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Application of Fuzzy Multy Attribute Decision Making Method in Decision Making System for Determining the Provision of Achievement Scholarship in SMP N 1 SIMPATI

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Abstract. Prospective recipients of scholarships are chosen based on the criteria determined by the institution that gives the scholarship. Scholarships are given as well as awards for outstanding students. To help determine who receives a scholarship, a method is needed that can provide valid scholarship recipient recommendations. Therefore Fuzzy Multi Attribute Decision Making (FMADM) is used. This method was chosen because it was able to select the best alternative from a number of alternatives. Here the alternative in question is the prospective scholarship recipient based on predetermined criteria. The study was conducted by looking for weight values for each attribute. Then the ranking process is carried out which determines the optimal alternative.

Keywords: FMADM,Decision system,Scholarships.

1. INTRODUCTION

In determining the acceptance of scholarships in general, he has used computer assistance, but his use has not been optimal. This results in ineffective scholarship data processing, especially in terms of time and the number of iterations of the process that can actually be streamlined. Therefore, it is necessary to have a system that supports the process of determining scholarship recipients, so as to shorten the selection time and improve the quality of decisions in determining scholarship recipients.

The selection process as to who is entitled to receive scholarships at SMP N 1 SIMPATI is still an obstacle, especially in the decision-making system that is less effective and efficient. This is because there is no objective method and a good computer system to decide quickly based on existing data who is entitled to receive the scholarship.

Many schools usually rely on informal methods of solving problems. Belief in tradition causes the parties to take the same decision as the previous decision on the same problem or opportunity, ask for advice from the authorities and make decisions based on the advice of an expert or someone of a higher level, so that the results of the decision have an impact on the scholarship recipients especially students who excel or are unable to cause inequality and social inequality.

2. METHODS

Fuzzy logic is the study of methods and principles of thought wherein this thought produces a new preposition from the old preposition. In the old logic, a preposition is needed between right and wrong, the truth value of the preposition is between 1 or 0. Fuzzy logic makes a general statement of the two old logic values by assessing the truth of a preposition to be used any number between intervals (1,0).

2.1 Fuzzy Multy Attribute Decision Making (FMADM)

The FMADM algorithm is:

1. Give the value of each alternative (Ai) on each predetermined criterion (Cj), where the value is obtained based on the crisp value; i = 1,2, ... m and j = 1,2, ... n.

2. Give a weight value (W) which is also obtained based on the value of crisp.

3. Normalize the matrix by calculating the normalized performance rating value (rij) from the Ai alternative on the Cj attribute based on the equation adjusted for the attribute type (profit / benefit = MAXIMUM attribute or cost / cost = MINIMUM attribute). If it is in the form of profit, the value of crisp (Xij) from each attribute column is divided by the value of crisp MAX (MAX Xij) from each column, while for the cost attribute, the value of crisp MIN (MIN Xij) from each attribute column is divided by the value of crisp (Xij) each column.

4. Ranking process by multiplying the normalized matrix (R) with the weight value (W).

5. Determine the preference value for each alternative (Vi) by adding the product times between the normalized matrix (R) and the weight value (W). A greater value of Vi indicates that alternative Ai is more selected .[1]

2.2 Decent Living Costs

Based on Republic of Indonesia Minister of Manpower and Transmigration Regulation No. 17 of 2005 concerning Components and Implementation of Stages of Achieving Decent Living Needs [2], stating that Decent Living Needs is a standard of needs that must be met by a single worker to live properly both physically, non-physically and socially for the needs of one month. The number of types of needs initially 46 types in the Minister of Manpower Decree No. 17 of 2005 to become 60 types of Decent Living Costs in the Minister of Manpower Decree No. 13 of 2012 [3].

In addition to the addition of 14 new types of Decent Living Costs, there are also adjustments/ additions to the type of quality and quantity of Decent Living Costs and changes in the types of needs. The following are components of the food and beverage component of the Decent Living Costs standard based on Minister of Manpower Decree No. 13 of 2012 [3]:

2.3 Decision Support System (DSS)

According to Keen and Scoot Morton: "Decision Support Systems are a combination of individual intelligence sources with the ability of components to improve the quality of decisions. Decision Support System is also a computer-based information system for decision-making management that handles semi-structural problems.

With the above understanding, it can be explained that the decision support system is not a decision making tool, but rather a system that helps decision makers by equipping them with information from data that has been processed relevantly and is needed to make decisions about an issue more quickly and accurately. So this system is not intended to replace decision making in the decision making process.

3. RESULTS AND DISCUSSIONS

Input to make the decision making process of some of these alternatives is done by using the required variables, are as follows:

1. Average Report Card Value
2. Number of siblings
3. Income of parents
4. Number of dependents of parents

The output generated from this study is an alternative that has the highest value compared to other alternative values. In this study the results are taken from the highest alternative to the lowest alternative. The final results released by the program will come from the value of each criterion, because each criterion has a different value. The alternative order that will be displayed starts from the highest alternative to the lowest alternative, the alternative in question is the student.

3.1 Application SARIMA Model

Fuzzy Multiple Attribute Decision Making (FMADM) is one method that can help decision makers in making decisions on several alternative objects that must be taken through several criteria. Alternative decisions from criteria to criteria that contain uncertainty. Usually the judgments given by decision makers are carried out qualitatively and represented linguistically. Then the values of y, q, z are calculated by the equation:

$$Y_1 = \left(\frac{1}{k}\sum_{t=1}^{k}(O_{ik}A_i)\right)$$

$$Q_1 = \left(\frac{1}{k}\sum_{t=1}^{k}(P_{ik}B_i)\right)$$

$$Z_1 = \left(\frac{1}{k}\sum_{t=1}^{k}(Q_{ik}C_i)\right)$$

$$i = a, b, c, \ldots . n$$

In Fuzzy Multiple Attribute Decision Making (FMADM). The first thing to do is determine alternative decisions. The alternatives that will be produced are:

a. Linguistic variables that present the importance weight for each criterion, are: T (importance) W = (SR, R, C, T, ST) with SR = Very Low R = Low, C = Enough, T = High, ST = Very High, each of which is represented by a triangular fuzzy number as follows:
   SR= (0, 0, 0.25)
   R = (0, 0.25, 0.5)
   C = (0.25, 0.5, 0.75)
   T = (0.5, 0.75, 1)
   ST = (0.75, 1, 1)
b. Degree of the suitability of the decision with the decision criteria are: T (compatibility) S = {SK, K, C, B, SB}, with SK = Very Less, K = Less, C = Enough, B = Good, and SB = Very Good, each of which is represented by the fuzzy triangle numbers as follows
   SK = (0, 0, 0.25)
   K = (0, 0.25, 0.5)
   C = (0.25, 0.5, 0.75)
   B = (0.5, 0.75, 1)
   SB = (0.75, 1, 1)
c. Hierarchy structure can be seen in the image below:

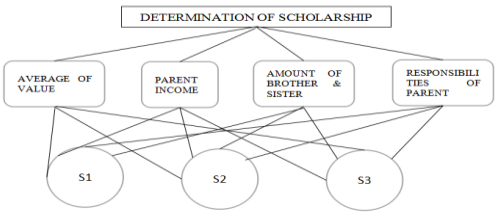

Figure 1 Hierarchical Structure

d. Average report cards

Table 1 Semester Criteria Weight

No	Average Value	Value
1.	Value < 60	0
2.	60 – 65	0.25
3.	65 – 70	0.50
4.	70 – 75	0.75
	Average ≥ 7.50	1

e. Criteria for Total Parent Income

Table 2 Weight Criteria for Total Parent Income

Parent Income	Value
X ≥ Rp 4.000.000	0
Rp 3.000.000 < X < Rp 4.000.000	0.25
Rp 2.000.000 < X ≤ Rp 3.000.000	0.5
Rp 1.000.000 < X ≤ Rp 2.000.000	0.75
X ≤ Rp 1.000.000	1

f. Criteria of Number of Siblings

Table 3 Weight of Criteria Siblings

Siblings	Value
1	0
2	0.25
3	0.5
4	0.75

≥ 5	1

3.2 Interest Rating and Criteria of Criiteria Match

a.Rating Interests

Tabel 5 Importance Rating

Criteria	C_1	C_2	C_3	C_4
Match rating	ST	ST	C	C

3.3 Fuzzy Match Index For Each Alternative

By substituting a fuzzy equatorial number into each linguistic variable a fuzzy match value is obtained, including:

Tabel 7 Indek Kecocokan setiap alternatif

the student (the sample)	Rating Kecocokan				Indeks Kecocokan *Fuzzy*		
	C_1	C_2	C_3	C_4			
Student -1	B	SK	B	B	0.1562	0.375	0.6875
Student-2	B	B	SB	SB	0.28125	0.625	0.875
Student-3	SB	C	K	K	0.1875	0.4375	0.6250
Student-4	B	K	SB	C	0.1562	0.4375	0.7031
Student-5	SB	K	C	C	0.1718	0.4375	0.6265
Student-6	SB	B	B	K	0.2656	0.5625	0.7812
Student-7	SB	SK	SK	SK	0.1406	0.25	0.4062
Student-8	B	SK	SB	C	0.1562	0.375	0.6406
Student-9	SB	B	B	B	0.2964	0.625	0.875
Student-10	SB	SK	K	SK	0.1406	0.2812	0.4531

3.4 Decision Analysis Results

From the results of the decision analysis, it was found that each alternative scholarship had a weight value. Among them:

From the results of the analysis, students who have a weight value> = 0.75 will be entitled to receive scholarships, and students who have a weight value> = 0.60 will be considered, while students who have a weight value <0.60 are not entitled to receive a scholarship.

Table 9 Results of Scholarship Analysis

the student (the sample)	Total Weight Obtained	Conclusion Results
Student -1	0.56	Do not accept
Student-2	**0.87**	**Receive**
Student-3	0.57	Do not accept
Student-4	0.62	be considered
Student-5	0.62	be considered

Student-6	0.69	be considered
Student-7	0.25	Do not accept
Student-8	0.56	Do not accept
Student-9	**0.81**	**Receive**
Student-10	0.31	Do not accept

4. CONCLUSION

With the construction of this decision-making system, SMP N 1 Simpati is able to make decisions more quickly and effectively in determining the awarding of scholarships to students of SMP N 1 Simpati based on criteria, and the attributes provided in the system.The decision-making system that was built was able to reduce the level of doubt of the school in determining the awarding of scholarships in SMP N 1 Simpati. Decision making systems may not be able to solve problems faced by decision makers, but can be a stimulant in decision making.In the development of this decision support system application Students can view information about scholarships through the website. or more precisely students no longer need to visit all the time to the administration office of SMP N 1 SIMPATI, now students only need to visit the web to get information.

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