

Decision Support System For Chicken Animal Feed Selection Using The Fuzzy Tsukamoto Method

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Abstract

Selection of chicken feed is a fairly important decision support process. This decision support system was developed to assist breeders in choosing chicken feed based on predetermined criteria and alternatives. In this study using the Tsukamoto fuzzy method which produces a model of a system that can provide recommendations for choosing chicken feed that is applied in a decision support system. The Tsukamoto fuzzy method in determining the selection of chicken feed is based on 3 variables, namely price, quality and stock. Each variable consists of 3 sets which are combined in order to obtain 4 fuzzy rules, which are then used in the inference stage. The choice of chicken feed to be recommended (z) is searched by the centralized average defuzzification method. Testing will be carried out objectively where the decision support system is tested directly for capacity and filling out a questionnaire regarding satisfaction with the content of the point requirements and distributed to the owner of the animal feed shop. With this test, it can be seen that the features provided are easy to learn and easy to understand.

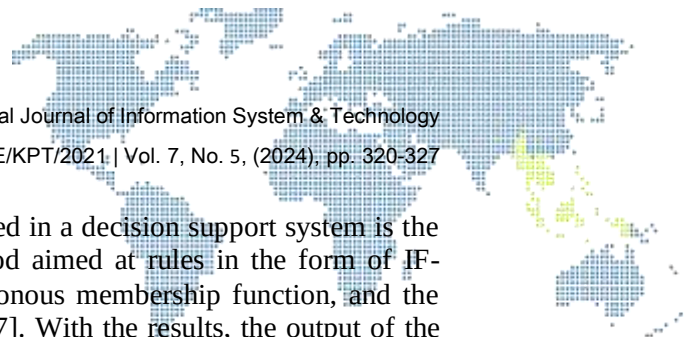
Keywords: Fuzzy Tsukamoto, Chicken Feed Selection, Decision Support System

1. Introduction

Feed is a basic food ingredient that is good for chickens to eat and has been prepared using specific rules. These rules follow the nutritional value of the food ingredients used. Feeding livestock chickens greatly influences the growth of these chickens[1]. The quality of the feed provided should have the right nutritional content for the growth of livestock chickens. The many types of artificial feed available on the market can make it difficult for chicken breeders to determine which feed is good for the growth of their chickens. Lack of information regarding clear criteria for determining good feed for livestock chickens can make chicken breeders make mistakes in choosing appropriate feed[2]. For this reason, we need a system that can help chicken farmers to easily choose the best feed for growing chickens. So that chicken farmers can achieve the best results when carrying out the process of harvesting livestock[3].

Broiler chickens are one type of commodity in the livestock sector that produces food from livestock and has quite potential economic value. Broiler chickens for sale are young male or female chickens under 8 weeks old with a certain body weight, have fast development and have a wide chest with good and abundant meat deposits.[4]. Selecting effective chicken feed requires a comprehensive assessment of various factors, such as nutritional needs, chicken preferences, feed availability, and cost constraints. Humans and animals need carbohydrates, protein, fat and other minerals[5].

The types of factory-produced chicken feed available on the market can make farmers choose the wrong feed that suits the needs of their chickens. In this way, it is difficult for breeders to choose good quality feed. If the feed quality is poor, the impact will definitely cause losses to breeders and sellers. Poor feed is caused by the fact that the feed does not survive if it comes into contact with water, which will cause it to quickly mold and become unfit for consumption[6]. In this way, SPK will provide a solution for chicken farmers, so that they are not confused in choosing good or good feed that suits the needs



of livestock chickens. One method that can be applied in a decision support system is the Fuzzy Tsukamoto method. This method is a method aimed at rules in the form of IF-THEN which represents a Fuzzy set with a monotonous membership function, and the criteria and rules used to determine the final result[7]. With the results, the output of the inference results from each rule is given firmly (crisp) based on the α -predicate (fire strength). The final results use a weighted average, determined because this method is intuitive and can provide recommendations and values based on information that is inaccurate, ambiguous or qualitative in nature.[8].

Fuzzy logic is defined as a set of mathematical principles for representing knowledge based on degrees of membership rather than the crisp membership of classical binary logic. Fuzzy systems are part of soft computing that work in the discipline of fuzziness and share results with methods that can be interpreted. Using a fuzzy system, fuzzy set theory, fuzzy reasoning and inference mechanisms, the system can be used in various applications[9].

SPK is intended to help decision makers to solve semi- and or unstructured problems with a focus on presenting information that can later be used as alternative material for the best decision making[10]. Based on research[11], in this research the Fuzzy Tsukamoto method is used as decision support in ensuring total production of goods so that it does not become more or less than the given production amount. The Fuzzy Tsukamoto method allows the integration of variables in one structured system and can provide more accurate and optimal decisions. By applying the Fuzzy Tsukamoto method in the SPK for choosing feed for livestock chickens, it is hoped that we can provide appropriate feed recommendations according to the nutritional needs and preferences of chickens, taking into account other factors such as feed availability and cost constraints[12]. This is expected to increase the efficiency and productivity of chicken farming, as well as reduce potential risks associated with inappropriate feed selection. By building a decision support system for selecting livestock chicken feed using the Fuzzy Tsukamoto method, it is hoped that it can be used by chicken farmers to be able to assist in selecting livestock chicken feed that matches the criteria chosen by the chicken farmer.

2. Research Methodology

2.1. Design Stage

In this stage, before carrying out the design, there are stages of work procedures. In carrying out this research, there are stages that must be carried out, namely the stages of preparation, design, testing and implementation.[13]. After the procedure stage, stage p is carried out. System design is the main part in creating a system or application, this system design is intended to provide general information about the application to be created. This system design is the initial stage of software design. This is done to find out the general condition of the system. Below the designs that will be explained include a flowchart of how the system works.

2.1.1. Flow chart System

The system flow in carrying out the decision support system process to obtain recommended feed results based on the range (low, medium and high) of price, quality and stock availability. After selecting the range, then select the Fuzzy Tsukamoto method process[14]. After selecting the process, the system will display the recommended livestock feed.

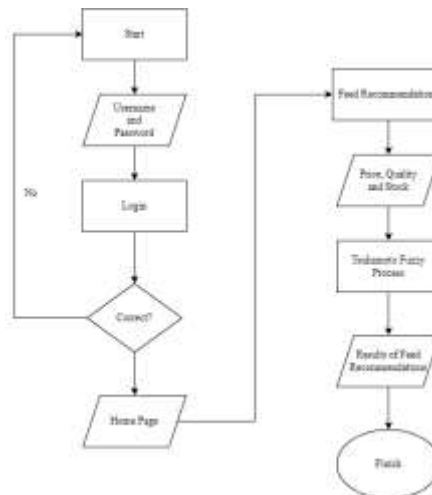


Figure 1. System Flowchart

2.1.2. Flow chart Fuzzy Tsukamoto Method

The flow of the Fuzzy Tsukamoto method in carrying out the decision support process in choosing chicken animal feed. The data to be processed is variable data (feed) and Fuzzy set data. Next, the inference process is carried out, after getting the inference results the system will carry out a defuzzification process to obtain a decimal value which will be used as a reference to see the closest variable value to the feed variable value input by the system user[15].

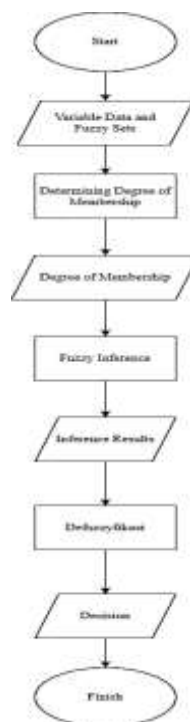
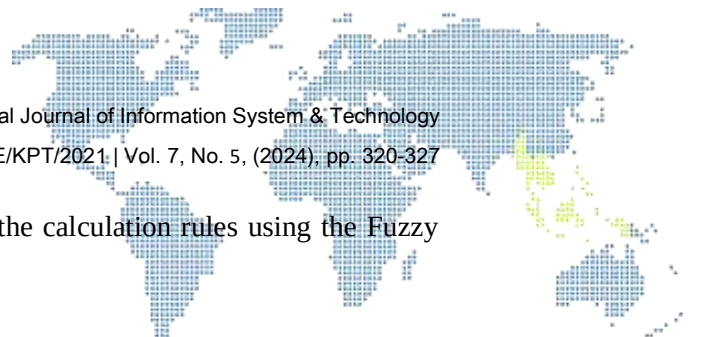


Figure 2. Fuzzy Tsukamoto Method Flowchart

2.2. Testing Phase

This test stage combines each module that has been designed and carries out testing to determine whether the resulting system is the same as the design that has been prepared and whether there are still errors or not. The tests carried out include trying to test the resulting system by starting the decision support process by selecting variables in the system to then see and compare the results displayed by the system with calculations



carried out manually whether they are correct with the calculation rules using the Fuzzy Tsukamoto method.

2.3. Implementation Stage

The final stage of the research work procedure carried out the application of SPK in the case of selecting the best feed for chickens. Next, carry out stages of analysis of the system to see the requirements that need to be added to the system. Further development will be carried out in order to maximize the usefulness of the resulting decision support system so that it can produce a more accurate level of choosing the best feed for livestock chickens.

3. Result and Discussion

Selecting livestock chicken feed using the fuzzy Tsukamoto method can help users in selecting the best livestock chicken feed according to the criteria desired by the user. The data used in the research is data on livestock chicken feed circulating on the market with criteria in the form of price, quality and stock [16].

Information:

$$\frac{\text{Amount of Feed During Maintenance}}{\text{Total Weight of Chickens harvested}} = \text{Quality} \quad (1)$$

The data in the research were obtained from interviews at several UD's that provide livestock chicken feed. In one feed product the price is worth per kg, while the quality of the feed is worth a number, where the numbers are obtained from interviews with chicken breeders with feed data for HI-PRO-VITE, Broiler, EGG-PRO, Bran, Milled Corn, etc. Based on livestock chicken feed data, the fuzzy Tsukamoto value of each livestock chicken feed is searched for:

- The "price" membership degree has three fuzzy set representations, namely a decreasing linear membership degree function for cheap fuzzy set representations, an increasing linear membership degree function for expensive fuzzy sets, and a triangular membership degree function for medium fuzzy sets.
- The "quality" membership degree has three fuzzy set representations, namely a decreasing linear membership degree function for low fuzzy set representations, an increasing linear membership degree function for high fuzzy sets, and a triangular membership degree function for medium fuzzy sets.
- The "stock" membership degree has three fuzzy set representations, namely a decreasing linear membership degree function for the representation of a small fuzzy set, an increasing linear membership degree function for a large fuzzy set, and a triangular membership degree function for a medium fuzzy set [17].

3.1. Rule Formation

The second way is to determine a rule in the form of IF-THEN from the fuzzy set that has been created [18].

Table 1. Rule Every Fuzzy Set

C1(Price)	C2 (Quality)	C3 (Stock)	Decision
Expensive	Tall	Lots	Best
Expensive	Tall	Currently	Best
Expensive	Tall	A little	Not the Best
Currently	Tall	Lots	Best
Currently	Tall	Currently	Best
Currently	Tall	A little	Not the Best
Cheap	Tall	Lots	Not the Best
Cheap	Tall	Currently	Not the Best
...	...	...	...
Cheap	Low	A little	Not the Best

1. Inference Engine

The next step is to implement the MIN implication function to obtain the smallest α value from the fuzzy set values contained in each rule[19]. Then look for the z value in each rule using the formula:

$$z_i = z_{\max i} - \alpha_i (z_{\max i} - z_{\min i}) \quad (2)$$

2. Defuzzification

The next step is defuzzification of the fuzzy output. The defuzzification process of the Tsukamoto method uses the Weight method, namely dividing the number of $\alpha \cdot z$ results in each rule by the number of α s in each rule.[20].

$$Z = \frac{(\alpha_1 \times z_1) + (\alpha_2 \times z_2) + \dots + (\alpha_{26} \times z_{26}) + (\alpha_{27} \times z_{27})}{\alpha_1 + \alpha_2 + \dots + \alpha_{26} + \alpha_{27}} \quad (3)$$

After obtaining the Z value, look for the membership of each output variable and then compare them.

3. Flow Chart System

a) Results

In this research, an application is displayed which is used as a decision support system for selecting livestock chicken feed using the fuzzy Tsukamoto method.

1) Login Page Display



Figure 3. Login Page

2) Admin Home Page Display



Figure 4. Admin Home Page

3) Master Feed and Variables Page



Figure 5. Master Feed and Variables Page

4) User/User Management Page

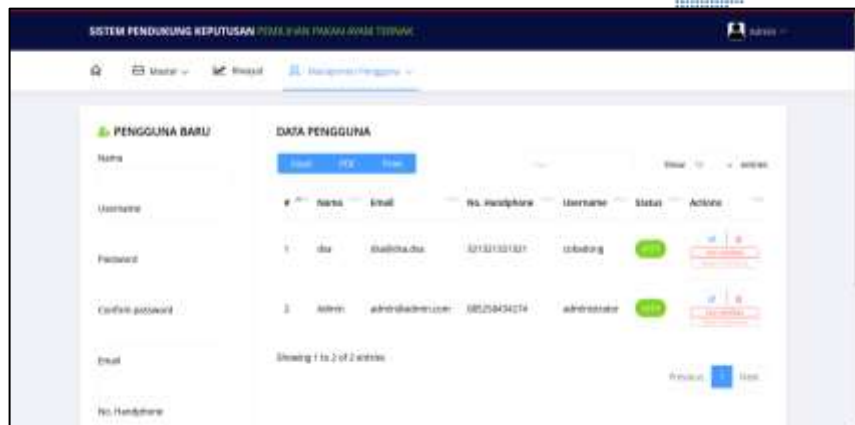
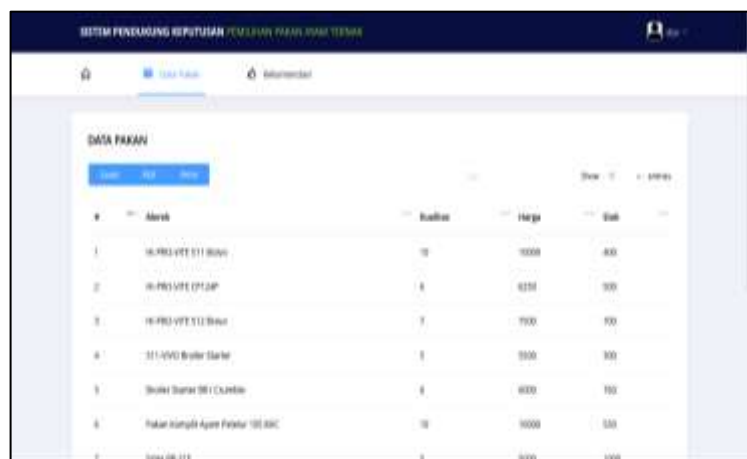


Figure 6. User/User Management Page

5) Feed Data Page



No	Merk	Jumlah	Harga	Stok
1	16-PRO-VET ST1 BROS	10	10000	800
2	16-PRO-VET ST12AP	8	8000	500
3	16-PRO-VET ST1 BROS	7	7000	500
4	ST1-450 Broiler Starter	5	5000	300
5	Stokel Starter ST1 CUMBI	8	8000	500
6	Pakan Komplek Ayam Petenak 100 BHC	10	10000	500
7	Stokel ST1	8	8000	500

Figure 7. Feed Data Page

6) Recommendations and Results Page



Figure 8. Recommendations and Results Page

4. Conclusion

The results and discussion obtained from this research can be concluded that this research produced an SPK application to determine the best livestock chicken feed using the Fuzzy Tsukamoto method and the criteria for the livestock chicken feed used were price, quality and stock. And the alternative used in this research is chicken feed data obtained from the interview process.

The SPK process to produce recommendations for the best livestock chicken feed is carried out by selecting price criteria consisting of cheap, medium, expensive and quality criteria consisting of low, medium, high and stock criteria consisting of little, medium and large. After determining the criteria, SPK will display recommendations for the best livestock feed based on the selected criteria. The system admin can see the defuzzification value of the history of the chicken feed selection process that has been completed by the system user. The SPK application in this research was designed using the PHP programming language using the MySQL database for managing feed data.

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