proper focus makes the system operate with fairness, TOPSIS and weighted product FMADM were used to select the most qualified student for the award of the bursary. This takes into account that relative bias and deterministic data filled by the scholarship seeker in the system can raise the stakes or lower the chances for the student's selection.

KEYWORDS: Attribute, Decision Maker,Criteria,FMADM, TOPSIS method, Weighted Product.

INTRODUCTION

Education is one of the fundamental tools for development of a country.As the technology changes everydaythere is need for every child to be given an opportunity to access quality education regardless of the child's economical background. Through education, students are able to advance their abilities so as they can have a diversified psychological nature that is mature and able to make them relate with their surroundings on a pure note. Despite the fact that some higher learning institutions have worked tirelessly to promote the access to education irrespective of the seeker's background, many questions remain unanswered. Some scholars have suggested that the eligibility of an individual should be based on issues that are addressable in their fine forms.As per the research done by these scholars, the best scheme should be for the decision maker to give priority on certain criteria. The decision maker gives preference on weighted criteria to make computation easier. As a result, there has been the emergence of the fuzzy models(Yuan-guang, 2008). Fuzzy models are used in research and expansion phase to select projects with multiple decisions making. As for this project, qualitative and quantitative criteria are used.The cost and other acquired advantages are included in this cost.Due to this aspect, TOPSIS algorithm is used in Fuzzy Multiple Attribute Decision Making(FMADM)for assessing the best bursary applicants and it aids the decision maker to make quick selection of the most eligible applicants.TOPSIS algorithm is used in multiple criteria group decision.

MATERIAL AND METHODS

TOPSIS algorithmanalyzes issues that relate to a setting. The data, which is applied in the TOPSIS algorithm,is crisp data that gives an output of quantitative and qualitative data.TOPSIS use multiplication operation of triangular fuzzy number in order to solve delinquency in the decision making phase. The Fuzzy TOPSIS multiple attribute decision making then accesses the applicant's ability to get the reward of the bursary.

The mechanism employs client-based procedures. This follows the aspect that fuzzy scheme uses the information provided from a source to follow the steps defined for it follow. This acts as a general lead meant to obtain the best fit(Attaei, 2010).The procedure entailed is specific to the steps describable below:

1. The initial tempo is to set up the key parameters. These parameters are two and marginally intertwined to operate. Alternatives are set for the reality check. Special symbols are selected with due respect to promote the chance. The key issue is to set the alternative for the characters. It is good to note that these characters are numerical.
2. The second step isto evaluate Fuzzy set where the weight of attribute and degree of suitability for alternative with criteria is set and later evaluated. This entails the weight of criteria and degree of suitability for each alternative with the criteria.

In the case of TOPSIS mechanism, five steps are employed as defined in the table below(Moneiyan, 2011):

Description	Formula applicable	Comment
1. There is normalization of the decision matrix. An equation is applicable to evaluate the performance of necessary alternatives	$Xij=yij/\sqrt{\left((1)\sum_{i=1}^{n}[\![(yij^2)]\!]\right)}$	The arithmetic used is deterministic of the next trend
2. Here, positive and negative ideals are determined by virtue that bases the concepts of normalized rating	rij=wij	All the variables are integers
3. Positive and negative ideal solutions are determined using the extremes that are present	$K^+=(r1^+,r2^+,r3^+,\ldots\ldots\ldots\ldots\ldots rn^+)$ $K^-=(r1^-,r2^-,r3^-\ldots\ldots\ldots\ldots\ldots\ldots.....rn^-)$	Each equation resembles the extreme to be taken
4. The distance for each specific ideal situation is determined from the respective extreme representation	1. $K_i^+=\sqrt{\sum_{j=1}^{m}(r1-(rij))^2}$ 2. $K_i^-=\sqrt{\sum_{j=1}^{m}((rij-(r1)^-))^2}$)	Each equation resembles the extreme to be taken
5. The preference value for every extreme is found out using the present alternatives	Derived from previous solutions	Numbers treated as digits

The weighted product method

In this scheme of FMADM, the logically manifested steps are three. This scheme is merge-able with others in a manner that obeys and details the fundamental bits of the decision process. It should be noted that recovery aspects should normally be given to the systems that are under milestone creation and minute focus on decisions(Chen, 2010). These steps are as detailed below:

1) There is the initial normalization of the decision matrix. The decision is based on the fuzzy modalities. A product is used to interrelate the powered rating.
2) Alternative's performance is determined using the provided equation. This equation is known as the weighted product performance formula.
3) The correlation of the preference alternative is determined. This determination is also based on the design formula that is believed to be accurate and perfect.

RESULT AND ANALYSIS

As found out from respective schemes, the government or private sectors that give the bursaries useevaluation data on the application to generalize a mechanism for awarding the bursaries to needy students.The process of selecting the bursary of the needy student is describable using the techniques that are provided for in the descriptions given in the paper. This is as follows (Zeleny, 1982):

1. The applicant's bursary details are entered. The system does control monitoring for ease of the next steps.
2. Eligibility for qualification is confirmed. In case there is ineligibility, an immediate rejection is fostered.
3. Once there is a rejection as provided for in the second step, the system shows the rejection details and shuts instantly.
4. In the case of acceptance from the second step, the bursarycriteria are checked. This is solely for affirmation.
5. There is a calculation of the procedures and rules of the bursary using the best schemes as already discussed.
6. The bursary award details are shown. A similar procedure seen in step three then follows.

When one entered the data of the student, the system is able to give the bursary application result by calculating rules of the bursary using the TOPSIS and weighted product. This makesthe selection of the students to be given bursaries easy and more accurate (Dubois & Prade, 1978).

RESULTS AND DISCUSSION

In this stage, the number of alternatives and attribute are set and three criteria are used based on student academic achievement and family background(Heilpern, 1997). Y1 for all the grade point the student got in previous years.Y2 is used to represent the financial stability of the family or the sponsors.Y3 is used to represent the number of dependents in the family.In this case, the preference for bursary awarding is given to the students with high grade points,the ones that come from poor background and the ones that come from families with high dependence ratio.Other student with lower academic achievement but were excelling in other extra curriculum activities are selected using the following criteria.Y4 represents the involvement of student in the community affairs,Y5 represents the skills and talent of the applicant,Y6 represents the moral values of the applicants.Y7 is used to represent the leadership quality of the student. The preference in this case is given to students best moral values, the one with skills and talent, the one that are involved in communal duties andone with good leadership qualities. The following students passed the requirement given in the administrator's passing grade.N1,N2,N3,N4,N5,N6,N7,N8,N9.In order to grade the student, the decision for the academic bursaries is represented in the table below(Terano, Asai, & Sugeno, 1992).

CRITERIA	LIGUISTIC VARIABLES	FUZZY NUMBERS
Y1	Medium	0.25,0.5,0.75
Y2	High	0.5,0.75,1.0
Y3	Very high	0.75,1.0,1.0

For non-academicbursaries the criteria to grades the applicants is represented as in the table below(Klir & Bo, 1995):

CRITERIA	LIGUISTIC VARIABLE	FUZZY NUMBER
Y1	Medium	0.25,0.5,0.75
Y2	High	0.5,0.75,1.0
Y3	Very high	0.75,1.0,1.0
Y4	Very low	0.00,0.25,0.5
Y5	Very low	0.00,0.25,0.5
Y6	High	0.5,0.75,1.0
Y7	Very high	0.75,1.0,1.0

In this case, rating of the student by the decision maker is represented as in the table below:

Alternative	Y1	Y2	Y3	Y4	Y6	Y7
N1	560	Low	8	Good	Very good	Good
N2	489	medium	2	Very good	Good	Poor
N3	563	Medium	5	Excellent	Good	Poor
N4	578	High	9	Good	Very good	Good
N5	412	Low	5	Excellent	Poor	Good
N6	458	Very low	4	Very good	Excellent	Very good
N7	514	Very high	7	Good	Poor	Poor
N8	509	Medium	8	Low	Good	Good
N9	477	low	3	Low	Very good	Very good

The results of TOPSIS for academic and non-academic bursaries are represented in the table and are used to choose the best candidates in order of their preference.Questions that are relevanthelp in complete evaluation in a manner that allows decision-making to be realistic and accurate(Xu, 2008).

CONCLUSION

It is noticed that selection of the bursaries is done using FMADM with TOPSIS and weighted product method. The order of preference after calculation varies in both academic and non-academic bursaries because different approach can be applied in the analyses(Kusumadewi, Hartati, & Harjoko, 2006).Preferenceis given to student with highest grades both in academic and non-academic bursaries. The resultant issue is fairness and timesavingaspects of the selection process using a good system.

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