

CSR Beneficiary Recommendation System Using Multi-Attribute Utility Theory Method

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Abstract— The concept of Corporate Social Responsibility (CSR) involves a partnership responsibility between the government, companies, and the active and dynamic local community (Anatan, 2010). There are many ways to implement CSR, one of which is distributing CSR in the form of educational assistance to individuals who wish to pursue higher education but are constrained by costs. To ensure that the assistance reaches its target, clear criteria are needed as the basis for determining the recipients of this educational assistance. Decision Support Systems (DSS) can be utilized to build a recommendation system for determining recipients of educational assistance. DSS is a computer program used to make a decision from various options by considering several criteria. In the application of decision support systems, the Multi-Attribute Utility Theory (MAUT) Method is used. With the decision support system using the MAUT method, it can facilitate the determination of recipients of educational assistance to eligible communities.

Index Terms— Corporate Social Responsibility (CSR), Decision Support System (DSS), Multi-Attribute Utility Theory (MAUT).

I. INTRODUCTION

Corporate Social Responsibility (CSR) has become an important aspect of modern business operations. CSR encourages companies to be responsible for the social, environmental, and economic impacts of their activities. Through CSR, companies strive to make positive contributions to society and the surrounding environment, while still paying attention to the sustainability of their business. CSR covers a wide range of initiatives, from philanthropic programs and volunteer activities to responsible business practices, such as sustainable environmental management, protection of human rights, and support of local communities.

According to the World Bank, CSR is a commitment of companies to behave ethically and contribute to sustainable development through collaboration with all relevant stakeholders to improve their lives in ways that are beneficial for business interests, sustainable development agendas, and society in general. Through CSR programs, companies can contribute to achieving SDGs, especially related to improving the economic, social, and environmental conditions of the communities surrounding the company (Humaira & Cupian, 2023).

CSR encompasses three main aspects: profit, emphasizing the need for companies to prioritize economic gains for sustainable business growth; people, emphasizing the importance of companies being mindful of the welfare of communities they operate in; and planet, stressing the responsibility of companies towards environmental

conservation. Consequently, Sustainable Development Goals (SDGs) serve as a guiding framework for corporations to ensure their business practices align with environmental preservation and social welfare. Various CSR initiatives, such as reforestation efforts, clean water provision, community development projects, poverty alleviation, educational enhancements, and other sustainable development endeavors, contribute to realizing SDGs while fostering positive impacts on society and the environment (Kadek et al., 2021; Kumar and Lata, 2022). The benefits of CSR practices are not only felt by society and the environment, but also by the company itself. Effective CSR implementation can improve brand image, increase employee engagement, and strengthen relationships with customers and other stakeholders. Thus, CSR is not only a moral responsibility, but also a smart strategy to achieve sustainable business growth and have a positive impact on the entire social and environmental ecosystem (Barauskaite & Streimikiene, 2020).

One implementation of CSR that businesses can undertake is providing assistance to families categorized communities with lower middle-class economies who reside around the company. This activity aims to help improve the welfare of communities with financial constraints. CSR assistance is provided in the form of educational scholarships. Recipients of CSR assistance are prioritized for those who have financial limitations and are unable to pursue higher education. Determining the recipients of CSR assistance needs to be done properly by using several criteria as requirements. One way to do this is by utilizing a Decision Support System (DSS). DSS is a computer program used to make decisions from various options by considering multiple.

DSS aims to provide information, guide, make predictions, and direct information users to make better decisions (Shely Amalia & Alita, 2023; Lata & Kumar, 2022). In the implementation of decision support systems, there are several methods that can be used, one of which is the Multi-Attribute Utility Theory (MAUT) method. The advantage of Multi-Attribute Utility Theory (MAUT) is its ability to handle complexity in decision-making by integrating various quantitative and qualitative factors into a structured model.

The system will be built using the PHP programming language and the MySQL database server. PHP is one of the scripting languages available freely and still open for further development. PHP can be integrated (embedded) into a web server, or it can function as a separate CGI program. The most outstanding and robust characteristic of PHP is its database integration layer. Another advantage of PHP is its simplicity, making it easy to learn. It can run on various operating systems such as Linux, Unix, Windows, and Mac OS, and it has been proven to have higher speed compared to other programming languages. Although PHP is an open-source scripting language, it is continuously developed to keep up with evolving needs and technologies. Another function of PHP is to transform static websites into more dynamic and interactive ones for users.

MySQL is a database management system that utilizes the basic SQL (Structured Query Language) commands and is quite well-known. This multi-user and multi-threaded MySQL database management system has been used by over 6 million users worldwide. Some advantages of MySQL include its support for integration with other programming languages, minimal RAM requirements, multi-user support, open-source nature, flexible table structure, varied data types, and good security.

II. METHODS

A. Multi-Attribute Utility Theory (MAUT)

Multi-Attribute Utility Theory (MAUT) is a quantitative comparison method that typically integrates measurements of different risks and benefits. Each criterion has several alternatives that can provide solutions. To identify alternatives that closely match the user's preferences, they are multiplied by predetermined priority scales. Therefore, the best and closest results from these alternatives are chosen as the solution. MAUT is used to convert several interests into numerical values on a scale from 0-1, where 0 represents the worst choice and 1 represents the best. This allows for diverse size comparisons (Aldo et al., 2019). The normalization of the matrix is determined by the formula:

$$U(x) = \left(\frac{x - x_i^-}{x_i^+ - x_i^-} \right) \quad (1)$$

$U(x)$ = normalization weight of alternative

x = weight of alternative

x_i^- = minimum wight criteria of the i-th

x_i^+ = maximum wight criteria of the i-th

The next step will involve multiplying the normalization matrix by the preference weights using the formula:

$$V(x) = \sum_i^n W_j, X_{ij} \quad (2)$$

$V(x)$ = the evaluation value of the i-th object.

I = iteration until the n -th.

W_j = the weights predetermined according to each criterion

X_{ij} = the matrix row I and column j (utility).

Where $V(x)$ is the evaluation value of an object to i and W_j is the weight that determines the value of how important the element i to other elements. Whereas n is the number of elements. The total weight is 1.

$$\sum_{i=1}^n w_i = 1 \quad (3)$$

Figure 1 depicts the flowchart of the MAUT procedure. First, identify the alternatives and criteria that qualify for receiving educational scholarship assistance. Second, determine the weights of each criterion and then determine the weights of each parameter. Fourth, perform the normalization matrix calculation. Fifth, determine the preference values, done by adding the multiplication result from the normalization result with the criteria weight. Finally, rank the alternatives based on the highest value.

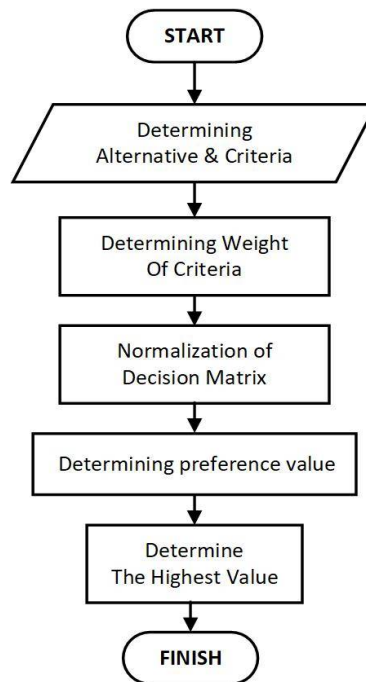


Figure 1. Flowchart of procedure multi attribute utility theory

III. RESULT AND DISCUSSION

The Multi-Attribute Utility Theory (MAUT) method is a quantitative comparison method that typically combines measurements of different risk costs and benefits. Each criterion has several alternatives that can provide solutions (Taufik et al., 2021). To find alternatives that approximate the user's desires, their prioritized scale is multiplied to identify them, resulting in the best and closest solution among these alternatives. Based on Figure 1, the first step is to determine the alternative data, namely potential recipients of CSR aid recipients, which are the communities surrounding the company. The alternative data can be seen in Table 1.

TABLE I. THE ALTERNATIVE DATA OF PROSPECTIVE EDUCATIONAL SCHOLARSHIP RECIPIENTS

Alternative	Name
A ₁	Fajar Utama
A ₂	Dina Apriani
A ₃	Maya Kurniawati
A ₄	Rifky Setiawan
A ₅	Dani Hendrawan
A ₆	Adi Wicaksono
A ₇	Intan Sukma Arum
A ₈	Meliana Ratnawai

The next step is to determine the criteria used as the basis in the recommendation system for selecting CSR aid recipients and to assign weights to each criterion as shown in Table 2.

TABLE II. DATA OF CRITERIA DAN WEIGHT OF CRITERIA

Criteria	Description	Weight of Criteria
C ₁	Salary	5
C ₂	Parents income	5
C ₃	Home status	3
C ₄	Academic scores	3
C ₅	Academic/non-academic achievements	2
C ₆	Number of family members	3

Next, a score based on indicators as shown in Table 3 will be used.

TABLE III. ASSESSMENT INDICATORS

Indicator	Score
Excellent	5
Good	4
Fair	3
Poor	2
Very Poor	1

The next step is to determine the weight of each criterion and its parameters as shown in Table 4.

TABLE IV. CONFIGURING CRITERIA VALUE

Criteria	Parameter	Weight Value
Parents occupation	temporary job	5
	construction worker	5
	farmer	4
	tailor	4
	masseuse	2
	small-scale trader	3
	household assistant	5
	employee in the private sector	1
	civil servant.	1
Parents income	<Rp. 500.000,-	5
	Rp. 500.000 - 1.500.000,-	3
	Rp. 1.500.000 - 3.000.000	2
	≥ Rp. 3.000.000,-	1
Home status	Rented house	5
	Family house	3
	Own house	1
Academic scores	>8.00	5
	7.00 – 8.00	3
	<7.00	1
Academic/non-academic achievements	International	5
	National	3
	Regional	1
Number of family members	>6	5
	4-6	4
	2-3	2
	<2	1

After the indicator score, values for each criterion and parameter are known, the assessment data for each alternative will be used as shown in Table 5.

TABLE V. WEIGHT OF ALTERNATIVE

Alternatif	C1	C2	C3	C4	C5	C6
A ₁	5	5	5	1	2	4
A ₂	3	3	3	1	2	5
A ₃	4	5	3	5	2	2
A ₄	1	2	1	1	1	5
A ₅	1	2	3	1	2	4
A ₆	5	3	3	1	2	5
A ₇	5	5	5	5	3	5
A ₈	1	2	1	1	3	1

The next stage involves normalizing the matrix using equation (1), resulting in data as shown in Table 6.

TABLE VI. NORMALIZATION METRIX

Alternatif	C1	C2	C3	C4	C5	C6
A ₁	1	1	1	0	0,25	0,75
A ₂	0,50	0,50	0,50	0	0,25	1
A ₃	0,75	1	0,5	1	0,25	0,25
A ₄	0	0,5	0	0	0	1
A ₅	0	0	0	0	0	0
A ₆	0	0,25	0,50	0	0,25	0,75
A ₇	1	0,50	0,50	0	0,50	1
A ₈	1	0,25	1	1	1	1

The next step involves determining preference values, below is the calculation of the matrix multiplication of the normalization matrix using equation (2).

$$\begin{aligned}
 A_1 &= (5*1)+(5*1)+(5*1)+(1*0)+(2*0.25)+(4*0.75) = 18.5 \\
 A_2 &= (3*0.5)+(3*0.5)+(3*0.5)+(1*0)+(2*0.25)+(5*1) = 10 \\
 A_3 &= (4*0.75)+(5*1)+(3*0.5)+(5*1)+(2*0.25)+(2*0.25) = 15.5 \\
 A_4 &= (1*0)+(2*0.5)+(1*0) + (1*0) + (1*0) + (5*1) = 6 \\
 A_5 &= (1*0) + (2*0) + (3*0) + (1*0) + (2*0) + (4*0) = 0 \\
 A_6 &= (5*0) + (3*0.25) + (3*0.5) + (1*0) + (2*0.25) + (5*0.75) = 6.5 \\
 A_7 &= (5*1) + (5*0.5) + (5*0.5) + (5*0) + (3*0.5) + (5*1) = 16.5 \\
 A_8 &= (1*1) + (2*0.25) + (1*1) + (1*1) + (3*1) + (1*1) = 7.5
 \end{aligned}$$

Based on the calculation results using equation (2) as above, the final step is to rank based on the highest total score. The results are shown in Table 7 and the ranking has been carried out.

TABLE VII. RANKING RESULT

Alternative	Name	Total Score
A ₁	Fajar Utama	21
A ₇	Intan Sukma Arum	14,5
A ₃	Maya Kurniawati	14,25
A ₂	Dina Apriana	12,5
A ₈	Meliana Ratnawati	10
A ₆	Adi Wicaksono	5,5
A ₄	Rifky Setiawan	4,25
A ₅	Dani Hendrawan	0

IV. CONCLUSION

Based on the research conducted during the development of the recommendation system to determine recipients of educational scholarships as one implementation of CSR using the Multi-Attribute Utility Theory (MAUT) method, several conclusions can be drawn. The Decision Support System (DSS) for recommending recipients of CSR assistance in the form of educational scholarships using the MAUT method is a solution to existing problems, making the determination more effective and efficient in terms of time and selection of CSR beneficiaries. The decision support system for determining CSR assistance recipients can be more detailed and accurate because it is based on established criteria. The MAUT method can assist companies in decision-making using predefined weights.

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