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 of 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_Cas_ Assistance, DSS, MAUT.

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].

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 RT. Then, it has a population of about 12,042 people. Generally, the people 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 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 villagers is about 12,042 people. Of the many villagers must be residents living below the poverty line, 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. In this study, the method used in the calculation of the determination of the recipient of direct cash assistance is 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 MAUT method, make it easier for village officials who serve as selectors for Village Fund Direct Cash Assistance (BLT – DD).

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 BLT-DD based on the many different types of attributes [2]-[5].

Therefore, this study raises the title DSS to determine Candidates for Direct Cash Assistance – Village Funds using the MAUT method. 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 DSS 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 [6]-[12].

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

BLT-DD is one of the government's assistance to poor families in villages whose sources of funds come from village funds 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 three months and IDR 300,000 every month for the next three months. The BLT-Village Fund is tax-free [13]-[17].

C. Multi Attribute Utility Theory (MAUT)

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 [18]-[25].

Alternative evaluation is obtained by normalizing alternative weights with equation 1:

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

Where $U_{(x)}$ is the normalized alternative weight, x_i is the alternative weight, x_i^- is the worst (min.) weight of the the criterion, x_i^+ is the best (max.) weight of the criterion [5]-[10]. Calculation attribute normalization utility is based on Equation 2:

$$V_{(x)} = \sum_{i=1}^{n} w_j \cdot x_{ij} \quad \dots\dots\dots\dots\dots\dots\dots\dots(2)$$

Where $V_{(x)}$ is the overall value of the alternative choice of a sub-criteria, W_j is the weight of the criteria, x_{ij} is the value of the alternative choice of a sub-criteria, i is the alternative choice, j is sub-criteria, n is 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 [26]. The description of 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*, 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*, to study several journals, books, and documents both in print and electronic form related to the research being carried out.
4. *Formulation of the Problem*, formulate all existing problems based on field observations and interviews, so that it can be concluded what solutions can be given to the village to solve their problem.
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 method is the weight of the criteria and sub-criteria of each alternative.
7. *System Planning*, starts designing the Waterfall model, analyzing the ERD, flowcharts, DFD, and designing the UI of the system.
8. *Implementation*, to implement of the system that has been designed previously.
9. *System Testing*, after implementing the system, the next stage is testing the system against its functionality. In this stage, testing the system using the Black box method.
10. *Analysis of Results and Conclusion*, at this stage analyze all the things that have been produced and conclude whether this system is in accordance with user need or not [27].

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 journals, 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.

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, so that researchers can determine what things implemented to solve the problems.

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. This study used 148 data samples which were then determined based on the criteria to calculate using the MAUT method. The determination of the value of the weight of the criteria and the sub-criteria were obtained from interviews with village officials. There are at least 14 criteria and 148 samples based on the guidelines for recording the BLT - Dana Desa from the Ministry of Social Affairs of the Republic of Indonesia (Table 1):

TABLE 1. CRITERIA

No	Criteria	Criteria Weight
1	Building floor size	10%
2	Type of house floor	5%
3	Types of house walls	5%
4	Sanitary facilities	5%
5	Power source	5%
6	Source of drinking water	5%
7	Cooking fuel	5%
8	Consumption of chicken/meat/milk	5%
9	Clothing needs	5%
10	Consumption in a day	10%
11	Ability to treat	10%
12	Total income	10%
13	Education	10%
14	Do not have savings max Rp 500.000	10%

Building Floor Size criteria are determined by the floor area of the residence of the prospective beneficiaries. Further information regarding the C1 criteria can be seen in Table 2:

TABLE 2. BUILDING FLOOR SIZE

No	Building Floor Size	Weight Value
1	Less than 8m²	3
2	More than 8m²	1

The criteria for the type of floor of the house are determined by what type of floor is used by the prospective beneficiaries. Further information regarding the C2 criteria can be seen in Table 3:

TABLE 3. TYPE OF HOUSE FLOOR

No	Type Of House Floor	Weight Value
1	Soil	5
2	Bamboo	4
3	Wood	3
4	Ceramic	2
5	Marble	1

The criteria for the type of house walls are determined by the quality of the walls where the beneficiaries live. Further information regarding the C3 criteria can be seen in Table 4:

TABLE 4. TYPES OF HOUSE WALLS

No	Types Of House Walls	Weight Value
1	Thatch	5
2	Bamboo	4
3	Wood	3
4	Wall without plaster	2
5	Wall with plaster	1

The criteria for sanitary facilities are determined by what kind of sanitation facilities are used by potential beneficiaries. Further information regarding the C4 criteria can be seen in Table 5:

TABLE 5. SANITARY FACILITIES

No	Sanitary Facilities	Weight Value
1	Without facilities	3
2	Share with others	2
3	One's own	1

The criteria for the power source are determined by how much power the potential beneficiaries use. Further information regarding the C5 criteria can be seen in Table 6:

TABLE 6. POWER SOURCE

No	Power Source	Weight Value
1	Without Electricity	5
2	450 Watt	4
3	900 Watt	3
4	1300 Watt	2
5	More Than 1300 Watt	1

The criteria for drinking water sources are determined based on where the water sources used for daily needs are bathing, washing, and latrines. Further information regarding the C6 criteria can be seen in Table 7:

TABLE 7. SOURCE OF DRINKING WATER

No	Source Of Drinking Water	Weight Value
1	Water springs	5
2	River water	4
3	Refill water	3
4	Well	2
5	PDAM	1

The criteria for cooking fuel are determined by the type of fuel, especially for households used by the prospective beneficiaries. Further information regarding the C7 criteria can be seen in Table 8:

TABLE 8. COOKING FUEL

No	Cooking Fuel	Weight Value
1	Firewood	5
2	Kerosene	4
3	3kg gas	3
4	More than 3kg gas	2
5	Electricity	1

The criteria for consumption of chicken/meat/milk is determined based on how much consumption of chicken, beef and milk is in a week. Further information regarding the C8 criteria can be seen in Table 9:

TABLE 9. CONSUMPTION OF CHICKEN/MEAT/MILK

No	Consumption Of Chicken/Meat/Milk	Weight Value
1	Not at all	5
2	1 time a week	3
3	More than 1 times a week	1

The criteria for clothing needs are determined based on the ability of prospective recipients to purchase clothing needs within one year. Further information regarding the C9 criteria can be seen in Table 10:

TABLE 10. CLOTHING NEEDS

No	Clothing Needs	Weight Value
1	Not at all	5
2	1 Set of clothes a year	3
3	More than 1 set of clothes a year	1

The consumption criterion in a day is determined from how much food is needed in a day. Further information regarding the C10 criteria can be seen in Table 11:

TABLE 11. CONSUMPTION IN A DAY

No	Consumption In A Day	Weight Value
1	1 Time A Day	4
2	2 Times A Day	3
3	3 Times A Day	2
4	More Than 3 Times A Day	1

The criteria for the ability to seek treatment are determined from how capable the prospective recipient is in carrying out treatment at the selected health facility. Further information regarding the C11 criteria can be seen in Table 12:

TABLE 12. ABILITY TO TREAT

No	Ability To Treat	Weight Value
1	Unable To Treat	5
2	Polyclinic	3
3	Public Health Center	1

The criteria for the amount of income are determined from how much income the prospective recipient will earn within 1 week. Further information regarding the C12 criteria can be seen in Table 13:

TABLE 13. TOTAL INCOME

No	Total Income	Weight Value
1	Rp 0 - Rp 100.000	5
2	Rp 100.000 - Rp 300.000	3
3	Rp 300.000 - Rp 600.000	1

Education criteria are determined from the last education of the prospective recipient. Further information regarding the C13 criteria can be seen in Table 14:

TABLE 14. EDUCATION

No	Education	Weight Value
1	Dropout	5
2	Elementary School/Equivalent	4
3	Junior High School/Equivalent	3
4	Senior High School/Equivalent	2
5	College	1

Criteria have savings money max. 500.000 rupiah determined saved by the prospective recipient. Further information regarding the C14 criteria can be seen in Table 15:

TABLE 15. SAVINGS MONEY

No	Do Not Have Savings Max Rp 500.000	Weight Value
1	Rp 0 - Rp 100.000	5
2	Rp 100.000 - Rp 250.000	3
3	Rp 250.000 - Rp 500.000	1

III. RESULTS AND DISCUSSION

A. Data processing

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.
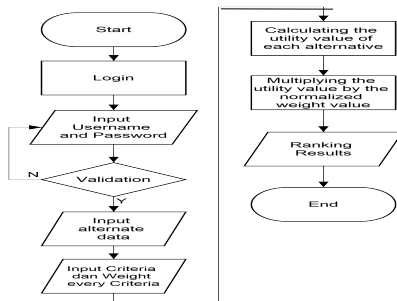

Fig. 1. Flowchart System

B. 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 [28]-[30].

TABLE 16. MATRIX NORMALIZATION AND CRITERIA WEIGHT

Alternate	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

$$C1 = \frac{3-1}{3-1} = \frac{2}{2} = 1$$
$$C2 = \frac{3-1}{5-1} = \frac{2}{4} = 0.5$$
$$C3 = \frac{3-1}{5-1} = \frac{2}{4} = 0.5$$
$$C4 = \frac{3-1}{5-1} = \frac{2}{4} = 0.5$$

$$C8 = \frac{5-1}{5-1} = \frac{4}{4} = 1$$
$$C9 = \frac{3-1}{5-1} = \frac{2}{4} = 0.5$$
$$C10 = \frac{3-1}{4-1} = \frac{2}{3} = 0.7$$
$$C11 = \frac{3-1}{5-1} = \frac{2}{4} = 0.5$$

TABLE 17. 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	0.5	...	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

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

2. Finally, the calculation results based on the Equation formula are shown as follows (Table 18):

TABLE 18. NORMALIZED MATRIX MULTIPLICATION RESULTS

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

C. 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. 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. The alternative page in this system displays a list of potential recipients of BLT funds. It can only be accessed by the admin to perform CRUD commands (Create, Read, Update, and Delete) on data that will be entered into the database. Evaluation Value Data and Ranking Results page displays the evaluation value data and the normalized value multiplied by the weight. This page displays the results of calculations and performs a ranking (Fig.2).

Fig. 2. Ranking Results Page

D. Calculation of Accuracy Value

The level of accuracy of the system for the suitability of the data obtained from the large number of people who deserve to receive assistance as many as 137 people, then for the discrepancy data obtained from the number of people who cannot receive assistance as many as 11 people [31].

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

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

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

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

IV. CONCLUSION

Based on the results of the research, the MAUT method is applied to recommends eligible community candidates to receive Direct Cash Assistance Village Funds using 148 sample data. The accuracy value test that has been carried out, it can provide recommendations to prospective BLT-DD recipients which 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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