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Design of a Web-Based Decision Support Information System for YMM FI Scholarship Recipients Using the SMART Method

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ABSTRACT (10 PT)

YMM FI is a zakat fund management foundation which has several programs. Edu Care Program is one of program which still running and focuses on funding education to support the funding form elementary grade to higher education. However, the selection of prospective grantee are still manually, which cause the selected scholarship recipients to be unsuitable. So, this research proposes in designing a web-based YMM FI scholarship recipient decision support information system using the SMART Method. SMART Method consist in three stages. There are determining criteria, determine the weight of the criteria, calculate the normalization of each criterion weight, and provide criteria parameter values for each criterion as an alternative. The criteria are based on volunteer activity, parents' income, final report grade and memorizing Qurán. Hopefully, it can help YMM FI to select the right scholarship grantee based on the criteria. The result showed that by using a website-based decision support system can support easily in selecting prospective recipients of scholarship assistance. Finally, the results also generate the candidate ranking, so it can be helpful in selecting scholarship candidate to be funded from YMM FI Scholarship.

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1. INTRODUCTION

Today, globalization and digitalization are growing. This era was followed by the expansion of the field of science and technology. The rapid development of technology today, especially in information systems and information technology (SI/IT). It provides a significant role in various fields. The role of IT/IT is very influential to change in business processes in an organization that provides increased efficiency and effectiveness of the organization in achieving its goals and objectives. It can also shadow the organization in increasing productivity and reducing expenditure[1]. It is a process that formulates a long-term plan that will guide the development and management of information systems within the organization. The aim is to integrate information systems with the organization's business strategy so that the organization can its goals and long-term goals. In the current era of Industry 4.0, technology is developing increasingly rapidly, as is decision making which can be done through systems with detailed data. Decision Support System is a decision making based on a system so it does not just use human instinct or be done manually, but must be based on an accurate system[2]. So that decision making can be faster and more efficient. One organization that needs a decision making system is YMM FI. YMM FI (Freeport Indonesia Muslim Community Foundation) itself is a foundation that operates in the field of zakat fund management. Zakat funds will be distributed based on several programs, one of the programs that is still running today is the Edu Care Program. This program focuses on providing educational scholarship assistance from Elementary to Upper Level.

Many research has been done by using decision support systems. The research has been done in selecting scholar candidate in SMK Bima. Analitycal Hierarchy Process (AHP) algorithm is needed to assist in decision-making and determine students. The AHP algorithm uses multiple criteria assessments and a hierarchical framework to calculate weights for eligibility. The study aims to rank prospective scholarship recipients[3]. Then, the research which have done in implementing at Vocational High Schools. The study focused on selecting candidate for scholarships based on various criteria, including report cards, attendance, achievement, organizational involvement, and violations. A Decision Support System (DSS) is needed to provide scholarship recommendations based on these criteria. One method is Fuzzy Multiple Attribute Decision Making (FMADM), which uses a criteria weighting method. The study uses the Simple Additive Weighting (SAW) method to calculate the FMADM method, selecting the best alternative from many alternatives[4]. Other research that focused on selecting candidate using Decision Support System are done by Rivera and Lagarteja. The study developed a Decision Support System (DSS) using Decision Tree Algorithm for the Scholarship Board of Santiago City, Isabela. The system helps assess students' pre-application requirements and determine eligibility for scholarship grants. The system's acceptability was evaluated using ISO 9126 and a four-point Likert Scale. It expedited the pre-application process from 40% to 90%, addressing previously identified problems[5].

However, YMM FI still uses manual methods for decision making in determining recipients of educational scholarship assistance, which sometimes results in inaccurate targets for recipients. Therefore, there is a need for a Decision Support System for YMM FI Scholarship Assistance Recipients using the Simple Addictive Weighting (SAW) method. The Simple Addictive Weighting (SAW) is a straightforward programming language that allows for easy calculation, comparison of criteria, and is suitable for decision-making in personnel selection problems[6][7]. So, the decisions can be more accurate because it based on data calculation that has criteria and value weights[8].

2. METHOD

Research Methodology is carried out by researchers for certain purposes, which is based on scientific activities to obtain data. The science in question must be carried out in an orderly, logical or reasonable manner. And the choice of research methodology must be adapted to the field you want to research. So that the results obtained are maximal in accordance with the research carried out. Useful research is research that offers solutions to the problem subject being studied[9]. The benefits of this research can be felt by researchers or readers. However, to produce useful or conclusive research results, comprehensive research is needed in order to carry out the research in depth, so someone must be able to conduct research systematically or use a research methodology[10]. The creation of valid methodological and research information sources is meticulously done to ensure no gaps in proposed solutions to thematic research problems. The advantage of using research methods is that the research results can be considered. This advantage can be achieved because the data source is of very high quality when using research methodology[11]. In addition, many people trust the results of researchers with the help of valid sources of information. In fact, many people can trust researchers who can conduct high quality research.

Decision Support Systems (DSS) are part of computer-based information systems including knowledge-based systems or knowledge management that are used to support decision making in an organization or company or can be said to be computer systems that manage data into information to make decisions. the final decision is algorithmic and specific[12][13]. In this technological era, decisions can be taken not only manually but can also be done through a structured system, therefore the need for a decision support system[14].

The use of the SMART Method (Simple Multi Attribute Rating Technique) is a decision making model that takes into account qualitative and quantitative matters[15]. Each criterion has a different weight and the parameters determine the decision and have a range of values[16]. Stages in using the SMART method according to Goodwin and Wright are as follows[17]:

1) Determine the number of criteria used.
2) Determine the weight of the criteria for each criterion using an interval of 1-100 for each criterion with the most important priority.
3) Calculate the normalization of each criterion weight by comparing the criterion weight value with the number of criterion weights. Using the formula:
    a. Normalization = Wj (1) $\sum Wj$ Where Wj is the weight value of a criterion while $\sum Wj$ is the total amountweight of each criterion.
    b. Provide criteria parameter values for each criterion for each alternative, determine the utility value by converting the criterion value for each criterion into a standard data criterion value.
    c. Determine the final value of each criterion by transferring the value obtained from the normalization of the standard data criterion values with the normalized value of the criteria weights. Then add up the values of these multiplications.

SMART is a multi-criteria decision making method and is a multi-criteria decision making method which is based on the theory that each alternative consists of a number of criteria that have values and each criterion has a weight that describes how important it is compared to other criteria[18][19]. This weighting is used to assess each alternative in order to obtain the best alternative[20]. The Data Collection Method is carried out as follows:

1) Retrieving Data from YMM FI, data provided by YMM FI employees online via Social Media. The data provided is in accordance with the request on the basis of research by researchers.
2) Interviewing several students who will be used as alternatives. Interviews were conducted with each student assisted by YMM FI via social media.

3. RESULTS AND DISCUSSION

Designing a Decision Support System for YMM FI Education Scholarship Recipients Using the WEB-Based SMART Method, can help YMM FI in analyzing data on prospective YMM FI Education Scholarship recipients because with a system that uses a data analysis algorithm it can take place more quickly, efficiently and can save costs as well as energy. By taking into account several alternatives that have values for each weighted criterion, it is easier to find the highest ranking so that you can make the right decision precisely through the website application system.

3.1. SMART Method

Stages in using the SMART method according to Goodwin and Wright:

1) Determining Criteria
   At this stage there are criteria that are used as determining factors in assigning grades or making decisions. Some of the criteria used are:
   a. Volunteer Activity
   b. Parents' income
   c. Final Report Grade
   d. Memorizing the Qurán (JUZ 30)
2) Determine the weight of the criteria for each criterion. Each criterion is given a weighted value on a scale of 1-100.

Table 1. Criteria Weight

Criteria	Weight
Volunteer Activity	30
Parents' Income	30
Final Report Grade	20
Memorizing the Qurán (JUZ 30)	20
Total Criteria Weight	100

3) Calculate the normalization of each criterion weight by comparing the criterion weight value with the number of criterion weights. Using the formula:
4) Normalization = $\frac{W_j}{W_i}$ …… (1)

   Where Wj is the weight value of a criterion while $\sum Wj$ is the totalthe sum of the weights of each criterion.

5) Provide criteria parameter values for each criterion as an alternative
   a. Criteria

Table 2. Criteria Values

Criteria	Weight
Volunteer Activity	3
Parents' Income	3
Final Report Grade	2
Memorizing the Qurán (JUZ 30)	2

b. Criteria Category
Determining the Category for each Criteria, if the criteria is in the Benefit category then what will be seen is the largest value, whereas if the Criteria is in the cost category then what will be seen is the smallest value.

Table 3. Criteria Categories

Criteria	Category
Volunteer Activity	Benefits
Parents' Income	Cost
Final Report Grade	Benefits
Memorizing the Qurán (JUZ 30)	Benefits

c. Parents' Income
Provide a score value against the Parental Income criteria. The highest score is income on a scale of 0 – 500,000 (Five Hundred Thousand Rupia).

Table 4. Parental income

Parental Income Criteria	Score
N > 1 million	10
850 < N >= 1 million	20
700 < N >= 850	30
500 < N >= 700	40
0 <= N >= 500	50

d. Specifies the Utility value
Determination of the Utility value is obtained based on the use of the formula below:

$$Cost: (ai) = \frac{Cmax - Cout}{Cmax - Cmin} \ldots\ldots\ldots\ldots\ldots (2)$$

$$Benefit: (ai) = \frac{Cout - Cmin}{Cmax - Cmin} \ldots\ldots\ldots\ldots\ldots (3)$$

e. Final Grade Calculation
The final value is determinedby using formula (4) so that the final score will be obtained from the results of the selectors as scholarship recipients.

6) SMART Method Stages
From the normalization calculation of each criterion by comparing the criteria weight value with the total weight of the criteria, the normalization calculation results have been obtained:

Table 5. Parental Income

No	Criteria	Name Criteria	Category Criteria	Weight (Wj)	Normalization
1	C1	Liveliness Volunteer	Benefits	30	30/100 = 0.30
2	C2	Income Parent	Cost	30	30/100 = 0.30
3	C3	Report Card Value End	Benefits	20	20/100 = 0.20
4	C4	MemorizingAl Koran (JUZ30)	Benefits	20	20/100 = 0.20
		Total		100	1.00

Specifies the Utility value
Determination of the Utility value is obtained based on the use of the formula below:

$$Cost: (ai) = \frac{Cmax - Cout}{Cmax - Cmin} \ldots\ldots\ldots\ldots\ldots (2)$$

$$Benefit: (ai) = \frac{Cout - Cmin}{Cmax - Cmin} \ldots\ldots\ldots\ldots\ldots (3)$$

Final Grade Calculation
The final value is determined by using formula (4) so that the final score will be obtained from the results of the selectors as scholarship recipients.

$$\mu j(\alpha i) = \sum_{j=1}^{m} Wj \; \mu j \; (\alpha i) \ldots\ldots\ldots\ldots\ldots (4)$$

7) Normalization calculation
From the normalization calculation of each criterion by comparing the criteria weight value with the total weight of the criteria, the normalization calculation results have been obtained:

Table 6. Normalization Calculation

No	Criteria	Name Criteria	Category Criteria	Weight (Wj)	Normalization
1	C1	Liveliness Volunteer	Benefits	30	30/100 = 0.30
2	C2	Income Parent	Cost	30	30/100 = 0.30
3	C3	Report Card Value End	Benefits	20	20/100 = 0.20
4	C4	Memorizing the Qurán (JUZ 30)	Benefits	20	20/100 = 0.20
		Total		100	1.00

f. Display of the User Interface of the Decision Support System for YMM FI Education Scholarship Recipients

Figure 1. Home Page Display

In Figure 1 and 2, The result of this research is a website consisting of various views that have been built based on the features student data page display.

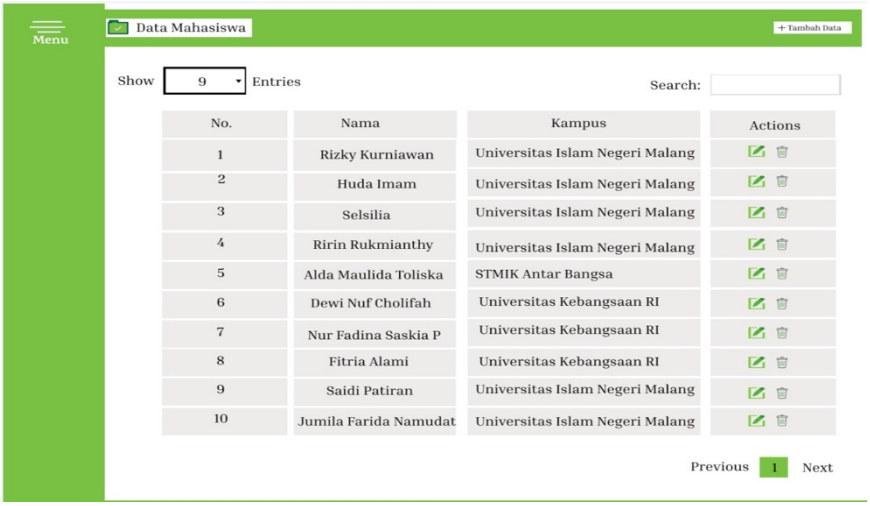

Figure 2. Student Data Display

In Figure 3, The figure shows the interface on the data criteria in using the SMART method. It can be seen in below figure.

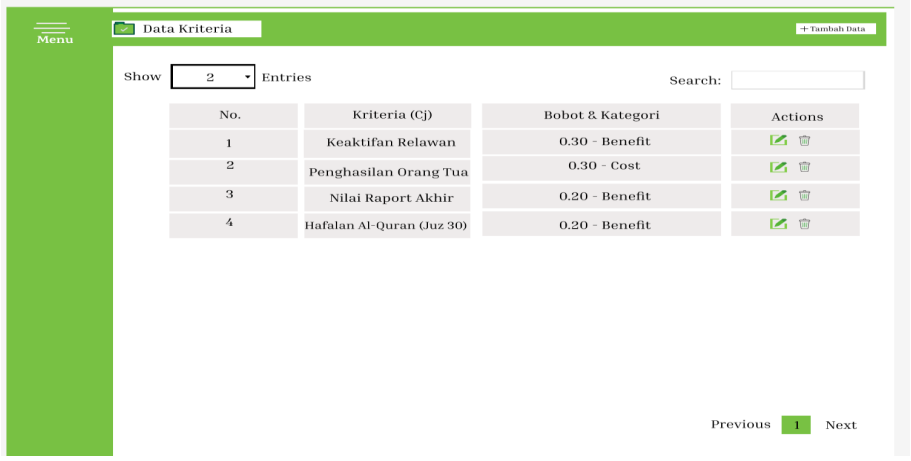

Figure 3. Criteria Data SMART

Figure 3 and 4 shows emerges the interface on the sub data criteria in using the SMART method, can be seen in this image:

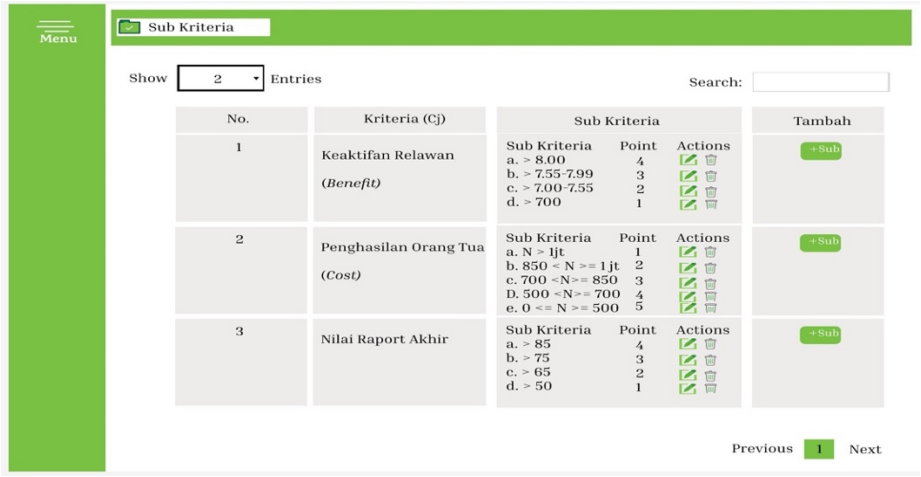

Figure 4. Sub Criteria SMART

Figure 5 shows the result of the interface on the anchoring in the use of the SMART method in this application, can be seen in this image :

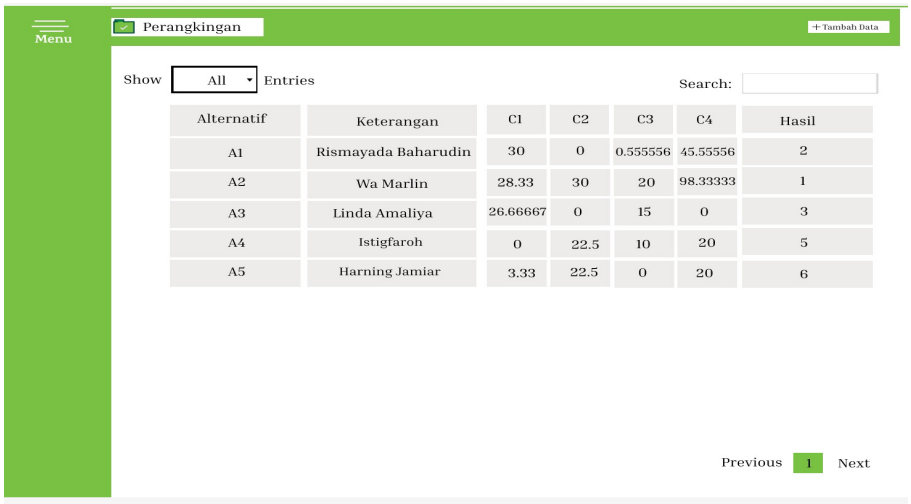

Figure 5 Ranking Page Display

4. CONCLUSION

Based on the results that have been carried out and have produced relevant results. The aim is to get the right decision for several potential YMM FI educational scholarship recipients. A decision has been found based on data analysis by calculating alternatives and weighted criteria. It can be said that a website-based decision support system is very necessary for YMM FI for progress and ease in selecting prospective recipients of scholarship assistance. The result showed that selecting YMM FI scholarship dan making rank can be done based on the score. So, determining candidates for the YMM FI scholarship can be done by considering the scores and rankings that have been generated in the system.

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