A Comparative Study using SAW, TOPSIS, SAW-AHP, and TOPSIS-AHP for Tuition Fee (UKT)

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Abstract. Tuition Fee or UKT has a different group, in which each group has a percentage each of the which has been set by the government based on the economy of each student. The absence of clear standardization in determining Tuition Fee raises many problems. The approach of Decision Support Systems (DSS) will help in the decision making of Tuition Fee students are more effective and efficient. The purpose of this study research is to compare the 4 DSS methods used in the decision making process, Simple Additive Weighting (SAW), Technique for Order Preference by Similarity to Ideal Solution (TOPSIS), a combination of Simple Additive Weighting (SAW) and Analytical Hierarchy Process (AHP), and Technique for Order Preference by Similarity to Ideal Solution (TOPSIS) and Analytical Hierarchy Process (AHP) is used in making Decision determination Tuition Fee students in accordance with established criteria determine the method relevant to the problem. By using a comparison of four methods: SAW, TOPSIS, SAW-AHP and AHP-TOPSIS, the experimental results obtained using accuracy measure where the highest accuracy obtained by TOPSIS-AHP is 80%, then followed by the TOPSIS method 78%, SAW-AHP 74% and SAW 76%, so the TOPSIS-AHP is the best method used in determining Tuition Fee.

1. Introduction

The decision-making process is not easy, this is a problem that is faced every day by everyone carrying out their activities. This arises because of the many alternatives to decisions we will make based on the considerations that we do to produce the best decisions. In some cases, the many choices or alternatives available make us confused or difficulty in making decisions about the problem. Current technological developments can be utilized to provide recommendations or considerations for the decisions we will make.

In this study, the authors chose the problem of Determining Tuition Fee the which is the tuition fee incurred each student specific at the state university at Indonesian. Since the issuance of Permendikbud Number 55 of 2013 concerning Tuition Fee raises several problems due to various factors in the determination Tuition Fee students, Many students felt that they disagreed with Tuition Fee and some students were unable to continue their studies in college because they could not afford the Tuition Fee that was charged to students. Make use Decision Support System (DSS) will assist the process of Determining Tuition Fee for students so that the determination of Tuition Fee can provide assessment Objective.
Research will compare right between the four methods that are often used in some cases the decision-making that is Simple Additive Weighting (SAW), Technique for Order Preference by Similarity to Ideal Solution (TOPSIS), as well as the incorporation of methods Simple Additive Weighting (SAW) and Analytical Hierarchy Process (AHP), and Technique for Order Preference by Similarity to Ideal Solution (TOPSIS) and Analytical Hierarchy Process (AHP) here we will determine the level of a covering accuracy of four methods are in determining Tuition Fee resulting in recommendation methods that are relevant for the problem.

2. Literature Review
Tuition Fee in Indonesian is UKT based on the regulation of the Ministry of Education and Culture of the Republic of Indonesia number 55 of 2013 is part of the Tuition Fee fees borne by each student based on his economic ability. Tuition Fee determination also consists of several groups determined based on the economic capacity of students [1].

Decision Support System (DSS) is a methodology used to support decision making. Decision support systems should be flexible, interactive and can be adapted to support solutions to specific unstructured management problems. Decision support systems usually use various models and are built through interactive and iterative processes so that they can run as expected. Decision Support Systems are now widely developed and can be used on PCs, applications or the web for many people to use even in different locations [2]. As for several methods that can be used in the determination of Tuition Fee such as Multiple Criteria Decision Making (MCDM), some examples of MCDM are Simple Additive Weighting (SAW), Technique for Order Preference by Similarity to Ideal Solution (TOPSIS), PROMENTHEE, and Analytical Hierarchy Process (SAW-AHP) [3].

3. Research Method
This study will compare the four methods that are often used in several cases of decision making, namely Simple Additive Weighting (SAW), Techniques for Order Preference with Similarity to Ideal Solutions (TOPSIS), and the incorporation of the Simple Additive method. Weighting (SAW) and Analytical Hierarchy Process (AHP), and Techniques for Order Preference with Similarity with Ideal Solutions (TOPSIS) and Analytical Hierarchy Process (AHP) here we will determine the level of accuracy of the closure of the four methods in determining Cost Education resulting in a recommendation method that relevant for the problem. Testing is done by calculating the level of accuracy using Accuracy Measure [4, 5].

4. Result and Discussion
The research was started by doing sample data Student Tuition Fee.

Table 1. Research data students of Universitas Sulawesi Barat

| No. | Name/Criteria | C1  | C2  | C3  | C4  | C5  | C6  | C7  |
|-----|---------------|-----|-----|-----|-----|-----|-----|-----|
| 1   | A1            | 500,000 | 1   | 1   | 10  | 5   | 6   | 10  |
| 2   | A2            | 500,000 | 1   | 1   | 10  | 5   | 6   | 10  |
| 3   | A3            | 250,000 | 1   | 1   | 7   | 8   | 6   | 5   |
| 4   | A4            | 500,000 | 1   | 1   | 7   | 5   | 6   | 10  |
| 5   | A5            | 900,000 | 1   | 10  | 10  | 5   | 6   | 10  |
| 6   | A6            | 1,500,000 | 1   | 1   | 10  | 5   | 6   | 10  |
| 7   | A7            | 500,000 | 1   | 15  | 10  | 5   | 6   | 10  |
| 8   | A8            | 500,000 | 1   | 1   | 10  | 5   | 6   | 10  |
| 9   | A9            | 500,000 | 1   | 1   | 7   | 5   | 6   | 10  |
| 10  | A10           | 500,000 | 1   | 1   | 7   | 5   | 6   | 10  |
| 11  | A11           | 500,000 | 1   | 1   | 10  | 5   | 6   | 10  |
Table 1 shows the student data that is used as a reference for determining UKT with 7 criteria, C1 is Parental Income, C2 is GPA, C3 is the amount of Siblings, C4 is Achievement, C5 is the amount of dependents, C6 is electrical fee, and C7 is water source where each of them have weights. Data that used was 50 student samples taken randomly, A1, A2, ..., A50.
Based on the data shown in Table 1, the results obtained from the ranking obtained from the 4 methods, then the results are compared so that they can see the results of the comparison between the methods of SAW, TOPSIS, SAW-AHP, TOPSIS-AHP in the case of the determination of tuition fee in Universitas Sulawesi Barat. The results of the comparison are accumulated in the accuracy measure formula which can be shown in Equation 1.

\[
\frac{\text{same amount of data}}{\text{lots of data}} \times 100\% 
\]

(1)

So that the accuracy of each method is obtained as follows:

- **SAW**
  \[ \frac{38}{50} \times 100 = 76\% \]

- **TOPSIS**
  \[ \frac{39}{50} \times 100 = 78\% \]

- **SWA-AHP**
  \[ \frac{37}{50} \times 100 = 74\% \]

- **TOPSIS-AHP**
  \[ \frac{40}{50} \times 100 = 80\% \]

In calculating the accuracy results have been obtained the results of comparisons of the four methods used. So as to obtain a comparison diagram of the calculation results of each method seen through the diagram in Figure 1.

![Figure 1. Comparison results of the four methods tested](image)

Based on the results of calculating the accuracy of each method by using manual calculation data in Figure 1, the most optimal method to use is evaluated from the accuracy of each method by inputting student data, so it can be said that the TOPSIS-AHP method is the most optimal method used so that TOPSIS-AHP is the best method used in determining Tuition Fee that is suggested by the author, it is because AHP has the highest accuracy value compared to the accuracy value of other methods which is as much as 80%, then followed by the TOPSIS method 78%, SAW-AHP 74% and SAW 76%.

5. Conclusion
From experiments on the problem of determining the Tuition Fee using the SAW, TOPSIS, and SAW-AHP methods, The selection of the TOPSIS-AHP method as the best recommended solution looks at the accuracy of each method using the accuracy measure formula where the TOPSIS-AHP has a similarity or an accuracy rate of 80%. Then the second alternative is the TOPSIS method with TOPSIS 78%, SAW-AHP 74 % and SAW 76%.
References
[1] Draft Permandikbud UKT, The Ministry of Education and Culture, 2013.
[2] S. Sendana, H. A. Wibawa dan S., “Determination System of Tuition Fee Groups at Universitas Diponegoro Using the Analytic Hierarchy Process,” 2014. [In Bahasa]
[3] M M D Widianta, R. T, D P S Setyohadi dan H Y Riskiawan, “Comparison if Multi-Criteria Decision Support Methods (AHP, TOPSIS, SAW & PROMENTHEE) for Employee Placement,” IJCST, no. Serie 953, 2018.
[4] A. Pranolo dan S. M. Widyastuti, “Simple Additive Weighting Method on Intelligent Agent for Urban Forest Health Monitoring,” IEEE, 2014.
[5] A. Cahyapratama dan R. Sarno, “Application of Analytic Hierarchy Process (AHP) and Simple Additive Weighting (SAW) Methods in Singer Selection Process,” IEEE, 2018.