Decision Support System for Foundation Beneficiaries Using the Simple Additive Weighting (SAW) Method

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Abstract

Receipt of compensation funds for underprivileged students needs to be selected so that they are not wrong in providing assistance, so that the recipients of assistance are students who deserve to receive. The decision support system is an effective way of selecting students who need compensation funds. The criteria are as a stage for selecting students who are entitled to grant aid, with these criteria all students who participate in receiving the compensation funds will be ranked. The results of the ranking are based on calculations, the first order is Farhan Rifai with a value of 0.8; second place is Sidratul Muntaha with a value of 0.7666

Keywords: Decision Support System, Compensation, SAW Method.

INTRODUCTION

The Compensation Template is a form of our concern for fellow creatures of God which should be carried out sincerely and voluntarily. Compensation is a fund allocated and issued by an agency/foundation to underprivileged people such as orphans. Giving compensation by the foundation to underprivileged students is an activity that has become a good habit to be carried out every year with the aim of easing the burden for those in need. The MDTANurul Ikhwan Foundation is one of the foundations that has made the activity of providing compensation to underprivileged students in the family economy and orphans a habit every year with a predetermined allocation of funds. The foundation in providing compensation to students every year is carried out with a direct system for paying monthly tuition fees and data collection is still carried out in recording in the ledger so that it is less effective and efficient in its implementation. Data collection that has not used a computerized system or manual data collection creates difficulties, such as in selecting students who receive compensation alternately each year with the allocation of compensation funds which will be given to 10% of the total number of students in each class per year with the allocated funds. The problem of decision making is basically a form of selection from various alternative actions that may be chosen, the process through a certain mechanism in the hope of producing the best decision.[1]. The SAW method is a method used in dealing with Fuzzy Multiple Attribute Decision Making (FMADM) situations or decision making by finding the optimal alternative from a number of alternatives with certain criteria.[2]. The Simple Additive Weighting (SAW) method is known as the weighted addition method. Basically the working concept of SAW is to find the weighted sum of the performance of each alternative on all attributes. The total score for the alternatives is obtained by adding

up all the multiplication results between the rating (which can be compared across attributes) and the weight of each attribute[3]. The rating of each attribute must be dimension-free in the sense that it has passed the previous matrix normalization process. Previous research has journals that use the Simple Additive Weighting (SAW) method.[4]. Designing a system that can assist the foundation in determining which students are eligible to receive foundation compensation for the annual period, so that it can be more efficient and effective in its implementation[5]. With the Simple Additive Weighting (SAW) method, the results of the calculation of ranking (rank) and the amount of the recommended aid fund are different[6]. The provision of financial assistance or financing is very helpful for small entrepreneurs in the context of business expansion, it's just that for the bank this also causes problems, because of the large number of problematic refunds.[7]. The SAW method because it provides the highest alternative value and gives the best ranking results[8]. The SAW method is carried out by finding the weight value for each criterion, and then making a process that will determine the optimal ranking of the alternative, which is the best student who will be considered by decision makers to get a scholarship.[9]. The method used in this study uses the SAW method, namely the Decision Making System method[10].

METHODS

Decision Support System

Basically DSS is almost the same as SIM because it uses a database as a data source[11]. DSS originates from MIS because it emphasizes the function of supporting decision makers at all stages, although the actual decision remains the exclusive authority of the decision maker. A class of computerized information systems at a higher level is the Decision Support System (DSS).[12]. DSS is almost the same as traditional MIS in that they both depend on a database as a data source. Although the actual decision is still the exclusive authority of the decision maker.

Simple Additive Weighting

The Simple Additive Weighting (SAW) method is often also known as the weighted addition method[13]. The basic concept of the Simple Additive Weighting (SAW) method is to find the weighted sum of the performance ratings on each alternative on all attributes[14].

$$r_{ij} = \begin{cases} \frac{X_{ij}}{\max X_{ij}^i} & \text{If } j \text{ is an attribute of benefit (Benefit)} \\ \frac{\min X_{ij}^i}{X_{ij}} & \text{If } j \text{ is the cost attribute (Cost)} \end{cases} \quad (1)$$

Where r_{ij} is the normalized performance rating of alternative A_i on attribute C_j ; $i=1,2,\dots,m$ and $j=1,2,\dots,n$. The preference value for each alternative (V_i) is given:

- r_{ij} = Normalized work rating.
- $\max_i$ = maximum value of each row and column. $\min_i$ = the maximum value of each row and column. X_{ij} = rows and columns of the matrix.

(r_{ij}) is the normalized performance rating of the alternative (A_i) on the attributes (C_j) $i = 1, 2, \dots, m$ and $j = 1, 2, \dots, n$.

$$V_i = \sum_{j=1}^n W_j r_{ij} \dots \dots \dots (2)$$

A larger V_i value indicates that alternative A_i is preferred.

Where :

V_i = final value of the alternative.

W_i = predetermined weight.

r_{ij} = matrix normalization

a larger value indicates that the alternative is preferred.

There are several steps in completing the Simple Additive Weighting (SAW) method. Which is applied as follows:

1. Determine the criteria used as a reference in decision support, namely C_i .
2. Determine the suitability rating of each alternative on each criterion.
3. Make a decision matrix based on the criteria (C_i).
4. Then normalize the matrix based on the equation that is adjusted to the type of attribute (profit attribute or cost attribute) in order to obtain a normalized matrix R .
5. The final result is obtained from the ranking process, namely the addition of the normalized matrix multiplication R with the weight vector so that the largest value is chosen as the best alternative (A_i) as the solution.

Annual Period Foundation Compensation

Compensation is a form of our concern for fellow creatures of God which should be carried out sincerely and voluntarily [15]. Compensation is a fund allocated and issued by an agency/foundation to underprivileged people such as orphans. Foundation compensation for the annual period is a fund in the form of assistance allocated and issued by a foundation to underprivileged students and the provision of compensation is carried out on an annual/periodic period every year. [16]. Compensation provided by the foundation to students with various criteria/alternatives that will be a reference in providing compensation. The criteria/alternatives for receiving foundation compensation include:

1. Students who are less well off in the family economy (amount of parents' income).
2. Students with family status, namely: orphans, orphans and orphans.
3. Students with how many children their parents depend on.
4. Students who excel / win from grade 2 to grade 6.

RESULTS & DISCUSSION

Application of the SAW Method

In determining students who are entitled to receive compensation at the MDTA Nurul Ikhwan Foundation, the school/foundation selects students-student and those who are entitled to become students who receive foundation compensation for the annual period with predetermined criteria. One of the solutions to the FMADM problem, criteria and weights are needed in carrying out the calculations so that the best alternative will be obtained as follows :

Determining each of the criteria can be seen in the table below:

Table 1: Code and Criteria Terms

Code	Criteria	Attribute
C1	Parents' Income	Benefits
C2	Family Status	Benefits
C3	Parental Dependence	Cost
C4	Student Achievement	Benefits

Furthermore, decision makers give preference weights to each criterion as W as shown in table 2:

Table 2 : Determination of W . Value

Criteria	Range (%)	Weight
C1	40	0.40
C2	25	0.25
C3	20	0.20
C4	15	0.15

Criteria for the amount of parental income.

Table 3 : Parental Income Criteria

Parent's income (C1)	Variable	Score
C1 ≤ IDR 500,000	Very high	1
C1 > IDR 500 thousand < C1 ≤ IDR 1 million	Tall	0.75
C1 > IDR 1 million < C1 ≤ IDR 1.5 million	Currently	0.50
C1 > IDR 1.5 million < C1 ≤ IDR 2.5 million	Low	0.25
C1 > IDR 2.5 million	Very low	0

Status criteria in the family

Table 4 : Criteria for Family Status

Family Status (C2)	Variable	Score
Orphans	Very high	1
Orphans	Tall	0.75
Orphans	Currently	0.50

Table 5 : Student Data Submitted

Alternative	Criteria			
	Parents' Income	Family Status	Parental Dependence	Student achievement
1	IDR 500,000	orphan	3 children	2
2	IDR 800,000	orphan	2 children	4
3	IDR 1,000,000	Orphan	4 kids	1
4	IDR 1,400,000	orphan	3 children	3
5	IDR 2,500,000	orphan	4 kids	2

The sample above is data from students who become alternatives, namely, A1 (Farhan Rifai), A2 (Syashi Ajeng Sachira), and A3 (Sidratul Muntaha), A4 (Aqila Zahra Daulay), and A5 (Alif Putra Kelana).

The ranking calculation value for each alternative with a value of V_i can be seen in the following table:

Table 6: Ranking Calculation Results

Alternative	V_i	Rank
A1	0.8	1
A2	0,6625	3
A3	0.7666	2
A4	0.5	4
A5	0,4666	5

From the calculation above, the first order is Farhan Rifai with a value of 0.8; second place is Sidratul Muntaha with a value of 0.7666; Syashi Ajeng Sachira with grades 0.6625; fourth place is Aqila Zahra Daulay with a value of 0.5 and the last order is Alif Putra Kelana with a value of 0.4666.

CONCLUSION

Based on the results of research and discussion of the decision support system for recipients of foundation compensation for this annual period, conclusions can be made, including: With this research, it can find out the requirements or criteria needed in applying for foundation compensation recipients such as criteria seen from the amount of parental income students, student status in the family, number of dependents of parents, and student achievements or champions. Applying the SAW (Simple Additive Weighting) method produces values from determining criteria, weighting, compatibility ratings, normalization, and rankings so as to produce values for each criterion. Designing a decision support system for the calculation above, the first order is Farhan Rifai with a value of 0.8; second place is Sidratul Muntaha with a value of 0.7666; Syashi Ajeng Sachira with grades 0.6625;

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