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A SMART-Based Decision Support System for Identifying Recipients of Village Fund Direct Cash Assistance (Case Study in Mburukulu Village)

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Abstract

Bantuan Langsung Tunai Dana Desa (BLT-DD) or direct cash assistance from village funds is a financial assistance program aims at poor and vulnerable communicates who have difficulty meeting their daily living need. Although the process prioritizes consultation and community participation, there are potential problems related to targeting accuracy because of the poor criteria or standards used. This study aims to design and implement a decision support system (DSS) to increase objectivity, transparency, and accuracy in determining BLT-DD recipients in Mburukulu Village. The following criteria are used: income, number of dependents, employment status, social assistance eligibility, education level and physical condition. The study used the Simple Multi Attribute Rating (SMART), which is a decision-making method used to assess and compare alternatives based on several attributes or criteria. Data collected through interviews and documentation to officials of the village. The system was developed using the waterfall method and tested using black box methods and user testing. Results showed that the SMART-based DSS has been successfully designed and implemented to assist the apparatus in determining prospective BLT-DD recipients objectively and target specific because of its ability to produce an accurate ranking of potential recipients based on the final score of each alternative.

Keywords: *Direct Cash Assistance, SMART Method, Mburukulu Village.*

1. Introduction

Direct Cash Assistance for Village Funds (BLT-DD) is a social assistance program from the government and is given to poor or underprivileged families in the village. This program aims to help village communities affected by economic conditions, such as due to the pandemic or other factors that cause financial difficulties. The Village Fund also aims to increase people's purchasing power to make it easier to meet their daily needs. The BLT-DD is expected to overcome poverty and contribute to economic recovery. In other words, BLT-DD is designed to reduce the burden of expenses for beneficiary families and help people in need in maintaining their welfare in the face of economic difficulties. By meeting basic needs and daily needs, the decline in living standards should be prevented [1]

Mburukulu Village is one of the administrative areas in East Sumba Regency. Similar to other areas in East Sumba, the process of determining the eligibility of BLT-DD recipients in Mburukulu Village is carried out through data collection by local RTs and RWs based on a number of criteria, i.e., Miskin (Poor), Miskin Ekstrim (Extreme Poor), Disabilitas (Disabled), and Lansia (the Elderly). The data of prospective recipients who meet these criteria is then brought in deliberations conducted by the head of RT, the head of the RW, the Village Government and local community leaders. Although the process prioritizes consultation and community participation, there are potential problems related to targeting accuracy because of the poor criteria or standards used. The assessment of whether aid recipients are eligible is usually based on direct data collection and subjective considerations in village discussions [2]. Considerations carried out through village discussions are prone tosubjectivity so that they have the potential to cause inaccuracies in the aid distribution. The potential cause of the problem is that the BLT-DD recipients is determined solely through a meeting without criteria or standards that are a reference to be mutually agreed upon. In other words, the potential for not being on target is quite high.

Previous studies showed that, one of the tools that can help decision-making in a number of ways is the Decision Support System (DSS). This method has been widely used to overcome the problem of determining aid recipients who are not on target. The DSS methods are *the AHP, SAW, TOPSIS, and SMART* methods. SMART (*Simple Multi Attribute Rating Technique*) has become the preferred method because because it is a flexible approach to decision-making and is more popular because of its ease of use in meeting the needs of decision-makers and analyzing their answers.

This study also chose SMART for its simplicity in the calculation process and its ability to solve decision-making problems involving many criteria. Therefore, the BLT-DD will be distributed in a targeted manner [3]. Based on the background description above, the

researcher proposed a study entitled Decision Support System for Recipients of Direct Cash Assistance for Village Funds Using the SMART method.

2. Literature Review

2.1. Village Fund

According to Kementrian Desa, Pembangunan Tertinggal, dan Transmigrasi (Kemendes), Direct Cash Assistance for Village Funds (BLT-DD) is assistance for poor people who come from village funds. As stipulated in the Ministry of Finance Regulation Number 25 of 2020, village funds are funds derived from the state budget sent through the district/city APBD intended for villages to finance government administration, development implementation, community development and community empowerment [4].

2.2. Method *SMART*

SMART method (*Simple Multi Attribute Rating Technique*) is a decision-making method pioneered by Edward in 1977 [5]. Multicriteria decision-making is based on the theory that each alternative consists of a number of criteria that have values and that each criterion has a weight that describes how important it is compared to the other criteria [6]. SMART works in several stages as follows::

1) Determining Criteria

Determining criteria is a step to choose the factors that will be used to evaluate alternatives in the decision-making process. In the context of the recipients of the Village Fund Direct Cash Assistance (BLT-DD) of the Village Fund, the criteria determined must include the aspects that are considered most relevant to ensure that the assistance is on target.

2) Determining the Weight of the Criteria

Give criteria weight to each criterion using an interval of 1-100 for each criterion with the most important priority.

3) Normalization of Weight Criteria

Calculate the normalization of the weights of each criterion by comparing the value of the criterion weight with the sum of the criteria weights [7].

$$Normalisasi\frac{Wj}{\Sigma Wj}$$

Equation 2. 1 Normalization

Information:

- Wj : Weight of a criterion
- ΣWj : total weight of all criteria

4) Assigning a criterion value to each alternative

Providing parameter values for each criterion is the process of assigning a score or number to each category in a criterion that reflects the level of importance or eligibility, so that qualitative data can be converted into quantitative values used in the calculation of the decision support system.

5) Calculating utility values

a. For the Benefit criteria

The greater the value, the better or more profitable.

$$U(x) = \frac{x-xmin}{xmax-xmin} \text{ x } 100$$

Equation 2. 2 *Benefit*

Information:

- U(x): Utility value(on a scale of 0-100)
- X: Actual Value of the alternatives to the criteria
- Xmin: Minimum of all alternatives to the criteria
- Xmax: The maximum value of all alternatives on the criteria

b. For Cost criteria

The smaller the value, the better or more profitable.

$$U(x) = \frac{xmax-x}{xmax-xmin} \text{ x } 100$$

Pequation 2. 3 *Cost*

Information:

- U(x): Utility value(on a scale of 0-100)
- X: Actual Value of the alternatives to the criteria
- Xmin: Minimum of all alternatives to the criteria
- Xmax: The maximum value of all alternatives on the criteria

c. Addition of Epsilon (ε) if utility = 0
In some cases, the utility calculation results can be zero (0). This can cause the weight on those criteria not to contribute to the final score. Therefore, a small value (epsilon) can be added to keep the utility value contributing.

$$U'(x) = U(x) + \in$$

Equation 2. 4 *Epsilon*

Information:
- ∈: is a very small value (e.g. 0.001)
- Used only if utility result = 0

6) Determining the Final Value

Determine the final value of each by multiplying the value obtained from the normalization of the value of the standard data criteria by the normalization value of the weight of the criteria.

$$u(ai) = \sum_{j=1}^{m} Wj\ Ui(ai),$$

Equation 2. 5 Determining the Final Value

Information:
- Or : the total value for the i alternative
- Wj : the value of the weight of the criterion that has been normalized

Uj(ai) : utility valueThe Jth criterion for the Ith alternative [8].

7) Alternative Ranking Stages Based on Final Score

The alternative ranking stage based on the final score is to arrange all alternatives (potential recipients) from the highest to the lowest score, where the alternative with the highest final score is considered the most feasible to be prioritized as the recipient of assistance.

2.3. Information Systems

A system is a network of interconnected procedures, coming together to perform an activity or to accomplish a certain goal. A system is a set of objects that are related and interact with each other and the relationship between objects can be seen as a single unit designed to achieve a single goal [9].

2.4. Waterfall Method

Waterfall type is the most commonly used model in the development phase. It is also known as the traditional model or the classic model which applies linear sequencing (sequential linear) or classic lifeline (Classic cycle). This waterfall model provides an approach where the software lifecycle sequentially passes through the analysis, design, coding, testing, and support phases. The rapid development of information technology supports the provision of communication and information services in Indonesia, especially in rural areas [10].

2.5. System Usability Testing

System Usability Scale (SUS) was created by John Brooke in 1986. SUS can be used to take quick measurements of how people perceive the usefulness of a computer system. SUS proves to be a very simple and reliable tool to use when evaluating usability, it can also be used to compare systems [11]

3. Research Methods

3.1. Research Flow

The research was conducted in Mburukulu Village in East Sumba Regency, Pahunga Lodu District, whose population is 1,830 people, consisting of 929 males and 901 females. Based on the village data, the number of poor families are 168 people. Having an area of 18 km², most of the residents of Mburukulu village are farmers. The development of the Decision Support System (DSS) in this study involved three main phases: data collection, system development, and validation through user testing as illustrated in Figure 1.

Figure 1: Research Flow

3.2. Data Collection

This study used several methods to collect data. First, to obtain relevant information related to the process of determining the recipients of the assistance, data were collected through direct interviews with the Mburukulu Village government because they are the officials in charge of implementing Village Fund Direct Cash Assistance (BLT-DD). Second method used was documentation, used to collect the required data, such as documents of poor families found in Mburukulu Village. Third, literature studies were applied in this study. One of which is by referring to the book Methods & Applications of Decision Support Systems by Diana, S.Si., M.Kom (2018) as a valid scientific reference.

3.3. System Creation

Method *System Development Life Cycle* (SDLC) is a process of developing or modifying a software system by utilizing models and methodologies that have been used by software system developers in the past [12]

In this study, SDLC is used as a guide to design and develop a system that can assist in the decision-making process of recipients of Village Fund Direct Cash Assistance (BLT-DD) objectively and measurably using the SMART method.

Figure 2: Use Case Diagram

Figure 2 illustrates a use case diagram on the system designed. The administrator is responsible for managing the data and criteria of BLT recipients and the community whose data will be processed for the determination of BLT recipients.

3.4. Testing to Users

a) Black Box Testing

At this stage, a test was carried out after implementation. It applied the Black Box test method by the creator to evaluate whether the application operates according to expectations and runs in line to the desired specifications.

b) Testing to Users

The system test will be carried out to the head of the village, secretary, treasurer and 5 residents as respondents. The test aims to:

a. Gather User Feedback: Assess how users interact with the product and collect feedback about their overall experience.
b. Enhance User Experience: Identify design or functional issues that can be addressed to improve user comfort and satisfaction.
c. Validate Concepts: Test new features or concepts to see if they meet the needs and expectations of users.
d. Mitigate Risk: Identify potential problems before the product is launched, thereby reducing the risk of failure in the market.
e. Increase User Engagement: Ensure that users feel engaged and satisfied with the product to foster loyalty and long-term retention.

4. Results and Discussions

4.1 Implementation

The Decision Support System for Recipients of Direct Cash Assistance-Village Funds using *the SMART* method (Case Study: Mburukulu Village) has been successfully built and provides information related to the determination of BLT-DD recipients, namely providing a ranking of each of these analyses.

a) Login Page

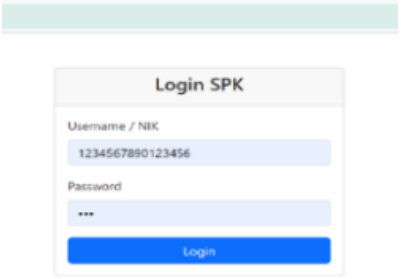

Figure 4: Login Page

Figure 4 illustrates the login page. The login system acts to set the limit of user access in the application.

b) Home Page

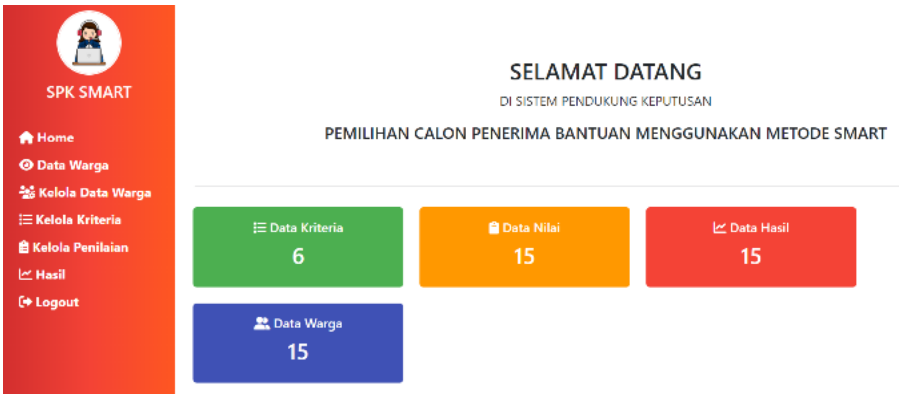

Figure 5: Home page

Figure 5 illustrates the home page. It displays a summary of the amount of criterion data, value data, result data, and citizen data.

c) View Citizen Data

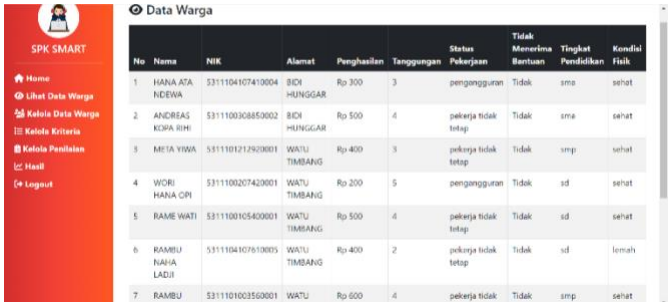

Figure 6: Citizen Data Page

Figure 6 illustrates a page displaying the citizen data. This menu will display a table of citizen data that has been registered in the system, both administrator and the public can see this menu.

d) Data Management

Figure 7: Manage Citizen Data page

Figure 7 illustrates data management. This menu is restricted to only administrator, where they can add, edit, and delete citizen data.

e) Criteria Management

Figure 8: Manage Criteria page

Figure 8 illustrates the Data Kriteria (criteria management) page. This menu is also restricted to only administrators, where they can add, edit and delete the criteria. Once the criteria was modified, the normalization value would automatically updated.

f) Manage Assessments

Figure 9: Manage Assessments page

Figure 9 illustrates the Assessment page. The assessment uses 1-5 score for each criterion. The greater the value, the more influential it is.

g) Result

Figure 10: Results Page

Figure 10 illustrates the results page, displaying information on the results of data calculation using the SMART method. This page also shows the names of residents, final score, ranking, and status of the number of recipients.

4.2 Testing

1. BlackBox Testing

Table 1: Black Box Testing

No	What's Your Activity	Expected realization	Succeed (Yes/No)
1.	*Login*	Incorrect username *and* password warnings System *successfully logged in* and logged in to the home page	Yes / ~~No~~ Yes / ~~No~~
2.	View citizen data	The public and also admins can view citizen data	Yes / ~~No~~
3.	Manage Citizen Data	Admins can manage citizen data	Yes / ~~No~~
4.	Manage Criteria	Admins can manage criteria	Yes / ~~No~~
5.	Manage Assessments	The system will automatically assign a score of 1-5 for each criterion which is more influential	Yes / ~~No~~
6.	Result	Admins and the community can see which calculation results are feasible and which are not feasible	Yes / ~~No~~
7.	*Logout*	The user can log out of the system	Yes / ~~No~~

2. User Testing

Table 2: User Testing

Yes	Question	Response
1.	How easy is this system used by village officials in determining BLT-DD recipients?	Very easy to understand
2.	Is this system transparent in the selection process of BLT-DD recipients?	It is very transparent because of the Criteria and is clearly defined. For example: income, number of dependents, and so on are determined at the beginning and apply to all citizens.
3.	What are the criteria for BLT-DD recipients included in the system?	Yes listed
4.	How does the system display the results of the recipient selection in an easy-to-understand form?	Very easy to understand

5.	Is the information about the BLT-DD recipient displayed in detail and easy to understand?	Yes it is easily displayed
6.	Can this system help the village in the process of determining BLT-DD recipients?	It is very helpful for the village in the process of determining BLT-DD recipients in Mburukulu village

5. Conclusion

Results showed that Decision Support System for Direct Cash Assistance of Village Funds (BLT-DD) in Mburukulu Village using the Simple Multi Attribute Technique (SMART) method has been successfully implemented with the following detailed information:

1. The Decision Support System (DSS) with the SMART method has been successfully designed and implemented to assist the Mburukulu Village apparatus in determining prospective BLT-DD recipients in a more objective, transparent, and targeted manner.
2. The results of the test and simulation of the system show that the SMART method is able to produce an accurate ranking of potential recipients based on the final score of each alternative.

Reference

[1] L. K. Safitri and Jasmir, "Decision Support System for Families of Beneficiaries of Direct Cash Assistance for Village Funds (BLT-DD)," *Sist. Supporters of the decision of the beneficiaries. Direct Cash Village Funds*, vol. 8, p. 608, 2023, [Online]. Available: https://ejournal.unama.ac.id/index.php/jurnalmsi/article/view/1519

[2] A. LIS, *DECISION SUPPORT SYSTEM FOR RECEIVING DIRECT CASH ASSISTANCE FROM VILLAGE FUNDS USING THE SIMPLE ADDITIVE WEIGHTING (SAW) METHOD IN GUNUNGAN MOJOK VILLAGE*. 2024.

[3] M. Huzaifa and E. Refianti, "Decision Support System for Recipients of Direct Cash Assistance for Village Funds Using the SMART Method," vol. 7, no. 2, pp. 132–144, 2022.

[4] N. Suparman, G. Washillah, and T. Juana, "EFFECTIVENESS OF DIRECT CASH ASSISTANCE DISTRIBUTION," vol. 19, no. 2, pp. 44–60, 2021.

[5] M. K. Diana, S.Si., *Methods & Applications DECISION SUPPORT SYSTEM*. Palembang: CV BUDI UTAMA, 2018.

[6] S. Surati, S. Siswanti, and A. Kusumaningrum, "Simple Multi Attribute Rating Technique Method for Decision Support System for Determination of Scholarship Recipients," *jurna; l Ilm. in you*, no. 2, pp. 57–66, 2022.

[7] U. Irwan, H. Pratiwi, Purnamasari, and Dessy, "Decision Support System for Determining Building Material Suppliers Using the Smart Method (Simple Multi Attribute Rating Technique) at Toko Bintang," pp. 34–42, 2014, [Online]. Available: https://media.neliti.com/media/publications/237601-sistem-pendukung-keputusan-penentuan-sup-3cd0c03a.pdf

[8] B. T. Hutagalung, E. T. Siregar, and J. H. Lubis, "The Application of the SMART Method in the Selection of Social Assistance Recipients for Community Residents Affected by COVID-19," *J. Media Inform. Budidarma*, vol. 5, no. 1, p. 170, 2021, doi: 10.30865/mib.v5i1.2618.

[9] R. Adrianto, "SCHOLARSHIP RECIPIENT INFORMATION SYSTEM (CASE STUDY: FACULTY OF ENGINEERING, ISLAMIC UNIVERSITY OF RIAU) BY: RIAU ISLAMIC UNIVERSITY," 2022.

[10] S. Supiyandi, M. Zen, C. Rizal, and M. Eka, "The Design of the Information System of Tomuan Holbung Village Using the Waterfall Method," *JURIKOM (Jurnal Ris. Computer)*, vol. 9, no. 2, p. 274, 2022, doi: 10.30865/jurikom.v9i2.3986.

[11] A. Setiawati, A. Rahim, D. Kisbianty, P. Studi, T. Informatika, and S. D. Bangsa, "Development and Testing of Usability Aspects in Library Information Systems (Case Study: STIKOM Dinamika Bangsa Jambi)," vol. 13, no. 1, 2018.

[12] E. B. Sambani and F. Nugraha, "Decision Support System to Determine the Status of Contract Employees to Permanent Employees Using the SMART Decision Method, namely the Simple Multi Attribute Rating Tachnique (SMART) method which is the System Development Life Cycle (SDLC) method. A system of proofing," *J. Sist. Inf. and Technology. Inf.*, vol. 7, no. 2, pp. 116–123, 2018.