



## Application to Determine the Quality of Coconut with Fuzzy Tsukamoto Method

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### ABSTRACT

Coconut is one of the plants that are important enough to meet the daily needs of human beings. While the expert system is a system that uses human knowledge are recorded in a computer to solve problems which usually require human expertise. Expert system of quality meat selection coconuts is an expert system that is designed as a tool to know the quality of the meat of the coconut fruit. This expert system is built to provide information regarding the prediction of the quality of girth chops coconuts, and can yield a prediction without the need to consult an expert. Research on application of peper's focus to the methods of fuzzy expert system in a tsukamoto. The results of this research are expected to be useful information in the development and implementation of artificial intelligence into hardware (hardware).

**Keywords:** *Coconut, Cocos Nucifera, Expert System.*

### 1. INTRODUCTION

Coconut still belongs to the largest plantation crops in Indonesia compared to other plantation crops, such as oil palm. Coconut occupies 3.7 million hectares from 14.2 million acres of plantation area or 26% of the total area and about 97% is plantation. However until now the fulfillment of the needs of the cooking oil is still dominated by Palm oil which is expected to reach 9 kg/capita/year (Budianto and Allorerung, 2003), compared to coconut oil just 2.89 kg/capita/year (Andries et al., 1997).

The vast area of coconut 3.7 million acres, comprising domestic and Hybrid coconut, with maintenance of intensive production can reach each of 2.5 tons of copra/ha/yr. and 4.0 tons of copra/ha/yr (Allolerung and Mahmud, 2003). When this production was achieved would certainly be available raw material coconut flesh of the fruit. Therefore, the potential of this raw material should be optimally harnessed, so coconuts can be lifted into commodities Prima Donna in increasing added value

to about 16.32% of the population of Indonesia are still dependent on commodities (coconut Brotosunaryo, 2003). To support the utilization of coconut fruit flesh optimally, as basic necessities, then the research about how to find out the quality of a particular characteristic of coconut is done in order to facilitate the consumers get coconut in accordance with his wishes. The use of coconuts for processing a wide range of products, varying levels of ripeness, the age factor is therefore the harvest from each type of coconut in accordance with the product to be produced have to be traced. Various research results reveals, that this type of coconut and the level of age harvest will affect the characteristics of the fruit of the coconut palm. In this paper will be elaborated planning expert system to find out the quality of the meat of the coconut fruit.

Research methods previously used is manual methods providing questionnaire to the sellers of coconut and coconut supliyer so that results can be eveluasi as a standard level of quality of a coconut. In the availability of qualified quality coconut research method manual are considered has not met the standard. To get the appropriate results of the research with us using the fuzzy method implementations in a quality menentukan Tsukamoto coconut with standard values currently set for the determination of value by measuring the thickness of the Palm the meat of the coconut fruit is considered able to meet the satisfaction to the buyer.

The method which will be Tsukamoto is represented with a set of fuzzy membership functions are monotone. Then the resulting output is the result of every inference rules in accordance with the calculation of standard values already assigned to each variable, there are three variables: the number of types of coconut, the number of levels of the thickness of the flesh of the fruit and the weight of the fruit of the coconut palm. This system is required to able to help shoppers pick coconuts according to the desires of the buyer.

## 2. LITERATURE REVIEW

- A. A Prediction System Design For the Amount of Corn Production Using Tsukamoto Inference System (Fitria, 2015). In this study the author using a fuzzy inference system to predict the amount of production tsukamoto corn. The fuzzifikasi value of the membership will be searched using fuzzy set membership function because along with the minimum and maximum values of each variable. In the method of Tsukamoto every consequent upon the rules of the IF – then it will be represented by fuzzy set membership. From the resulting prediction research of corn production.
- B. The application of fuzzy method to predict production results Tsukamoto Palm (Juliansyah, 2015). The study outlines the development of system for predicting the outcomes of palm oil production based on market demand. The methods used in this research is haslinya and Tsukamoto FIS was predicted in accordance with computation using FIS-Tsukamoto.
- C. Year 2000 by (Boushehri, 2000) in his thesis entitled "Applying Fuzzy Logic To Stock Price Prediction". He wrote that "Fuzzy Modeling includes the following two categories: objective and subjective modeling Modeling. Modeling objective it is assumed that either the absence of any a priori knowledge about the system, or expert knowledge is not enough to believe. As for the subjective approach, it is assumed a priori knowledge about the system already exists and can be directly requested from an expert. It is therefore not a priori interpretation of the system, input and output the raw data that was used to add knowledge of a subjects or even generate new knowledge about the system.

## 3. THEORITICAL BASIS

### 3.1 Fuzzy Logic

Fuzzy logic first recommend by Prof. Lotfi a. Zadeh in 1965. Fuzzy logic is a rule-based decision-making method used to solve the system problem on the grayish hard modelled or have ambiguity. Basic fuzzy logic is fuzzy set theory.

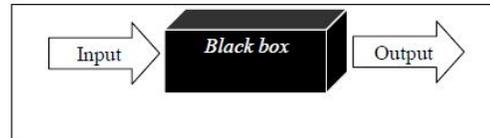


Fig. 1. Block diagram ' Fuzzy logic as a Black box

In the image above fuzzy logic can be thought of as a black box that berhuungan between the input spaces towards the output space (Kusuma Devi, 2003). The black box that is intended is a method that can be used to manipulate the input data into output in the form of good information.

As for some of the reasons why the use of fuzzy logic is:

1. The concept of fuzzy logic is easy to understand.
2. The use of flexible fuzzy logic.
3. fuzzy logic is able to model the nonlinear functions are very complex.
4. There is need for training process to model pengetahuan which is owned by the experts.
5. fuzzy logic based on everyday language so that it is easy to understand.

Fuzzy set is called the set of assertive (crisp), the value of membership an item  $x$  in a set  $A$  is written with  $u_A[x]$ , where it has two possibilities, namely: value

1. One (1), meaning that an item becomes a member in a particular set.
2. Zero (0), meaning that a particular item is not a member of a specific set.

Fuzzy set has two attributes, namely:

1. Variety, is the naming of grub that represents a certain State or condition by using natural language/everyday. For example: short, medium, HIGH
2. Numerical value is an number that indicates the size of a variable. For example: 140, 160, 180

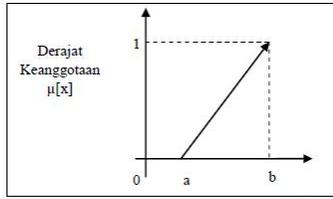
### 3.2 Membership Function

Fuzzy membership function is a curve that shows the mapping points to the input data into the membership degree whose value ranges from 0 to 1. Some fuzzy membership functions, namely:

#### 1. Linear Representation

A Linear representation is mapping input to engage the degrees described as a straight line. On a linear representation, there are two possibilities, namely:

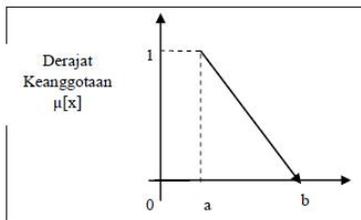
- a. Increase the set starts at the value of domains that have a membership degree of zero (0)is moving to the right towards the value of domains that have a higher degree of membership.



Representation Of A Linear Curve Rises Membership Functions:

$$\mu[x, a, b] = \begin{cases} 0; & x \leq a \\ \frac{x-a}{b-a}; & a \leq x \leq b \\ 1; & x \geq b \end{cases} \dots\dots\dots(2-1)$$

- b. decrease in the set, starting from the value of the domain with the highest degree of membership on the left side, moving kemudian descending to value domains that have lesser degrees of membership.

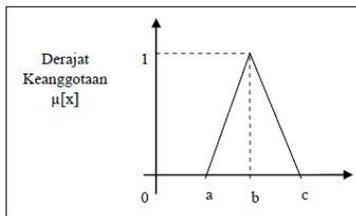


Representation Of A Linear Curve Down Membership Functions:

$$\mu[x, a, b] = \begin{cases} \frac{b-x}{b-a}; & a \leq x \leq b \\ 0; & x \geq b \end{cases} \dots\dots\dots(2-2)$$

2. Representation of curve Triangle

The curves of the triangle are basically formed from a combination of 2 lines (linear).

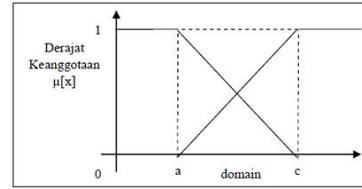


Representation of curve Triangle Membership Functions:

$$\mu[x, a, b] = \begin{cases} 0; & x \leq a \text{ atau } \geq c \\ \frac{x-a}{b-a}; & a \leq x < b \\ \frac{c-x}{c-b}; & b \leq x < c \end{cases} \dots\dots\dots(2-3)$$

3. Representation of the Curve of The Shoulder

The area that is formed in the middle of a variable is represented in the form of a triangle, a curve on the side of right and left are going up and down. But sometimes one side of the variable is not changed. Fuzzy set "shoulder", used to terminate a variable fuzzy area.



Representation of the Curve of The Shoulder Membership Functions:

$$\mu[x, a, b] = \begin{cases} 0; & x \geq b \\ \frac{b-x}{b-a}; & a \leq x \leq b \\ 1; & x \leq a \\ 0; & x \geq a \\ \frac{x-a}{b-a}; & a \leq x \leq b \\ 1; & x \geq b \end{cases} \dots\dots\dots(2-4)$$

A Method Of Fuzzy Tsukamoto

Fuzzy Inference system is a computational framework based on the fuzzy set theory, fuzzy rule "IF-THEN"-shaped, and fuzzy reasoning. Broadly speaking, fuzzy inference process block diagram (Kusumadewi, 2003).

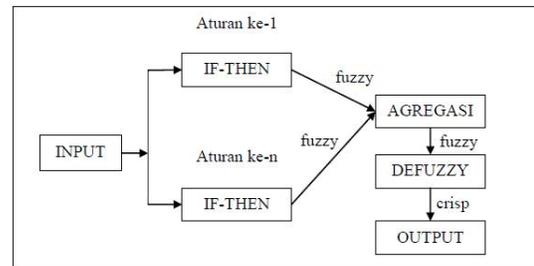


Fig. 3. Fuzzy inference system block diagram Tsukamoto

Fuzzy inference system receives input crisp. This input is then sent to a knowledge base that contains n fuzzy rules in the form of IF-THEN. Fire strength will be sought on each rule. When more than one rule number, it will be done the aggregation of all the rules. Next, on the results of the aggregation to be performed defuzzy to get the value of the crisp as the output of the system.

Basically, the method of applying reasoning tsukamoto monotony on any rule. If on a monotonous reasoning, the system has only one rule, on methods of tsukamoto, the system consists of several rules. Because it uses the basic concept reasoning method on monotonous, tsukamoto, any consequent on the rule in the form of IF-THEN it must be represented by a set of fuzzy membership functions are monotone. Output the results of each inference rule is given expressly (crisp) based on  $\alpha$ -predicate (fire element). The process of aggregation between the rules made, and the end result is obtained using defuzzy with the concept of weighted average.

Suppose there is an input variable, namely x and y, as well as one variable output i.e. z. variable x is divided into 2 sets of i.e. A1 and A2, the variable y is divided into 2 sets as well, i.e., B1 and B2, while the output variable Z is

divided into 2 sets namely C1 and C2. Of course the set C1 and C2 should be a set that are monotone. Given two rules as follows:

IF x is A1 and y is B2 THEN z is C1  
 IF x is A2 and y is B2 THEN z is C1

#### 4. RESEARCH DETAIL

##### 4.1 Stage Research Activities

For the sake of terselesaikannya research, then the required order of phases of research activities that are structured and precise. Here are the stages of the activities that will be undertaken by researchers:

##### 4.1.1 Study Of Literature

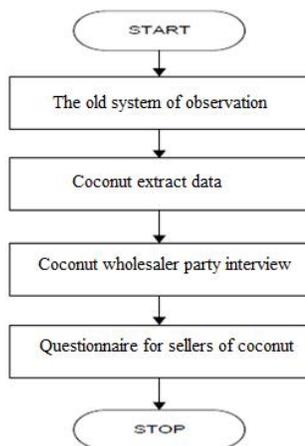
This method is used to get the provision teoriacuan writer to do research. Theory related library became reference writers are:

1. Fuzzy Logic
2. Characteristic Of Coconut

This literature study will be the reference material and basic theory as supporting research and writing paper.

##### 4.1.2 Observations in the Field

This method is used to find out the real work arrangement of observation. Here is a flowchart of research methodology conducted:



Flowchat Description:

- The old system of Observation  
 We do the old system with the goal of observation we can find out the deficiencies of the old system and make improvements to the system.
- Retrieve data coconut  
 coconut extract data to obtain data that we need in the process of pembutan the system.  
 Interview with the middleman

- Doing interviews with the middleman with the purpose to find out the specifications desired by buyers in the booking.

Questionnaire for coconut seller

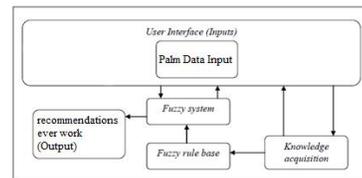
Questionnaire for coconut seller to know the characteristics of the good and bad of coconut.

##### 4.1.3 Needs Analysis And Design System

After getting the data taken from observations in the field then the writer will analyze the need to build this system. The model design of the system needs to be used for this research is a use case diagram, because it illustrates the needs and functional system.

##### 4.1.4 Block Diagram Of The System

The following block diagram of the system implementation of Fuzzy logic to determine the quality of the coconut method using tsukamoto:



#### 4.2 Needs Analysis Software

Stages of the needs analysis system has the goal to model information to be used in the design stage. Required system needs analysis includes the identification of actors, list of the needs of the system, and use case diagram. Here is an explanation of each of the stages.

#### 4.3 Identify the Actor

This stage aims to identify actors who will interact with the system. In the column mentioned actor actors who play a role in the system and on other columns will show the description of the actor. Table 4.1 shows the actor who plays a role in a system that comes with the explanation that is the result of the process of identification of the actors.

Aktor	Deskripsi Aktor
User	User is a user who wants to get an actor computation of fuzzy logic in the form of a determination of the quality of the coconut.

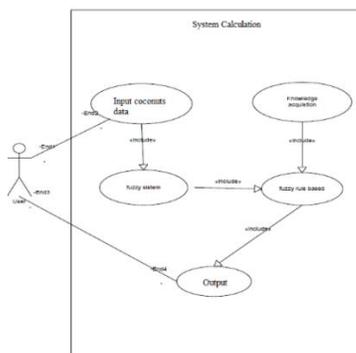
#### 4.4 A List of System Requirements

This stage aims to explain the system requirements that must be met when the actor performs an action. A list of these needs consists of a column which is the stuff that should be provided by the system, while on the other column shows the name of the use case featuring the functionality of each of those needs.

Necessity	Actor	The Name of Use Case
The system must be able to perform calculations with Tsukamoto method	User	System Calculation
The system should be able to change the rule before	User	System Change Rule
The system should be able to menguba restriction	User	System Change Restrictions

#### 4.5 Usecase Diagram

Use case diagram is one of the diagrams are used to describe the needs and the functionality of the system and is used to show the action performed by the actors of the system. Figure 4.2 is a use case diagram expert system which shows the specifications of the functionality provided by a system in terms of actors.



#### 4.6 Use Case Scenarios

Use case described in the diagram use case will describe in more detail in a use case scenario. The use of this use case scenario aimed at getting global description on use case, start and end conditions that must be met by the use case after functionality has been run. In table 4.3 will

explain how the system's response against the action performed by the actors.

Indentification	
Name	Process Data
Description	This use case describes the process of data input in the system
Actor	User
Scenario Data Input	
Action Actor	Reaction System
> The actor goes into the main page.	> The system displays the main page.
➤ The actor entered menginputkan data.	<ul style="list-style-type: none"> <li>• The system displays a page for data input.</li> <li>• The system can perform calculations, change the rule, and change the limit.</li> </ul>

### 5. Result and Conclusion

Expert system using the method of tsukamoto is designed in such a way that the later this system can be implemented in a company or can be used by the consumer to be able to choose the coconut and get coconut in accordance with his needs. This expert system in the design of generating the form data to the calculation of the weighting of each variable and then do the calculation of one by one on a rule set. Development and required further study to apply to users with large scale. However, the expected results of the study with the study of literature can be useful for the development of expert system either in scope or Fuzzy expert system as a whole.

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