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Implementation of Multi Attribute Utility Theory Method for Government Assistance Recipient Recommendation System in Dadapayu Village, Semanu District, Gunung Kidul Regency

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***Abstract*— The Indonesian government is furnishing help in the form of" Bantuan Langsung Tunai(BLT)" or the Direct Cash backing program in order to make up for the recent increase in the price of energy oil painting(BBM), which has easily had an impact on the lives of the destitute and the general public. The BLT program is enforced throughcross-sectoral collaboration, where institutions unite grounded on their separate functions and duties. Aid distribution opinions are grounded on multiple applicable rudiments and aren't primarily determined by one criterion when the MAUT fashion is applied. A system's recommended feasibility score of 78 is attained from the evaluation findings of system testing, which were carried out using a questionnaire exercising the System Usability Scale(SUS) approach. With a score in the "Acceptable" range, the system is supposed good since it's adequately satisfactory..**

***Index Terms*— BLT Programme, Direct Cash Assistance, Multi Attribute Utility Theory (MAUT), System Usability Scale (SUS).**

I. INTRODUCTION

Bantuan Langsung Tunai (BLT) is well known as one of the government of Indonesia's programs that provides loans in the form of tunai money or other loans that are either fully or partially paid to the less fortunate members of society (Agustina & Hendra, 2021; Tumbel et al., 2021). Funds from BLT are disbursed in accordance with national government objectives. The less fortunate members of society are the focus of a number of social assistance programs that Indonesia has put in place, such as BLT, house restorations, the Family Hope Program (*Program Keluarga Harapan*), support with staple items, and others (Rachaju, 2021). Institutions work together according to their specific roles and responsibilities to implement the BLT program through cross-sectoral collaboration. Additionally, the government expands the Social Safety Net (Jaring Pengaman Sosial, or JPS) to protect the poor (Asher et al., 2018). This includes the provisions found in Minister of Village Development Regulation No. 6 of 2020, which amends Minister of Village Development Regulation

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No. 11 of 2019 regarding the Priority Use of Village Funds. One of the provisions of this regulation is the availability of Direct Cash Assistance, which is funded by village funds (Astuti & Mukaromah, 2020). Dadapayu Village evaluates the financial circumstances of its citizens in order to identify families that are impoverished. Data gathered by local neighborhoods or hamlets is submitted to the Village Office without taking into account the proper standards, based on observations and interviews with Mr. Nanang Arianja S.Pd., the Village Head of Dadapayu. As a result, worthy families who are actually in need do not receive direct financial support. Establishing a mechanism to stop mistakes in government aid distribution is necessary to improve Dadapayu Village's operations and performance (Pasaribu et al., 2022).

The village authorities can identify destitute families that are deserving of assistance and those that are not by using the Recommendation System, which facilitates decision-making in both structured and semi-structured circumstances. The Multi Attribute Utility Theory (MAUT) approach is used in this research. When compared to alternative techniques, MAUT may be impacted by variables like data accessibility, efficiency, and accuracy (Sahoo et al., 2023). If there is enough data to support MAUT analysis, this approach might be a reliable one (Fajirwan et al., 2018). Based on the outlined issues, the author is interested in pursuing a research topic titled "Government Assistance Recipient Recommendation System in Dadapayu Village, Semanu District, Gunung Kidul Regency Using Multi Attribute Utility Theory Method". The system's goal with this approach is to improve the effectiveness of choosing village-level recipients of government support (Lata & Kumar, 2022).

II. RESEARCH METHODS

In its development process, the System Development Life Cycle (SDLC) method is applied to create systematic and easily understandable research (Joshi et al., 2022). SDLC also provides clear and straightforward guidelines for addressing existing issues. The sequence of steps in this research can be viewed in Figure 1.

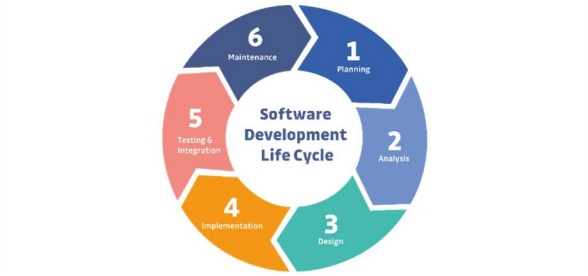

Figure 1. System Development Life Cycle (SDLC)

The steps of the System Development Life Cycle are as follows:

1. Planning: The Planning phase involves conducting a literature review, referring to relevant journals and other sources. Subsequently, observations are made to gather data from the staff at the Dadapayu Village office, followed by interviews with Mr. Nanang Arianja, S.Pd., the Village Head. These steps aim to gain direct insight into field practices and activities.

2. Analysis: Analyze the existing manual system in Dadapayu Village. Renew the existing system by designing and building a new application according to criteria (Lata & Kumar, 2021).

3. Design: The system design phase involves determining the processes and data needed by the newsystem.However, the design may include specifications of the outfit to be used, If the system is computer-grounded. During this phase, resident data and database tables are created grounded on the information attained from the Dadapayu Village Office. also, plates similar as UML(Unified Modeling Language), Flowchart, Use Case Diagram, and exertion Diagram can be employed to prop in system design.

4. Implementation: The implementation phase involves acquiring and integrating physical and conceptual resources to create a functioning system. During this stage, several activities are performed, including coding, testing, and installation. The outputs of this phase include source code, procedures, and training materials. In this phase, the author will use PHP (Hypertext Preprocessor) programming language with MySQL database and CSS (Cascading Style Sheets) for application design. Steps in this phase include creating system page objects such as home, login, criteria, and user instruction documents.

5. System Usability Scale (SUS): Testing: Use System Usability Scale (SUS) as a measure to estimate the usability of the system (Holden, 2020).

6. System Maintenance: During system operation, various modifications are made to insure the system continues to give the necessary support. These variations are appertained to as system conservation. In this final stage, the system is maintained by regularly checking for and making changes to the data on the website.

A. Decision Support System

Decision Support Systems (DSS) is an advanced development of computerized Management Information Systems designed to be interactive with its users (Alamanos et al., 2021). Its interactivity aims to facilitate the integration of various components in the decision-making process, including procedures, policies, analysis, managerial experience, and insights, to enable better decision-making. DSS plays a role in assisting in handling situations and achieving specific goals by selecting the best available options. In general, the objective of Decision Support Systems is to provide accurate information and support data modeling and manipulation to facilitate solutions to problems. DSS functions as a system that provides information and tools to assist users in addressing the challenges they face.

B. Multi Attribute utility Theory (MAUT) Method

An effective and thorough method for choice analysis is Multi-Attribute Utility Theory (MAUT). It enables decision-makers to evaluate and choose options according to a range of characteristics or standards. Even if MAUT offers a strong approach, its effective use still necessitates precise data and a thorough comprehension of the preferences and values of decision-makers. MAUT provides a systematic and quantitative framework to resolve uncertainty in decision-making by taking into account preferences, weights, and utility of each criterion. Its application allows for diversified comparisons of different indicators across a range of situations, such as product development, investment, and company planning. A ranked series of alternative assessments that represent the decisions made by decision-makers is the final result of MAUT calculations.

The following are the implementation steps in solving using the MAUT method:

1) The first step is to create a decision matrix using Equation 1.

$$X_{ij} = \begin{bmatrix} X_{11} & X_{12} & X_{13} \\ X_{21} & X_{22} & X_{23} \\ X_{31} & X_{32} & X_{33} \end{bmatrix} \quad (1)$$

2) The second step involves creating a normalized matrix, determined by Equation 2.

$$U_{(x)} = \frac{X - X_i^-}{X_i^+ - X_i^-} \quad (2)$$

Where X is the alternative weight, X_i^- is the minimum weight of criterion X, and X_i^+ is the maximum weight of criterion X.

3) The final step is to calculate the final utility value as follows: by computing the preference value, we will multiply the normalized matrix by the preference weights using Equation 3.

$$V_{(x)} = \sum_{i=1}^{n} Wj.Xij \quad (3)$$

III. Results and Discussion

A. The Decision Matrix Builder for Alternative and Criterion Data

1. Determining Alternatives: The first step in the decision-making process is identifying alternatives, wherein potential options are taken into account. The best alternative recommendation is then obtained by evaluating each alternative in accordance with predetermined criteria. Eight options have been listed in this context, as Table 1 illustrates.

TABLE I. ALTERNATIVE DATA

Code	Recipient Name Alternatives
A1	Budi
A2	Wijanarko
A3	Aziz
A4	Mahfud
A5	Supriadi
A6	Rukijo
A7	Tejo
A8	Tarno

2. Determining Criteria: After the alternative determination phase is finished, the next important step is to define criteria and their weights, since this might have a big impact on the result. The weights and criteria utilized are displayed in Table 2 below.

TABLE II. CRITERIA WEIGHTS

Code	Description	Weight
CI	Occupation	5
C2	Income	5
C3	Housing Type	3
C4	Home Lighting Source	3
C5	Toilet Type	2
C6	Number of Family Members	3

Subsequently, an evaluation scale based on the indicators used—which are shown in Table 3—will be applied.

TABLE III. ASSESSMENT INDICATORS

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

*3. Determination of sub-criteria and weights: T*he next stage is to identify sub-criteria for each criterion based on the criteria data and their corresponding weight values based on the assessment indicators, as indicated in Table 4.

TABLE IV. SUB-CRITERIA WEIGHT

Criteria	Sub Criteria	Weight
Occupation	Odd Jobs	5
	Construction Worker	5
	Fried Snack Seller	4
	Farmer	4
	Masseur	5
	Small Trader	3
	Housemaid	2
	Private Employee	1
	Government Employee	1
Income	Rp. 500.000,-	5
	Rp. 500.000 s/d 1.500.000,-	3
	Rp. 1.500.000 s/d 2.500.000	2
	≥ Rp. 2.500.000,-	1
Housing Type	Dirt Floor	5
	Cement Floor	3
	Tiled Floor	1
Home Lighting Source	Non-Electricity	5
	From Electricity	1
Toilet Type	Traditional Squatting Toilet	5
	Squatting Toilet with Septictank	2
	Sitting Toilet	1
Number of Family Members	≥ 5 people	5
	3-4 people	4
	2 people	2
	1 person	1

B. MAUT Matrix Normalization Process

The normalization calculation is performed by inputting all criterion and sub-criterion weight data into Equation 2, displayed in Table 5. And the calculation are presented below.

Normalisasi Budi

$C1 = \frac{5-1}{5-1} = \frac{4}{4} = 1$

$C2 = \frac{5-1}{5-1} = \frac{3}{3} = 1$

$C3 = \frac{3-1}{5-1} = \frac{2}{4} = 0{,}5$

$C4 = \frac{1-1}{5-1} = \frac{0}{4} = 0$

$C5 = \frac{2-1}{5-1} = \frac{1}{4} = 0{,}25$

$C6 = \frac{4-1}{5-1} = \frac{3}{4} = 0{,}75$

Normalisasi Wijanarko

$C1 = \frac{3-1}{5-1} = \frac{2}{4} = 0{,}5$

$C2 = \frac{3-1}{5-1} = \frac{2}{4} = 0{,}5$

$C3 = \frac{3-1}{5-1} = \frac{2}{4} = 0{,}5$

$C4 = \frac{1-1}{5-1} = \frac{0}{4} = 0$

$C5 = \frac{2-1}{5-1} = \frac{1}{4} = 0{,}25$

$C6 = \frac{5-1}{5-1} = \frac{4}{4} = 1$

Normalisasi Aziz

$C1 = \frac{4-1}{5-1} = \frac{3}{4} = 0{,}75$

$C2 = \frac{5-1}{5-1} = \frac{4}{4} = 1$

$C3 = \frac{3-1}{5-1} = \frac{2}{4} = 0{,}5$

$C4 = \frac{5-1}{5-1} = \frac{4}{4} = 1$

$C5 = \frac{2-1}{5-1} = \frac{1}{4} = 0{,}25$

$C6 = \frac{2-1}{5-1} = \frac{1}{4} = 0{,}25$

Normalisasi Mahfud

$C1 = \frac{1-1}{5-1} = \frac{0}{4} = 0$

$C2 = \frac{2-1}{5-1} = \frac{1}{4} = 0{,}25$

$C3 = \frac{1-1}{5-1} = \frac{0}{4} = 0$

$C4 = \frac{1-1}{5-1} = \frac{0}{4} = 0$

$C5 = \frac{1-1}{5-1} = \frac{0}{4} = 0$

$C6 = \frac{5-1}{5-1} = \frac{4}{4} = 1$

NormalisasiRukijo

$C1 = \frac{5-1}{5-1} = \frac{4}{4} = 1$

$C2 = \frac{3-1}{5-1} = \frac{2}{4} = 0{,}5$

$C3 = \frac{3-1}{5-1} = \frac{2}{4} = 0{,}5$

$C4 = \frac{1-1}{5-1} = \frac{0}{4} = 0$

$C5 = \frac{2-1}{5-1} = \frac{1}{4} = 0{,}25$

$C6 = \frac{5-1}{5-1} = \frac{4}{4} = 1$

Normalisasi Tejo

$C1 = \frac{5-1}{5-1} = \frac{4}{4} = 1$

$C2 = \frac{5-1}{5-1} = \frac{4}{4} = 1$

$C3 = \frac{5-1}{5-1} = \frac{4}{4} = 1$

$C4 = \frac{5-1}{5-1} = \frac{4}{4} = 1$

$C5 = \frac{5-1}{5-1} = \frac{4}{4} = 1$

$C6 = \frac{5-1}{5-1} = \frac{4}{4} = 1$

Normalisasi Supriadi

$C1 = \frac{1-1}{5-1} = \frac{0}{4} = 0$

$C2 = \frac{2-1}{5-1} = \frac{1}{4} = 0{,}25$

$C3 = \frac{3-1}{5-1} = \frac{2}{4} = 0{,}5$

$C4 = \frac{1-1}{5-1} = \frac{0}{4} = 0$

$C5 = \frac{2-1}{5-1} = \frac{1}{4} = 0{,}25$

$C6 = \frac{4-1}{5-1} = \frac{3}{4} = 0{,}75$

Normalisasi Tarno

$C1 = \frac{1-1}{5-1} = \frac{0}{4} = 0$

$C2 = \frac{1-1}{5-1} = \frac{0}{4} = 0$

$C3 = \frac{1-1}{5-1} = \frac{0}{4} = 0$

$C4 = \frac{1-1}{5-1} = \frac{0}{4} = 0$

$C5 = \frac{1-1}{5-1} = \frac{0}{4} = 0$

$C6 = \frac{1-1}{5-1} = \frac{0}{4} = 0$

TABLE V. MAUT MATRIX NORMALIZATION

No	Alternative BLT Recipient	C1	C2	C3	C4	C5	C6
1	Budi	5	5	1,5	0	0,5	2,25
2	Wijanarko	2,5	2,5	1,5	0	0,5	3
3	Aziz	3,75	5	1,5	3	0,5	0,75
4	Mahfud	0	2,5	0	0	0	3
5	Tarno	0	0	0	0	0	0
6	Supriadi	0	1,25	1,5	0	0,5	2,25
7	Rukijo	1	2,5	1,5	0	0,5	3
8	Tejo	5	5	3	3	2	3

C. Final Utility Value Determination

Equation 3 will be utilized to multiply the normalized matrix by the preference weights in order to produce the final utility value for obtaining preference values. Table 6 presents the preference values calculated for the final utility, and Figure 2 illustrates the findings.

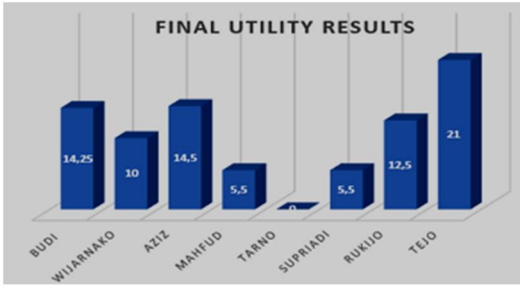

Figure 2. Final Utility Result

TABLE VI. FINAL UTILITY RESULT

No	Alternative BLT Recipient	C1	C2	C3	C4	C5	C6	Total	Rank
1	Budi	5	5	1,5	0	0,5	2,25	14,25	2
2	Wijanarko	2,5	2,5	1,5	0	0,5	3	10	5
3	Aziz	3,75	5	1,5	3	0,5	0,75	14,5	3
4	Mahfud	0	2,5	0	0	0	3	5,5	6
5	Tarno	0	0	0	0	0	0	0	8
6	Supriadi	0	1,25	1,5	0	0,5	2,25	5,5	7
7	Rukijo	1	2,5	1,5	0	0,5	3	12,5	4
8	Tejo	5	5	3	3	2	3	21	1

The final utility results are ranked to provide recommendations. Rank 1 represents the best recommendation as a potential recipient of government assistance, which is the recipient named Tejo. Based on the implementation of the MAUT method and the completed stages, the Decision Support System provides a recommendation that the potential recipients of government assistance in Dadapayu Village are obtained with ranks 1-3, with the highest total score of 21 for Tejo, 14.25 for Budi and Aziz. Ranks 4-8 are for potential recipients with scores of 12.5 for Rukijo, 5.5 for Wijanarko and Supriadi, and 0 for Tarno.

D. System Testing

The last step in creating the Multi Attribute Utility Theory Village Aid Recipient Recommendation System is system testing, which is carried out by five respondents who work at Dadapayu Village. Finding out if the system can operate in accordance with the requirements it was built for is the aim of this system testing. The System Usability Scale (SUS) approach is used in this system testing. Table 7 displays the assessment results provided by the respondents.

TABEL VII. QUESTIONNAIRE RESULTS

No	Respondent	Questionnaire Question Item									
		Q1	Q2	Q3	Q4	Q5	Q6	Q7	Q8	Q9	Q10
1	R1 (Nanan A)	4	2	5	3	4	2	4	2	4	2
2	R2 (Dani Surya)	4	2	5	2	5	2	4	2	5	2
3	R3 (Lusiana)	4	2	4	2	4	1	4	2	4	1
4	R4 (Hajar P)	4	2	4	3	5	2	4	2	4	2
5	R5 (Rusdi)	4	2	4	2	4	1	4	2	4	2

The next step is calculating the System Usability Scale score. Before using the System Usability Scale formula, the following conditions need to be considered:

1. For odd-numbered questions, subtract 1 from each score obtained from user ratings.
2. For even-numbered questions, subtract the user's obtained score from 5.

The final score obtained from the summation of each statement is then multiplied by 2.5. Thus, the calculation of scores for the respondents' answers in Table 7 is entered into Equation 4. The average score for each question should then be determined.

$$SUS\ Score = ((R1 - 1) + (5 - R2) + (R3 - 1) + (5 - R4) + (R5 - 1) + (5 - R6) + (R7 - 1) + (5 - R8) + (R9 - 1) + (5 - R10)) * 2.5 \quad (4)$$

Table 8 displays the outcome of determining the SUS scores based on the responses provided by the respondents.

TABLE VIII. SUS SCORE CALCULATION RESULTS

No	Respondent	Questionnaire Question Item										Sum	Score (Sum x 2.5)
		Q1	Q2	Q3	Q4	Q5	Q6	Q7	Q8	Q9	Q10		
1	R1	3	3	4	2	3	3	3	3	3	3	30	75
2	R2	3	3	4	3	4	3	3	3	4	3	33	83
3	R3	3	3	3	3	3	4	3	3	3	4	32	80
4	R4	3	3	3	2	4	3	3	3	3	3	30	75
5	R5	3	3	3	3	3	4	3	3	3	3	31	78
Average Score (Final Result)													78

The Multi Attribute Utility Theory Village Aid Recipient Recommendation System has a final SUS score of 78. The acceptability range places this score in the "Acceptable" category. As illustrated in Figure 3, the Village Aid

Recipient Recommendation System receives a grade B for the SUS score and is rated as "Good" in the adjective area.

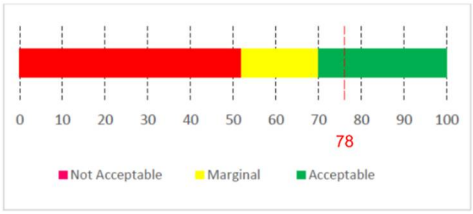

Figure 3. SUS Final Result for the System

III. CONCLUSION

The Government Assistance Recipient Recommendation System in Dadapayu Village was tested using the Multi Attribute Utility Theory (MAUT) approach in this study. The findings can be summed up as follows: The stages that have been completed correspond with the application of the MAUT approach. Dadapayu Village residents who may be eligible for government aid are indicated by the recommendation findings of the Decision Support System, which are ranked from 1 to 3. At 21, Tejo has the highest score, followed by Budi and Aziz at 14.25. However, Rukijo, who received a score of 12.5, Wijanarko and Supriadi, who received a score of 5.5, and Tarno, who had a score of zero, were among the grantees placed fourth to eighth. A final System Usability Scale (SUS) score of 78, which falls inside the "Acceptable" category in the acceptability range criteria, was obtained from testing the system with five staff respondents from Dadapayu Village. As so, the system is considered adequate and classified as efficient.

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