Decision Support System of Direct Cash-Village Fund Recipients using Multi Attribute Utility Theory

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Abstract— Direct Village Fund Cash Assistance (BLT-Dana Desa) is a form of assistance from the government in the form cash to poor families in villages sourced from the Village Fund to reduce the impact of the COVID-19 pandemic. To facilitate village officials in determining aid recipients quickly, accurately and on target, the MAUT method was chosen which was deemed suitable for use in the Decision Support System (DSS) which had many criteria so that it could easily calculate each alternative based on the many types of criteria and sub-criteria used and with a predetermined weight. There are 148 data samples of BLT recipients registered in the Social Welfare Integrated Data (DTKS) of Loa Janan Ulu village. The criteria in this study are building floor Size, type of house floor, types of house walls, sanitary facilities, power source, source of drinking water, cooking fuel, consumption of chicken/meat/milk, clothing needs, consumption in a day, do not have savings max. 500.000 rupiah. Based on the results of calculations using the MAUT method, a recommendation for direct cash assistance recipients was obtained with an accuracy value of 92.57%.

Keywords ; Direct Village Fund Cash Assistance, Decision Support System, MAUT Method

I. INTRODUCTION

Today, the whole world including the Indonesian nation is facing the same problem regarding health, namely the COVID-19 pandemic or what we commonly call corona. How not, the social and economic impact caused by COVID-19 is very influential for the level of community welfare. This is due to macro-restrictions on economic activities that reduce economic growth, causing many people to lose their jobs and further increasing the potential number of poor people.

Village Cash Direct Assistance (BLT-Dana Desa) is one form of assistance from the government in the form of cash to poor families in the village sourced from the Village Fund to reduce the impact of the COVID-19 pandemic that resulted in many people who were previously actively working who were then laid off or even fired from where they worked as one way to save on company expenses. The implementation of BLT-Dana Desa is based on the Issuance of Law (UU) Number 2 of 2020 on State Financial Policy and Financial System Stability for Handling the COVID-19 Pandemic intended to provide protection for the lives of underprivileged people who are clearly threatened by the massive spread of COVID-19, both from the health and safety aspects of each individual, as well as in the social and economic life of the community. The value of BLT-Dana Desa assistance provided by the government to underprivileged residents is Rp 600.000 for each month for poor families who have met the criteria and will be given for 3 (three) months, then Rp 300.000 every month for the next 3 (three) months and BLT-Dana Desa is free from taxes [1-2].

Loa Janan Ulu Village is one of the villages located in Loa Janan District of Kutai Kartanegara Regency, where this village gets obligations and duties to carry out the Instruction of the Minister of Home Affairs No. 3 of 2020 regarding the handling of COVID-19 in the village through APBDesa (Village Revenue and Expenditure Budget) and The Minister of Finance Regulation No. 40 of 2020 regarding changes to the

Regulation of the Minister of Finance No. 205 of 2019 on Village Fund Management. Based on data from the Central Statistics Agency (BPS) of Kutai Kartanegara Regency in 2019, Loa Janan Ulu Village consists of 4 Hamlets and 36 Neighboring Pillars (RT). Then, Loa Janan Ulu Village has a population of about 12,042 people. Generally, the people of Loa Janan Ilir Village work as Civil / Private Employees, Mine Workers, Farmers, Ranchers, and Housewives.

One of the common problems that occurred in Loa Janan Village was during the distribution of direct cash assistance, it resulted in the inappropriate target of BLT-DD aid recipients in the village. As a result, many complaints made by residents related to the unregistered members of their families as recipients of BLT-DD funds. Generally in determining the recipient of direct cash assistance is done through data collection conducted by the chairman of RT or RW or field team from the local village, so that it often results in differences in perception in determining the prospective recipient of the right aid in accordance with the criteria that have been determined. By utilizing the decision support system, it is expected to help village devices in selecting or filtering the names of BLT-DD recipients based on predetermined criteria, and also in the decision support system will use certain methods used in the selection of prospective recipients of direct cash assistance. It is known that the total number of loa janan ulu villagers is about 12,042 people. Of the many villagers of Loa Janan Ulu there must be residents living below the poverty line, so that with this there needs to be assistance from the government to the poor in the form of cash directly that is expected to be able to help and raise the wheels of their economy.

The presence of technology which is increasingly developing has resulted in changes to all aspects of life, such as services, transportation, education, to social services which are expected to help all human needs, which are increasingly becoming more numerous and complex. So with the involvement of technology in various fields of human work, it makes experts to always be able to innovate in developing technology. Computers are one of the devices that are present due to technological developments that are chosen as one of the right alternatives in helping to complete work and handle the flow of information in very large quantities and can assist in making appropriate and accurate decisions. In this study, the method used in the calculation of the determination of the recipient of direct cash assistance is the Multi Attribute Utility Theory (MAUT) method in which the method will calculate the weight of the criteria and sub-criteria for each alternative and produce alternatives with precise and accurate results in the form of values. evaluation which will then rank all alternatives so that they can provide the best solution in determining the recipients of direct cash assistance in Loa Janan Ulu Village. In addition, the MAUT method was chosen because it is considered appropriate and accurate, another reason is that the MAUT method is very suitable for use in DSS which has many criteria so that it can easily calculate each alternative according to the predetermined weight. By creating a system which uses the Multi Attribute Utility Theory method, it is hoped that it will make it easier for village officials who serve as selectors for Village Fund Direct Cash Assistance (BLT – DD).

Multi Attribute Utility Theory (MAUT) is a method of decision making. MAUT is a method in which to find the weighted number of the same values for each utility on each attribute. This method can also process data from all attributes with different utilities. The MAUT method is expected to assist in making decisions in selecting candidates for Village Fund Direct Assistance (BLT-DD) based on the many different types of attributes [3-7].

Therefore, this study raises the title Decision Support System to determine Candidates for Direct Cash Assistance – Village Funds using the Multi Attribute Utility Theory method in Loa Janan Ulu Village. This is intended to make it easier for village officials, especially members of the selection team from the People's Welfare section (KESRA) and the Social Welfare section (KESOS) in Loa Janan Ulu Village.

II. RESEARCH METHODOLOGY

A. Decision Support System

Decision Support System (DSS) is an interactive computer-based system, which helps decision makers utilize data and models to solve unstructured and semi-structured problems. Initially, the Decision Support System was a system where the system was based on a model that contained the procedures used in data processing and the results from the data were used in consideration to assist managers or superiors in determining the decisions to be taken. In order to achieve its objectives, the system must be simple, easy to control, adaptable, complete.

B. Cash Direct Assistance – Village Funds (BLT-DD)

Direct Cash Assistance-Village Funds (BLT-DD) is one of the government's assistance to poor families in villages whose sources of funds come from village fund which are used to help or reduce the impact of reduced income due to the COVID-19 pandemic. The value of the Village Fund BLT is IDR 600,000 per month for each poor family who meets the criteria and is given for 3 (three) months and IDR 300,000 every month for the next three months. The BLT-Village Fund is tax-free [1-4].

C. Multi Attribute Utility Theory (MAUT)

Multi-Attribute Utility Theory (MAUT) is a schema in which the final evaluation, v(x), of an object x is defined as a weight that is summed with a value relevant to its dimension value. The expression commonly used to refer to it is utility value. MAUT is used to change from some importance into a numeric value with a scale of 0-1 where 0 represents the worst choice and 1 is the best. This allows direct comparison of various sizes. The end result is a ranking order of alternative evaluations that describes the choices of the decision makers [3-7]. Alternative evaluation is obtained by normalizing alternative weights with equation 1 :

$$U_{(x)} = \frac{x - x_i^-}{x_i^+ - x_i^-} \quad \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots (1)$$

Where U(x) is the normalized alternative weight, xi is the alternative weight, xi- is the worst (minimum) weight of the criterion, xi+ is the best (maximum) weight of the criterion [5-

10]. Calculation attribute normalization utility is based on Equation 2:

$$V_{(x)} = \sum_{i=1}^{n} w_j . x_{ij} \qquad \text{...............................} .(2)$$

Where $V(x)$ is the overall value of the alternative choice of a sub-criteria, Wj is the weight of the criteria, xij is the value of the alternative choice of a sub-criteria, i is the alternative choice, j sub-criteria, n the number of research samples.

D. Stages of research implementation

In this study there are several stages in carrying out research, namely field studies, literature studies, data collection, data analysis, system analysis to be built (Fig. 1).
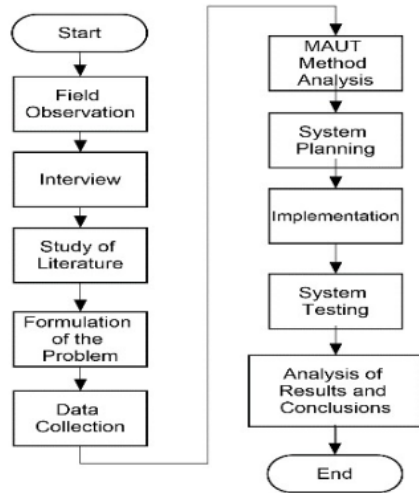
Fig. 1. Research Method

The description of Fig. 1, each stage is as follows:

1. *Field Observation*, at this stage, the researcher reviews or observes directly in the field to look for any obstacles or problems experienced by the village and then conclude several things from what has been observed.
2. *Interview*, After having some conclusions related to field observations, then they will conduct questions and answers to the parties involved in the problems or obstacles experienced by the village with the aim of sharpening the information that has been previously owned.
3. *Study of Literature*, at this stage, they begin to study or study several journals, books, and documents both in print and electronic form related to the research being carried out.
4. *Formulation of the Problem*, At this stage, formulate all existing problems based on field observations and interviews, so that it can be concluded what solutions can be given to the village so that the research becomes useful.

5. *Data Collection*, at this stage, start collecting data related to the research to be carried out. The data collected in this study were in the form of prospective BLT-DD recipients in Loa Janan Ulu Village and what criteria were used.
6. *MAUT Method Analysis*, after obtaining the data, the next step is to analyze the calculations using the MAUT method. What will be analyzed using the MAUT method is the weight of the criteria and sub-criteria of each alternative.
7. *System Planning*, At this stage, start designing the system to be built using the Waterfall model so that the design can be monitored from every work process so as to minimize errors that can occur. Things that can be done at this stage include analyzing the Entity Relationship Diagram (ERD), then system flowcharts, data flow diagrams ranging from context diagrams to level 2 DFDs, and designing the appearance of the system to be built.
8. *Implementation*, This stage is the application or implementation of the previous stage, which is only a design, then at this stage it realizes the things that have been designed previously.
9. *System Testing*, After implementing the system, the next stage is to test the software or system against its functionality, whether the system can run according to its function or an error occurs. In this stage, testing the system using the Black box method.
10. *Analysis of Results and Conclusion*, After many stages have been passed, at this stage analyze all the things that have been produced and conclude whether this system is in accordance with what is desired or not.

E. Data Collection

Data collection was carried out by carrying out several data collection methods which could then support this research. The data collection carried out in this study was divided into three, namely, literature study, field study, and interviews.

1) Literature Study
Literature study is a method of collecting data by conducting a review study of books, literatures, notes, and reports that are related to this research.

2) Field Study
Field study is a method of collecting data by direct observation of the object to be and is being studied, then the results obtained will be analyzed and used in this study.

3) Interview
Interview is a method of collecting data which is done by asking questions to the people involved in making the data, besides that researchers can also find out about the problems faced so far, so that researchers can determine what things might be. will be researched and implemented to solve the problems encountered.

F. Data Design

The data used during this research is data on Poor Families who are prospective beneficiaries of the 2020 Village Fund BLT which were collected by the field survey team from the Social Welfare section of Loa Janan Ulu Village and this study used 148 data samples which were then determined based on 9 criteria to be able to calculate using the method. MAUT. The determination of the value of the weight of the criteria and the value of the weight of the sub-criteria were obtained from interviews with village officials. In this study there are at least 14 criteria and the data sample used is 149 data samples based on the guidelines for recording the BLT - Dana Desa data and the data forms for prospective beneficiaries of the BLT - Dana Desa from the Ministry of Social Affairs of the Republic of Indonesia used by Loa Janan Ulu Village (Table 1):

TABLE 1. CRITERIA

No	Criteria	Criteria Weight	Sub-criteria	Sub-criteria weight
1.	Building Floor Size (C1)	10%	Less Than 8m²	3
			More Than 8m²	1
2.	Type Of House Floor	5%	Soil	5
			Bamboo	4
			Wood	3
			Ceramic	2
			Marble	1
3.	Types Of House Walls	5%	Thatch	5
			Bamboo	4
			Wood	3
			Wall Without Plaster	2
			Wall With Plaster	1
4.	Sanitary Facilities	5%	Without Facilities	5
			Share With Others	3
			One's Own	1
5.	Power Source	5%	Without Electricity	5
			450 Watt	4
			900 Watt	3
			1300 Watt	2
			More Than 1300 Watt	1
6.	Source Of Drinking Water	5%	Water Springs	5
			River Water	4
			Refill Water	3
			Well	2
			PDAM	1
7.	Cooking Fuel	5%	Firewood	5
			Kerosene	4
			3kg Gas	3
			More Than 3kg Gas	2
			Electricity	1
8.	Consumption Of Chicken/ Meat/Milk	5%	Not At All	5
			1 Time A Week	3
			More Than 1 Time A Week	1
9.	Clothing Needs	5%	Not At All	5
			1 Set Of Clothes A Year	3
			More Than 1 Set Of Clothes A Year	1
10.	Consumption In A Day	10%	1 Time A Day	4
			2 Times A Day	3
			3 Times A Day	2
			More Than 3 Times A Day	1
11.	Ability To Treat	10%	Unable To Treat	5
			Polyclinic	3
			Public Health Center	1
12.	Total Income	10%	Rp 0 - Rp 100.000	5
			Rp 100.000 - Rp 300.000	3
			Rp 300.000 - Rp 600.000	1
13.	Education	10%	Dropout	5
			Elementary School/Equivalent	4
			Junior High School/Equivalent	3
			Senior High School/Equivalent	2
			College	1
14.	Savings Rp 500.000	10%	Do Not Have Rp 0 - Rp 100.000	5
			Rp 100.000 - Rp 250.000	3
			Rp 250.000 - Rp 500.000	1

III. RESULTS AND DISCUSSION

A. Data processing

The data that will be used in data processing comes from Loa Janan Ulu Village by taking as many as 148 data samples of BLT recipients registered in the Social Welfare Integrated Data (DTKS) of Loa Janan Ulu Village. Then do the grouping of data which aim to facilitate the analysis so that the processed data has information that can be used to help solve problems in this study.

B. System Implementation

The system is started by the Admin entering the login page to enter the username and password, then the next step is to validate whether the admin account is in accordance with the data in the database, if successful, the next step is the admin fills in alternative data, then criteria data, sub-criteria data. After inputting everything the system will calculate the utility value of each alternative entered, then after the results are obtained the next process is to multiply the utility value by the normalized weight value. After the calculation process is carried out, it will produce a value which will then be ranked against the results and will produce prospective BLT-DD recipients [1-4].
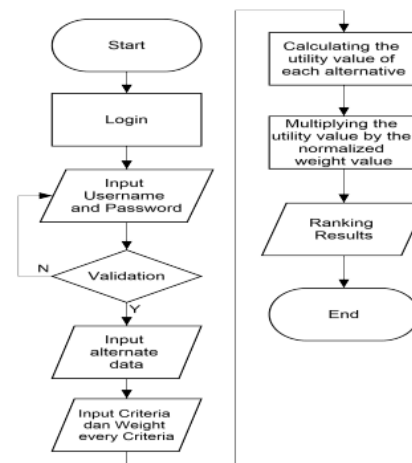
Fig. 2. Flowchart System

C. MAUT Method Process

After determining the alternatives that will be used in the process of determining the prospective recipients of BLT funds, then determining the criteria and weights for each alternative, the next step is to normalize the matrix and preference weights using the equation formula [5-8].

TABLE 2. MATRIX NORMALIZATION AND CRITERIA WEIGHT

rnate	C1	C2	C3	C4	...	C11	C12	C13	C14
A1	3	3	3	3	...	3	3	4	1
A2	1	5	3	3	...	3	3	4	3
A3	1	3	3	1	...	3	1	3	1
A4	1	2	2	1	...	1	1	2	1
A5	3	3	3	3	...	5	3	3	3
Weight Criteria	10	5	5	5	...	10	10	10	10

Alternate 1

$$C1 = \frac{3-1}{3-1} = \frac{2}{2} = 1$$

$$C2 = \frac{3-1}{5-1} = \frac{2}{4} = 0.5$$

$$C3 = \frac{3-1}{5-1} = \frac{2}{4} = 0.5$$

$$C4 = \frac{3-1}{5-1} = \frac{2}{4} = 0.5$$

$$C5 = \frac{4-1}{5-1} = \frac{3}{4} = 0.8$$

$$C6 = \frac{3-1}{5-1} = \frac{2}{4} = 0.5$$

$$C7 = \frac{3-1}{5-1} = \frac{2}{4} = 0.5$$

$$C8 = \frac{5-1}{5-1} = \frac{4}{4} = 1$$

$$C9 = \frac{3-1}{5-1} = \frac{2}{4} = 0.5$$

$$C10 = \frac{3-1}{4-1} = \frac{2}{3} = 0.7$$

$$C11 = \frac{3-1}{5-1} = \frac{2}{4} = 0.5$$

$$C12 = \frac{3-1}{5-1} = \frac{2}{4} = 0.5$$

$$C13 = \frac{4-1}{5-1} = \frac{3}{4} = 0.8$$

$$C14 = \frac{1-1}{5-1} = \frac{0}{4} = 0$$

TABLE 3. MATRIX NORMALIZATION RESULTS

Alternate	C1	C2	C3	C4	...	C11	C12	C13	C14
A1	1	0.5	0.5	0.5	...	0.5	0.5	0.8	0
A2	0	1	0.5	0.5	...	0.5	0.5	0.8	0.5
A3	0	0.5	0.5	0	...	0.5	0	0.5	0
A4	0	0.3	0.3	0	...	0	0	0.3	0
A5	1	0.5	0.5	0.5	...	1	0.5	0.5	0.5
Weight Criteria	10	5	5	5	...	10	10	10	10

1. After the normalization of the matrix, the next step is to calculate the multiplication of the results of the normalization of the matrix with the preference weights by using the equation formula.

$$A1 = (10×1) + (5×0.5) + (5×0.5) + (5×0.5) + (5×0.8) +$$
$$(5×0.5) + (5×0.5) + (5×1) + (5×0.5) + (10×0.7) +$$
$$(10×0.5) + (10×0.5) + (10×0.8) + (10×0)$$
$$= 59$$

$$A2 = (10×0) + (5×1) + (5×0.5) + (5×0.5) + (5×0.8) +$$
$$(5×0.8) + (5×0.5) + (5×1) + (5×0.5) + (10×0.7) +$$
$$(10×0.5) + (10×0.5) + (10×0.8) + (10×0.5)$$
$$= 58$$

$$A3 = (10×0) + (5×0.5) + (5×0.5) + (5×0) + (5×0.8) +$$

$$(5×0.3) + (5×0.3) + (5×0.5) + (5×0.5) + (10×0.7)+$$
$$(10×0.5) + (10×0) + (10×0.5) + (10×0)$$
$$= 34$$

$$A4 = (10×0) + (5×0.5) + (5×0.5) + (5×0) + (5×0.8) +$$
$$(5×0) + (5×0.5) + (5×0.5) + (5×0.5) + (10×0.7) +$$
$$(10×0.5) + (10×0) + (10×0.3) + (10×0)$$
$$= 25$$

$$A5 = (10×1) + (5×0.5) + (5×0.5) + (5×0.5) + (5×0.8) +$$
$$(5×1) + (5×0.5) + (5×0.5) + (5×0.5) + (10×0.7) +$$
$$(10×1) + (10×0.5) + (10×0.5) + (10×0.5)$$
$$= 66$$

2. Finally, the calculation results based on the Equation formula are shown as follows (Table 4):

TABLE 4. NORMALIZED MATRIX MULTIPLICATION RESULTS WITH PREFERENCE WEIGHTS

No	Alternate	Results	Rank
1	A5	66	1
2	A1	59	2
3	A2	58	3
4	A3	34	4
5	A4	25	5

D. Display Application

The next stage after carrying out the calculation process using the MAUT method is to apply from the appearance of the decision support system to the prospective recipient of BLT funds. On the display of the decision support system for the prospective recipient of BLT funds, there are several pages such as login page, main menu page, alternative page, criteria page, sub criteria page, assessment page, assessment results page, user data page, and report print page.
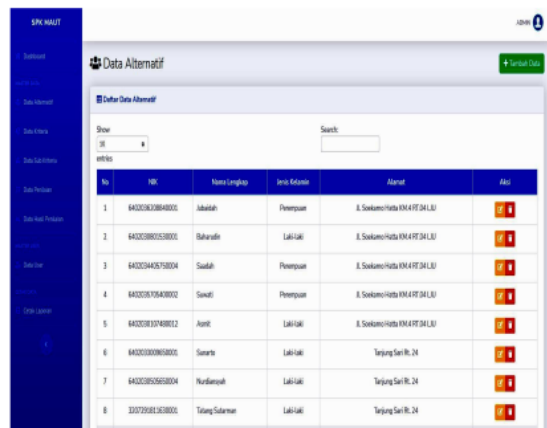
1) Alternate Page (Fig. 3).

Fig. 3. Alternate Page

2) Criteria Page (Fig.4).

Fig. 4.   Criteria Page

3) Sub-Criteria Page (Fig.5).

Fig. 5.   Sub-Criteria Page

4) Rating Page (Fig.6).

Fig. 6.   Rating Page

5) Alternative Data and Assessment Value page (Fig.7).

Fig. 7.   Alternative Data and Assessment Value page

6) Evaluation Value Data page (Fig.8).

Fig. 8.   Evaluation Value Data page

7) Ranking Results page (Fig.9).

Fig. 9.   Ranking Results Page

E. Calculation of Accuracy Value

From the results of calculations on the Decision Support System using the MAUT method, a formula is obtained to determine the level of accuracy in the system with data obtained from Loa Janan Ulu Village. In order to calculate the level of accuracy of the system [9-14].

- Number of Sample Data for Prospective BLT Recipients : 148
- Suitability Data : 137
- Mismatch Data : 11

$$Suitability\ Data = \frac{suitability\ data}{amount\ of\ data} \times 100\%$$

$$Suitability\ Data - \frac{137}{148} \times 100\% - 92{,}57\%$$

$$Mismatch\ Data = \frac{Mismatch\ data}{amount\ of\ data} \times 100\%$$

$$Mismacth\ Data = \frac{11}{148} \times 100\% = 7{,}43\%$$

IV. CONCLUSION

A. Conclusion

Based on the results of the research that has been done it can be concluded in several ways as follows: the Multi Attribute Utility Theory (MAUT) method is applied to a Decision Support System that recommends eligible community candidates to receive Direct Cash Assistance – Village Funds in Loa Janan Ulu Village using 148 sample data. Based on the results of the accuracy value test that has been carried out, the MAUT method can provide recommendations to prospective BLT-DD recipients in Loa Janan Ulu Village which produces an accuracy value of 92.57% or as many as 137 people are eligible to receive assistance, and 7, 43% or as many as 11 people are not eligible to receive assistance.

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