A Decision Support System to Determine the Familiy's Economic Status for Certificate of The Low-Income Household Using MAUT Method

Muhammad Yahya[1], Jumadi Mabe Parenreng[2], Fathahillah[3], Abdul Wahid[4], M. Syahid Nur Wahid[5], Muhammad Fajar B[6]

[1,2,3,4,5,6]Universitas Negeri Makassar, Jl. A. P. Pettarani

Email: m.yahya@unm.ac.id[1], jparenreng@unm.ac.id[2], fathahillah@unm.ac.id[3], wahid@unm.ac.id[4], syahid@unm.ac.id[5], fajarb@unm.ac.id[6]

Abstract. The problem of unemployment and poverty is a significant issue that the government have yet to address completely. The number of working-age people continues to rise, yet there are insufficient employment openings to meet demand. The government then provided extensive aid to the community. The Village Information System, part of the digitization system in Laguruda Village, Takalar Regency, comprises an integrated intelligent system that can forecast the eligibility of people who come to apply for a certificate of incapacity so that they are no longer inappropriate targets. The method employed is the Multi-Attribute Utility Theory (MAUT), based on 14 criteria set forth by the Ministry of Social Affairs. The results of a 49-person sample of household heads who identified themselves as poor and in need of assistance from the Ministry of Social Affairs revealed that 57.14% were in the mediocre category, 36.73% were in the rich category, 4.08% were in the poor category, and 2.04% were in the very poor category. This information demonstrates the system's ability to filter requests for poverty certifications. On the other hand, village officials were assisted in determining the right conditions for residents to be eligible for a poverty certificate.

Keywords – SIMDA, Local Potential, Certificate of Low-Income, Entrepreneurships.

Intisari - Masalah pengangguran dan kemiskinan di usia produktif merupakan permasalahan yang sampai saat ini masih menjadi persoalan hidup yang belum bisa di atasi sepenuhnya. Jumlah penduduk usia kerja terus bertambah sedangkan lapangan kerja belum cukup tersedia bagi para pencari kerja. Kemudian pemerintah melalui kementrian sosial banyak menggulirkan bantuan ke masyarakat. Salah satu syarat untuk mendapatkan bantuan ini dibuktikan dengan surat keterangan tidak mampu dari desa. Sistem digitalisasi Desa Laguruda Kabupaten Takalar melalui Sistem Informasi Desa (SIMDA) yang didalamnya terintegrasi sistem cerdas yang mampu melakukan prediksi kelayakan warga yang datang untuk meminta surat keterangan tidak mampu sehingga aparat desa tidak lagi salah sasaran mengeluarkan surat ini. Sistem cerdasnya menggunakan metode Multi Attribute Utility Theory (MAUT) yang didasarkan pada peraturan kemensos yang terdiri dari 14 kriteria. Hasil akhirnya dari 49 sampling kepala keluarga yang selama ini mengdefinisikan diri sebagai warga yang kurang mampu dan layak mendapatkan bantuan dari kemensos ternyata 57.14% kategori menegah, 36.73% kategori kaya, 4.08% kategori miskin dan 2.04% kategori fakir. Data ini memunjukkan kemampuan sistem ini melakukan filtering terhadap masyarakat yang datang untuk meminta surat keterangan tidak mampu. Sisi lain apparat desa terbantu untuk menentukan kriteria warganya sehingga surat keterangan tidak mampu ini dikeluarkan sesuai dengan peruntukan dan mengenai sasaran.

Kata Kunci - SIMDA, potensi lokal, keterangan tidak mampu, Kewirausahaan.

I. INTRODUCTION

Rural and urban life is very different, not only in terms of facilities and appearance that seem luxurious. But they don't realize that city life is usually not what it is in the sense that it only looks and seems rich or luxurious, but it can be categorized as a mediocre life. On the

other hand, life in the village tends to be mediocre and far from luxurious, but life is what it is and in accordance with reality.

Laguruda Village is located in the Sanrobone District, Takalar Regency, South Sulawesi Province. In Sanrobone District, there are six villages included, one of which is Laguruda Village. Laguruda village has a population of 1,429 people, the average population of Laguruda village has jobs as farmers and fishers based on the statistics on the potential of villages in the Takalar District 2018. To maximize village services, in this case, the government has data related to residents who are categorized as poor and deserve to be helped. This data on the poor people will then be prioritized to obtain social assistance from the government in the hope that this assistance will be a trigger so that these citizens can work and have businesses so that in the future, their lives are better and are no longer categorized as poor citizens who need assistance from the government [1].

When there is social assistance, most people hope to get government assistance even though economically, these citizens are not entitled. The poverty certificate as a condition for administering this assistance is easily obtained for anyone, as long as the concerned citizen wants to care for it and claims to be a poor citizen. The Laguruda Village Information System (SIMDA) has been designed with an intelligent system based on poverty criteria to sort out which residents deserve assistance and those who do not [10].

Based on the Regulation of the Minister of Social Affairs of the Republic of Indonesia Number: 146/HUK/2013 concerning Determination of Criteria and Data Collection for the Poor and Very Poor People, there are 14 poverty criteria as follows [2]:
1. The floor area of a residential building is less than 8 m^2 per person.
2. The type of floor of the residence is made of cheap earth/bamboo/wood.
3. Type of residential wall made of bamboo/ thatch/low-quality wood/ unplastered wall.
4. Do not have defecation facilities/shared with other households.
5. Household lighting sources do not use electricity.
6. The source of drinking water comes from wells/unprotected springs/rivers/rainwater.
7. The fuel for daily cooking is firewood/charcoal/kerosene.
8. Only eat meat/milk/chicken once a week.
9. Buy only one new set of clothes a year.
10. Only able to eat once/twice a day.
11. Unable to pay medical expenses at the Puskesmas/Polyclinic.
12. Sources of income for the head of household are: Farmers with a land area of 500 m^2, Farm Workers, Fishermen, Construction Workers, Plantation Workers, and/or Other Jobs with incomes below Rp600 thousand per month.
13. Highest education of the head of household: no school/not finished elementary school/graduated elementary school.
14. Do not have savings/goods that are easy to sell with a minimum of Rp. 500,000, credit/non-credit motorbikes, gold, livestock, motorbikes, or other capital goods.

The above poverty criteria are then utilized as a starting point for developing a Decision Support System (DSS), a computer-based information system that aids decision-making in an organization or firm [3]. It's also a computer system that converts input into information to make decisions on semi-structured challenges. DSS combined with computer-based information systems can assist someone in improving their decision-making and forecasting abilities. DSS combines the intellectual resources of persons with computer capabilities to improve decision quality [4].

With the advancement of information technology and the need for decision-making in determining and submitting a certificate of incapacity, an intelligent decision-making system (DSS) is needed to make it easier for village officials in Laguruda Village, Sanrobone District, Takalar Regency to predict family economic status.

DSS with a knowledge-based decision support system is part of a computer-based information system that performs knowledge management to support decision-making in an organization or company. DSS can also be described as a system capable of supporting ad hoc data analysis and decision modeling, decision-oriented, future planning orientation, and is used when making decisions and making choices difficult [5], [6]. Decision Support System (DSS) was created to meet the needs of a manager in making specific decisions in solving specific problems. This DSS is used for Decision Support for the Acceptance of Family Hope Program Assistance (PKH), which is one of the government's conditional assistance programs as a form of compensation for the rise in the price of fuel oil (BBM), which, of course, has an impact on the lives of the general public, including the poor. The Analytical Hierarchy Process (AHP) [7] ensures that the predicted results are more accurate and that the system is structured systematically. Other research uses DSS to verify and validate poverty data to aid in implementing the social welfare system, preventing invalid or out-of-date data, reducing the same problems that recur, such as inaccuracy in program targets and poverty reduction activities, and lowering the poverty reduction target. It's challenging to get out of poverty [8].

II. METHODS

The decision model analysis is done using the Multi-Attribute Utility Theory (MAUT) technique, and the modeling, analysis, and system design stages are completed. Data Flow Diagrams (DFD), Entity Relationship Diagrams (ERD), Flowcharts, and Interfaces are used to define system analysis. Furthermore, the database structure, table linkages, and a data dictionary define the system design. Then, during the construction stage, the system is coded, and the system is tested.

MAUT is the final evaluation scheme $v(x)$ of item x, defined as the weight added to the criterion value's value. MAUT is a program that converts various criteria into a numeric value on a scale of 0 to 1, with 0 being the worst option and 1 being the best. MAUT is a decision-making tool that uses a utility function to measure decision-maker's preferences by assigning a numerical index to vary satisfaction levels.

This method is based on determining the value of each alternative in terms of the decision maker's preferences, which can be done by breaking down the decision into things of value, calculating the value provided by each available alternative, and calculating the value of a function that includes attribute performance measures and weights that reflect the decision maker's interests and scale.

Figure 1 depicts the phases in the MAUT technique for calculating the value of the population's economic level:

a.   Divide the decision into different criteria.

b.   Determine the normalization of criteria for each criterion.

$$w_i = \frac{w_i}{\sum_{i=1}^{n} w_i} \tag{1}$$

c.   Furthermore, the normalized criterion weight if the total weight of the criteria is added up is 1 (one).

$$\sum_{i=1}^{n} w_i = 1 \tag{2}$$

Remark:

$w_i = i^{\text{th}}$ criterion weight

n = number of criteria
i = criteria

d. Making a list of all alternatives.
e. Calculates the normalized value of the matrix for each alternative according to its attributes.

$$U(x) = \frac{(x - x^-)}{(xi^+ - xi^-)}$$

(3)

Remark:
$U(x)$ = normalization of alternative weights
xi^- = minimum value criteria (lowest weight)
xi^+ = maximum value of criteria (highest weight)
x = alternative weight

f. Multiply the utility by its weight to find the value of each alternative.

$$V(x) = \sum_{i=1}^{n} w_i U(x)$$

(4)

Remark:
$V(x)$ = evaluation value
n = number of criteria
i = criteria
w_i = ith criterion weight
$U(x)$ = utility value on the ith criterion
x = alternative

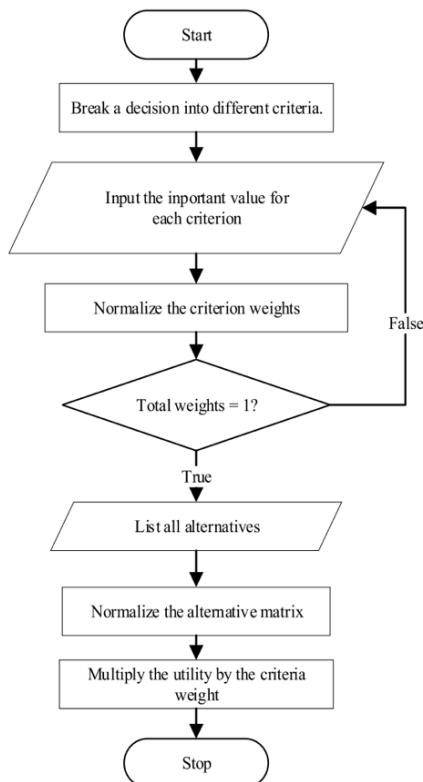The complete phase of the MAUT method used in this study can be seen in Figure 1 below.

Figure 1. MAUT Calculation Flowchart

188

Criteria 1 to 14 use the reference measurement of poverty according to the Regulation of the Minister of Social Affairs of the Republic of Indonesia Number: 146/HUK/2013 [2] to determine the economic level of the population in Takalar district, while criterion 15 uses the reference measurement of poverty according to the BKKBN [9]. A rubric has been created for each of these criteria based on consultations with experts and literature reviews.

III.   RESULTS AND DISCUSSION

A. Result

Based on 49 respondent data analyzed, the statistics are shown in the diagram in Figure 2 which shows that from the total sampling of household heads who have defined themselves as poor and deserving of assistance from the Ministry of Social Affairs, it turns out that 57.14% are in the mediocre category, 36.73% are in the rich category, 4.08 % poor category and 2.04% very poor category.
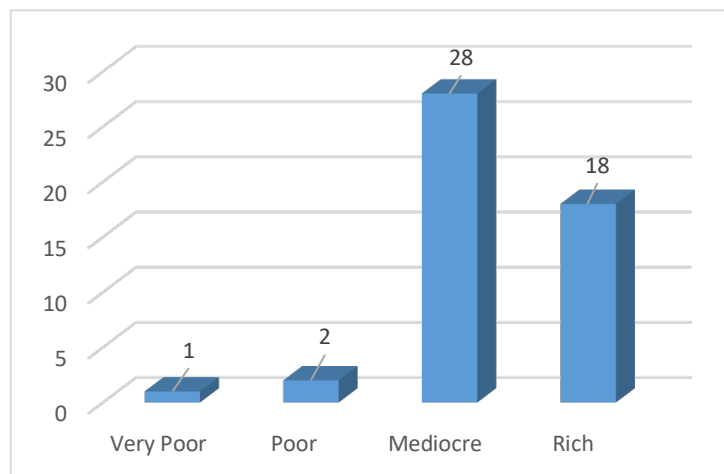

Figure 2. Analysis of Determination of Economic Status of Respondents in Takalar Regency

The results of the analysis obtained are based on the MAUT method. The threshold that has been determined can then be used as a model for analyzing new data to be tested for its economic status so that this model can be used as a predictive model for the economic level of society in Takalar Regency in the future.

B. Discussion

The weights used in the analysis of the economic level of the residents of Takalar Regency can be seen in the following table.

TABLE I.
WEIGHT OF CRITERIA

Code	Criteria	Weight
C1	Building area	10
C2	Floor type	7
C3	Wall type	7
C4	Defecation facilities	10
C5	source of light	10
C6	Source of drinking water	10
C7	cooking fuel	8
C8	Frequency of buying meat in a week	3

Code	Criteria	Weight
C9	Number of clothes bought in a year	4
C10	Frequency of eating in a day	8
C11	Cost of treatment	5
C12	Income	10
C13	Last education of household head	6
C14	Savings	8

The level of the economic standing of the population in Takalar Regency is determined using 14 factors. According to the Regulation of the Minister of Social Affairs of the Republic of Indonesia Number: 146/HUK/2013, all of these criteria are used to measure poverty. Each criterion has a weight, which is calculated based on the importance of the criteria in determining the outcomes, which has been reviewed and analyzed with experts, and the weights are calculated as shown in Table 1. The MAUT technique has a wide range of criteria weight scores. However, to make it easier to understand, the range of scores utilized in the weighting criteria goes from 1 to 10.

Each criterion has a parameter value set by a rubric based on the applicability of real-world situations in the Takalar Regency. The next step is to equalize the weight criteria after finding the weights for each criterion. Normalization is performed on each weight criterion to be scaled from a range of values ranging from 0 to 1 and used in the next stage. All normalized weight values are shown in Table II.

TABLE II
CRITERIA WEIGHT NORMALIZATION

Code	Criteria	Weight	Normalization
C1	Building area	10	0,094339623
C2	Floor type	7	0,066037736
C3	Wall type	7	0,066037736
C4	Defecation facilities	10	0,094339623
C5	source of light	10	0,094339623
C6	Source of drinking water	10	0,094339623
C7	cooking fuel	8	0,075471698
C8	Frequency of buying meat in a week	3	0,028301887
C9	Number of clothes bought in a year	4	0,037735849
C10	Frequency of eating in a day	8	0,075471698
C11	Cost of treatment	5	0,047169811
C12	Income	10	0,094339623
C13	Last education of household head	6	0,056603774
C14	Savings	8	0,075471698

The next step is to translate the respondent's response form into a specified weight based on each criterion's parameter values. The weight of the category input values of the 14 criteria is shown in Table III. There are two numeric data type criteria: the income (C12) and savings (C14) criteria, which differ from categorical data type criteria. The C12 and C14 criteria can be processed immediately at the following stage: normalization of the weight value.

TABLE III
INPUT RESPONDENT CRITERIA VALUE BASED ON PARAMETER VALUE

Code	C1	C2	C3	...	C12	C13	C14
P1	1	4	3	...	30000000	4	20000000
P2	5	6	2	...	500000	1	20000000
P3	1	5	2	...	10000000	4	10000000
P4	1	6	2	...	500000	2	30000000
P5	2	1	3	...	30000000	6	10000000
P6	5	4	4	...	5000000	4	30000000
P7	2	1	5	...	500000	5	10000000
P8	2	5	4	...	20000000	5	20000000
P9	1	2	4	...	30000000	3	500000
P10	5	3	3	...	10000000	7	5000000

Weight normalization is done by performing MinMaxScaler based on the input data so that the results shown in Table IV. It can be seen that respondents who have the lowest criterion parameter values are represented by a value of 0, while the highest is represented by a value of 1.

TABLE IV
NORMALIZATION RESULT OF INPUT CRITERIA

Code	C1	C2	...	C12	C13	C14
P1	0	0,5	...	1	0,5	0,661
P2	1	0,833	...	0	0	0,661
P3	0	0,667	...	0,322	0,5	0,322
P4	0	0,833	...	0	0,167	1
P5	0,25	0	...	1	0,833	0,322
P6	1	0,5	...	0,153	0,5	1
P7	0,25	0	...	0	0,667	0,322
P8	0,25	0,667	...	0,661	0,667	0,661
P9	0	0,167	...	1	0,333	0
P10	1	0,333	...	0,322	1	0,153

After obtaining the normalization results on the criteria weights and normalization on the input values, the following step is to multiply these values such that the results are in the form of MAUT scores. As indicated in Table V, the overall score is calculated by summing the results of each criterion's normalization with the normalized weights.

After determining the total value, the next step is to determine the economic status based on the total MAUT value obtained. There are four categories of economic status, namely very poor, poor, mediocre, and rich. To determine the threshold or limit value for each category, a field analysis is carried out according to the minimum criteria value for each category. It was found that the very poor category was determined with a threshold value below 0.2. The poor category is determined by a value between 0.2 and 0.3. The mediocre category is determined with a value of 0.3 to 0.5. The rich category is defined with a value greater than 0.5.

TABLE V
MULTIPLYING CRITERIA NORMALIZATION BY WEIGHT NORMALIZATION

Code	C1	C2	...	C13	C14	Total
P1	0	0,033	...	0,028	0,049	0,449
P2	0,094	0,055	...	0	0,049	0,417
P3	0	0,044	...	0,028	0,024	0,476
P4	0	0,055	...	0,009	0,075	0,445
P5	0,024	0	...	0,047	0,024	0,577
P6	0,094	0,033	...	0,028	0,075	0,581
P7	0,024	0	...	0,037	0,024	0,422
P8	0,024	0,044	...	0,037	0,049	0,477
P9	0	0,011	...	0,018	0	0,491
P10	0,094	0,022	...	0,056	0,011	0,427

IV. CONCLUSIONS

1. DSS with the MAUT method is the right solution for making decisions and predicting the future. This method has become part of the Laguruda Village Information System (SIMDA) in Takalar Regency to make it easier to predict the economy and status of residents who come to take care of a certificate of incapacity.

2. Based on a sampling of 49 residents of Laguruda Village who submitted a certificate of being unable to get assistance from the Ministry of Social Affairs, it turned out that 57.14% were in the mediocre category, 36.73% in the rich category, 4.08% in the poor category and 2.04% in the very poor category.

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