

Determining the Eligibility of Livestock Assistance using the Weighted Aggregated Sum Product Assessment Method

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Abstract

Livestock is a part of the agricultural sector in Indonesia's national development which aims to increase the income and welfare of farmers and ranchers. This is evidenced by the growth rate which is always positive and the contribution which tends to increase, one of which is the Agam Regency Animal Husbandry Service. In providing assistance, the Livestock Service Office of Agam Regency, in providing assistance, livestock assistance is often not on target and the livestock assistance that is given is not properly managed because often groups of farmers or livestock after receiving assistance after being checked again, the livestock that are given are not well cared for. In providing livestock assistance, it is still being carried out by using a manual process, namely the Agam Regency Animal Husbandry Service in providing assistance does not use a special calculation method such as using the scientific method. The implementation of the Decision Support System in this study uses the Weighted Aggregated Sum Product Assessment (WASPAS) method, which is a combination method of the WP method and the SAW method. The WASPAS method is expected to provide better results in assisting the determination of decision support systems. Then the best solution will be made to help make a decision to determine the feasibility of livestock assistance using the Weighted Aggregated Sum Product Assessment (WASPAS) method. The results of this study that get the highest ranking is Breeder 4 with a preference value of 0.84. This research also produces a decision support system that can analyze the right assistance to be given to farmers so that farmers can receive assistance according to the problems they face.

Keywords: Breeders, Decision Support Systems, Weighted Aggregated Sum Product Assessment Method, Ranking, Preferences .

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the function of administering government affairs and public services in the livestock sector.

1. Introduction

Livestock is a part of the agricultural sector in Indonesia's national development which aims to increase the income and welfare of farmers and ranchers. This is evidenced by the growth rate which is always positive and contributions that tend to increase, one of which is the Livestock Service Office of the Agam Regency .[1] The Agam Regency Office provides assistance to a group of farmers. In providing assistance, the Livestock Service Office of Agam Regency often does not meet the target and the livestock assistance that is given is not taken care of properly because often groups of farmers or livestock after receiving assistance have checked again that the livestock that have been given are not well taken care of.[2]

The Agam Regency Animal Husbandry Service provides livestock assistance to be able to accelerate the economic growth of Agam Regency by increasing the income and welfare of the community and being able to make a real contribution to the economic growth of the Agam Regency. Therefore, the Agam district livestock service has the main task of carrying out government affairs in the livestock sector as referred to in paragraph 1. The livestock service has

In providing livestock assistance, it is still carried out using a manual process, namely the Agam District Animal Husbandry Service in providing assistance does not use special calculation methods such as using the scientific method in determining the feasibility of livestock assistance. Given the times that are constantly changing and developing, which cannot be denied by humans, renewal in all respects in a more scientific direction will definitely occur , as well as in providing livestock assistance to farmer groups or livestock, you can also use a scientific approach.

The process that runs at the Agam District Animal Husbandry Service in providing an assessment for providing livestock assistance, the Agam District Animal Husbandry Service still uses the mainstream assessment, namely by summing up all the criteria that have been collected. And whose group is the most complete in collecting these requirements, has the greatest chance of getting livestock assistance, so that in implementing this livestock assistance it is still deemed irrelevant. This is because the agency does not see the level of importance of each existing criterion or in other words equates all the values of each existing criterion.

Decision support system is a concept contained in computer science where this concept can help decision makers to overcome problems that are semi-structured or unstructured [3]

Decision support system is a decision making using a computer-based system. Decision support systems can also be used to support an agency in carrying out analytical work in unfavorable situations and with unclear criteria [4]

SPK aims to provide information, guide, provide predictions and direct users of information so they can make better decisions. DSS is an implementation of decision-making theories that have been introduced by sciences such as operations research and management science, the only difference is that in the past, to find a solution to the problem at hand, manual iteration calculations had to be carried out (usually to find a minimum, maximum, or optimum value).), currently PC computers have offered their ability to solve the same problem in a relatively short time [5].

The implementation of the Decision Support System in this study uses the Weighted Aggregated Sum Product Assessment (WASPAS) method, which is a combination method of the WP method and the SAW method. The WASPAS method is expected to provide better results in assisting the determination of decision support systems. Then the best solution will be made to help make decisions to determine the eligibility of livestock assistance using the Weighted Aggregated Sum Product Assessment (WASPAS) method [6]. The reason for using this method is because this method is defined as a multi-criteria decision making (MCDM) which can be seen in the selection of a series of alternatives based on criteria [7]

WASPAS is a method that can reduce errors or optimize the assessment for selecting the highest and lowest values [8]. The Weight Aggregated Sum Product Assessment (WASPAS) method is a combination of the WSM and WPM methods. The WASPAS method is a unique combination method that can be used in the process of solving Multi Criteria Decision Making (MCDM) problems. The WASPAS method can minimize errors by optimizing the estimation of the low and highest values. The WASPAS method evaluates optimal performance for each criterion, then forms a normalization matrix for each criterion and calculates the value i of the normalization matrix [9].

The Weight Aggregated Sum Product Assessment (WASPAS) method is a method that searches for the most suitable location priority by using a weighting method. The use of this method is a combination of two sources known as WMM, MCDM approaches and the weight product model (WPM) initially requires linear normalization of the result elements. Using the WASPAS method, the highest combination of criteria is searched based on the two highest criteria. The first

criterion is optimal, the average success criterion is the same as the WSM method. This approach is popular and is used by MCDM for decision making [10].

The WASPAS method is a method used to reduce errors or optimize each interpretation in selecting the highest and lowest values. The WASPAS method is one of the MCDM (Multi Criteria Decision Making) methods. The WASPAS method can be estimated to have an accuracy of 1.3 times greater than the Weighted Product Model method and up to 1.6 times greater than the Weighted Sum Model [11].

2. Research methodology

The research framework created in this research methodology has the goal of getting results as expected and easy to solve problems and easy to understand. The steps to be made in this study are arranged systematically. Then a research framework is needed, where the research framework is carried out as shown in Figure 1:



Figure 1. Research Framework

The research stage is a sequence of processes or steps that will be carried out in completing this research. The stages of this research are as follows:

2.1 Preliminary Research

Preliminary research is the first step in conducting a study. Preliminary research was carried out by reading books, journals and other literature related to the research to be carried out and visiting the Livestock Office of the Agam Regency directly and asking for the data needed in the research.

2.2 Identification of problems

At this problem identification stage the researcher identified what problems were found at the preliminary research stage. From the problems that have been found, researchers are looking for solutions by collecting data that can be obtained through field research, interviews, observations and reading literature.

2.3 Data collection

In this study, data were collected from various sources by searching for references such as books, scientific works and journals, both in the library and on the internet related to research. Data can also be obtained from field studies by conducting direct observations and interviews.

2.4 Analysis

Based on the preliminary research above, data analysis is carried out with the aim that problem solvers can find the right solution and avoid the emergence of new problems

2.5 System planning

At this stage the author will make a system design that will be executed, starting from analyzing the running system, and designing the program that will be executed.

2.6 Implementation

System implementation is a stage that is carried out when the designed system is ready to operate. Implementation is carried out with the aim of confirming the results of the system design, so that users can provide input (feedback) on system development.

2.7 Testing

At this testing stage, monitoring or the use or function of the system that has been made is carried out, which will be periodically audited.

3. Results and Discussion

The steps for completing the WASPAS method are as follows [12]:

1. Normalization

The first step, the criterion value is converted into a form that has been normalized with the equation below :

$$\bar{x}_{ij} = \frac{x_{ij}}{\max_i x_{ij}} \quad (1)$$

Where:

x is the criterion value before normalization

\bar{x} is the criterion value that has been normalized

i denotes the i-th alternative

j denotes the jth criterion

benefit criteria , meaning that the criteria are increasingly desirable if the value of these criteria is high, while the *cost criteria* means the criteria are increasingly desired if the value of these criteria is low. Normalization for *cost criteria* is done with the equation below:

$$\bar{x}_{ij} = \frac{\min_i x_{ij}}{x_{ij}} \quad (2)$$

2. Calculations with WSM use the formula in the following equation:

$$WSM_i = \sum_{j=1}^n \bar{x}_{ij} \cdot W_j \quad (3)$$

Where:

\bar{x} is the criterion value that has been normalized

W is the criterion weight

i denotes the i-th alternative

j is the jth criterion

3. Calculations with WPM with the formula in the following equation:

$$WPM_i = \prod_{j=1}^n (\bar{x}_{ij})^{w_j} \quad (4)$$

4. WASPAS value calculation by combining WSM and WPM calculation results using the formula in the following equation:

$$Q_i = \lambda \cdot WSM_i + ((1 - \lambda) \cdot WPM_i) \quad (5)$$

Where:

Q = WASPAS value

WSM_i = is the result of calculations using WSM

WPM_i = is the result of calculations using WPM

λ = is a *real number* or 0 to 1

3.1 WASPAS (Weighted Aggregated Sum Product Assessment) Method Calculation

1. Steps to enter the criterion value: [13]

Where the value will be processed and the result will be a decision.

Table 1Table of Criteria Data

Criteria	Information	Weight Value
C1	Have members of the herd	15%
C2	Registered number of members	20%
C1	Business activities of livestock groups	15%
C4	Proposal	25%
C5	Verify local candidate recipients	25%

Information:

Rating Weight (Very Good) = 1.0

Weight Rating (Good) = 0.8

Rating Weight (Good Enough) = 0.6

Weight Rating (Not Good) = 0.4

Rating Weight (Not Good) = 0.2

Information:

C1 (Criterion 1) = Have livestock group members

C2 (Criterion 2) = Registered number of members

C3 (Criterion 3) = Business activities of the livestock group

C4 (Criterion 4) = Proposal

C5 (Criterion 5) = Verify local candidate recipients

Table 2 Alternative Assessment

No	Alternative	C1	C2	C3	C4	C5
1	Breeder 1	3	4	4	3	3
2	Breeder 2	5	3	3	4	1
3	Breeder 3	3	5	4	1	3
4	Breeder 4	3	3	4	4	5
5	Breeder 5	4	3	5	4	2

In Table 2 it can be seen that there are 5 alternatives and alternative values from each alternative starting from C1 to C5.

2. Steps to Determine Matrix Normalization Values

The following is to determine the matrix normalization of alternative values according to the type of criteria with conditions.

$$\text{Profit Criteria : } X_{ij} = \frac{x_{ij}}{m_{ixij}}$$

$$\text{Advantage : } X_{ij} = \frac{m_{ixij}}{x_{ij}}$$

Normalization for Criteria 1

$$A_1 = \frac{3}{5} = 0.6$$

$$A_2 = \frac{5}{5} = 1$$

$$A_3 = \frac{3}{5} = 0.6$$

$$A_4 = \frac{3}{5} = 0.6$$

$$A_5 = \frac{4}{5} = 0.8$$

Normalization For Criterion 2

$$A_1 = \frac{4}{5} = 0.8$$

$$A_2 = \frac{3}{5} = 0.6$$

$$A_3 = \frac{5}{5} = 1$$

$$A_4 = \frac{3}{5} = 0.6$$

$$A_5 = \frac{3}{5} = 0.6$$

Normalization For Criterion 3

$$A_1 = \frac{4}{5} = 0.8$$

$$A_2 = \frac{3}{5} = 0.6$$

$$A_3 = \frac{4}{5} = 0.8$$

$$A_4 = \frac{4}{5} = 0.8$$

$$A_5 = \frac{5}{5} = 1$$

Normalization For Criterion 4

$$A_1 = \frac{3}{4} = 0.75$$

$$A_2 = \frac{4}{4} = 1$$

$$A_3 = \frac{1}{4} = 0.25$$

$$A_4 = \frac{4}{4} = 1$$

$$A_5 = \frac{4}{4} = 1$$

Normalization For Criterion 5

$$A_1 = \frac{3}{5} = 0.6$$

$$A_2 = \frac{1}{5} = 0.2$$

$$A_3 = \frac{3}{5} = 0.6$$

$$A_4 = \frac{5}{5} = 1$$

$$A_5 = \frac{2}{5} = 0.4$$

Then the results of normalization of the decision matrix as a whole are as follows:

$$\begin{bmatrix} 0.6 & 0.8 & 0.8 & 0.75 & 0.6 \\ 1 & 0.5 & 0.6 & 1 & 0.2 \\ 0.6 & 1 & 0.8 & 0.25 & 0.6 \\ 0.6 & 0.6 & 0.8 & 1 & 1 \\ 0.8 & 0.6 & 1 & 1 & 0.4 \end{bmatrix}$$

Calculating Qi Values

$$Qi = 0.5 \sum_j^n X_{ijkw} + 0.5 \prod_j^n (x_{ij})^{w_j}$$

$$Qi = 0.5 \sum (0.6 * 0.15) + (0.8 * 0.20) + (0.8 * 0.15) + (0.75 * 0.25) + (0.6 * 0.25)$$

$$= 0.5 (0.70)$$

$$= 0.35$$

$$= 0.5 \prod (0.6^{0.15} * 0.8^{0.20} * 0.8^{0.15} * 0.75^{0.25} * 0.6^{0.25}) = 0.35$$

$$= 0.35 + 0.35$$

$$= 0.70$$

$$Qii = 0.5 \sum (1 * 0.15) + (0.5 * 0.20) + (0.6 * 0.15) + (1 * 0.25) + (0.2 * 0.25)$$

$$= 0.5 (0.64)$$

$$= 0.32$$

$$\begin{aligned}
 &= 0.5 \prod (1^{0.15}) * 0.5^{0.20} * 0.6^{0.15} * 1^{0.25} * 0.2^{0.25}) \\
 &= 0.5 (0.53) \\
 &= 0.263 \\
 &= 0.32 + 0.263 \\
 &= 0.583
 \end{aligned}$$

$$\begin{aligned}
 Q_{iii} &= 0.5 \sum (0.6 * 0.15) + (1 * 0.20) \\
 &\quad + (0.8 * 0.15) + (0.25 * 0.25) \\
 &\quad + (0.6 * 0.25) \\
 &= 0.5 (0.62) \\
 &= 0.31 \\
 &= 0.5 \prod (0.6^{0.15} * 1^{0.20} * 0.8^{0.15} * 0.25^{0.25} * \\
 &\quad 0.6^{0.25}) \\
 &= 0.5 (0.55) \\
 &= 0.275 \\
 &= 0.31 + 0.275 \\
 &= 0.585
 \end{aligned}$$

$$\begin{aligned}
 Q_{iv} &= 0.5 \sum (0.6 * 0.15) + (0.6 * 0.20) \\
 &\quad + (0.8 * 0.15) + (1 * 0.25) \\
 &\quad + (1 * 0.25) \\
 &= 0.5 (0.83) \\
 &= 0.41 \\
 &= 0.5 \prod (0.6^{0.15} * 0.6^{0.20} * 0.8^{0.15} * 1^{0.25} * \\
 &\quad 1^{0.25}) \\
 &= 0.5 (0.87) \\
 &= 0.43 \\
 &= 0.41 + 0.43 \\
 &= 0.84
 \end{aligned}$$

$$\begin{aligned}
 Q_v &= 0.5 \sum (0.8 * 0.15) + (0.6 * 0.20) + (1 * 0.15) \\
 &\quad + (1 * 0.25) + (0.4 * 0.25) \\
 &= 0.5 (0.74) \\
 &= 0.37 \\
 &= 0.5 \prod (0.8^{0.15} * 0.06^{0.20} * 1^{0.15} * 1^{0.25} * \\
 &\quad 0.4^{0.25}) \\
 &= 0.5 (0.43) \\
 &= 0.215 \\
 &= 0.37 + 0.215 \\
 &= 0.585
 \end{aligned}$$

From the calculation above, the preference value of each alternative can be seen in Table 3 below:

Table 3 Search Results for Qi Values

No	Alternative	C1	C2	C3	C4	C5	Preference
1	Breeder 1	0.6	0.6	0.8	1.0	1.0	0.70

2	Breeder 2	0.8	0.6	1.0	1.0	0.4	0.583
3	Breeder 3	0.6	0.8	0.8	0.7	0.6	0.585
4	Breeder 4	1.0	0.6	0.6	1.0	0.2	0.84
5	Breeder 5	0.6	0.6	0.8	0.2	0.6	0.585

From the table above the next step is to rank based on the preference value from the highest to the lowest preference value.

Table 4 Ranking Results

No	Alternative	Preference Value	Rank
1	Breeder 4	0.84	1
2	Breeder 1	0.70	2
3	Breeder 3	0.585	3
4	Breeder 5	0.585	4
5	Breeder 2	0.583	5

The table above explains that those who get the highest preference value are breeder 4 with a value of 0.84.

System Interface Testing

After manual data analysis using the WASPAS method, it is necessary to carry out the data testing process by building applications using the VB.NET 2010 programming language and MySQL Database. The purpose of building this application is so that the livestock service office can easily use it in making decisions to determine the feasibility of livestock assistance. The display of the WASPAS method calculation process can be seen in Figure 2:

The screenshot shows a web application interface titled 'Form Proses'. It contains a table for 'Data Penilaian' with the following data:

id_alternatif	nama_alternatif	c1	c2	c3	c4
A01	Peternak 1	1	0.8	0.8	0.8
A02	Peternak 2	1	0.6	1	0.4
A03	Peternak 3	1	0	1	1
A04	Peternak 4	1	1	1	1
A05	Peternak 5	1	0	1	1
A06	Peternak 6	1	0	1	1
A07	Peternak 7	1	1	1	1

Below the table is a green button labeled 'Hasil Keputusan'.

Figure 2. Calculation Process Application Page

Based on the menu display from the calculation process menu, then the decision results are displayed in a report in the form of eligibility. The display of the assessment results report based on the criteria for obtaining livestock assistance in the form of eligibility information can be seen in Figure 3.

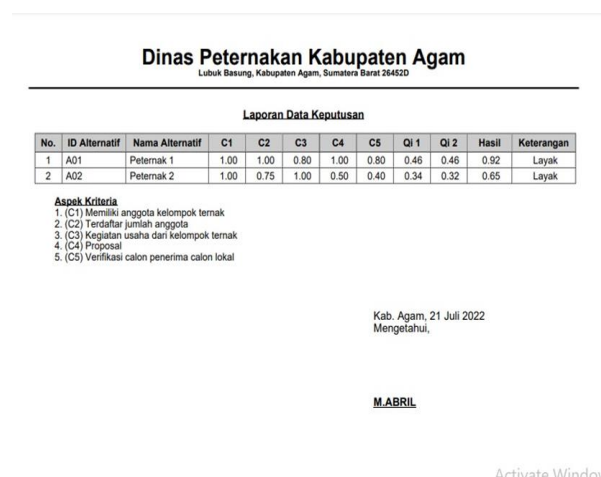


Figure 3 Results Report Page

4. In conclusion

After implementing a new system, namely a decision support system using the Waspas method, this system has succeeded in assisting the Agam Regency Animal Husbandry Service in answering and assisting in solving the problem of determining the eligibility of livestock assistance according to the agency's specifications. 3. After designing a decision support system, this system has succeeded in determining the criteria for eligible livestock assistance .

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