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IMPLEMENTATION OF FMCDM IN DETERMINING DECISION MAKING

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ABSTRACT

Banana fruit is one of the fruits that are consumed by the public in their daily lives, with the status of a tropical country, there are quite a lot of farmers cultivating banana trees with various variants and types of bananas, in general the taste, color, shape and texture of bananas have almost the same at first glance. However, if you feel in more detail, all types of bananas must have something in common and some are almost similar to one type of another. With this condition, many farmers are confused about which bananas are most interested in and which are not, if the farmers plant bananas carelessly without knowing which ones are the most popular and which ones will not affect the income of the harvest. The FMCDM method is a method that will help determine decisions by grouping criteria and several alternatives, after going through a normal calculation process it will produce an integral value as the final result.

INTRODUCTION

By occupying the sixth rank position obtained from the aspect of international trade, bananas can be categorized as a commodity that can be improved in cultivation and production [1]. Along with its development, farmers began to look to plant fruit that has economic value that can be categorized as high which is due to the increasing public interest in consuming bananas with a figure of 1.32% per year, better than 2002 to 2010 which was only 0.04% per year according to the data. quoted from the Bureau of Statistics and the Directorate General of Horticulture. [2]

The continuous increase in consumers consuming bananas has resulted in a large shortage of supply of bananas which is felt from the regional level to the national level, this is also due to the lack of interest in cultivating bananas, if there is very often banana plants chosen by farmers are found. have a strong tree and a longer age, but farmers are less aware that the banana fruit is less attractive to the community in general. [3]

As it is known that the Fuzzy Multi Criteria Decision Making (FMCDM) method is the method most often used to determine decision making, with the Fuzzy Multi Criteria Decision Making (FMCDM) method, there is no doubt that the

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calculation results can be said to be accurate, for example in application is the selection of universities, determining crop patterns, producer determination to others.

In making any decision, the final stage determination is the decision of the owner, admin or leader, but in the world of technology, thought, perception or decision can also be processed using a method which will be calculated through criteria and alternatives, both alternatives and criteria, will be included in the values obtained, right? from the questionnaire.

In this discussion, the object of discussion is banana farmers who have the habit of planting bananas by prioritizing the age of the trees which may last longer or on the other hand, bananas will bear fruit more quickly, by relying only on these predictions, in general, many farmers experience losses because they do not follow the demand. market, so from this problem a direct observation of the field was held, namely traditional markets that sell a lot of various fruits by getting results from the field, so it was concluded that the research to determine the best bananas used the Fuzzy Multi Criteria Decision Making (FMCDM) method.

METHOD

Decision Support System

Various kinds and ways can be used in making decisions, with the development of technology, humans can easily measure human thinking through observations that convert to numbers and then process it computerized. [4] Decision Support System (DSS), also known as the Decision Support System (DSS), in the 1970s as a replacement for the term System Management Information (MIS). [5] One method by determining alternatives and criteria is the Fuzzy Multi Criteria Decision Making (FMCDM), by applying predetermined rules and standards, values will be obtained in accordance with human thinking. [6] In some cases the Fuzzy Multi Criteria Decision Making (FMCDM) method is often applied in selecting the best trees that appear capable of supporting or measuring human and technological thinking. [8] Fuzzy Multi Criteria Decision Making (FMCDM) can also break doubts in humans who will make the final decision where decision making can lead to the risk of jealousy, with the Fuzzy Multi Criteria Decision Making (FMCDM) method it is expected to be able to break this risk by giving each number each. criteria. [8] Each method must have characteristics that will make a system work properly, while the characteristics of a Decision Support System are: [9]

a. Problems that are semi-structured can be compared between human thinking and technology.
b. The analysis model is a model that can be used as a process in processing data.
c. The design that is formed is also user friendly
d. High adaptability is also able to apply the flexibility

aspect The decision support system is also supported by several components that will form the basis for the formation of the system [10]

a. Data Management System

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All activities related to the collection, storage and management of data relevant to the context of the decisions to be taken. Apart from that, this component also provides various security functions, data integrity procedures, and general data administration related to DSS. These various tasks are carried out in the data management system and its sub-systems, which include databases, database management systems, data repositories, and data query facilities.

b. Management System Model
The system features data retrieval, storage and management activities with various quantitative models, which provide analytical capabilities for the DSS.

c. Knowledge Base
Activities related to problem recognition, and to produce final and temporary solutions, matters related to problem-solving process management are at the core of this component. Knowledge base is the "brain" of the five components of the DSS. Data and models are processed so that the results are taken into consideration for the user in making decisions.

d. User Interface
Is a link between the system and the user, so that the components of the DSS system can be accessed and manipulated easily by the user to provide support for decision making. Ease of use and communication between users and the SPK is basically a measure of the success of using the DSS itself.

e. User
The design, implementation and utilization of DSS will not be effective if it is not accompanied by user roles. Ability, skills, motivation, and knowledge of users as a regulator of DSS will determine the effectiveness of the use of DSS.

RESULT AND DISCUSSION

Choosing the best fruit for the right banana fruit is one of the efforts made by farmers or banana enthusiasts to solve the problem, the lack of interest of farmers or people who consume them to choose the best fruit available. Analyze a system, choose alternative solutions to problems and solve problems. Fuzzy Multi Criteria Decision Making (MCDM) is a method used in making decisions for selecting the best fruit on bananas.Banana fruit consists of various types, many farmers or enthusiasts who want to consume bananas and many also cultivate these bananas. There are many benefits of bananas, such as the many nutritional content that are beneficial to the body found in bananas.In this case the best alternative is the best fruit in bananas.

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The alternatives in choosing the best fruit for bananas can be seen in table 1:

Tables For Alternatives

Alternatives	Information
A_1	Plantain fruit
A_2	Long banana (peeled)
A_3	Barangan banana fruit
A_4	Golden banana fruit
A_5	Kepok banana fruit
A_6	Jackfruit banana fruit

Tabel for criteria

Criteria	Information
C_1	Fruit shape
C_2	Length
C_3	Width
C_4	Measuring Perimeter of the Fruit
C_5	Skin thickness
C_6	Sweetness Level
C_7	Flesh Color
C_8	Number of Fruits per comb
C_9	Weight

To determine the degree of importance of each alternative to the criteria, the fuzzy number membership function used is the triangular fuzzy number function, whose membership function has been stated in equation (3), namely:

$$\mu A[x] = \begin{cases} 0 \;\; ; x < a \; atau \; x > c \\ (x-a)/\,(b-a); \qquad a \leq x \leq b \\ (c-x)/\,(c-b)\,; \qquad b \leq x \leq c \end{cases}$$

To determine the weight of importance for each criterion, as shown in the table below

Table of Importance Rank for Each Criteria

Criteria	C_1	C_2	C_3	C_4	C_5	C_6	C_7	C_8	C_9
Twig	T	C	C	C	C	ST	C	T	ST

Information on table 4.3 for criteria, namely C1 (Shape), C2 (Length), C3 (Width), C4 (Size of the Perimeter of the Fruit), C5 (Skin Thickness), C6 (Sweetness Level), C7 (Fruit Color), C8 (Total Fruit per comb), C9 (Weight). Where the importance of the criteria is weighted, there are five criteria, namely C2, C3, C4, C5 and C7 which have Sufficient importance weight (C), and two criteria, namely, C1, and C8, which have High importance weight (T), and two criteria. that is, C6 and C9 have Very high importance weight (ST).

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Table of Compatibility of Each Alternative Against Each Criterion

Alternative	Matched twigs								
	C_1	C_2	C_3	C_4	C_5	C_6	C_7	C_8	C_9
A_1	C	B	C	C	B	C	C	C	SB
A_2	B	C	C	C	B	C	C	C	SB
A_3	B	SB	C	C	B	SB	B	B	SB
A_4	C	C	B	C	C	SB	C	B	SB
A_5	C	B	B	B	C	B	B	C	SB
A_6	C	C	C	B	B	C	SB	C	B

By substituting the triangular fuzzy number into each linguistic variable into the equation, the fuzzy match value is obtained in the table with the following details:

Table of Rank of Interest and Rank of Fit for Each Criterion for Alternative **A_1**

Alternative **A_1**	Criteria	C_1	C_2	C_3	C_4	C_5	C_6	C_7	C_8	C_9
	Interests of interest	T	C	C	C	C	ST	C	T	ST
	Matched twigs	C	B	C	C	B	C	C	C	SB

Table 4.5 for alternatives A1 (Banana Fruit), and for criteria, namely C1 (Shape), C2 (Length), C3 (Width), C4 (Size of the Perimeter of the Fruit), C5 (Skin Thickness), C6 (Sweetness Level), C7 (Flesh Color), C8 (Number of Fruits per Comb), C9 (Weight). Rank of interest C (Enough), T (High), ST (Very High). Matched ranks C (Enough), B (Good), and SB (Very Good). Where to find the match index value for each alternative Y1, Q1, and Z1, for each branch the value is taken from the fuzzy triangle.

On Alternatives A_1

Y_1 = 1/9 ((T * C) + (C * B) + (C * C) + (C * C) + (C * B) + (ST * C) + (C * C) + (T * C) + (ST * SB))
= 1/9 ((1*0.75) + (0.75*1) + (0.75*0.75) +(0.75*0.75)+ (0.75 * 1) + (1.5 * 0.75) + (0.75 * 0.75) + (1 * 0.75) + (1.5 * 1.5))
= 0.895833

Q_1 = 1/9 ((T * C) + (C * B) + (C * C) + (C * C) + (C * B) + (ST * C) + (C * C) + (T * C) + (ST * SB))
= 1/9 ((1.5*1) + (1*1.5) + (1*1) + (1*1) + (1*1.5) + (2*1) + (1*1) + (1.5*1) + (2*2))
= 1.666667

Z_1 = 1/9 ((T * C) + (C * B) + (C * C) + (C * C) + (C * B) + (ST * C) + (C * C) + (T * C) + (ST * SB))
=1/9*((2*1.5)+(1.5*2)+(1.5*1.5)+(1.5*1.5)+(1.5*2)+(2*1.5)+(1.5*1.5)+(2*1.5) +(2*2))
= 2.86111

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Where in alternative A1 to find the fit index for each alternative Y1, Q1, and Z1 taken from Table 4.4 Compatibility Rank of Each Alternative Against Each Criterion, and each alternative is taken in Table 4.5 Importance Rank and Suitability Rank of Each Criterion for Alternative A1. From the results of the above calculations, it can be seen that in alternative A1 Raja Banana fruit has a fuzzy compatibility index: 0.895833; 1.666667; 2.86111.

Next, do the calculation loop up to alternative 6 (A6) to find the match index for each alternative until it looks like the rabel below:

Match Index Table for Each Alternative

Alternatives	Fuzzy Match Index		
	Y	***Q***	***Z***
A_1	0.895833333	1.666666667	2.861111111
A_2	0.902777778	1.694444444	2.888888889
A_3	1.138888889	2.166666667	3.277777778
A_4	1.027777778	1.916666667	3
A_5	0.979166667	1.888888889	3.138888889
A_6	0.875	1.666666667	2.944444444

By distributing the fuzzy fit index in table 4.11, and taking the degree of optimism (α) = 0 (not optimistic), α = 0.5 and α = 1 (very optimistic), an integral value will be obtained for each alternative.

The calculation for the value (α) = 0 dims from Table 4.11. Fit Index for Each Alternative

$I_{\mathbf{1}}^{\mathbf{0}}$ = 1/2*((0)*(2.861111111)+(1.666666667)+(1-0)*(0.895833333))
= 1.28125

$I_{\mathbf{1}}^{\mathbf{0}}$ = 1/2*((0)*(2.888888889) + (1.694444444) + (1-0)*(0.902777778))
= 1.298611111

$I_{\mathbf{1}}^{\mathbf{0}}$ = 1/2*((0)*(3.277777778) + (2.166666667) + (1-0)*(1.138888889))
= 1.652777778

$I_{\mathbf{1}}^{\mathbf{0}}$ = 1/2*((0)* (3) + (1.916666667) + (1-0)*(1.027777778))
= 1.472222222

$I_{\mathbf{1}}^{\mathbf{0}}$ = 1/2*((0)* (3.138888889) + (1.888888889) + (1-0)*(0.979166667))
= 1.434027778

$I_{\mathbf{1}}^{\mathbf{0}}$ = 1/2*((0)* (2.944444444) + (1.666666667) + (1-0)*(0.875))
= 1.270833333

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Table of Totally Integral Value of Each Alternative

Alternative	Totally Integral Value		
	$\propto = 0$	$\propto = 0.5$	$\propto = 1$
A_1	1.28125	1.772569444	2.263888889
A_2	1.298611111	1.795138889	2.291666667
A_3	1.652777778	2.1875	2.722222222
A_4	1.472222222	1.965277778	2.458333333
A_5	1.434027778	1.973958333	2.513888889
A_6	1.270833333	1.788194444	2.305555556

From the siatas table, it can be seen that A3 has the largest total integral regardless of the degree of optimism, so that farmers or enthusiasts who want to consume the best fruit on the best selected bananas. After re-analysis and testing of the results of manual calculations using the fuzzy total integral value, it turns out that the results of manual calculations are confirmed by the researcher.

Where the results of the calculations are carried out above, then the alternative is to choose the best fruit in bananas, namely Barangan Bananas, which is a good alternative to existing bananas.

From the calculation of the total integral value ranking of all available alternatives, it can be seen that Alternative A3 for the integral column one has the highest value, so it can be concluded that the alternative is the best alternative with a value of 2.722222222.

Table of Integral *F* Value Calculation of Rank Order

Alternative	Totally Integral Value			Information
	$\propto = 0$	$\propto = 0.5$	$\propto = 1$	
A_3	1.652777778	2.1875	2.722222222	Barangan banana fruit
A_5	1.434027778	1.973958333	2.513888889	Kepok banana fruit
A_4	1.472222222	1.965277778	2.458333333	Golden banana fruit
A_6	1.270833333	1.788194444	2.305555556	Jackfruit banana fruit
A_2	1.298611111	1.795138889	2.291666667	Long banana (peeled)
A_1	1.28125	1.772569444	2.263888889	Plantain fruit

CONCLUSION

By calculating the results of the research, it is said that using the Fuzzy Multi Criteria Decision Making (MCDM) method in determining the best banana fruit can help the decisions of farmers and researchers in developing and cultivating the bananas that consumers like the most and increasing the knowledge of researchers. No matter how sophisticated and perfect the technology can produce, the final decision remains in the hands of the farmer.

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