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Decision Support Systems for The Determination of Cattle with Superior Seeds using AHP and SAW Method

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Abstract

Department of Animal Husbandry and Fisheries of Semarang District is an institution in charge of livestock and animal health. Basically the Animal Husbandry Department has provided standardization for quality livestock cattle with superior seeds that usually can be judged or measured by various criteria.They are weight, age and value of BCS (Body Condition Score). They needed a system that could help the Department of Livestock and Fisheries of Semarang District in determining the electoral process cattle with superior seeds. In this research, the manufacture of Decision Support Systems in the determination cattle with superior seedsis using a combination of two methods is Analytical Hierarchy Process (AHP) and the Simple Addictive Weighting (SAW). In AHP will perform an importance value calculation criteria that will be paired up with an alternative to the SAW the next process is the sum of the weight from performance rating of all the attributes to each alternative, a ranking conducted to determine the result of cattle with superior seeds. Suggestions on this system, can be developed further by combining other methods to determine the recommendation that more effective.

Keyword: decision support systems, cattle, superior seeds, analitical hierarchy process, simple addictive weighting.

1. INTRODUCTION

Department of Animal Husbandry and Fisheries Semarang District is an institution in charge of livestock and animal health. Basically the Animal Husbandry Department has provided standards for cattle with superior seeds. In selecting cattle with superior seeds are both usually can be judged or measured by various criteria that can be seen on the weight of cattle, aged and value of BCS (Body Condition Score), which is an engineering assessment of the level of fatty or obesity in cattle judged from the coccyx, back and hip cattle. the selection of superior seedlings cattle must also be with the criteria and type of cattle fattening. BCS of cattle is the optimal 3- 4,5 as well as feeder cattle age determination is a very important step in the cattle fattening. And so we need a container that can help the Department of Livestock and Fisheries of Semarang District in providing solutions seeds determination cattlel.

Currently, there are many systems that can help people in determining the choice of alternatives to be used as a decision. Application of decision support systems are widely used in various fields because it was built to support a solution to a problem and evaluate an opportunity. The system was used to aid decision-making in situations semistructured and unstructured situations, where no one knows for sure how the decision should be made. In making a decision support system as for the

approach it takes to find the attribute weights. DSS can expose an alternative choice to the decision makers. Whatever an however the process, on the most difficult stages of information that will be faced by decision makers in terms of application[1]. While the intention of the approach, the weights are calculated mathematically that ignores the subjectivity of the decision makers [2].

In making the decision support system that will be used in the determination of cattle with superior seeds are AHP and SAW, on the manufacture of systems programming language PHP using MySQL database contained in XAMPP package and designed the web-based. AHP was developed by Thomas L. Saaty, a mathematician. This method is a framework for making effective decisions on complex matters with simplify and accelerate the decision-making process to solve the problem into its parts, arranging parts or variables in a hierarchical arrangement, giving a numerical value to the consideration of the subjective importance of each variable and synthesize these considerations to set the variables which have the highest priority and act to affect the outcome of the situation. This method also combines the strength of feeling and logic are concerned on various issues, and then synthesize a variety of diverse considerations into the matching results dengann we intuitively estimate as presented to the considerations that have been made. AHP is a process to identify and provide an estimate of the overall system interaction.

SAW method commonly known term weighted summation method. The basic concept is to find a method of SAW weighted summation of the performance rating of all the attributes of each alternative. SAW method requires a process of normalizing the decision matrix (X) to a scale that can be compared with all the ratings of existing alternatives. In the method (SAW), there are criteria that preception as benefit and cost criteria. Categories of criteria benefit or advantage, if these criteria have a greater value, the better. While the criteria of cost or charge the smaller the value, the better. [3].

2. METHOD

In designing and developing a system of AHP and SAW as a method for decision support system for the selection of cattle with superior seed in the Livestock and Fisheries of Semarang District Waterfall Model approach. Using a Waterfall This model is a sequential software development. Waterfall Model approach process is divided into 4 phases affect each other. Four phases of the Waterfall Model is a needs analysis (analysis), design (design), coding (code), test (test).

At this stage of analysis was used to identify and evaluate the problems, at the design stage used for needs to be representation in the form of software. On stage is a stage code translation system design which has been made into the form of commands that computers understand. The last stage is the stage of testing where the system will be tested to eliminate errors and ensure that all functions can be used with either. Waterfall Model is shown in Figure 1.

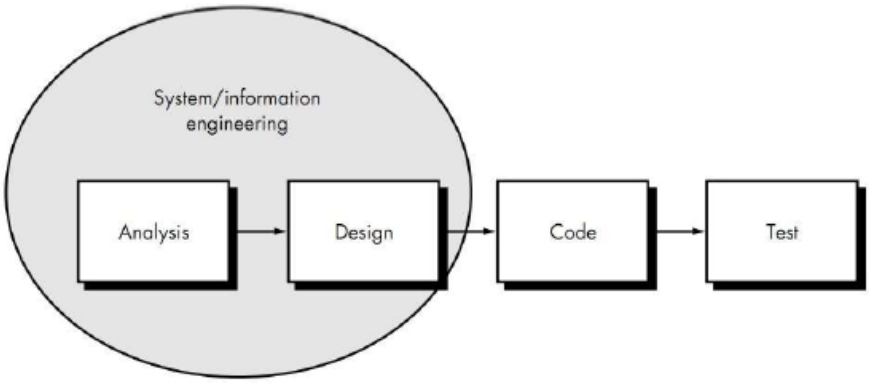


Figure 1. *Waterfall Model*

In this selection of AHP-SAW method is suitable for decision support system, because basically AHP discuss how to determine the relative importance of a series of events in the multi-criteria decision problem. AHP is based on three principles: first, the structure of the model; The second, alternative comparison and assessment criteria; Third, the synthesis of priority [4]. While the basic concept SAW method is to find the weighted sum of the performance assessment of each alternative on all attributes. AHP is used because there are a lot of qualitative data and criteria in the determination [5] taking into account the decisions and reduce the complexity of a decision to make a comparison of the one of the various criteria selected. because it needs to make the grouping criteria for limiting criteria that many, so as to facilitate the process of comparing the criteria couples then weighted criteria and test the consistency of the pairwise comparison matrix. While the SAW method is known as a weighted summation method of rating on each alternative, so just that generate the greatest value will be selected as the best alternative in determining cattle with superior seeds.

3. RESULTS AND DISCUSSION

AHP method is used to determine the value of the weight on each criteria. Data regarding the criteria will explain what criteria are used as cattle with superior seeds ratings. Here are three criteria that can be seen in Table 1.

Table 1. Criteria of Cattle with Superior Seeds.

Criteria	Name of Criteria
C1	*Body Condition Score* (BCS)
C2	Weight
C3	Age

At this stage of weighting criteria given prior importance value to each criterion, then be computed weighted priorities that have been normalized by dividing the number of the criteria. The result of the weight calculation priority value as shown in Table 2.

Table 2. Criteria Priority Value of Interest

Criteria	C1	C2	C3	Weight
C1	0,238095	0,225806	0,384615	0,282839
C2	0,714286	0,677419	0,538462	0,643389
C3	0,047619	0,096774	0,076923	0,073772

Next will be checking the consistency of comparison matrix criteria. In search of consistency index value, it takes the value λ maks that the average value λ of each criterion. The table λ maks calculation results as shown in Table 3.

Table 3. Calculation of λ max

Criteria	C1	C2	C3	Total	Weight	λ
C1	0,282839	0,214463	0,368861	0,866163	0,282839	3,062387
C2	0,848517	0,643389	0,516405	2,008311	0,643389	3,121457
C3	0,056568	0,091913	0,073772	0,222253	0,073772	3,012692
Total λ						9,196535

λ maks highest value will be used to find consistency with the index value using the equation (1).

$$CI = (\lambda \text{ maks-n}) / n \quad 1)$$

In the above equation value (n) in the equation obtained from the number of criteria were used that as many as 3 λ maks criteria and values obtained from the value of the highest λ maks. Enter a value into the equation so that it becomes CI = (λ maks-n) / n = (3,121457-3) / 3 = 0.040486. After the CI value is obtained, we then calculate the value of CR by dividing the value of CI with a value of CR4 (0.58). The CR value calculation using the equation (2).

$$CR = CI / CR4 \quad 2)$$

Enter a value into the equation so that it becomes CR = CI / CR4 = 0.04048 / 0.58 = 0.069803. 0.069803 value is the value obtained from the calculation of CR. This value is smaller than the limit value of consistency ($0 \leq 0.039 \leq 0.1$), so that the matrix of pairwise comparisons among criteria is consistent.

After gaining weight value criteria followed in the calculation method of SAW. SAW method is used to perform a ranking in the selection of cattle with superior seeds. The following is an analysis method using SAW in the ranking process includes comparing alternative criteria, create a matrix of pairwise comparisons between alternative criteria, normalizing the decision matrix of alternatives with the criteria of a matrix, ranking as the end result preference value and achieve the results recommendations cattle with superior seeds. Selection of cattle with superior seeds used in this system has cattle data based on a survey that was conducted. Here is example 5 cattle data from the total of 110 cattle data, 5 cattle data will be processed

is the alternative selection cattle with superior seeds that will be paired with each of the criteria in Table 4.

Table 4. Pairwise Matrix Alternative & Criteria

Alternative/ Criteria	C1	C2	C3
A1	4	340	18
A2	4	300	15
A3	4	340	15
A4	3	250	9
A5	4,5	450	19
:	:	:	:
A110	3,5	300	10

From the matrix of pairwise matrix normalization process will be conducted with the alternative decision criteria, by calculating the value of normalized performance rating (rij) of alternative (Ai) on the criterion (Cj).

In the calculation process of normalization (r) will obtain the results of the normalization matrix. Thus obtained normalized matrix (r) which will be shown in Table 5.

Table 5. Matrix normalized

Alternative/ Criteria	C1	C2	C3
A1	0,88889	0,75556	0,3
A2	0,88889	0,66667	0,25
A3	0,88889	0,75556	0,25
A4	0,66667	0,55556	0,15
A5	1	1	0,31667
:	:	:	:
A110	0,77778	0,66667	0,16667

The next stage will be made of matrix multiplication W * R value W (weight) is the weight value generated from the AHP process while the value of R is the value of the normalized between alternative criteria. After getting the results of the matrix multiplication W * R, then the sum of the multiplication result is used to obtain the best alternative by doing the following ranking of the largest (V) of the equation. After doing the calculations to find the value of V, will obtain the highest value for the results of ranking cattle with superior seeds. A total of 110 cattle data were processed to obtain the value of V, then obtained the highest score on the alternative v5 with the value of V = 0.949589 as a result of recommendations cattle with superior seeds.

The use of Data Flow Diagrams (DFD) to illustrate or describe the process flow of data contained in a decision support system with AHP and SAW method to determine cattle with superior seeds. In the DFD level 1 system consists of 4 first process is the process of data input cattle by admin containing id, age, weight bcs and types of cattle

and administrators were also asked to input the data of criteria in a second process of value age criteria, criteria weights and criteria bcs. Data that has been entered in the first process will be stored in the input database and the data that has been entered in the second poses will go on matrix_ahp database. Furthermore, the calculation process AHP criteria weight value will be processed on the database and the database lambda matrix to obtain data values and value criteria interest criteria. The output of the calculation process AHP is the weight value criteria that will be stored in the database criteria to be weighted priority. In the latter process is the calculation SAW where in this process priority weight will be paired with cattle data to obtain an alternative calculation results with the criteria so as to produce output in the form of recommendations cattle with superior seeds. DFD Level 1 AHP and SAW to determine cattle with superior seeds can be seen in Figure 2.

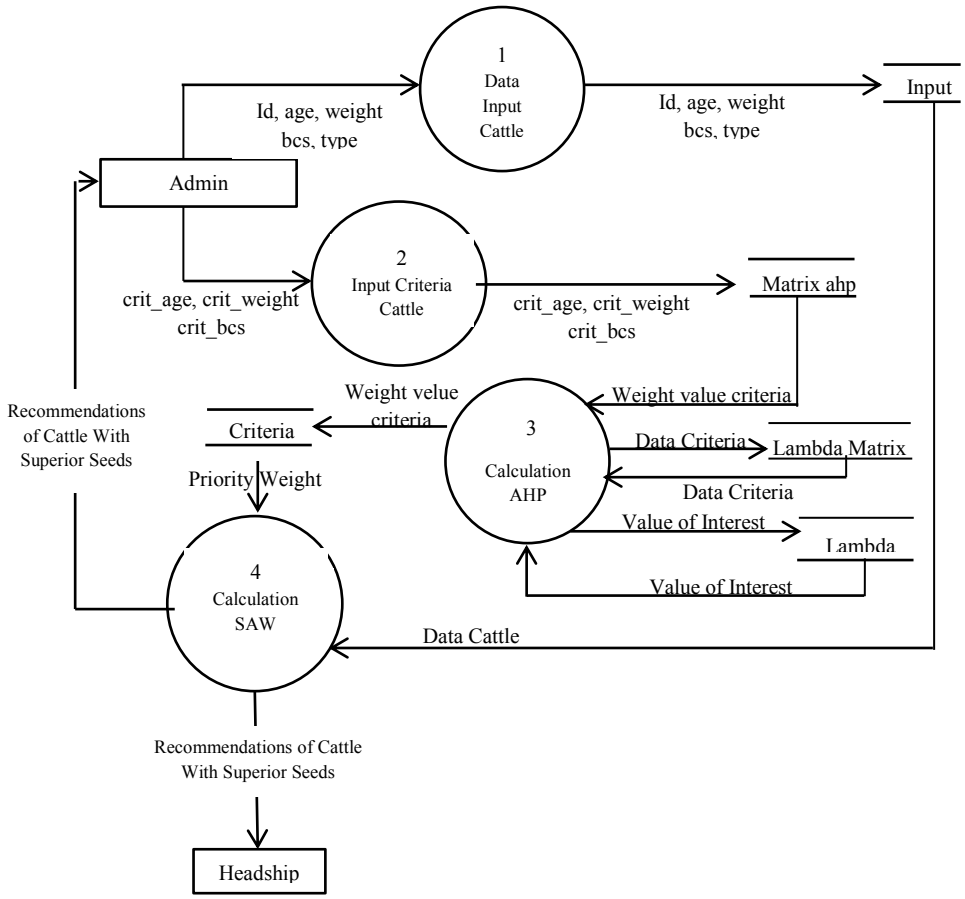


Figure 2. DFD Level 1 Cattle with Superior Seeds

In the process of database development, data obtained will be built basis design data by using Entity Relationalship Diagram (ERD). In this depiction ERD will show the

relation between tables in the database selection decision-making support system berbibit superior cattle. ERD can be seen in Figure 3.

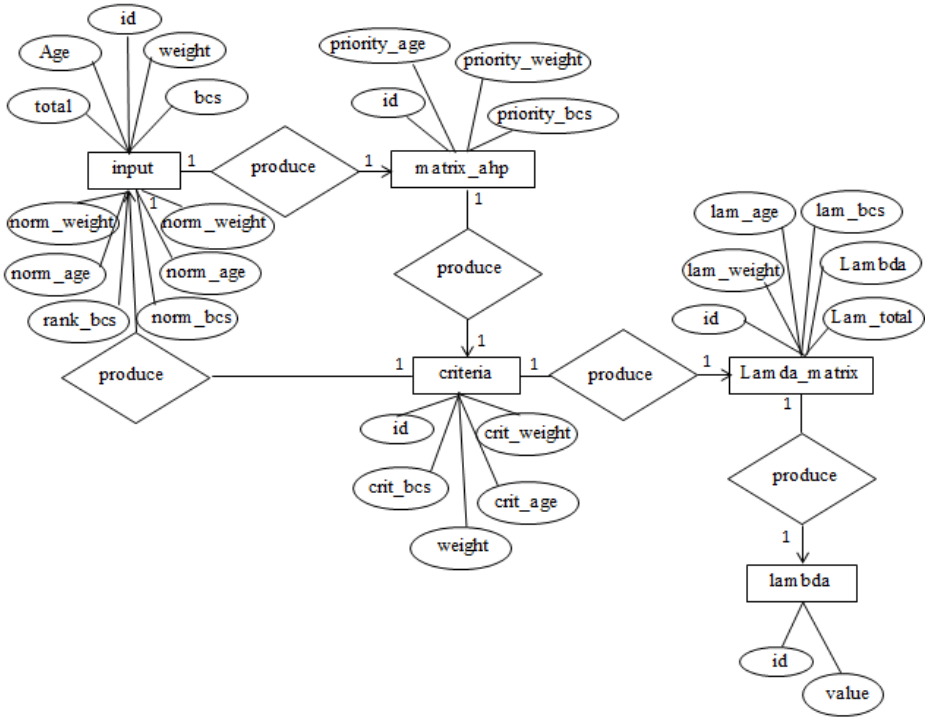


Figure 3. ERD DSS Cattle with Superior Seeds

Based on the information in Figure 3, which explains that the input table has a table matrix_ahp with cardinality one-to-one relationship. While on the table matrix_ahp generate tables of criteria with cardinality relationships one to one, to have a criteria table to save the table lambda_matirx lambda each criterion cattle with cardinality relationships between tables one to one. Then on the table lambda_matrix generate tables lamda with cardinality relationships between tables one to one.

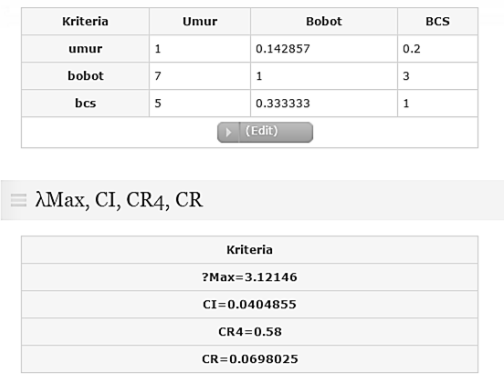
Here is the implementation of the system, the system development process based on the results of analysis and system design. In the decision support system for the selection of cattle with superior seeds by using AHP and SAW consists of 2 access: access as admin / staff and access as a headship.

On this page used to enter the requested data on the system. While the administrators must fill Id cattle, aged cattle, cattle weights, grades 1-5 BCS with provisions. Once the data has been entered, the data will be stored in the data table cattle, the cattle to see the data table is also equipped with 2 action for editing and delete the data that has been entered. Here is a view of the data page of cattle that will be shown in Figure 4.

No	ID Sapi	Umur	Bobot	BCS	Action
1	PO111	18	331.24	3.5	(Edit) (Delete)
2	PO112	15	295.84	3	(Edit) (Delete)
3	PO113	15	331.24	3.5	(Edit) (Delete)
4	PO114	9	249.64	2.5	(Edit) (Delete)
5	PO115	19	449.44	4	(Edit) (Delete)

Figure 4. Page of Data Cattle

In Figure 4 will show the data has been successfully entered by admin, on this page where there are two actions to edit the data and delete data cattle. Furthermore, there is a criteria value shown in Figure 5.



Kriteria	Umur	Bobot	BCS
umur	1	0.142857	0.2
bobot	7	1	3
bcs	5	0.333333	1

(Edit)

λMax, CI, CR4, CR

Kriteria
?Max=3.12146
CI=0.0404855
CR4=0.58
CR=0.0698025

Figure 5. Application of AHP Method on the System

Of the weighting criteria values obtained CR (Consistency Ratio) = 0.0698025, where if there is a value of CR (Consistency Ratio) obtained from the weighting of the criteria <0.10 means that the matrix is consistent. Once the matrix is consistent, it can be continued in the ranking process by using SAW method.

Application of the method lies in the SAW in the system to see the results table ranking cattle with SAW method. On display in this image will show the results of ranking of selection cattle with superios seeds. Where the first ranking a ranking of the selection of cattle with superior seeds. Where in the rankings The first is the end result of the total weighting of these three criteria, age, weight and value of BCS. Total final value of the weighting is obtained and processed by the competent admin to input data cattle and provide an assessment of interest rate after processing will

produce a total weighting as the reference ranking. SAW method application in the system can be seen in Figure 6.

Ranking	ID	Age	Weight	Bcs	Total
1	PO005	19	450	4.5	0.949589
2	PO031	48	410	4.5	0.928056
3	U031	58	390	4.5	0.911756
4	U047	60	370	4.5	0.88562
5	U032	60	370	4.5	0.88562

Figure 6. SAW on the System Implementation Method

The output produced at SAW process is a sequence of alternative cattle that have weighted values from the highest to the lowest. From the calculation method of SAW on this system earned alternative cattle with superior seeds ID: PO005 with the total value of the highest weighting is 0.949589.

4. CONCLUSION

Based on the results and the above discussion it can be concluded that the application of the Analytical Hierarchy Process (AHP) method and Simple Addictive Weighting (SAW) a web-based decision support systems the selection of cattle with superior seeds ahead by three criteria: age of the cattle, weight of the cattle and the value of the BCS can combined to produce recommendations cattle with superior seeds alternative. By doing a combination of both methods will produce a weighting of criteria of assessment the next level of interest to test the consistency of the pairwise comparison matrix obtained value of CR (Consistency Ratio). If the value of CR (Consistency Ratio) obtained from the weighting of criteria ranging from <0.10 then obtained consistent criteria weights that can be continued in the SAW method. SAW method will do a ranking derived from the calculation of weighted criteria multiplied by the weight of each alternative has been normalized to get the total weighting that will be used as a ranking for the election of the cattle with superior seeds in the Livestock and Fisheries District Semarang. As for suggestions for the future can be developed further by combining other methods to determine the results of the recommendations more effective.

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