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DECISION-MAKING BASED ON AHP AND TOPSIS METHODS IN SUBMISSION OF STUDENTS TO THE PIP SCHOLARSHIP

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ABSTRAK

Pendidikan merupakan usaha untuk membantu individu dalam mencapai potensi maksimal mereka. Sesuai dengan Undang-Undang Nomor 20 Tahun 2003 tentang Sistem Pendidikan Nasional, pendidikan dasar adalah tingkat paling awal dalam sistem pendidikan nasional. Sekolah Dasar (SD) Negeri 018 Loa Janan adalah salah satu sekolah dasar yang terletak di Dusun Tani Bahagia, Desa Batuah, Kecamatan Loa Janan, Kabupaten Kutai Kartanegara, Provinsi Kalimantan Timur. Untuk mendukung kesejahteraan para siswanya, sekolah tersebut mendaftarkan siswa-siswinya dalam berbagai program beasiswa, termasuk Program Indonesia Pintar (PIP). Namun, ketiadaan kriteria yang jelas menyebabkan kesulitan bagi pihak sekolah dalam menentukan siswa yang layak diajukan untuk beasiswa PIP. Oleh karena itu, Sistem Pendukung Keputusan (SPK) akan diterapkan untuk membantu sekolah dalam proses seleksi siswa yang akan diusulkan untuk beasiswa PIP. Penelitian ini bertujuan untuk mencapai hal tersebut. Keputusan akan diambil menggunakan kombinasi metode *Analytical Hierarchy Process* (AHP) untuk menghitung bobot kriteria dan metode *Technique for Order Preference by Similarity to Ideal Solution* (TOPSIS) untuk melakukan pemeringkatan alternatif. Terdapat 5 kriteria dan 67 alternatif. Hasil penelitian menunjukkan bahwa pemeringkatan menggunakan metode AHP dan TOPSIS memberikan prioritas kepada siswa dengan nilai preferensi tertinggi. Metode ini membantu memastikan bahwa proses seleksi berlangsung secara konsisten dan objektif, sehingga hanya siswa yang memenuhi kriteria yang diusulkan untuk diajukan ke beasiswa PIP.
Kata kunci: SPK, pembobotan, AHP, TOPSIS, PIP

ABSTRACT

Education is an effort to help individuals achieve their maximum potential. In accordance with Law Number 20 of 2003 concerning the National Education System, basic education is the earliest level in the national education system. Sekolah Dasar Negeri (SDN) 018 Loa Janan is an elementary school in Tani Bahagia Hamlet, Batuah Village, Loa Janan District, Kutai Kartanegara Regency, East Kalimantan Province. To support the welfare of its students, the school enrols its students in various scholarship programs, including the Program Indonesia Pintar (PIP). However, the absence of clear criteria causes difficulties for schools in determining which students are eligible to apply for PIP scholarships. Therefore, a Decision Support System (DSS) will be implemented to assist schools in the selection process of students who will be proposed for PIP scholarships. This research aims to achieve this. Decisions will be taken using a combination of the Analytical Hierarchy Process (AHP) method to calculate criteria weights and the Technique for Order Preference by Similarity to Ideal Solution (TOPSIS) method to rank alternatives. There are 5 criteria and 67 alternatives. The research results indicate that ranking using the AHP and TOPSIS methods prioritizes students with the highest preference values. These methods help ensure that the selection process is conducted consistently and objectively, allowing only students who fulfill the criteria to be recommended the PIP scholarship.
Keywords: DSS, weighted, AHP, TOPSIS, PIP

1. INTRODUCTION

Education is a process in which each individual can gain the knowledge, experience, values and understanding necessary for growth and participation in society and contribute to the progress of the nation in the future. Especially at this time the flow of world education development continues to increase [1]. In realizing the welfare of a society or nation, a good education system is needed. The quality of a nation can also be judged by the quality of its education [2]. One of the important steps in improving the quality of education in Indonesia is the implementation of a scholarship program, so that every element of society can

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pursue education. Scholarships are a form of support given to students who are studying at the elementary school (SD), junior high school (SMP), high school (SMA) level, and also to students who are studying at higher education [3].

In the context of education in Indonesia, the elementary school level is the initial stage in the National Education system, as stated in Indonesian Law Number 20 of 2003 concerning the National Education System. One of the state elementary school is located in Kutai Kartanegara Regency, East Kalimantan Province is SDN 018 Loa Janan, which is located on Jalan Soekarno Hatta KM. 31, RT. 041 Tani Bahagia Hamlet, Batuah Village, Loa Janan District. The students at SDN 018 Loa Janan have the opportunity to get scholarships that are useful to help parents financially in paying for school needs. One of the scholarships that can be achieved to alleviate personal costs is the Program Indonesia Pintar (PIP). This program includes the provision of Kartu Indonesia Pintar (KIP) to students from families with economic limitations. With the implementation of this scholarship, it is hoped that it will help to reduce the potential of students who face difficulties to continue their education due to the limited costs [4]. However, in applying for a PIP scholarship at SDN 018 Loa Janan, parents often face obstacles. The obstacle experienced is that every parent/guardian of a student wants to enroll their child in this scholarship. Many parents of students who are considered sufficient want to enroll their children in the PIP scholarship program. This shows the importance of having clear and objective criteria to determine who is eligible to receive the scholarship. Without clear criteria, there is a potential for abuse or injustice, where students who should be more in need do not get the same opportunities [5]. If all students are enrolled in this scholarship, there are some students who can afford it instead of underprivileged students. This can lead to PIP scholarships not being on target and reducing the effectiveness of this program in helping students in need. Therefore, there needs to be a more transparent selection system based on valid data and measurable criteria [6]. This happened because there were no clear criteria in the data collection and the assessment process of student categories in determining the students who would be submitted to the PIP scholarship program. Therefore, through the results of this study, not all students will be proposed to participate in the PIP scholarship program. Only students who meet the criteria will be submitted to the PIP scholarship program.

Based on the problems mentioned, this study aims to assist SDN 018 Loa Janan in screening its students to be submitted to the PIP scholarship program by developing a Decision Support System (DSS). With its objective, precise, fast, consistent and accurate nature [7][8], DSS is expected to make it easier for the school to determine prospective PIP scholarship recipients. In this study, two approaches to the DSS method are used, namely, Analytical Hierarchy Process (AHP) and Technique for Order Preference by Similarity to Ideal Solution (TOPSIS). Both methods were chosen because AHP can calculate the weight of each criterion through a paired comparison between existing criteria [9][10]. Furthermore, the AHP method is combined with the TOPSIS method, which is an approach method in decision-making based on the principle that a well-performing alternative not only has the shortest distance from a positive ideal solution, but also has the farthest distance from a negative ideal solution [11].

There are two previous studies related to this research that discuss Decision Support Systems (DSS) for PIP scholarship applications. Both studies examined DSS for prospective PIP scholarship recipients using the TOPSIS method [12][13]. Additionally, a prior study developed a web-based DSS, which was implemented at SMP Negeri 1 Trawas using the SMART method [14]. Another previous study determined PIP scholarship recipients using the FUZZY C-MEANS method, with the research conducted at SMA Negeri 2 Kupang [15]. Furthermore, a subsequent study developed a DSS to evaluate the performance of the best mechanical employees at PT. Auto Mobil Prima Dealer Hino Sampit [16]. Although some of these studies have some similarities, they do not discuss the combined use of AHP and TOPSIS in elementary school scholarship selection. Moreover, no prior research specifically examines scholarship selection at SDN 018 Loa Janan. Another distinguishing aspect of this study is that the criteria used in the selection process differ from previous studies. The selection criteria employed in this research, utilizing AHP and TOPSIS, have been carefully defined based on the specific conditions and needs of SDN 018 Loa Janan, ensuring a more tailored and accurate decision-making process. Therefore, this study fills the gap by integrating AHP and TOPSIS to develop a DSS tailored to the specific context of elementary education scholarship allocation.

2. MATERIAL AND METHODS

Decision

Decision making can be interpreted as an action in choosing several action options to achieve a certain goal [17]. Through the process of converting data into information, the decision making is carried

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out with a systematic procedure for a problem at hand. There are several factors to consider in the decision-making process involving the steps as shown in Figure 1 [18][19].

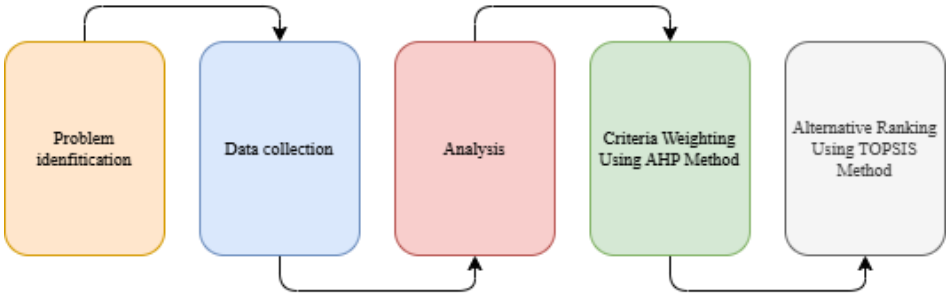

Figure 1. Decision-Making Process Flow

The following is an explanation of the stages of decision-making based on Figure 1:

a. Determining the Problem
   This stage is carried out to identify problems by conducting interviews and observations. At this stage, it can be concluded that it is necessary to determine decisions to overcome existing problems.
b. Data Collection
   Data collection was carried out at SDN 018 Loa Janan. The data collected are criteria and alternative data.
c. Analysis
   Conduct an analysis of the types of criteria that have been prepared. Furthermore, weighting the type of criteria is obtained.
d. Weighting Criteria Using the AHP Method
   The type of criteria is obtained from the school. Determined by the Principal and School Operator. There are 5 types of criteria and then weighting of each existing criterion using the AHP method.
e. Criteria Ranking Using the TOPSIS Method
   After weighting with the AHP method, the next step is to rank from 67 existing alternatives using the TOPSIS method

Data Collection

Data collection in this study was carried out using three methods. First, by means of literature study, which is a stage of searching for data sourced from books, scientific works, articles, magazines and other literature to complete the theoretical foundation. Second, through observation, which is a way to collect data by visiting or reviewing directly at the location of SDN 018 Loa Janan. To obtain actual data from the findings of the research carried out, observations are carried out by collecting data from direct observations. At this stage, the researcher took data from SDN 018 Loa Janan. Third, by means of interviews conducted to determine criteria, alternatives, information about school, and systems created. Based on the results of interviews with SDN 018 Loa Janan, there are five criteria that were selected to determine the eligibility of students in getting PIP scholarships, namely Parents' Income, Total Number of Parents' Dependents, Parents' Marital Status, Student Pocket Money, and Distance Between Homes to School. Parents' income is crucial as low income indicates financial need. The number of dependents reflects the economic burden on parents. Marital status is considered since students from single-parent households may face greater financial difficulties. Pocket money serves as an indicator of family financial limitations, and distance to school affects transportation costs and accessibility. These five criteria were chosen because each provides a clear picture of the economic conditions and needs of the students which will help determine who is most eligible to apply to the PIP scholarship program. In this study, a questionnaire containing the five criteria was distributed to the students who would be taken home, then their parents were asked to fill in the relevant data. With clear and objective criteria, it is hoped that the selection process for scholarship applications to the PIP scholarship can run fairly and on target. All criteria and reasons why these criteria were chosen and determined by SDN 018 Loa Janan were obtained based on the results of the interview.

Data Planning

The input is determined through the analysis of election result data. This study utilizes two variables: alternatives and criteria. The alternative refers to the list of student names from SDN 018 Loa Janan, covering grades 1 to 5, totaling 67 students. The criteria as material for the selection of each student in accordance with the data that have been obtained are summarized in Table 1.

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Table 1. Criteria for SDN 018 Loa Janan

No.	Criteria	Symbol	Description	Criteria Type
1	Parents' Income	C1	The amount of parents' monthly income	Cost
2	Total Number of Dependents of Parents	C2	Number of children to be provided with	Benefit
3	Parents' Marital Status	C3	The status of the parents whether they are still married or divorced	Benefit
4	Student Pocket Money	C4	The amount of children's pocket money per day	Cost
5	Distance from Home to School	C5	Distance from home to school in meters	Benefit

Process Design of AHP Method

The AHP and TOPSIS methods are used for decision-making. The AHP method functions as the first step or process basis whose input value comes from the user and obtains the priority weight value of the criteria that will be processed by calculating the selected alternative ranking using the second method, namely the TOPSIS method [20]. The AHP method can be applied to give the highest weight to the criteria with the greatest variation in values [21]. The procedure is [22]:

1. Create a hierarchy of the problems encountered after detailing the problems and determining the desired solution.
2. Start by defining goals and build a hierarchy from there, starting from the criteria and possible lowest-level alternatives.
3. Form a paired comparison matrix that describes the effect of each element on the level of the next goal or criterion in relation to it. The "*judgment*" of the decision-maker will be the basis for comparison. By determining how important an element is in relation to other elements.
4. To get the total *judgment*. Construct a pairwise comparison matrix $A = [a_{ij}]$, where n is the number if elements being compared. At this point, there are a few things that need to be done:
   a. Calculate the sum of each column in the matrix using equation (1).
   $$S_j = \sum_{i=1}^{n} a_{ij} \quad (1)$$
   b. Normalize the matrix by dividing each element by the column sum using equation (2).
   $$N_{ij} = \frac{a_{ij}}{S_j} \quad (2)$$
   c. Compute the priority vector by averaging each row using equation (3).
   $$w_i = \frac{1}{n}\sum_{j=1}^{n} N_{ij} \quad (3)$$
5. Measure consistency.
   Decision-making should be made without being influenced by inconsistent evaluations or analysis, so it is important to ensure consistency of decisions in an objective manner. The complete steps are as follows:
   a. Multiplied each value in the first column with the priority of the first element, the value in the second column with the priority of the second element, and continue this process until it is complete using equation (4).
   $$v_i = \sum_{j=1}^{n} a_{ij} w_j \quad (4)$$
   b. Compute the consistency vector using equation (5).
   $$\lambda_i = \frac{v_i}{w_i} \quad (5)$$
   c. The result of summing each row is divided by the relative priority values corresponding to those elements. Then add the result of the calculation of step c in the above step with all the available elements, where the final result will be referred to as λ *max*. This calcualtion using equation (6)
   $$\lambda_{max} = \frac{1}{n} = \sum_{i=1}^{n} \lambda_i \quad (6)$$
6. The next step is to find the *Consistency Index* (CI) by applying equation (7).
   $$CI = \frac{\lambda maks - n}{n-1} \quad (7)$$
   where n is the number of elements
7. The next process is to find the *Consistency Ratio* (CR) by applying equation (8).
   $$CR = \frac{CI}{RI} \quad (8)$$

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where is CR = *Consistency Ratio*, CI = *Consistency Index* and IR = *Index Random Consistency*

8. The last step is to verify the consistency of the hierarchy.

TOPSIS Method Process Design

The basic principle that is the basis of the TOPSIS method states that the alternative should have the longest distance (farthest) from the negative ideal solution and the closest or shortest distance from the positive ideal solution. Evaluation of the relative proximity of an alternative to the optimal solution is carried out using the Euclidean distance matrix, which is the distance between two points [23]. The TOPSIS method consists of the following set of steps [24]:

1. Constructing the normalized decision matrix.
   The *rij* elements of normalizing the decison matrix R with the application of the Euclidean length of a vector using equation (9).
   $$r_{ij} = \frac{x_{ij}}{\sqrt{\sum_{i=1}^{m} x_{ij^2}}} \quad (9)$$
   where rij is the calculation results from the normalized decision matrix. r; i = 1,2,3,4,5,..., n; j = 1,2,3,4,5,..., n;
2. Assess the weighted decision matrix.
   The weitght *W = (w1, w2,w3,w4,w5,.....,wn)*, then calculate the numbered weight rating using equation (10).
   $$Y_{ij} = w_i r_{ij} \quad (10)$$
3. Calculate the negative ideal solution matrix and calculate the positive ideal solution matrix.
   A positive ideal solution can be defined as shown in equation (11).
   $$A^{+} = (y_1^{+}, y_2^{+}, .., y_n^{+}) \quad (11)$$
   The formula for a negative ideal solution can be defined as shown in equation (12).
   $$A^{-} = (y_1^{-}, y_2^{-}, .., y_n^{-}) \quad (12)$$
   with:
   $$y_i^{+} = \begin{cases} max\ y_{ij}; if\ j\ is\ a\ benefit\ attribute \\ min\ y_{ij}; if\ j\ is\ a\ cost\ attribute \end{cases} \quad y_i^{-} = \begin{cases} max\ y_{ij}; if\ j\ is\ a\ cost\ attribute \\ min\ y_{ij}; if\ j\ is\ a\ benefit\ attribute \end{cases}$$
   The distance between alternative A_i and the positive ideal solution is formulated in equation (13).
   $$D_i^{+} = \sqrt{\sum_{j=1}^{n} (y_i^{+} - y_{ij})^2} \quad (13)$$
   The distance between alternative A_i and the negative ideal solution is formulated in equation (14).
   $$D_i^{-} = \sqrt{\sum_{j=1}^{n} (y_i^{+} - y_i^{-})^2} \quad (14)$$
   The preference value for each alternative (V_i) is formulated in equation (15).
   $$V_i = \frac{D_i^{-}}{D_i^{-} + D_i^{+}} \quad (15)$$
   A larger value V_i indicates that alternative A_i is preferred.

3. RESULTS AND DISCUSSION

Data Implementation/Processing

The application of this data uses data from 67 students of SDN 018 Loa Janan as altenatives. Meanwhile, the 5 criteria used in this research were derived from interviews with School Principals and School Administrators.

Process Implementation

The implementation of the process is a calculation stage using the AHP and TOPSIS methods. The TOPSIS method is used for alternatives ranking. The AHP method is used to determine the weight of the criteria.

Results of AHP Method Implementation

The implementation of the process is a calculation stage using the AHP and TOPSIS methods. The following are the steps to calculate the AHP method.

a. Table 2 displays the results of the summation of the values in each paired matrix column.

Table 2. Paired Matrix and Summing Values from All Matrix Columns

Symbol	C1	C2	C3	C4	C5
C1	1	3	3	5	9

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C2	0.333	1	2	3	5
C3	0.333	0.5	1	3	3
C4	0.2	0.333	0.333	1	4
C5	0.111	0.2	0.333	0.25	1
Sum	1.978	5.033	6.667	12.25	22

b. Calculating relative priority
The calculation of relative priority has been summarized in Table 3.

Table 3. Calculation of Relative Priority

Symbol	C1	C2	C3	C4	C5	Eigen	Relative Priority Weight
C1	0.506	0.596	0.45	0.408	0.409	2.369	0.474
C2	0.169	0.199	0.3	0.245	0.227	1.139	0.228
C3	0.169	0.099	0.15	0.245	0.136	0.799	0.16
C4	0.101	0.066	0.05	0.082	0.182	0.481	0.096
C5	0.056	0.04	0.05	0.02	0.045	0.212	0.042

c. Determining λ *max*
The calculation process in determining λ *max* has been summarized in Table 4.

Table 4. Calculation λ

Symbol	C1	C2	C3	C4	C5	Eigen	Relative Priority Weight	Lambda
C1	0.506	0.596	0.45	0.408	0.409	2.369	0.474	0.937
C2	0.169	0.199	0.3	0.245	0.227	1.139	0.228	1.147
C3	0.169	0.099	0.15	0.245	0.136	0.799	0.16	1.066
C4	0.101	0.066	0.05	0.082	0.182	0.481	0.096	1.178
C5	0.056	0.04	0.05	0.02	0.045	0.212	0.042	0.932
λ *max*								5.259

To get *λ max* is calculated with the equation (6) so that the result is 5.259.

d. Calculate Index Consistency
The consistency of the index is calculated using the equation (7), which is *λ max* minus the number of criteria after dividing by the total number of criteria minus one as follows:

$$CI = \frac{(5.259 - 5)}{(5 - 1)} = 0.065$$

e. Calculate Ratio Consistency.
Ratio consistency is calculated using the equation (8), namely index consistency divided by *random index concistency* adjusted to the number of existing criteria. The total number of criteria is shown in Table 1.

$$CR = \frac{0.065}{1.12} = 0.058$$

f. Checking Hierarchy Consistency.
The value of the hierarchy consistency obtained from the calculation process is 0.058 or <= 0.1. So that the hierarchy of the scale of importance of the criteria is declared consistent.

Results of the Implementation of the TOPSIS Method

a. Specify alternate initial data or match rating matrix
The first step executed in this TOPSIS method is to determine the match rating matrix of 67 alternatives. There are parameters of each criterion that can be seen in Table 5. Furthermore, the determination of alternative data of the match matrix is presented in Table 6.

Table 5. Criteria Parameters

No.	Criteria	Parameter
1	Amount of Parents' Income	1. < Rp. 1,000,000 (less than one million rupiah) 2. Rp. 1,000,000 – Rp. 2,000,000 (one to two million rupiah) 3. > Rp. 2,000,000 – Rp. 3,000,000 (above two million to three million rupiah) 4. > Rp. 3,000,000 – Rp. 4,000,000 (above three million to four million rupiah) 5. > Rp. 4,000,000 – Rp. 5,000,000 (above four million to five million rupiah) 6. > Rp. 5,000,000 – Rp. 8,000,000 (above five million to eight million rupiah)

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		7. > Rp. 8,000,000 – Rp. 10,000,000 (above eight million to ten million rupiah)
		8. > Rp. 10,000,000 (above 10 million rupiah)
2	Total Number of Dependents of Parents	1. 1 child 2. 2 children 3. 3 children 4. 4 children 5. 5 children 6. > 5 children (more than five children)
3	Parents' Marital Status	1. Marry 2. Divorce
4	Student Pocket Money	1. < Rp.5,000 (under five thousand rupiah) 2. Rp. 5,000 – Rp. 9,000 (five thousand to nine thousand rupiah) 3. Rp. 10,000 – 15,000 (ten thousand to fifteen thousand rupiah) 4. Rp. 16,000 – 20,000 (sixteen thousand to twenty thousand rupiah) 5. > Rp. 20,000 (above twenty thousand rupiah)
5	Distance from Home to School	1. < 100 meters (less than a hundred meters) 2. 100 – 500 meters 3. > 500 – 1000 meters (above five hundred meters to one kilometer) 4. > 1000 meters – 1,500 meters (above one kilometer to 1.5 kilometers) 5. > 1,500 meters – 2,000 meters (above 1.5 kilometers to two kilometers) 6. > 2,000 meters – 3,000 meters (above two to three kilometers) 7. > 3,000 meters – 4,000 meters (above three to 4 kilometers) 8. > 4,000 meters – 5,000 meters (above four to five kilometers) 9. > 5,000 meters (above 5 kilometers)

Table 6. Match Rating Matrix Value

No	Alternative	C1	C2	C3	C4	C5
1	Ahmad Aril Al-Fikri	3	2	1	2	3
2	Andi Mohamad Revan	3	4	1	1	4
3	Athifah Aisyah Putri	4	2	1	2	2
4	Fitria Khaedah	2	3	1	1	6
5	Muhammad Fadlan Raisy Tajud. J	3	2	1	2	6
...	...	...	...	...	...	...
67	Sintita	6	2	2	2	2

b. Searching for normalized decision matrices
Calculate the normalized decision matrix using the equation (9). The results of the calculation have been summarized in Table 7.

Table 7. Dialized Matrix

No	Alternative	C1	C2	C3	C4	C5
1	Ahmad Aril Al-Fikri	0.1081	0.0998	0.1104	0.1508	0.0605
2	Andi Mohamad Revan	0.1081	0.1995	0.1104	0.0754	0.0807
3	Athifah Aisyah Putri	0.1441	0.0998	0.1104	0.1508	0.0404
4	Fitria Khaedah	0.0721	0.1496	0.1104	0.0754	0.1211
5	Muhammad Fadlan Raisy Tajud. J	0.1081	0.0998	0.1104	0.1508	0.1211
…	…	…	…	…	...	...
67	Sintiya	0.2162	0.0998	0.2209	0.1508	0.0404

c. Calculate *the normalized matrix decision* weighted
The weighted normalized matrix is obtained using equation (10). i.e. multiply each element in Table 7 by the weight of the criteria that have been obtained by using the AHP method in Table 3. So that the results of the *normalized matrix decision* calculation have been summarized in Table 8.

Table 8. Weighted Normalized Matrix Decision

No	Alternative	C1	C2	C3	C4	C5
1	Ahmad Aril Al-Fikri	0.0512	0.0227	0.0177	0.0145	0.0026
2	Andi Mohamad Revan	0.0512	0.0455	0.0177	0.0072	0.0034
3	Athifah Aisyah Putri	0.0683	0.0227	0.0177	0.0145	0.0017

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4	Fitria Khaedah	0.0341	0.0341	0.0177	0.0072	0.0051
5	Muhammad Fadlan Raisy Tajud. J	0.0512	0.0227	0.0177	0.0145	0.0051
…	…	…	…	…	...	...
67	Sintiya	0.1024	0.0227	0.0353	0.0145	0.0017

d. Assign negative ideal solution values and positive ideal solution values
Determining the value of the negative and positive ideal solution is done by finding the maximum value and the minimum value per column in Table 8 using the formula of equations (11) and (12). The results of the calculation have been summarized in Table 9.

Table 9. Determining the value of the negative ideal solution and the value of the positive ideal solution

Positive Values	0.0171	0.0568	0.0353	0.0072	0.0077
Negative Values	0.1366	0.0114	0.0177	0.0362	0.0009

e. Determining positive and negative alternative distance values
Determining the calculation of positive alternative distance values and negative alternative distance values is carried out by involving Table 9 and Table 8 and then calculated with the equation (13) for the value of positive alternative distance and the formula of equation (14) for negative alternative distance. So that the results of the calculation can be seen in Table 10.

Table 10. Calculation of Positive and Negative Alternative Distance Values

No	Alternative	D+	D-
1	Ahmad Aril Al-Fikri	0.0521	0.0888
2	Andi Mohamad Revan	0.0403	0.0964
3	Athifah Aisyah Putri	0.0647	0.0726
4	Fitria Khaedah	0.0336	0.109
5	Muhammad Fadlan Raisy Tajud. J	0.052	0.0889
...	...	...	...
67	Sintiya	0.0924	0.0456

f. Set the preference value (V) for all alternatives.
The determination or determination of the preference value is calculated using Table 10 and then using the equation formula (15). So that the results that have been summarized in Table 11 are obtained.

Table 11. Assess Alternative Preference

No	Alternative	V
1	Ahmad Aril Al-Fikri	0.6301
2	Andi Mohamad Revan	0.7052
3	Athifah Aisyah Putri	0.5287
4	Fitria Khaedah	0.7645
5	Muhammad Fadlan Raisy Tajud. J	0.6312
...	...	...
67	Sintiya	0.3305

Discussion

Using the combination of AHP and TOPSIS methods, this research was carried out with the intention of assisting the school of SDN 018 Loa Janan in selecting students who received PIP scholarships. The ranking is done based on V's preferences to help schools select students to apply for PIP scholarships. The ranking based on V preferences has been summarized in Table 12.

Table 12. TOPSIS Method Ranking

No	Name	V	*Rank*
1	Elbara Mukti	0.8589	1
2	Dimas Aprianto	0.8097	2
3	Riyan	0.8054	3
4	Juan Saputra	0.7651	4
5	Andi Rasya Fadillah	0.7651	5
…	…	…	…
67	Aisyah Afiqah	0.2512	67

The ranking results in this study utilized AHP and TOPSIS methods for 67 students at SDN 018 Loa Janan, based on five criteria: parents' income (C1), number of dependents (C2), marital status (C3), pocket

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money (C4), and distance to school (C5). The top three rankings were Elbara Mukti (0.8589), Dimas Aprianto (0.8097), and Riyan (0.8054). Compared to a previous study by [25], which applied AHP and TOPSIS for remission eligibility at IIB Solok Prison—focusing on personality development, attitude, independence, and mental condition—this study emphasizes economic factors and educational accessibility. Despite using the same methods, the differing criteria highlight the flexibility of AHP and TOPSIS in various decision-making contexts. The preference value (V) determines priority levels, where higher scores indicate greater eligibility for scholarships. Small differences in V, such as the 0.0043 gap between second and third place, emphasize the importance of criteria selection and weighting in ranking outcomes. Similar to [25], this study reinforces how minor variations in preference scores can significantly impact fair and objective decision-making

4. CONCLUSIONS AND SUGGESTION

Based on the research conducted to identify and select students eligible for PIP scholarships using DSS that integrates the AHP and TOPSIS methods at SDN 018 Loa Janan, it can be concluded that the ranking of 67 alternatives has been successfully conducted and analysed. The AHP and TOPSIS methods ensure that the selection process is carried out objectively, consistently, and fairly based on five criteria, namely parents' income, the number of parents' dependents, parents' marital status, student pocket money, and the distance from home to school. The results showed that the students with the highest preference scores received priority, with Elbara Mukti ranked first (V grade: 0.8589). This research makes a significant contribution in helping educational institutions, in this case, SDN 018 Loa Janan makes more transparent and data-based decision-making in appointing students to be submitted for PIP scholarships.

Based on this research that has been carried out, there are several suggestions that can be given to further research developers. Namely adding the number of criteria used so that the final results obtained can be more accurate. Researchers can also apply the use of mobile programming to a decision support system that can make it easier for users to access applications because they can be accessed anytime and anywhere through smartphones. In addition, long-term evaluation of the implementation of this system is also important to ensure that the decisions produced remain relevant to needs. Future studies may consider the use of machine learning, to improve the accuracy and adaptability of the system to various decision-making conditions.

REFERENCES

[1] S. A. Amanatulloh and R. Soelistijadi, "Implementasi Metode AHP TOPSIS pada Pemilihan Santri Berprestasi," *J-Sakti*, vol. 6, pp. 726–739, 2022, doi: 10.30645/j-sakti.v6i2.485.

[2] M. R. Ridho, H. Hairani, K. A. Latif, and R. Hammad, "Kombinasi Metode AHP dan TOPSIS untuk Rekomendasi Penerima Beasiswa SMK Berbasis Sistem Pendukung Keputusan," *JTK*, vol. 15, no. 1, pp. 26–39, Feb. 2021, doi: 10.33365/jtk.v15i1.905.

[3] B. Fajariyanto and R. T. Wahyuningrum, "Kajian Literatur Sistem Pendukung Keputusan Penerimaan Beasiswa," *Jurnal SimanteC*, vol. 9, no. 2, pp. 45–50, Jun. 2021, doi: 10.21107/simantec.v9i2.9841.

[4] R. D. Gunawan, T. Oktavia, and R. I. Borman, "Perancangan Sistem Informasi Beasiswa Program Indonesia Pintar (PIP) Berbasis Online (Tudi Kasus: SMAN 1 Kota Bumi)," *MIKROTIK*, vol. 8, no. 1, pp. 43–54, 2018. [Online]. Available: https://ojs.ummetro.ac.id/index.php/mikrotik/article/view/745

[5] K. Kharunnisa, I. Y. Sari, E. Rahmi, and M. H. H. Sihombing, "Sistem Pendukung Keputusan Calon Penerimaan Bantuan Program Indonesia Pintar Menggunakan Metode TOPSIS," *Jatilima*, vol. 2, no. 1, pp. 19–29, Mar. 2022, doi: 10.54209/jatilima.v5i01.395.

[6] R. D. Mainingsih and M. Hamka, "Sistem Pendukung Keputusan untuk Menentukan Penerima Bantuan Beasiswa dengan Metode AHP dan TOPSIS," *Sainteks*, vol. 18, no. 1, pp. 65–74, Jun. 2021, doi: 10.30595/sainteks.v18i1.9613.

[7] D. Wardani, W. Mahayanti, H. Setiadi, M. Ulfa, and E. Wihidayat, "TATOPSIS: A decision support system for selecting a major in university with a two-way approach and TOPSIS," *J. Teknol. dan Sist. Komput*, vol. 10, no. 1, pp. 20–25, Jan. 2022, doi: 10.14710/jtsiskom.2021.14074.

[8] R. Akbar, A. A. Arifnur, J. Rahmadoni, and S. J. Putri, "Pemanfaatan Metode TOPSIS dalam Merancang Aplikasi Pendukung Keputusan untuk Memberikan Rekomendasi Hasil Medical Check Up pada Rumah Sakit," *JEPIN*, vol. 9, no. 1, pp. 96–104, Apr. 2023, doi: 10.26418/jp.v9i1.60173.

ISSN: 2337-7631 (Printed)
ISSN: 2654-4091 (Online)

[9] R. Sarita and L. Bachtiar, "Analisis Sistem Pendukung Keputusan Penentuan Penerima Beasiswa Menggunakan Metode SAW dan AHP," *JSON*, vol. 4, no. 1, pp. 56–53, Sep. 2022, doi: 10.30865/json.v4i1.4573.

[10] M. Jupri and R. Sarno, "Data mining, fuzzy AHP and TOPSIS for optimizing taxpayer supervision," *IJEECS*, vol. 18, no. 1, p. 75, Apr. 2020, doi: 10.11591/ijeecs.v18.i1.pp75-87.

[11] I. K. A. Wijaya, G. R. Dantes, and I. M. Candiasa, "Implementasi Sistem Pendukung Keputusan Pemilihan Guru dan Siswa Berprestasi dengan Kombinasi Metode Analytical Hierarchy Process dan Technique for Order Preference by Similarity to Ideal Solution," *JANAPATI*, vol. 10, no. 2, pp. 77–90, Jul. 2021, doi: 10.23887/janapati.v10i2.29386.

[12] R. Ainaya and D. Gustian, "Sistem Pendukung Keputusan Calon Penerima Program Indonesia Pintar Pada Siswa Sekolah Dasar Menggunakan Metode TOPSIS," *SISMATIK*, pp. 197–208, 2021. [Online]. Available: https://sismatik.nusaputra.ac.id/index.php/sismatik/article/view/29.

[13] D. Ayudia, G. W. Nurcahyo, and S. Sumijan, "Optimalisasi Penentuan Kriteria Penerima Bantuan Program Indonesia Pintar dengan Metode TOPSIS," *JSisfotek*, pp. 142–149, Aug. 2021, doi: 10.37034/jsisfotek.v3i3.57.

[14] F. A. Kurniawan, Y. S. Dwanoko, and J. W. Kuswinardi, "Rancang Bangun Sistem Pendukung Keputusan Penerima Beasiswa PIP Di SMPN 1 Trawas Dengan Menggunakan Metode Smart," *Journal of Information Technology*, vol. 1, no. 2, 2023, [Online]. Available: https://ejournal.unikama.ac.id/index.php/JISTIC/article/view/9160/4156.

[15] M. T. G. Kadja, N. D. Rumlaklak, and B. S. Djahi, "Penerapan Metode FUZZY C-MEANS Dalam Penentuan Penerima Beasiswa Program Indonesia Pintar (PIP) (Studi Kasus: SMA Negeri 2 Kupang)," *J-ICON*, vol. 11, no. 1, pp. 37–43, Mar. 2023, doi: 10.35508/jicon.v11i1.9846.

[16] N. Arianto and N. Nurahman, "Sistem Pendukung Keputusan Penilaian Kinerja Mekanik Menggunakan Metode AHP dan TOPSIS," *MIB*, vol. 5, no. 4, pp. 1326–1335, Oct. 2021, doi: 10.30865/mib.v5i4.3235.

[17] A. B. Fawait, A. Yudhana, and R. Umar, "Pengambilan Keputusan Penentuan Sentra Industri Kecil dan Menengah Unggulan Menggunakan Metode Analytical Hierarchy Process (AHP)," *MIB*, vol. 6, no. 2, pp. 1110–1117, Apr. 2022, doi: 10.30865/mib.v6i2.3943.

[18] L. A. Latif, M. Jamil, and S. H. Abbas, *Sistem Pendukung Keputusan Teori dan Implementasi*. Deepublish Digital, 2018. Accessed: Aug. 02, 2022. [Online]. Available: https://bintangpusnas.perpusnas.go.id/konten/BK73288/buku-ajar-sistem-pendukung-keputusan-teori-dan-implementasi.

[19] M. I. Nasution, A. Fadlil, and S. Sunardi, "Perbandingan Metode AHP dan TOPSIS untuk Pemilihan Karyawan Berprestasi," *MIB*, vol. 6, no. 3, pp. 1712–1722, Jul. 2022, doi: 10.30865/mib.v6i3.4194.

[20] A. Zulherry, T. S. Gunawan, and W. Wanayumini, "Analisis Hasil Pendukung Keputusan Mendapatkan Rumah Dinas Perusahaan Menggunakan Metode Analytical Hierarchy Process (AHP) dan Technique for Order Preference by Similarity to Ideal Solution (TOPSIS)," *MIB*, vol. 5, no. 2, pp. 695–704, Apr. 2021, doi: 10.30865/mib.v5i2.2976.

[21] C. Wiguna, S. Mulyana, and R. Wardoyo, "Selection of TikTok Content Based on User Engagement Criteria Using the Analytic Hierarchy Process," *JUITA*, vol. 11, no. 1, pp. 125–132, May 2023, doi: 10.30595/juita.v11i1.16314.

[22] W. A. Jufri, A. Triayudi, and B. Rahman, "Penggunaan Metode AHP dan Topsis dalam Pemilihan Penyedia Suku Cadang Instalasi Perawatan Sarana Rumah Sakit," *MIB*, vol. 6, no. 4, pp. 1914–1923, Oct. 2022, doi: 10.30865/mib.v6i4.4497.

[23] R. Somya and R. Wardoyo, "Perancangan Sistem Pendukung Keputusan Seleksi Asisten Dosen Menggunakan Kombinasi Metode Profile Matching dan TOPSIS Berbasis Web Service," *Khazanah Informatika*, vol. 5, no. 1, pp. 25–32, 2019, doi: 10.23917/khif.v5i1.7924.

[24] U. Habibah and M. Rosyda, "Sistem Pendukung Keputusan Penerima Bantuan Langsung Tunai Dana Desa di Pekandangan Menggunakan Metode AHP-TOPSIS," *MIB*, vol. 6, no. 1, pp. 404–413, Jan. 2022, doi: 10.30865/mib.v6i1.3471.

[25] A. Syalsabilla, M. Yanto, and V. Ariandi, "Rekomendasi Penerima Remisi Menggunakan Metode AHP dan TOPSIS pada Lapas IIB Solok," *KomtekInfo*, pp. 25–32, Apr. 2024, doi: 10.35134/komtekinfo.v11i1.499.

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