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Decision Support System Determination of Recipients Subsidized Fertilizer Donation Using the SMART (Simple Multi Attribute Rating Technique)

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Abstract: The decision support system to determine recipients of subsidized fertilizer subsidies is a decision support system application that can process data to determine recipients of subsidized fertilizer subsidies. The purpose of this study is to create an information system that can identify beneficiaries of subsidized fertilizer grants. The existence of this system can optimize the provision of subsidized fertilizers to farmers who really need these fertilizers. In its application, this study uses existing research methods such as data collection techniques, observation and documentation methods, as well as testing methods using the black box testing method to test the functionality of the program / website to be created with a success percentage reaching 100% compared to existing excel calculations and researchers make qualitative testing with Likert scale testing for the level of acceptance of applications made where The Likert scale test results tested gave results of 86.27% with a very good research success rate. Therefore, this research is said to be successful so that it can be used as a basis for the implementation of decision support systems in existing research sites
Keyword: Application; Decision Support System; Method; Recipients; System;

1. INTRODUCING

The XYZ Regency Plantation and Livestock Office is an XYZ local government agency that deals with work related to plantations and animal husbandry. This agency was established with the authority to accommodate plantation and livestock problems such as the provision and distribution of subsidized fertilizers, plantation-related medicines, plant seeds and livestock grants in the XYZ Regency area.

Subsidized fertilizer is a fertilizer whose procurement and distribution receive subsidies from the Government for the needs of farmers which are implemented on the basis of the Central Government program. The purpose of this subsidized fertilizer is to increase

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agricultural production and support national food security, the Government of Indonesia through the Ministry of Agriculture (Kementan) coordinates with local agencies in providing subsidized fertilizer to farmers. Based on the Decree of the Minister of Agriculture of the Republic of Indonesia, Number: 04/Kpts/RC.210/B/02/2019, concerning the Procurement and Distribution of Subsidized Fertilizers for the Agricultural and Plantation Sectors. In Article 1 of the regulation, it is explained that subsidized fertilizers procurement and distribution receive subsidies from the government for the needs of farmers which are implemented on the basis of government programs. In addition, Article 3 states the types of subsidized fertilizers provided, such as Urea, SP-36, ZA, and NPK with a composition of N: P: K = 15: 15: 15 : 15 and 20: 10: 10. All fertilizers must meet the National Quality Standard (SNI). Subsidized urea fertilizer is one of the most widely used by farmers both for agricultural and cultivation land. This fertilizer has a high enough moisture content so that it accelerates plant growth. The presence of water content also makes plants grow green.

In accordance with the regulations mentioned above, there are several requirements that must be met by farmers to get subsidized fertilizers. One of them is that farmers must first join farmer groups in their villages and regions. The purpose of this process is that subsidized fertilizers can be distributed properly and on target. The requirements are in accordance with the Regulation of the Minister of Agriculture Number 47 of 2017 concerning the Allocation and Highest Retail Price of Subsidized Fertilizers. The regulation also regulates fertilizer producers. In the farmer group, other conditions are set to be able to become a farmer group such as: residents of surrounding villages, having their own gardens (control over the garden) and working as farmers.

After making observations at the research site, the process of distributing subsidized fertilizers is usually carried out not in accordance with the proper distribution. This distribution process is not right on target and usually the subsidized fertilizer is used by successful farmers so that the distribution is only enjoyed by a few farmers. This is evidenced by the use of subsidized fertilizers by some successful farmers in several villages in Kabupaten XYZ. Internal factors causing this are the weak administration and supervision system of subsidized fertilizer distribution and the absence of a mechanism for the distribution system and supervision of subsidized fertilizers.

Therefore, the management of subsidized fertilizer distribution is very important by paying attention to a careful analysis process. Based on this background, the researcher offers a solution, namely by making a decision support system for the distribution of subsidized fertilizers in which there is a calculation analysis process based on meeting the requirements that have been set in the distribution of subsidized fertilizers so that they can produce decisions that are right on target in making decisions regarding the provision of subsidized fertilizers in the XYZ Regency area.

The benefit of implementing the DSS application is to increase the ability and accuracy of decision makers by providing better alternative decision results with recommendations issued by the system so that it can be the basis for decision making for leaders to make a decision[1], [2]. Based on the above, a computer system is needed that can help determine the application of subsidized fertilizers so as to produce decisions that can facilitate quick and effective decision making for the Plantation and Livestock office.

The decision support system built by researchers using the SMART method. Simple Multi Attribute Rating Technique (SMART) method is a multi-criteria decision making search method based on the theory that each choice consists of several criteria that have value and each criterion has one weight to illustrate how important value is compared to other criteria[3]. The SMART method is more often used because of its simplicity to meet the needs of decision makers and analyze the answers. This method allows a way that can help leaders in making decisions on who are farmers who are entitled to subsidized fertilizer[4].

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2. RESEARCH METHOD

Research Sites and Data Sources

The research site that became the focus of the researcher was the Office of the Plantation and Livestock Office in XYZ Regency. The time required to work on this study ranged from 3 to 6 months in the same year.

The data sources used in the study are primary data types and secondary data.

a. Primary Data, Primary data is data obtained by taking directly from the source[5]. The primary data used in this study are as follows: Data from observations of the flow of determining recipients of Subsidized Fertilizer at the XYZ District Plantation and Livestock Office; Data from interviews with the Head of the Plantation and Livestock Office of XYZ Regency.
b. Secondary Data, Secondary Data is data obtained from existing sources [5][6]. The secondary data used in this study are as follows: Report on data on recipients of Subsidized Fertilizer in 2018; Report on the list of registered Farmer Groups in 2018.

Data Collection Techniques

Data collection techniques carried out by researchers in collecting data are as follows:

a. Observation, is the observation of events / activities that exist in the research location directly [7][8]. The observations made by researchers lasted for 3 months from August to October 2019.
b. Documentation, existing documents that are useful in this study. The document is in the form of reports related to the research topic [8].
c. Interview, is the process of giving questions to resource persons according to the topic raised.
d. Questionnaire, is a list of questions filled out by respondents according to the actual circumstances.

Thinking Framework

The framework of thinking in this study is contained in figure 1 which is divided into several elements, namely: Problems, Approaches, Software measurements, Implementation, Testing and Results [9], [10].

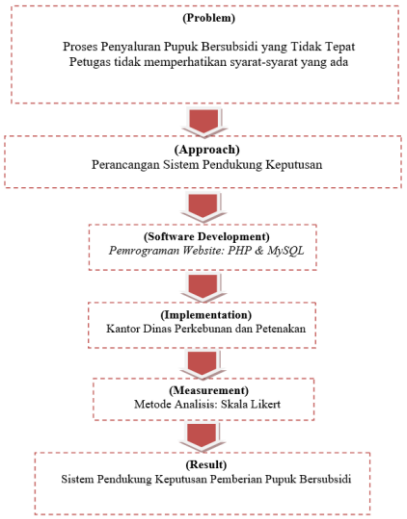

Figure 1. Thinking Framework

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System Development Methods

The system development method carried out by the researcher is the SDLC (System Development Life Cycles) method illustrated in figure 2. SDLC is the stages of work performed by system analysts and programmers in building information systems [9].

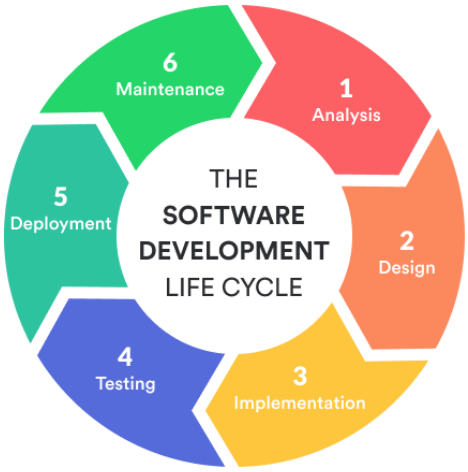

Figure 2. SDLC *Method*

The stages in the SDLC method are as follows [11]–[13]

a. Stages of Analysis. Analysis is the beginning and begins with finding and seeing what is needed by the system. After all the system needs are complete, everything will be implemented in the system to be created. In the design of this system, researchers collect data and use software and hardware that will be used to design the information system.
b. System Design. After the system analysis process, then designing the system is designing inputs, outputs, file structures, programs, procedures, hardware and software needed to support the information system.
c. System Implementation is switching from the old system to the new system, conducting guidance and guidance from the system that has been created.
d. Testing. Testing is a step to test whether this system is feasible to be applied in a research site.
e. Deployment. Deployment or repair of system errors
f. System Maintenance. After the next stage of implementation pay attention to the issue of system maintenance. System maintenance includes backing up and scanning for viruses. In addition, the implementation of the system that has been made will definitely experience changes caused by errors in the system that must adjust to the new operating system. In addition, make adjustments to maintain the system or correct errors that may occur.

Simple Multi Attribute Rating Technique (SMART) Method

SMART (Simple Multi-Attribut Rating Technique) is a multi-criteria decision-making method developed by Edward in 1997[14]. This multi-criterion decision-making technique is based on the theory that each alternative consists of a number of criteria that have values and each criterion has a weight that describes how important it is compared to other criteria. This weighting is used to assess each alternative in order to obtain the best alternative[3].

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Stages of *Simple Multi Attribut Rating Technique* (SMART)

In accordance with several sources, the stages of the SMART method are as follows [3], [4], [14]:

a. Determine alternatives and criteria that will be used to solve decision-making problems.
b. Give weight to each criterion using a scale of 1 to 100 with regard to the most important priorities.
c. After the weights are given then calculate the normalization of the criteria weights of each criterion by means of scores on the criteria weights divided by the total criteria weights according to the following equation (1)

$$Normalisasi = \frac{Wj}{\sum Wj} \quad (1)$$

Information:
Wj : Criteria Weight Score
$\sum Wj$: Total weight of all criteria

d. Provide a criteria score for each alternative. This criterion score can contain qualitative data or quantitative data (numbers). If the data is still qualitative, then the data will be used as lift / quantitative data first by making parameter values on the criteria. Calculate utility value by converting the criterion score for each criterion into a standard data criteria score. For criteria with benefit categories, it is calculated by equation (2) as follows::

$$ui\ (ai) = \frac{(cmax - cout)}{(cmax - cmin)} \quad (2)$$

While the criteria with the cost category (cost) are calculated by equation (3) as follows:

$$ui\ (ai) = \frac{(cout - cmin)}{(cmax - cmin)} \quad (3)$$

Information:
$ui\ (ai)$: Utility score of the first criterion
$cout$: I-th criterion score
$cmax$: Maximum Criteria Score
$cmin$: Minimum Criteria Score

e. Calculate the final value by summing the total multiplication result of the numerical criteria weight normalization result obtained from the standard data criteria score normalization with the criteria weight normalization score, as in the following equation (4)

$$ui\ (ai) = \sum \binom{m}{j=1} \text{wj} * \text{uj (ai)} \quad (4)$$

Information:
$u(ai)$: Alternative Final Value
wj : Results of Normalization of Weighting Criteria
$uj(ai)$: Result value of utility

f. Ranking. Ranking is the process of sorting the final value from largest to smallest. The best alternative is the one that derives the greatest value.

Qualitative Test and Measurement Methods

The system testing method used in this study is using the Blackbox Testing test method [15], [16] which is based on the results of manual calculations using Excel compared to

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the results of SPK calculations that have been made. In addition, researchers also use qualitative measurement methods using Likert scale respondent test tools [17], [18].

3. RESULT AND DISCUSSIONS

The results and discussion are adjusted to the existing system development methods.

Identify the Problem

The problem is that the determination of subsidized fertilizer is still not on target, so far it is only based on the initiative of related parties, therefore a system is needed that can help decision making in the distribution of subsidized fertilizer in XYZ district. The system used is in the form of a decision support system using the SMART method which is sought to help related parties in the distribution of subsidized fertilizers..

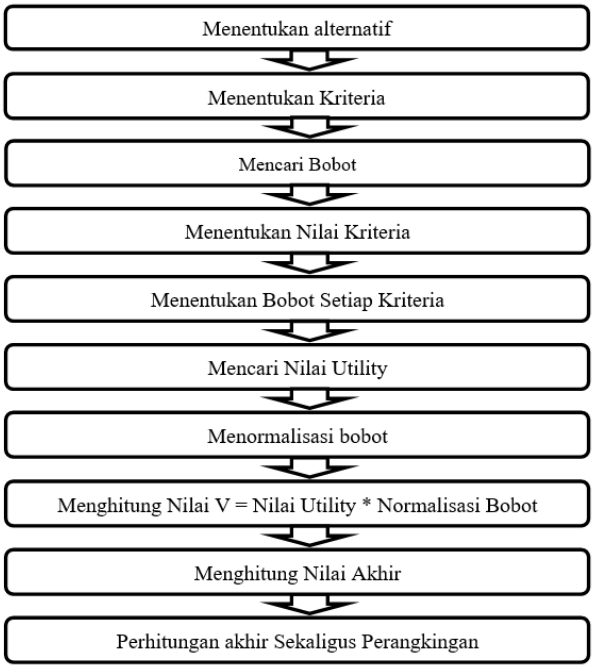
Data Collection

The data used in making decision support systems using this include:

1. Data from the collection of evidence of subsidized fertilizer for the period 2017-2019,
2. Data from the 2017-2019 home ownership survey,
3. Data from vehicle ownership survey for the period 2017-2019.

DSS Modeling SMART Method

The DSS modeling made is based on the steps in the SMART method with a combination of steps in data input and data output made based on the website shown in the figure 3.



Gambar 3. DSS Modeling SMART Method

Results of the SMART Method Steps

1. Determine alternatives. This step is the step where the researcher determines the object or data to be assessed. The alternatives determined as training data for this research are as follows:

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Table 1. Table of Alternatives (Recipients of Subsidized Fertilizers)

Nomor	Nama
A1	Yamiria
A2	Yakob
A3	Oca
A4	Man

2. Determine the criteria. At this stage the researcher determines the factors that will be used in this process in accordance with existing data. The criteria used appear in table 2.

Table 2. Criteria Data

Number	Name	Subcriteria
1	Income	- < 1.000.000 - < 1.500.000 >1.000.000 - < 2.000.000 >1.500.000 - < 2.500.000 >2.000.000 - > 2.500.000
2	Home Ownership Status	- Home Alone - Rented House - Boarding House - Pensions - No Home
3	Vehicle Ownership Status	- Have a Car and Motorcycle >3 - Own a Car - Have a > 3 Motor - Has Motor >= 1 <= 3 - Do not have a vehicle

3. Determine the value of the criteria. The stage where the researcher determines the value of the criterion according to alternative data that corresponds to the weight and value of the previously set criteria shown in the figure 4.

no	nama	n_c1	n_c2	n_c3
1	Yamiria	4.00	5.00	5.00
2	Man	4.00	3.00	3.00
3	Yacob	3.00	4.00	4.00
4	Oca	1.00	5.00	1.00

Figure 4. Results of Determining Criteria Values

4. Determine the weight of each criterion. Determine the weight of the criteria to be assessed according to the predetermined weight. This process is shown in the figure 5.

id_kriteria	nama	nilai
2	Status Kepemilikan Rumah	100
3	Status Kepemilikan Kendaraan	100
1	Penghasilan/Pendapatan Warga	80

Figure 5. Results of Determining Criteria Values

5. Calculates utility values and normalized utility weight values. Utility value calculated according to the image 6.

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no	nama	c1_ternormalisasi	c2_ternormalisasi	c3_ternormalisasi
1	Yamiria	1.1428571428571428	1.7857142857142858	1.7857142857142858
2	Man	1.1428571428571428	1.0714285714285714	1.0714285714285714
3	Yacob	0.8571428571428571	1.4285714285714286	1.4285714285714286
4	Oca	0.2857142857142857	1.7857142857142858	0.35714285714285715
(NULL)	*(NULL)*	*(NULL)*	*(NULL)*	*(NULL)*

Figure 6. Results of Utility Value Determination

6. Calculates the normalization of weights. Weight normalization is intended to normalize the weight number so that it can be calculated. Weight normalization is obtained from the weight value of each criterion divided by the total weight value in the figure 7.

no	nama	nilai
2	Status Kepemilikan Rumah	0.35714285714285715
3	Status Kepemilikan Kendaraan	0.35714285714285715
1	Penghasilan/Pendapatan Warga	0.2857142857142857
(NULL)	*(NULL)*	*(NULL)*

Figure 7. Weight Normalization Results

7. Calculate the final value marked with a U value. The U value is obtained from the weight normalization value multiplied by the utility value in the previous table while the results will be displayed in the figure 8.

no	nama	nilai_akhir
1	Yamiria	1.5714285714285714
2	Man	1.0952380952380951
3	Yacob	1.2380952380952381
4	Oca	0.8095238095238096

Figure 8. Results Calculate Final Value

8. Final grade calculation. The final stage where the researcher calculates the final grade and performs SMART cracking.

no	nama	nilai_akhir
1	Yamiria	1.5714285714285714
3	Yacob	1.2380952380952381
2	Man	1.0952380952380951
4	Oca	0.8095238095238096

Figure 9. Final Grade Ranking Results

Blackbox Test Results

Blackbox test results based on calculations according to the existing SMART method steps compared to manual calculations using Microsoft Excel produce the same calculations on all components. Therefore, it produces 100% testing.

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Likert Scale Qualitative Test Results

Based on the results of processing questionnaire data for each question item on each variable, the results are obtained as shown in figure 10 as follows::

Pertanyaan No	(SS) Bobot 5	(S) Bobot 4	(RR) Bobot 3	(TS) Bobot 2	(STS) Bobot 1	Jumlah X Bobot	Perhitungan Presentase	Hasil Presentasi
1	17 orang	14 orang	2 orang	0 orang	0 orang	147	$\frac{147}{170}$	86.47%
2	17 orang	11 Orang	5 orang	1 orang	0 orang	146	$\frac{146}{170}$	85.88%
3	17 orang	11 Orang	6 orang	0 orang	0 orang	147	$\frac{147}{170}$	86.47%
Jumlah						$\frac{440}{3}$ = 146,47	86.27%	

Figure 10. Final Data Processing Results

To conclude the results of processing questionnaire data, you must first know the value of the assessment interval
Percentage yield 0% - 19.99% : Very Not Feasible
Percentage Yield 20% - 39.99% : Not Worth It
Percentage Yield 40% - 59.99% : Hesitated
Presentation Results 60% - 79.99% : Decent
Presentation Results 80% - 100% : Very Decent

The results of processing questionnaire data based on three predetermined question variables are as follows:

Average: $\frac{440}{3} = \frac{146{,}67}{170}\ x\ 100\% = 86{,}27$

Based on the processing of questionnaire data, it can be concluded that the creation of this Information System was approved by users with the average presentation of the three assessment question variables was 86.274%. Therefore, based on the research success table, this test is said to be successful this system is categorized as very feasible.

4. CONCLUSION

The conclusion obtained by the researcher that in accordance with the results and discussions including the analysis and process of data collection, design and implementation of the SMART method in the SPK application, subsidized fertilizer applications were made, very feasible results were obtained with black box testing reaching 100% and qualitative testing with a Likert scale reaching 86.27%. It can be concluded that this research can help related parties.

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