Weighted Product Method for Selection of Superior Seeds Catfish in the *Clarias Gariepinus* Types (Sangkuriang)

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Abstract. Sangkuriang catfish is a famous *clarias* clan fish form his slick and long body non-scaly, with dorsal fins and a long rear fin, which sometimes merges into the tail fin makes it look like a short eel. Catfish also have additional breathing apparatus in the form of modifications from gill arc. There is a pair of fins that are spines bone that is sharp, on the pectoral fin. Some things to consider in order to select superior seedlings of sangkuriang catfish such as size, weight, color, physical defect, even water conditions, which in reality not all catfish farmers know about it. This decision support system using the Weighted Product (WP) method is one of the methods that use the true value in determining the rating of each alternative on each criterion to determine the conclusion of a problem. Based on the results of testing the Selection Decision Support System of the Superior Broodstock Sangkuriang Catfish has an accuracy rate of 87.5%.

Keywords: Weighted Product; selection; superior seeds; *Clarias Gariepinus*; Sangkuriang Catfish.

1 Introduction

Catfish is a freshwater fish that is widely cultivated almost throughout the territory of Indonesia. This is because catfish is one of the leading commodities, and has a good market prospect. Some of the advantages of catfish compared with other types of fish that is faster growth and maintenance and feeding easier [1]. Sangkuriang catfish including one type of freshwater fish that has been cultivated commercially by the people of Indonesia. Cultivation of catfish can provide a great income because now catfish is very popular by the community and the price is affordable by all people. This is indicated by the increase in the production of catfish consumption from 2008 amounted to 162.000 tons. Then in 2009 up to 250.000 tons in a year and in 2010 the demand has increased to 273.554 tons in a year. The information indicates that effort is needed to improve the production and quality of catfish seeds [2].

Sangkuriang catfish is the result of a cross from the male dumbo catfish F6 with female catfish dumbo F2. The result of this marriage was found to have superior properties such as the ability to spawn high up to 40-60 thousand eggs once process. Sangkuriang catfish is also more disease resistant, can be maintained in minimal water conditions and better meat quality [3] and can be used as seedlings for catfish, such as Fig 1. There are several things to consider in order to select superior seedlings of sangkuriang catfish, including

investment valuation factors in the selection of superior seeds that can provide the necessary consideration in the cultivation of fish farmers such as size, color, physical disability, and a number of whiskers and even conditions water. In fact, not all catfish farmers know that factors, it will be very helpful if there is a system that can provide decision support for catfish farmers. All these factors are combined to get an assessment that can help the decision - making process of superior catfish [1, 3].

Fig. 1. Sangkuriang Mother Catfish

The decision making process requires the right method that can be used [4], especially for cases such as the selection of superior seeds of this catfish. This research uses a decision making process with Weighted Product (WP)

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method [5]. Based on the description that has been described, it will be built a system with the name “Decision Support System Selection of Superior Seeds Sangkuriang Catfish Type (*Clarias Gariepinus*) Using Weighted Product (WP) Method” to find the best alternative solution.

2 Research Method

This research uses research and development models to develop the software engineering [6] and involves several local catfish farming businesses in East Kalimantan, Indonesia.

2.1 Decision Support System

Decision Support System (DSS) is a computer-based information system that approaches to generate various decision alternatives to assist certain parties in handling problems using data and models, as in Fig 2. A Decision Support System (DSS) only provides an alternative decision and then submitted to the user to make a decision [7]. Decision making is the result of a selection process from a variety of alternative actions that may be chosen by a particular mechanism to produce the best decision. The decision process is gradual, systematic, consistent, and in every step from the beginning has included all parties, which will give good results [8].

Fig. 2. Component of Decision Support System

The structure of a system includes input, process, output, feedback, environment and system limits. Input is an element that will affect the performance of a system. The process is the whole element to transform the input into an output. The output shows the final product or the consequences of a system. Feedback is the information flow from the output component to the decision maker about the performance of the system. The environment consists of several elements that are outside the system, in the sense of not input, process and output. The system boundary is a separator between a subsystem with another subsystem or system with its environment [9].

2.2 Weighted Product Method

The Weighted Product (WP) method is a part of the decision making model by multiplication in connecting an attribute rating. Weight for attributes, serves as a positive rank in the multiplication process between attributes, while the attribute rating serves as a negative rank for the cost attribute [5, 7-10].

$$1) \text{ Determination of value weight } W$$

$$W_j = \frac{w_j}{\sum w_i} \dots \dots \dots (1)$$

$$2) \text{ Determination of value Vector } S$$

$$S = (W_{ij}^{AW_j} \cdot w) \cdot (W_{in}^{AW_n} \cdot w) \dots \dots \dots (2)$$

$$3) \text{ Determination of value Vector } V$$

$$V_{jn} = \frac{S_i}{\sum S_i} \dots \dots \dots (3)$$

where:

V = Alternative preferences are analogous to vector V

W = Weight criteria / sub-criteria

j = Criteria

i = Alternative

n = Number of criteria

S = Alternative preferences are analogous to vector S.

3 Result and analysis

3.1 Criteria for Catfish Variables in Weighted Product

To determine the criteria for variable catfish as a reference in determining choices, there are 5 (five) fish that will be an alternative choice (R) : R1 = Sangkuriang catfish is tagged 1, Age 28 month, Weight 3.3 kg, Length 77 cm, Color Dark, It has been processed 2 times. R2 = Sangkuriang catfish is tagged 2, Age 21 month, Weight 1.4 kg, Length 37 cm, Bright Color, Unprocessed. R3 = Sangkuriang catfish is tagged 3, Age 19 month, Weight 2.1 kg, Length 60 cm, Color Dark, It has been processed 1 time. R4 = Sangkuriang catfish is tagged 4, age 32 months, Weight 1.4 kg, Length 52 cm, Bright Color, It has been processed 3 times. R5 = Sangkuriang catfish is tagged 5, Age 14 month, Weight 2.6 kg, Length 55 cm, Bright Color, It has been processed 5 times and they are 5 (five) variables used as consideration (C) : C1 = Age, C2 = Weight, C3 = Length, C4 = Color, C5 = It has been process/Unprocessed.

3.2 Decision Making for Level of Preferences

Decision Support System (DSS) was first introduced by Scott Morton in the early 1970s. He defines DSS as an interactive computer-based system that helps decision makers to use data and models to solve unstructured problems. According to Keen and Morton in 1978, the decision support system (DSS) combines the intellectual resources of individuals with computer capabilities to

improve the quality of a decision. DSS is a computer-based support system for management decision makers dealing with unstructured issues. In the decision making, the system will give for a level of preference weighting the following preference weight: $W = (5, 4, 1.5, 3.5, 3)$. With preference value such as Table 1, Table 2, Table 3, Table 4, Table 5.

Table 1. Preference Value C1 (Age)

Scale Value	Age of Catfish	Category
2	8-11 months	Minimum Age
3	12-17 months	Enough Age
4	18-24 months	Good Age
5	25-36 months	Maximum Age

Table 2. Preference Value C2 (Weight)

Scale Value	Weight of Catfish	Category
1	500-750 gr	Minimum Weight
2	760-900 gr	Enough Weight
3	1-2 kg	Medium Weight
4	2.1-3 kg	Good Weight
5	3-4 kg	Very Good Weight (Maximum)

Table 3. Preference Value C3 (Length)

Scale Value	Length of Catfish	Category
2	10-20 cm	Minimum Length
3	21-40 cm	Enough Length
4	41-70	Good Length
5	71-120 cm	Very Good Length (Maximum)

Table 4. Preference Value C4 (Color)

Scale Value	Color of Catfish	Category
1	Dark	Enough
2	Bright	Very Good

Table 5. Preference Value C5 (process/unprocessed)

Scale Value	Has Been Process	Category
1	It has been process 5 times	Process Maximum
2	It has been process 1-4 times	The intensity of spawning is still in quota (Enough)
3	Unprocessed	Very Good

Each alternative is given a scale value based on the value of preference C, so the values form the Table 6 below.

Table 6. New Value of Preference from Preference C

	C1 (Age)	C2 (Weight)	C3 (Length)	C4 (Color)	C5 (It has been process)
R1	5	5	5	1	2
R2	4	3	3	2	3

R3	4	4	4	1	2
R4	5	3	4	2	2
R5	3	4	4	2	1

3.3 The Value of Preference Weighting

The Weighted Product method uses multiplication as the attribute rating link, where the rating of each attribute must be raised first with the corresponding weight. This process is similar to the normalization process. Previously done weighting first, so the total weight **Error! Reference source not found.** = 1 with formula with equations 1.

So for the improvement of the weights to be:

$$W1 = \frac{5}{5+4+1.5+3.5+3} = 0.294$$

$$W2 = \frac{4}{5+4+1.5+3.5+3} = 0.235$$

$$W3 = \frac{1.5}{5+4+1.5+3.5+3} = 0.088$$

$$W4 = \frac{3.5}{5+4+1.5+3.5+3} = 0.205$$

$$W5 = \frac{3}{5+4+1.5+3.5+3} = 0.176$$

The determine the vector value of S using the following formula with equations 2

Rank and multiply the value of each of those criteria by the previously fixed weight:

$$S1 = (5^{0.294}) (5^{0.235}) (5^{0.088}) (1^{0.205}) (2^{0.176}) = 3.053$$

$$S2 = (4^{0.294}) (3^{0.235}) (3^{0.088}) (2^{0.205}) (3^{0.176}) = 3.003$$

$$S3 = (4^{0.294}) (4^{0.235}) (4^{0.088}) (1^{0.205}) (2^{0.176}) = 2.66$$

$$S4 = (5^{0.294}) (3^{0.235}) (4^{0.088}) (2^{0.205}) (2^{0.176}) = 3.062$$

$$S5 = (3^{0.294}) (4^{0.235}) (4^{0.088}) (2^{0.205}) (1^{0.176}) = 2.495$$

Specifies the value of the vector to be used to calculate the preference (Vi) for ranking. The formula is as follows with equations 3.

So the result of calculating preference (Vi) is as follows:

$$V1 = \frac{3.053}{3.053+3.003+2.66+3.062+2.495} = 0.213$$

$$V2 = \frac{3.003}{3.053+3.003+2.66+3.062+2.495} = 0.21$$

$$V3 = \frac{2.66}{3.053+3.003+2.66+3.062+2.495} = 0.186$$

$$V4 = \frac{3.062}{3.053+3.003+2.66+3.062+2.495} = 0.214$$

$$V5 = \frac{2.495}{3.053+3.003+2.66+3.062+2.495} = 0.174$$

From the above calculation, V4 value shows the greatest value so that in other words V4 is the best alternative choice.

4 Conclusion

The result of this system is obtained from the Weighted Product (WP) method, where based on the existing alternative is formed into a matrix and then calculated using the equations that exist in the WP method so that can be obtained the alternative recommendation of sangkuriang catfish to choose superior breeds as a tool for the catfish breeders.

Recommendations

The next, this system of Decision Support System Selection of Superior Seeds Sangkuriang Catfish Type (*Clarias Gariepinus*) Using Weighted Product (WP) Method can be developed online with managing network traffic [11] and the system can be accessed by mobile phone [12]. This system can be combined with expert systems using rule-based reasoning method [13] and the system can be saved in the cloud computing [14].

Acknowledgment

This research of collaboration between the Department of Computer Science, Faculty of Computer Science and Information Technology, Mulawarman University, East Kalimantan, Indonesia and Departement of Computer System, STEKOM Semarang, Majapahit Street 605, phone +62246723456, +62246710144, Semarang, Indonesia.

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