JOTECHCOM Journal of Technology and Computer
Vol. 1, No. 1, February 2024, pp. 6-10
ISSN: XXX-XXX, DOI:XXX/JOTECHCOM

Decisions Dealing System of Cultural Plant Type with Weighted Product Method

Irfan Hanif[1], Boy Juntak [2], Mumtaz[3]
[1] University of Santika, Indonesia
[2]Department of Engineering, Faculty of Technology, University of Santika, Indonesia

Article Info

Article history:

Received January 06, 2024
Revised January 20, 2024
Accepted February 02, 2024

Keywords:

Food Plants
Decision Support Systems
Weighted Product

ABSTRACT

In the field of agriculture there are some kinds of food crops that are developed and cultivated such as grapes, strawberries, corn, soybeans and so on which are essential food. The farmers should choose the land that is suitable for their food type. If the farmers do not choose the appropriate land, the result is a poor harvest or may be a failure to harvest. However, this is not done, because it takes a long process and impedes the process of cultivation of food crops. However, such problems can be solved using the Decision Support System, because with the Decission Support System (DSS) humans can obtain information in support of decisions. Weighted Product is a decision-support system that is currently evolving with several methods, including the weighted product method. This method is chosen by the authors because the weights product method requires a normalization process, because this method depends on the evaluation of each attribute. The result of the multiplication is not meaningful if not compared (divided) with the standard value. The weight for the benefit attribute serves as a positive rank in the overlapping process, while the cost weight acts as a negative rank. From the results of the research can be concluded among other things: The decision-supporting system built is very helpful in the selection of crop types of food crops UPTD Rare Agriculture.

Corresponding Author:

Irfan Hanif
Univesity of Santika
Email: irfanhanif@yahoo.com

1. INTRODUCTION

Food crops are a crucial sector, as they comprise plants that produce food as an energy source to sustain human life. Within agriculture, there are various types of food crops cultivated and developed, such as cassava, rice, maize, soybeans, and others, which are essential staple foods. The current issue faced is the limitation in food stocks. In cultivating food crops, farmers encounter several challenges, including the constantly changing climate conditions that may not be suitable for food crops, crop pests, expensive seed prices, and maintenance costs. If farmers do not select suitable types of food crops for cultivation, the result may be poor harvests or even crop failure. However, these issues can be addressed using a Decision Support System (DSS), as with a Decision Support System (DSS), humans can obtain information to support decision-making. There are several stages in DSS, namely defining the problem, collecting relevant and appropriate data, processing data into information, and determining alternative solutions. This system helps support decision-making for individuals and organizations, both in companies and institutions. [1]

The decision support system that is currently evolving with its various methods, one of which is the Weighted Product method. This method is chosen because the Weighted Product method requires a normalization process as it multiplies the assessment results of each attribute. The multiplication results are not meaningful until they are compared (divided) by the standard value. The weights for the benefit attributes

function as positive exponents in the multiplication process, while the weights for the cost attributes function as negative exponents. The Weighted Product method uses multiplication to connect attribute ratings, where the rating of each attribute must first be raised to the power of the respective weight. This process is similar to the normalization process. [2]

2. METHOD

The purpose of this research is that the author wants to implement the Weighted Product method in deciding the cultivation of food crops. This research is carried out through several stages as follows:

1. Field Research

Field research is a method of obtaining data by conducting direct research at the study location. The data collection techniques used by the author are as follows: [3]

a. Interview

Interview is a data collection technique involving direct question and answer sessions with relevant sources. The author conducted interviews directly with one of the employees of the BPP Langkat district regarding the cultivation of food crops. [4]

b. Observation

Observation is one of the effective methods of data collection for studying a system. The author made direct observations in the cultivation section of the BPP Langkat district to ensure the accuracy of the data obtained.

2. Library Research

The author conducted library research to obtain data related to thesis writing from various sources such as books on decision support systems, books on Visual Basic.net for creating database applications and creative programs, the internet, and others. [5]

Decision Support System (DSS) is a computer-based information system that approaches to generate various decision alternatives to assist specific parties in addressing problems using data and models. Decision-making is the outcome of a process of selecting from various possible courses of action with a specific mechanism, aiming to produce the best decision. [6]

Decision Support System (DSS) is a component of information systems that provides support to users and can be described as a computer system that processes data into information to make decisions about specific semi-structured problems. Before understanding the definition of a decision support system, it is better to understand the concept of a decision support system first, starting from systems, information, decisions, and information systems. [7]

The Weighted Product Method

The Weighted Product Method requires a normalization process because this method multiplies the evaluations of each attribute. The multiplication results are not meaningful until they are compared (divided) by standard values. The weights for the benefit attributes serve as positive exponents in the multiplication process, while the weights for costs serve as negative exponents. The Weighted Product Method uses multiplication to link attribute ratings, where the rating of each attribute must first be raised to the power of the corresponding weight. This process is similar to the normalization process. [8]

The Weighted Product method requires a normalization process because it multiplies the evaluations of each attribute. The multiplication results are not meaningful until they are compared (divided) by standard values. The weights for benefit attributes function as positive exponents in the multiplication process, while the weights for costs function as negative exponents. [9]

The steps in the calculation process of the Weighted Product method are as follows:

1. Multiply all attributes for all alternatives by weights as positive exponents for cost attributes, as in the equation

$$\mathrm{Wj} = \frac{\mathrm{Wj}}{\sum \mathrm{Wj}}$$

2. The multiplied results are summed to produce values for each alternative as in the equation

$$\mathrm{S} = (\mathrm{Wij}^{\mathrm{Awj}}.\mathrm{w}).(\mathrm{Win}^{\mathrm{Awn}}.\mathrm{w})$$

3. Dividing the value V for each alternative by the value for each alternative as in the equation

$$\mathrm{Vjn} = \frac{\mathrm{Si}}{\sum \mathrm{Si}}$$

The best alternative sequence that will become the decision is determined. [10]

3. RESULTS AND DISCUSSION

In this study, in making decisions on determining the cultivation of food crops, the author attempts to apply the Weighted Product method. This decision support system for determining the cultivation of food crops has three types of alternatives, including: [11]

A1 = Potato
A2 = Padi
A3 = Corn.

The criteria used as references in making decisions regarding the cultivation of food crops can be seen in the table.

Criteria	Criterion Name	Sub Criteria	Mark
C1	Seed Prices (/kg)	≤ 25.900	100
		26.000 – 50.900	80
		51.000 – 75.900	60
		≥ 76.000	40
C2	Selling price (/kg)	≥ 16.000	100
		11.000 – 15.900	80
		6.000 – 10.900	60
		≤ 5.900	40
C3	Pest Resistance	Good	100
		Enough	50
		Not enough	0
C4	Climate Resilience	Good	100
		Enough	50
		Not enough	0
C5	Harvest Age (/month)	≤ 4 month	100
		5 month – 7 month	70
		≥ 8 Bulan	50
C6	Maintenance costs	≤ 10.999.900	100
		11.000.000 – 15.999.900	70
		≥ 16.000.000	50

The criteria of selling price (C2), pest resistance (C3), and climate resilience (C4) are profit criteria. Meanwhile, the criteria of seed price (C1), harvest age (C5), and maintenance cost (C6) are cost criteria. The importance level of each criterion is assessed on a scale from 1 to 5, as follows:

1 = Very low
2 = Low
3 = Moderate
4 = High
5 = Very high

Table 2. Weight Value for Each Criteria

Criteria	Criterion Name	Weight (w)
C1	Seed Prices (/kg)	3
C2	Selling price (/kg)	5
C3	Pest Resistance	4
C4	Climate Resilience	4

C5	Harvest Age (/month)	3
C6	Maintenance costs	5

The criteria values for each alternative type of food crop can be seen in table III

Table 3. Criteria Values for Each Alternative

Alternative	Criteria					
	C1	C2	C3	C4	C5	C6
A1	100	100	100	100	100	100
A2	80	60	50	50	100	70
A3	60	40	100	100	100	100

Proper Previously, the weight will be corrected first so that $\sum w = 1$, by using the formula $\mathrm{Wj} = \frac{\mathrm{Wj}}{\sum \mathrm{Wj}}$

As follows :

$$w_1 = \frac{3}{3+5+4+4+3+5} = 0.125$$

$$w_2 = \frac{5}{3+5+4+4+3+5} = 0.208$$

$$w_3 = \frac{4}{3+5+4+4+3+5} = 0.167$$

$$w_4 = \frac{4}{3+5+4+4+3+5} = 0.167$$

$$w_5 = \frac{3}{3+5+4+4+3+5} = 0.125$$

$$w_6 = \frac{5}{3+5+4+4+3+5} = 0.208$$

Then the vector S is calculated based on the equation $S = (\mathrm{Wij}^{\mathrm{Awj}}.\mathrm{w}).(\mathrm{Win}^{\mathrm{Awn}}.\mathrm{w})$, with i = 1,2,...,m as follows:

$$S1 = (100^{0.125})(100^{0.208})(100^{0.167})(100^{0.167})(100^{0.125})(100^{0.208})$$
$$= (1.778)(2.606)(2.157)(2.157)(1.778)(2.606) = 99.88$$

$$S2 = (80^{0.125})(60^{0.208})(50^{0.167})(50^{0.167})(100^{0.125})(70^{0.208})$$
$$= (1.729)(2.343)(1.921)(1.921)(1.778)(2.419) = 64.29$$

$$S3 = (60^{0.125})(40^{0.208})(100^{0.167})(100^{0.167})(100^{0.125})(100^{0.208})$$
$$= (1.668)(2.153)(2.157)(2.157)(1.778)(2.606) = 77.41$$

The final step is to determine the vector values V which will be used for ranking, and it can be calculated based on the equation:

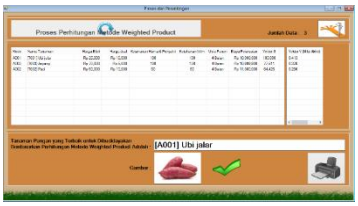
$$\mathrm{Vjn} = \frac{\mathrm{Si}}{\sum \mathrm{Si}}$$

$$V1 = \frac{99.88}{99.88+64.29+77.41} = 0.413$$

$$V2 = \frac{64.29}{99.88+64.29+77.41} = 0.266$$

$$V3 = \frac{77.41}{99.88+64.29+77.41} = 0.320$$

Based on the calculation results of the vector values V above, it can be determined that the largest value in V1 is 0.413, indicating that the suitable alternative for cultivation is alternative A1, which is Sweet Potato. The display of the results from the decision support system for determining the cultivation of food crops can be seen in Figure 1 below.



4. CONCLUSION

From the entitled "Decision Support System for Determining the Cultivation of Food Crops Using the Weighted Product Method," the conclusions drawn are as follows:

1. The decision support system developed greatly assists in expediting data processing in decision-making to determine the best cultivation of crops at BPP Langkat.
2. The Weighted Product method is suitable for decision-making with multiple alternatives, especially in determining the cultivation of food crops quickly and accurately. The level of accuracy from testing using the Weighted Product method is 100%.
3. The built decision support system application is dynamic regarding determining criteria, criteria weights, and criterion values. Thus, it can be adjusted according to the needs of BPP Langkat in determining the cultivation of food crops.

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