The Best Land Selection using Simple Additive Weighting

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Abstract*: Pringsewu Regency is an agrarian regency with the main livelihood of the population is from agro-industry agriculture. For on farm farming activities, a lot of cultivated commodities are food crops and rice crops. One of the key factors in creating equitable distribution of development or regional development and the right one result is the agricultural factor. While to know the feasibility of an agricultural area can be done by holding an assessment. The Assessment is made by Agriculture office in deciding the feasibility of agricultural areas include the assessment criteria of a region. The criteria of a region that is the type of soil, rainfall, water, temperature, and soil texture. Utilization of decision support system is very helpful in deciding the feasibility of agricultural area, and accompanied by the method of Simple Additive Weighting (SAW), this method can complete the research by finding the weight value for each attribute, then perform the ranking process that will determine the optimal alternative that is feasible for agriculture. With the decision support system with Simple Additive Weighting (SAW) method and with object oriented design using Unified Modeling Language (UML) this will make it easier for Agriculture Office and other institutions to monitor and to obtain information about agriculture that is useful for agricultural development.

***Index Terms*: agricultural land, simple additive weighting, rice production.**

I. INTRODUCTION

1.1 Background

Today, The development of computer has encountered many changes very rapidly, along with the more complex and more diverse human need [1-5]. Computer that was originally only used by academics and the military has now been used extensively in various fields, such as business, health, education, psychology, games and so on [6-9]. This encourages experts to develop computer in order to help human or even work beyond the ability of human labor [10-14]. Artificial intelligence is a part of computer science that makes the machine (computer) able to do work as and as well as human beings do. Smart system (intelligent system) is a system built using artificial intelligence techniques [15-19]. One that is studied in artificial intelligence is the theory of certainty by using the theory of Certainty Factor (CF). Another technology in the field of certainty is the expert system (Expert System). This is a computer program that imitates expert process of thinking and knowledge in solving a particular problem. Implementation of expert systems is widely used in the field of psychology because expert system is viewed as a way of storing expert knowledge in a particular field in a computer program so that decisions can be made in intelligent reasoning. The wedge between psychology and expert system bear an area known as cognition & psycolinguistics. Generally the knowledge is taken from a human expert in the domain and the expert system is trying to imitate the methodology and performance.

1.2 Problem Formulation

Based on the above background, it is determined that the problem that needs to be raised is proving the effectiveness of Simple Additive Weighting (SAW) method in designing expert system of agricultural land detection.

1.3 The Scope of Problem

Expert system will only prove the effectiveness of Simple Additive Weighting (SAW) method in designing expert system of agricultural land detection.

1.4 Research Objective

This research aimed to prove the effectiveness of Simple Additive Weighting (SAW) method in designing agricultural land detection information system.

1.5 Research Benefit

1. Assisting the people in increasing rice production
2. Adding reference in expert system of information technology field.

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II. THEORETICAL BASE

2.1 Decision Support System

Decision support system is an interactive computer-based system, which helps decision makers to use data and various models to solve unstructured issues [20-23]. Use combination of models, analysis techniques, and information retrieval, such systems help develop and evaluate the appropriate alternatives [24-27]. Decision support system is the information system which helps identifying decision-making opportunities or provide information to help decision-making [28-31]. Basically decision support system is almost the same as the management information system because it uses the database as a data source DSS begins with SIM because it emphasizes the function of supporting the decision maker throughout its stages, although the actual decision remains the exclusive authority of the manufacturer decision [31-35]. Decision support system is more aimed at supporting management in performing analytical work in less structured situations and with less obvious criteria [36-39]. DSS is not meant for automating decision, but presents interactive tool that allows decision making performing various analyzes using available models [40-43].

2.2. Efforts to Acquire Superior Seed

1. Selection: selection of living being characteristic in accordance with particular purpose.
2. Hybridation: breeding two different individuals but still in one lineage.
3. Mutation: alteration of molecular chemical structure to obtain the material of heredity.
4. Transplantation: gene transplantation. .

Efforts to Increase Agriculture Production

1) Agriculture mechanism
2) new agriculture lands clearing
3) . The use of new qualified fertilizers
4) Looking for right method to eradicate pest.

Efforts to Increase Food Production

1. Panca Farming :
   a. Selection of superior seed,
   rice species and age.
   – Gogo rice
   –PB(Pelita Baru) 5 rice + PB8
   – (International Rice) 36 rice + IR 64
   –Cisade rice
   –VOTW rice
   b. good soil management
   c. Fertilization
   d. Irigation
   e. Pest eradication
2. Agricultural Intensification. It is the business of agricultural production and the use of appropriate technology and the utilization of all means of production.
3. Agricultural Extensification. It is an effort to increase agricultural yield by expanding new agricultural land, such as clearing forests and shrubs, clearing areas around swamps, and clearing
4. abandoned agricultural areas.
   Agricultural diversification. It is an effort to diversify farming through an intercropping system.

2.3. Research Location

The change of agriculture area is obtained by overlaying intersect method and by clippling method to obtain land change per sub-district. However, for rainfed lowland area encountered a wide increase. Decrease in area of irrigated paddy field by 1 Ha, while for the dry land had decreased by 3 Ha and the increase of area for rainfed lowland area of 2 Ha. The increase of rainfed lowland area is likely due to land conversion from dryland and mixed dryands located around the Ambarawa sub-district due to the data processing, the sub-district encounters significant increase of 2.5 Ha. From the research results above can be obtained mapping agricultural land that can improve rice production in Pringsewu District Ambarawa District.

2.4. Simple Additive Weighting (SAW)

Simple additive weighting method is often also known as the weighted summing method. The basic concept of SAW is to find the weighted sum of the performance of each alternative at all. The SAW method requires the process of normalizing the decision matrix (X) to a scale comparable to all existing alternative ratings.

III. RESEARCH METHODS

3.1. Data Collection Technique

Data collection is done by the following methods:

1. Literature study, this method is the collection of data and information by reference reading books or ebook and website related to this research.
2. Observation method: this method is used by observing the quality of agricultural land in increasing rice production while observing the needs associated with rice production.
3. Interview method. This method is used by interviewing the farmers to obtain the necessary data for the purpose of designing expert systems of deciding agricultural land quality.

3.2. Design model

The design stage is done by using waterfall method. The core of waterfall method is the processing of a system performed sequentially or linearly. So if the stage one has not been done then it will not be able to do stage 2, 3 and so on. Automatically the 3rd stage will be done if the first and second stage have been done.

3.3. Data Analysis

To perform the analysis of data, it can be used descriptive and interpretative methods,
Descriptive analysis is done by describing all events and phenomena seen during the research, while interpretative model is used to illustrate

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conclusions by interpreting the existing phenomena.

3.4. Problem Analysis

Agriculture Office of Pringsewu Regency is an agency that gives the information on development of future agriculture planning, so that people can do agricultural development to achieve good agricultural yield, to realize food self-sufficiency and improvement of raw materials processing industry into finished goods. To realize development planning information is needed the determination of agricultural areas. Agriculture gives weighting value for each criterion based on its importance level, that is:

Table 1. Weight Score

Bobot	Nilai
Very low (SR)	1
Low (R)	2
Medium (C)	3
High (T)	4
Very High (ST)	5

To solve the problem with simple additive weighting method, Specify the criteria to be referenced in decision making, ie Ci ..
The criteria used to determine a region worthy or not to serve as agricultural areas, namely:

Table 2. Criteria

Criteria	Weight	Score
(C1) Soil Type	Very High (ST)	5
(C2) Soil Texture	High (T)	4
(C3) Rainfall	Fair (C)	3
(C4) Temperature	Low (R)	2

Table 3. Soil type criteria (C1)

Alternative	Criteria				
	C1	C2	C3	C4	C5
A1	4	5	3	3	4
A2	5	5	3	3	4
A3	3	1	4	4	3
A4	2	2	5	3	1

Table 4. Soil texture criteria (C2)

No	Soil texture	Weight	Score
1	Soft and wet	Very Low	1
2	Clayey	Low	2
3	Loose	Very High	5

Table 5. Rainfall criteria

No	Rainfall	Weight	Score
1	Low	Low	2
2	Medium	Medium	3
3	High	High	4
4	Very High	Very High	5

Table 6. Temperature criteria

No	Temperature	Weight	Score
1	Cold	Low	2
2	Normal	Medium	3
3	Warm	High	4
4	Hot	Very High	5

Table 7. Irigation criteria

No	Irigation System	Weight	Score
1	Traditional	Very Low	1
2	Water pump	Low	2
3	Local	Medium	3
4	Spray	High	4
5	Surface	Very High	5

Deciding each alternative's compatibility rating on each criteria. The compatile rate data from each alternative can be seen in table 9.

Table 8. Compatibility Rating from Each Alternative in Each Criteria

No	Soil Type	Weight	Score
1	Clay	Low	2
2	Organosol/Peat Soil	Medium	3
3	Humus Soil	High	4
4	Aluvial Soil	Very High	5

3.5. Accuracy test (Matrix)

So to obtain the Ai score on qualified agricultural land mapping at the Pringsewu District Agricultural Service are as follows:

Formula :

$$V_i = \sum_{j=1}^{n} wj.r_{ij}$$

Alternative score in each criterion

	Alternative	Criteria				
		C_1	C_2	C_3	C_4	C_5
	A_1	4	5	3	3	4
	A_2	5	5	3	3	4
	A3	3	1	4	4	3
	A_4	2	2	5	3	1

Where :

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

A1= (0.8 x 0.3)+(1 x 0.2)+(0.6 x 0.2)+(0.75 x 0.15)

+(1 x 0.15)

A2= (1 x 0.3)+(1 x 0.2)+(0.6 x 0.2)+(0.75 x 0.15) + (1 x 0.15)

A3= (0.6 x 0.3)+(0.2 x 0.2)+(0.8x0.2)+(1 x 0.15) +(0.75x 0.15)

A4=(0.4x0.3)+(0.4 x 0.2))+(1 x 0.2)+(0.75x0.15) + (0.25 x 0.15)

A1= 0.24+0.2+0.12+0.1125+0.15 =0.8225
A2= 0.3+0.2+0.12+0.1125+0.15=0.8825
A3=0.18+0.04+0.16+0.15+0.1125=0.6425
A4=0.12+0.08+0.2+0.1125+0.0375=0.55

The greatest score was in A2, so A2 alternative was the selected alternative as the best alternative. In other words, maintanance of information technology means will be selected as the solution for the best land selection.

3.6 Program Implementation

In the criteria form used alternative data and criteria as shown in figure 1. In the weight form that is used to calculate a criterion and find the weight of an alternative as shown in figure 2.

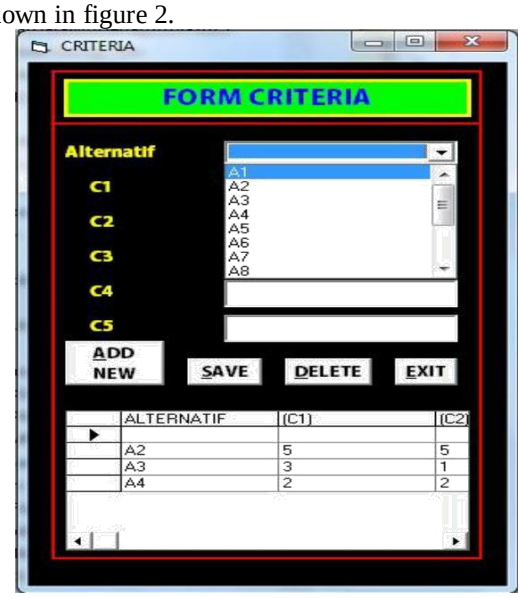

Figure 1. Criterial form

Figure 2. Weight form

IV. CONCLUSION

The decision support system for deciding the feasibility of agriculture can be used to:

1. Implementation of decision support system with simple additive weighting method which is done based on the results of ranking from the largest alternative until the smallest. The results of the decision support system process of deciding the feasibility of this area can be used as a consideration to determine the area that can be used as agricultural areas.
2. Completion of eligibility criteria of agricultural area was done by calculating the weight of the value of each criterion those are soil type, soil texture, rainfall, temperature and irrigation system.
3. Application of decision support system is designed based on the determination of criteria and calculations that have been obtained, and use design in the form of use case and activity diagram.

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