Decision Support System (DSS) For Determining Scholarships Using The MOORA Method

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Abstract— A decision support system is a system that uses computer technology to assist decision making. Every year, Baznas Riau Province conducts a selection process for scholarship acceptance. Scholarships are financial assistance for individuals, both students and students, for educational purposes. In the scholarship selection process, there are several criteria and sub-criteria, including KTP, no one has a bachelor's degree, IPK, parents' income, and housing conditions. The existence of quotas and specific criteria that must be met makes it difficult for Baznas Riau Province to select prospective scholarship recipients. This research implements the MOORA method, which was chosen for its simplicity, effectiveness, stability, and ability to produce accurate judgments in decision-making when compared to other methods. This method is simple and practical to use, and optimizes various objectives based on ratio analysis by giving values or weights to each predetermined criterion. After testing using the MOORA method, results were obtained from 13 students tested, with A12 obtaining the highest value of 0.2454 and A11 having the lowest value of 0.1987. This research results in a decision support system for identifying scholarship recipients at Baznas Riau Province, designed to assist Baznas in the scholarship selection process and improve its efficiency.

Keywords— Decision Support System, MOORA, Scholarship, Baznas Of Riau Province

I. INTRODUCTION

Technology is developing very rapidly and is often used today to manage data in both companies and agencies that use technology [1]. Computer technology is currently needed in almost every field because of its speed, accuracy, and security, one of which is education. [2][3]. Scholarships are awarded to eligible individuals, economic hardship, merit and classification [4].

The Scholarship Program is the provision of financial assistance provided to individual students [5]. Scholarship awards must consider the recipient's ability, application requirements, financial condition, and academic ability according to the rules [6]. Scholarships are funded by the government, private organizations, or educational institutions, not by parents' personal funds [7]. The duration of the scholarship bond depends on the giver. Scholarships are also often awarded to groups, for example in events organized by government, educational, or other institutions, with the prize being a scholarship [8].

Baznas Riau province almost opens scholarships every year. In 2023, 251 students applied for scholarship registration and 80 students received scholarships. Where every

student who registers will do file selection, exams, and interview tests. Where the smaller the parent's income, the greater the chance of receiving the scholarship.

Information management is built to support the decision-making process [9]. These systems are built to support decision-making in semi-structured circumstances, where there is no definitive way to make the best decision [10]. The decision-making process can be done easily and quickly through an effective selection mechanism, so that the decisions taken are more targeted and can be implemented optimally [11]. Decision support systems can also provide information Provides assistance in providing many alternatives that are taken in decision making [12]. The MOORA method is very easy, effective and stable. So this method can produce a very accurate assessment so that it is suitable in producing a very accurate assessment in decision making when compared to several other methods. The MOORA method is straightforward and simple to implement [13].

In developing a scholarship acceptance decision support system for this research, the MOORA method is used. This method is anticipated to assist Baznas Riau Province in selecting scholarship recipients. The choice of this method is grounded in its capacity to deliver optimal decisions based on established criteria [14]. Where the way of working is based on giving a value or weight to each criterion that has been given [15]. From the weight value, the highest ranking is taken to determine which students will receive the scholarship.

II. METHODOLOGY

Research methodology is used to outline the steps in a study in order to produce quality output. The following presents the research methodology that will be applied in this study:

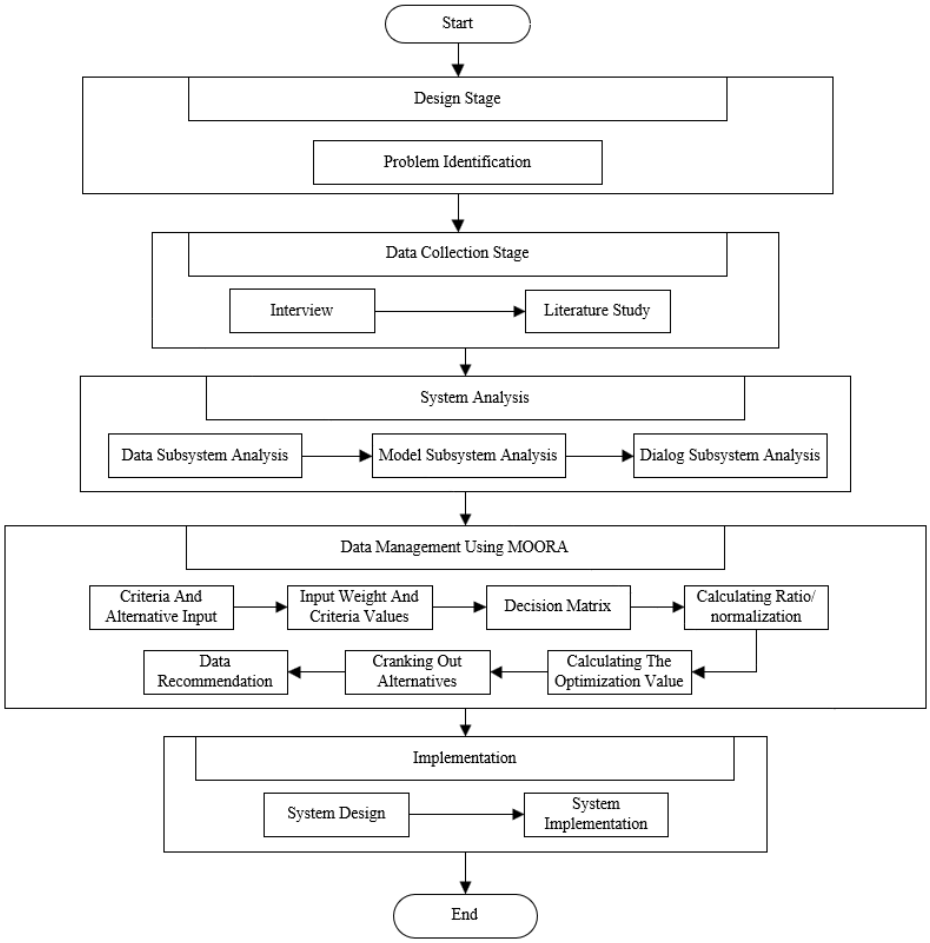

Figure 1. Research Methodology

A. Problem identification

Problem identification is the initial stage in the research methodology is to recognize the problem to be studied.

B. Data Collection

In carrying out the research, the data collection phase for this study is as follows:

1) Interview

Conducted through direct observation and interviews [16]. Direct interviews are conducted with related parties, namely administrative employees of distribution and utilization and Baznas Riau Province who provide data and criteria that are eligible or not to receive scholarships. And the data is used as a reference to complete this final project

2) Studi Pustaka

It is an activity of finding references, reading, managing research materials after getting a topic for research [17].

C. System Analysis

1) Data subsystem analysis

He initial stage in developing a system is system analysis, which is very important in determining the success of the system to be developed [18]. This step aims to formulate the criteria and sub-criteria needed in system development.

2) Model Subsystem Analysis

At this stage, the criteria model will be applied to determine scholarship awards at Baznas Riau Province

3) Dialog Subsystem Analysis

The next stage in this research is to analyze the dialog subsystem or the needs of the system to be built.

D. Data Management Using MOORA

The steps involved in the MOORA method process are as follows:

1) Input Criteria and alternatives

Involves the process of storing and inputting criteria data and alternative data to determine prospective scholarship recipients at Baznas Riau Province.

2) Input Weight of Each Criterion

Is the process of giving weights to each criterion used in Baznas Riau Province, converted into a decision matrix. *[19]*

$$X = \begin{vmatrix} X_{11} \dots X_{1j} \dots X_{1n} \\ X_{ij} \dots X_{1i} \dots X_{1j} \\ X_{m1} \dots X_{mi} \dots X_{mn} \end{vmatrix} \quad (1)$$

3) Calculating Ratio/Normalization

Aims to equalize each element in the matrix so that the values are consistent. The process is done by calculating the root of the sum of the squares of all criteria values for each alternative. The value is then used as a divisor to determine normalization, as described in [20].

$$x_{ij}^{*} = \frac{x_i j}{\sqrt{\sum_{j=1}^{m} x_{ij}^{2}}} \quad (2)$$

4) Calculating Optimization Value

The optimization value is determined by subtracting the benefit value from the cost value. At this stage, the benefit and cost values are grouped first, then a reduction is made. The result of the reduction is then multiplied by the weight of the criteria [21].

$$y_j = \sum_{j=1}^{g} WjWX_ij * \sum_{j=g+1}^{n} w_j \quad (3)$$

5) Ranking Alternatives

Ranking is done by referring to the largest value of each alternative, resulting in data recommendations from the system.

6) Data Recommendations

The final result is obtained, which produces the highest recommendation for each data.

III. RESULTS AND DISCUSSION

After the stages described above, the next process is the decision-making process for determining scholarships at Baznas Riau Province using the Moora method. The initial step involves identifying the criteria and weights for each component of the scholarship acceptance criteria. The outcomes of these criteria are presented in the table below:

Table 1. Criteria Data

Code Criteria	Criteria Name	Atribut	Points
C1	KTP	*Benefit*	10%
C2	No One Has A Bachelor's Degree	*Benefit*	20%
C3	IPK	*Benefit*	25%
C4	Parents' Income	*Benefit*	35%
C5	House Condition	*Cost*	10%

Determining sub-criteria where each sub-criteria is given a score, here is a table of sub-criteria that have been determined and given a score

Table 2. Scholarship Determination Criteria

Criteria	C1	Score
KTP	None	1
	Available	2
Criteria	**C2**	**Score**
No one has a bachelor's degree	Available	1
	None	2
Criteria	**C3**	**Score**
IPK	IPK <2,00	1
	IPK 2,00 - 2,49	2
	IPK 2,50 - 2,99	3
	IPK 3,00 - 3,49	4
	IPK 3,50 - 4,00	5
Criteria	**C4**	**Score**
Parents' Income	Rp >= 4.000.000	1
	Rp3.000.000 - Rp4.000.000	2
	Rp2.000.000 - Rp3.000.000	3
	Rp1.000.000 - Rp2.000.000	4
	Rp<= 1.000.000	5
Criteria	**C5**	**Score**
House Condition	Very good	1
	Good	2
	Simply	3
	Bad	4

Alternative data refers to the information that will be analyzed and chosen for determining the best option. This data, sourced from Baznas Riau Province, includes criteria such as KTP, No One Has A Bachelor's Degree, IPK, Parents' Income, and Home Conditions. A total of 13 data points were used and transformed into matrix format for testing.

A. Application Of MOORA

All data that has received a value for each criterion will be converted into a decision matrix. The values contained in the table below are the data previously described and have been given a score using formula (1).

Table 3. Matrix Formation

Code	C1	C2	C3	C4	C5
A1	2	2	5	4	3
A2	2	1	5	5	3
A3	2	1	5	4	2
A4	2	2	5	4	3
A5	2	2	5	4	4
A6	2	2	5	4	3
A7	2	2	5	4	2
A8	2	2	5	4	4
A9	2	2	5	5	4
A10	2	2	5	4	3
A11	2	2	5	3	3
A12	2	2	5	5	3
A13	2	2	5	4	3

The next step is the normalization stage of the decision matrix data. The following results are obtained using formula (2).

Table 4. Normalized Matrix

Dividers	7.211	6.782	18.028	15.1	11.31
Code	**C1**	**C2**	**C3**	**C4**	**C5**
A1	0.2774	0.2949	0.2774	0.2649	0.2652
A2	0.2774	0.1474	0.2774	0.3311	0.2652
A3	0.2774	0.1474	0.2774	0.2649	0.1768
A4	0.2774	0.2949	0.2774	0.2649	0.2652
A5	0.2774	0.2949	0.2774	0.2649	0.3536
A6	0.2774	0.2949	0.2774	0.2649	0.2652
A7	0.2774	0.2949	0.2774	0.2649	0.1768
A8	0.2774	0.2949	0.2774	0.2649	0.3536
A9	0.2774	0.2949	0.2774	0.3311	0.3536
A10	0.2774	0.2949	0.2774	0.2649	0.2652
A11	0.2774	0.2949	0.2774	0.1987	0.2652
A12	0.2774	0.2949	0.2774	0.3311	0.2652
A13	0.2774	0.2949	0.2774	0.2649	0.2652

After determining the normalized matrix, the next step is to determine the weighted normalization matrix.

Table 5. Weighted Normalization Matrix

Weight	0.1	0,2	0.25	0.35	0.1
Code	**C1**	**C2**	**C3**	**C4**	**C5**
A1	0.0277	0.059	0.0693	0.0927	0.0265
A2	0.0277	0.0295	0.0693	0.1159	0.0265
A3	0.0277	0.0295	0.0693	0.0927	0.0177
A4	0.0277	0.059	0.0693	0.0927	0.0265
A5	0.0277	0.059	0.0693	0.0927	0.0354
A6	0.0277	0.059	0.0693	0.0927	0.0265
A7	0.0277	0.059	0.0693	0.0927	0.0177
A8	0.0277	0.059	0.0693	0.0927	0.0354
A9	0.0277	0.059	0.0693	0.1159	0.0354
A10	0.0277	0.059	0.0693	0.0927	0.0265
A11	0.0277	0.059	0.0693	0.0695	0.0265
A12	0.0277	0.059	0.0693	0.1159	0.0265
A13	0.0277	0.059	0.0693	0.0927	0.0265

The subsequent step is to calculate the preference value prior to ranking and making a decision using Formula (3).

Table 6. Determining the Preference Value

Code	Max	Min	Yi (Max-Min)
A1	0.2488	0.0265	0.2222
A2	0.2425	0.0265	0.2159
A3	0.2193	0.0177	0.2016
A4	0.2488	0.0265	0.2222
A5	0.2488	0.0354	0.2134
A6	0.2488	0.0265	0.2222
A7	0.2488	0.0177	0.2311

A8	0.2488	0.0354	0.2134
A9	0.2719	0.0354	0.2366
A10	0.2488	0.0265	0.2223
A11	0.2256	0.0265	0.1991
A12	0.2719	0.0265	0.2454
A13	0.2488	0.0265	0.2222

The next step is to rank the results and give a ranking.

Table 7. Ranking Results

Code	Yi value	Rangking
A12	0.2454	1
A9	0.2365	2
A7	0.2311	3
A10	0.2222	4
A1	0.2222	5
A6	0.2222	6
A4	0.2222	7
A13	0.2222	8
A2	0.2159	9
A5	0.2133	10
A8	0.2133	11
A3	0.2015	12
A11	0.1987	13

According to the scholarship calculation results using the MOORA method, A12 secures the highest value of 0.2454, while A11 has the lowest value of 0.1987.

B. Database Design

The class diagram illustrates the system's structure that is set to be developed. The following is a class diagram for the Riau Province Baznas Scholarship decision support system.

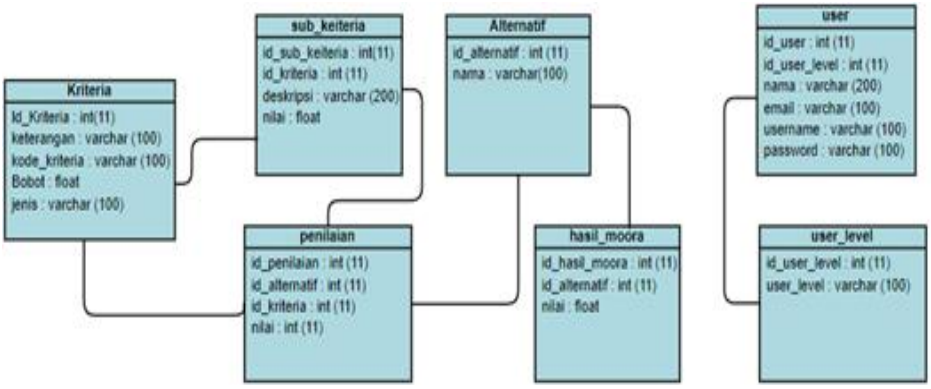

Figure 2. Class Diagram

C. Implementation Of The System

This page will be a Dashbord page accessed by the admin. This menu will be provided with several menus from the decision support system and there is a menu that can be clicked to the menu available on the Dashbord.

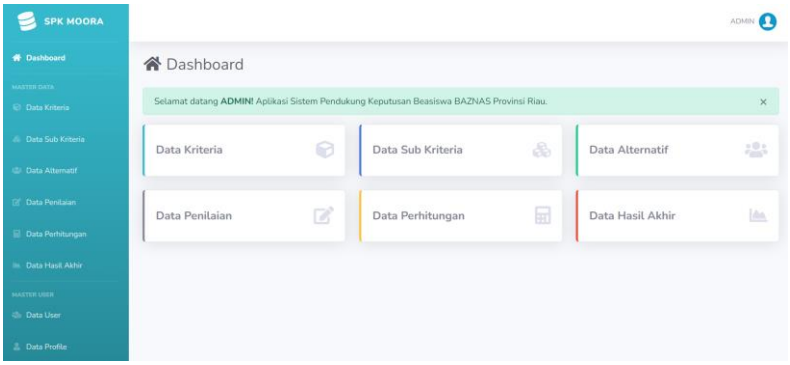

Figure 3. Dashbord Page Display

This page is a criteria page where this menu is the basis of the assessment to select the Riau Province Baznas Scholarship.

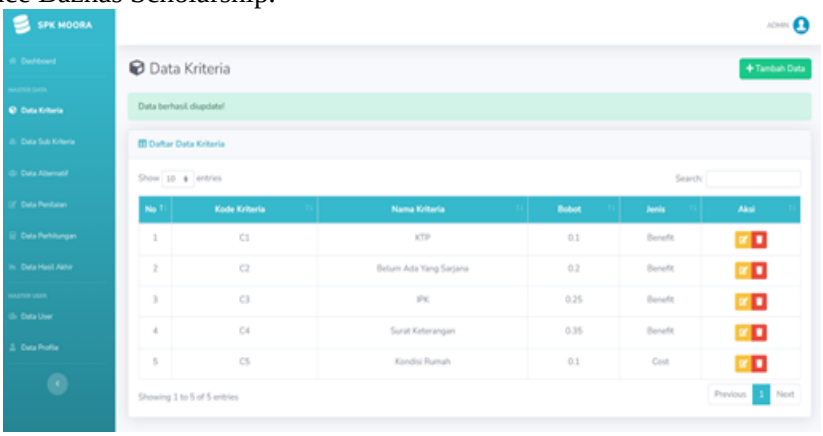

Figure 4. Criteria Page Display

Input on the criteria data menu where the criteria are given a value according to the score to enter the calculation process.

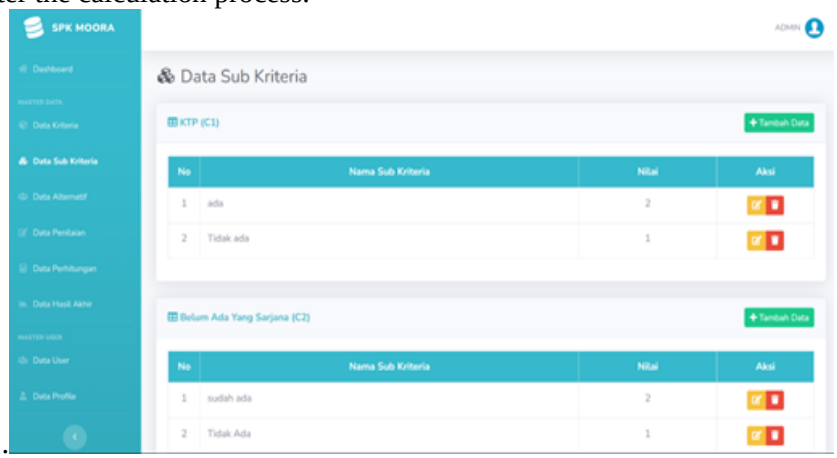

Figure 5. Display of Sub Criteria Page

This menu is alternative data that has been used which will be recommended.

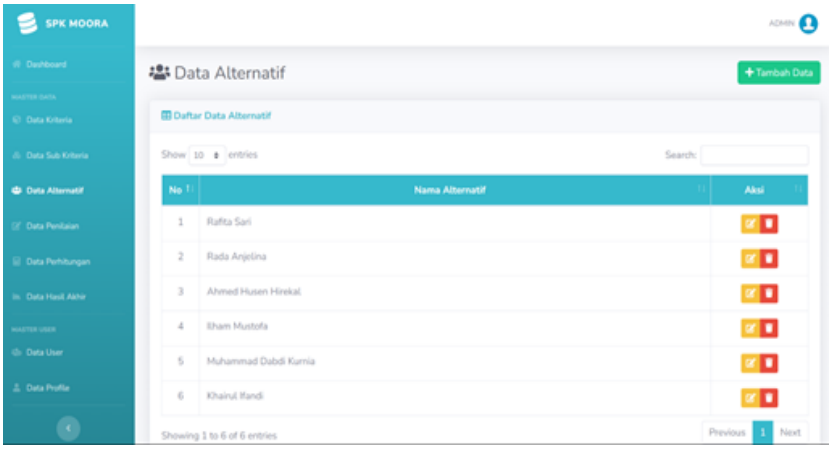

Figure 6. Alternate Data Page Display

The assessment data menu includes criteria and sub, so that scores are given for the calculation process.

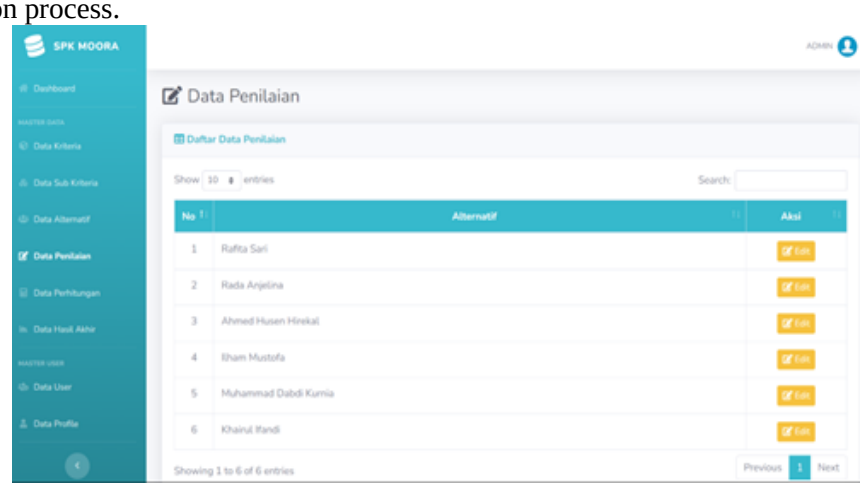

Figure 7. Display of Assessment Data Page

The calculation data menu is a menu used for the calculation process using the moora method.

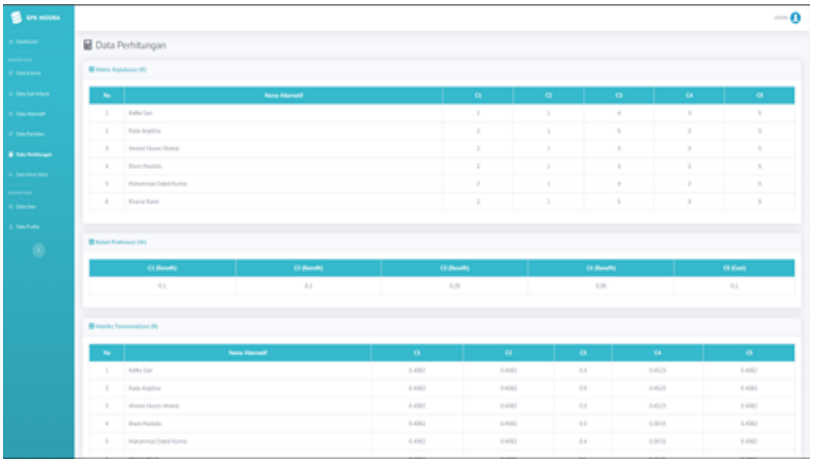

Figure 8. Calculation Data Page

IV. CONCLUSION

The MOORA method is very suitable to help decision making in this study, especially in the selection of scholarships at Baznas Riau Province. By setting several criteria and subcriteria, 13 students were tested. The calculation results indicate that A12 achieves the highest value of 0.2454, while A11 has the lowest value of 0.1987. These results are then presented in a system, facilitating decision-makers in selecting the best alternative.

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