

# PROPOSED CONTROL OF RAW MATERIAL INVENTORY IN CONDITION OF NOT REQUIRED WITH FUZZY MAMDANI METHOD IN CV. PINUS BAG'S SPECIALIST

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**Abstract.** CV. Pine Bag's Specialist is a business engaged in the manufacturing of various types of bags. One of the bags made in the form of a backpack. Parachute fabric is the main raw material for making backpacks. Uncertain demand causes a lot of accumulation (over stock) of raw materials in the storage area, so we need a method of supporting raw material inventory control to determine the optimal order. The research objective determines the optimal ordering of raw materials using variable raw material demand, raw material inventory variables and ordering variables in January the first week to March the fourth week. The Fuzzy Mamdani method used in this study because it has a flexible nature and can overcome the problem of uncertainty. The data processing of the Fuzzy Mamdani method carried out in several stages (a) the formation of the Fuzzy set, (b) the application of the implication function, (c) the composition of the rules, (d) Defuzzification. Defuzzification in research uses the centroid method. The results of Fuzzy Mamdani's manual calculation in January of the first week with input of raw material demand of 666 meters and 126 meters of inventory resulted in an optimal prediction of ordering raw materials of 876 meters. Calculations for January the second week to March the fourth week are performed with the help of the Matlab R2013a Fuzzy Toolbox software. The results of prediction data evaluation on the number of raw material orders Fuzzy Mamdani with actual data on the raw material number ordering CV. Pine Bag's Specialist, it is known that the average absolute error (MAE) is 193.8 meters with an average percentage of absolute error (MAPE) of 22%. So, it is said that the level of accuracy of predictions is reasonable. Future research is expected in the Fuzzy Mamdani method can be used more than two inputs and one output and the addition of linguistic variables. Combine the Fuzzy Mamdani method with other raw material inventory control methods so that the results obtained are getting better.

*Keywords: fuzzy mamdani, inventory control, uncertain demand, MAE, MAPE*

## 1. INTRODUCTION

CV. Pin Bag's Specialist is a company engaged in the manufacturing industry of various types of bags. Backpack is one type of bag that made. The main raw material used in the manufacture of backpacks in the form of cloth called parachute fabric. Companies in making decisions using simple methods manually and based on experience in determining the ordering of raw materials for parachute fabric needed. The simple method used in determining the ordering of parachute fabric raw materials by estimating the amount of demand for parachute

fabric raw materials ordered is adjusted to the number of bags production requested by consumers, but the parachute fabric raw material from the rest of the production results is not a consideration factor.

Negative impact if the control of parachute fabric raw materials do not use the right decision support methods in determining the optimal order will cause the accumulation of parachute fabric raw materials (over stock) in the storage area. Parachute fabric raw material that was over stock for the last three months from January 2019 to March 2019 with an average amount of 74.9 meters and a percentage of 12.8% per week. Parachute fabric raw materials that have accumulated in storage for a long time and are not considered causing a decrease in quality that is not suitable for reuse, causing losses for the company.

Based on previous research conducted by Abdurraiyid, et al. [1] resulted in the application of the Fuzzy Mamdani method in determining the predictions of procurement of goods to provide suitable alternatives to meet all user needs, and the application of the Fuzzy Mamdani Method can produce predictions of procurement of goods by looking at the inventory of goods and quantities demand for goods. Research conducted by Rahakbauw, et al [2] resulted in the application of Fuzzy Logic using the Mamdani Method effectively applied in the Matlab software application to assist the company in predicting the determination of the amount of rubber production in liters per day with a percentage of truth value of 87.82706% which means it is very close good. Fuzzy Mamdani method can be used as a decision support in controlling inventory of parachute fabric raw materials based on the amount of raw material demand and inventory of existing raw materials to get optimal ordering predictions in the CV. Pine Bag’s Specialist. Proposed inventory control of parachute fabric raw materials using Fuzzy Mamdani method as a decision support is expected to be able to overcome the problem of uncertain demand.

**2. METHODS**

**Fuzzy Logic**

Fuzzy Logic is a component of soft computing. Fuzzy logic is an appropriate way to map an input space into an output space. Fuzzy logic uses Fuzzy set theory which considers the degree of membership as a determinant of the state of the elements in a Fuzzy set. Fuzzy is a vague value that can be considered true or false simultaneously. Fuzzy truth and error values depend on the degree of membership possessed by a Fuzzy set. The degree of membership in Fuzzy has a value of zero to one. Fuzzy membership degree with a set that has a zero or one value (yes or no). In a firm set (crisp), the membership value of item x in a set A, which is often written as  $\mu_A(x)$ , has two possibilities, namely the value of one which means that an item is a member of a set and a zero value which means that an item not become a member in a set. Fuzzy membership has a different probability of having a value at intervals of zero to one but the interpretation of values is very different between the two cases. Fuzzy membership provides a measure of opinion or decision, while probability indicates the proportion of the frequency of an outcome that is true in the long run [3].

**Mamdani Method**

The Mamdani method is also known as the Min-Max method. Ebrahim Mamdani introduced this method in 1975. Output was obtained through four stages [3].

1. Formation of Fuzzy Association

Mamdani method input variables and output variables divided into one or more Fuzzy sets, and in each input and output variable there are linguistic variables

2.Application Function Implications

Input and output variables are used to determine the function implication. The function implication used in the Mamdani method is to take the minimum value (Min).

$$\text{IF } x \text{ is } A \text{ THEN } y \text{ is } B \tag{1}$$

3. Composition of Rules

The composition of the rules obtained from the implication function, which is determining the composition of each rule and the method used in conducting the Fuzzy System Inference, which is the maximum method (Max). In the maximum method (Max) the Fuzzy set solution is obtained by taking the maximum value of the rule, then used to modify the Fuzzy area and applied to the output using the OR (union) operator. If all propositions evaluated, the output will contain a Fuzzy set that reflects the contribution of each proportion.

$$\mu_{sf}(x_i) = \max(\mu_{sf}(x_i), \mu_{kf}(x_i)) \tag{2}$$

Description:

- $\mu_{sf}(x_i)$  = Fuzzy solution membership value up to rule i;  
Fuzzy solution membership value to the i-th rule;
- $\mu_{kf}(x_i)$  = Fuzzy solution membership value is the consequence rule i;  
Fuzzy consequence membership value i-th rule;

**Defuzzification**

Input from the defuzzification process is a set of Fuzzy obtained from the composition of Fuzzy rules, while the output produced is a number of Fuzzy set domains. If a Fuzzy set is given from a certain range, then a certain crisp value is taken as output. In this method crisp solution is obtained by taking the center point of the Fuzzy area. The formula of the Centroid (Composite Moment) method is as follows:

$$z^* = \frac{\int z\mu(z) dz}{\int \mu(z) dz} \tag{3}$$

Description:

- $z^*$  = The central point value of the Fuzzy area
- $z\mu(z) dz$  = Area of moments
- $\mu(z) dz$  = Total area

**Calculating the Level of Accuracy Forecasting Prediction**

There are several calculations commonly used to calculate forecast errors (Forecast Error). Mean Absolute Error (MAE), and MAPE (Mean Absolute Percentage Error) can measure forecast errors.

**MAE (Mean Absolute Error)**

MAE is a model of calculating the error value by calculating the difference between the predicted value and the actual value, which is then authenticated (regardless of positive or negative signs). Results from MAE values in the same form (size) as actual data [4].

$$\frac{1}{n} \sum_{t=1}^n |F_t - A_t| \tag{4}$$

Description:

$F_t$  = actual data;  $A_t$  = prediction data;  $n$  = lots of data

**MAPE (Mean Absolute Percentage Error)**

MAPE is a model of calculating the error value by calculating the difference between the predicted value and the actual value which is then absolute and then calculated in the form of a percentage of the original data (Chang, et al, 2007).

$$\frac{1}{n} \sum_{t=1}^n \left| \frac{F_t - A_t}{A_t} \right| \times 100\% \tag{5}$$

Description:

$F_t$  = actual data;  $A_t$  = prediction data;  $n$  = lots of data

Evaluation of the level of MAPE performance from a forecasting model divided into four categories, namely:

- a. <10% = Very good forecasting ability
- b. 10% - 20% = Good forecasting ability
- c. 20% - 50% = Fair forecasting ability
- d. >50% = Bad forecasting ability

**3. RESULTS AND DISCUSSION**

The data taken is data of black parachute fabric raw material that includes data on raw material demand, raw material inventory data and raw material ordering data for three months from January 2019 to March 2019 can be seen in Table 1.

Table 1. Raw Material Demand Data, Raw Material Inventory Data and Raw Material Order January-March 2019

No.	Month	Week	Demand of Raw Material (Meters)	Stock of Raw material (meters)	Booking of Raw Material (Meters)
1	January	1	666	126	771
2		2	846	105	1071
3		3	486	225	531
4		4	1791	45	1881
5	February	1	621	90	621
6		2	1408,5	0	1476
7		3	733	67,5	733,5
8		4	396	0,5	441
9	March	1	1971	45	2061
10		2	666	90	771
11		3	306	105	306
12		4	756	0	846

Based on Table 1 above, it can be explained that the largest number of fabric raw material requests reached 1971 meters per week and the smallest number of fabric raw material requests reached 306 meters per week. The largest amount of fabric raw material inventory reaches 225 meters per week and the smallest amount of fabric raw material inventory reaches 0 meters per week. The largest number of fabric raw material orders reached 2061 meters per week and the smallest number of fabric raw material orders reached 306 meters per week.

**Fuzzy Association Formation**

The first step is to determine the variables associated in the process that are determined by the appropriate fuzzification function. This research has input parameters, namely the demand for raw materials and supply of raw materials. Output parameters (orders) are ordered raw materials ordered. In this study there are three variables that are modeled, namely:

1. Demand variable

$$\begin{aligned} \mu_{PmtSEDIKIT}functional\ demand(x) &= \begin{cases} 0 & ; x \leq 306 \\ \frac{(1138,5-x)}{(1138,5-306)} & ; 306 \leq x \leq 1138,5 \\ 1 & ; x \geq 1138,5 \end{cases} \\ \mu_{PmtSEDANG}medium\ demand(x) &= \begin{cases} 0 & ; x \leq 306\ \text{atau}\ x \geq 1971 \\ \frac{(x-306)}{(1138,5-306)} & ; 306 \leq x \leq 1138,5 \\ \frac{(1971-x)}{(1971-1138,5)} & ; 1138,5 \leq x \leq 1971 \end{cases} \\ \mu_{PmtBANYAK}many\ demand(x) &= \begin{cases} 0 & ; x \leq 1138,5 \\ \frac{(x-1138,5)}{(1971-1138,5)} & ; 1138,5 \leq x \leq 1971 \\ 1 & ; x \geq 1971 \end{cases} \end{aligned}$$

The FUNCTIONAL, MEDIUM, and MANY Fuzzy set membership functions of the request variable are represented in Figure 1.

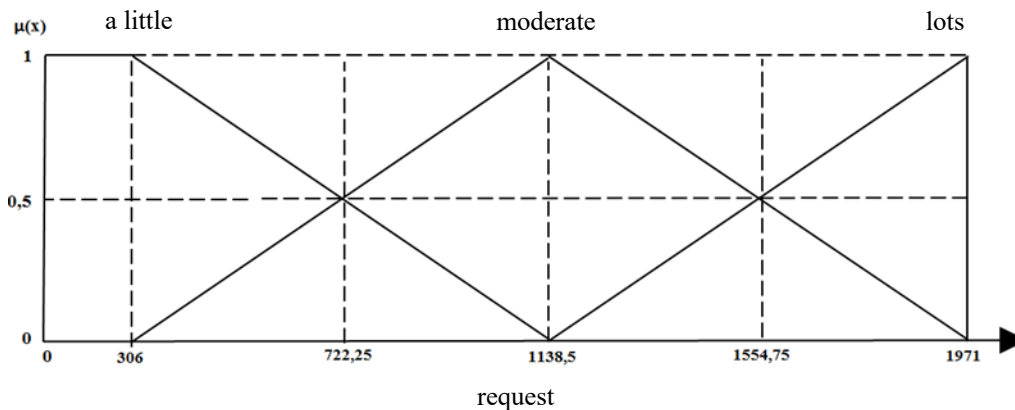


Figure 1. Membership Function Variable Demand

2. Inventory variables

$$\begin{aligned} \mu_{PsdSEDIKIT}functional\ inventory(y) &= \begin{cases} 1 & ; y \leq 0 \\ \frac{(112,5-y)}{(112,5-0)} & ; 0 \leq y \leq 112,5 \\ 0 & ; y \geq 112,5 \end{cases} \\ \mu_{PsdSEDANG}medium\ inventory(y) &= \begin{cases} 0 & ; y \leq 0\ \text{atau}\ x \geq 225 \\ \frac{(y-0)}{(112,5-0)} & ; 0 \leq y \leq 112,5 \\ \frac{(225-y)}{(225-112,5)} & ; 112,5 \leq y \leq 225 \end{cases} \\ \mu_{PsdBANYAK}many\ inventory(y) &= \begin{cases} 0 & ; y \leq 225 \\ \frac{(y-112,5)}{(225-112,5)} & ; 112,5 \leq y \leq 225 \\ 1 & ; y \geq 225 \end{cases} \end{aligned}$$

The FUNCTIONAL, MEDIUM, and MANY Fuzzy set membership functions of the inventory variable are represented in Figure 2

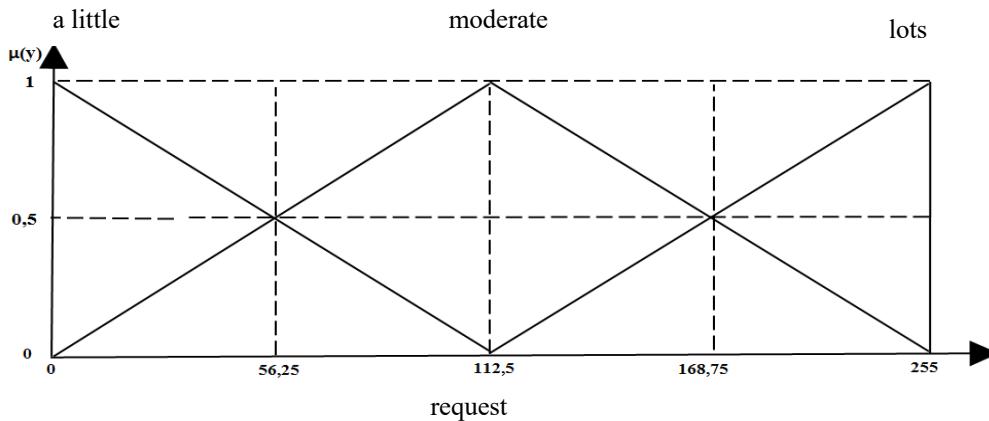


Figure 2. Inventory Variable Membership Function

3. Order variable

$$\mu_{PmsSEDIKITfunctional\ order}(z) \begin{cases} 1 & ; z \leq 306 \\ \frac{(1183,5-z)}{(1183,5-306)} & ; 306 \leq z \leq 1183,5 \\ 0 & ; z \geq 1183,5 \end{cases}$$

$$\mu_{PmsSEDANGmedium\ order}(z) \begin{cases} 0 & ; z \leq 306\ \text{atau}\ z \geq 2061 \\ \frac{(z-306)}{(1183,5-306)} & ; 306 \leq z \leq 1183,5 \\ \frac{(2061-z)}{(2061-1183,5)} & ; 1183,5 \leq z < 2061 \end{cases}$$

$$\mu_{PmsBANYAKmany\ order}(z) \begin{cases} 0 & ; z \leq 1183,5 \\ \frac{(z-1183,5)}{(2061-1183,5)} & ; 1183,5 \leq z \leq 2061 \\ 1 & ; z \geq 2061 \end{cases}$$

The FUNCTIONAL, MEDIUM, and MANY Fuzzy set membership functions of the ordering variable are represented in Figure 3

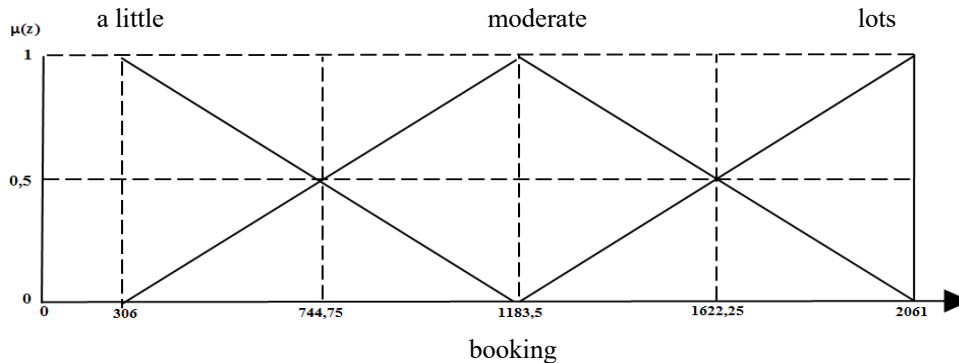


Figure 3. Ordering Variable Membership Function

**Application Function Implications**

Based on data analysis of the limits of each set of Fuzzy on each variable, the rules are formed in accordance with the knowledge base as follows:

- [R1] If the Request is LITTLE, and the supply IS LITTLE, Then the Order IS LITTLE
- [R2] If the request is MEDIUM, and the supply is LITTLE, then the order is MUCH
- [R3] If the demand is MUCH, and the supply is LITTLE, then the order is MUCH
- [R4] If the Request is LITTLE, and the Supplies ARE MEDIUM, then the Order is LITTLE
- [R5] If the request is MEDIUM, and the supply is MEDIUM, then the order is MEDIUM
- [R6] If MANY Requests, and Supplies ARE ON, Then Order A LOT
- [R7] If the Demand is LITTLE, and the Supplies are MUCH, then the Order IS LITTLE
- [R8] If the demand is MEDIUM, and the supply is MUCH, then the order is LITTLE

[R9] If the demand is a LOT, and the supply is a LOT, then the order is a LOT

Determination of the optimal order of parachute fabric raw materials for the first week of January 2019, if the demand for raw materials known to be 666 m, then:

$$\mu_{PmtSEDIKIT \text{ functional demand}(666)} = \frac{(1138,5-x)}{(1138,5-306)} = 0,56$$

$$\mu_{PmtSEDANG \text{ medium demand}(666)} = \frac{(x-306)}{1138,5-306} = 0,43$$

If the raw material inventory is known as 126 m, then:

$$\mu_{PsdSEDANG \text{ medium inventory}(126)} = \frac{(255-y)}{(225-112,5)} = 0,88$$

$$\mu_{PsdBANYAK \text{ many inventory}(126)} = \frac{(y-112,5)}{(225-112,5)} = 0,12$$

Rules that have a value or  $\neq 0$  become the rules chosen for the composition of Fuzzy Rules. The rules chosen as follows:

[R4] If the Request is LITTLE, and the Supplies ARE MEDIUM, then the Order is LITTLE

$$\begin{aligned} \alpha\text{-predicate4} &= \mu_{PmtSEDIKIT \text{ functional demand}} \cap \mu_{PsdSEDANG \text{ medium inventory}} \\ &= \min(0,56;0,88) \\ &= 0,56 \end{aligned}$$

[R5] If the request is MEDIUM, and the supply is MEDIUM, then the order is MEDIUM

$$\begin{aligned} \alpha\text{-predicate5} &= \mu_{PmSEDANG \text{ medium demand}} \cap \mu_{PsdSEDANG \text{ medium inventory}} \\ &= \min(0,43;0,88) \\ &= 0,43 \end{aligned}$$

[R7] If the demand is LITTLE, and the Supplies are MUCH, then the Order IS LITTLE

$$\begin{aligned} \alpha\text{-predicate7} &= \mu_{PmtSEDIKIT \text{ functional demand}} \cap \mu_{PsdBANYAK \text{ MANY inventory}} \\ &= \min(0,56;0,12) \\ &= 0,12 \end{aligned}$$

[R8] If the demand is MEDIUM, and the supply is MUCH, then the order is LITTLE

$$\begin{aligned} \alpha\text{-predicate8} &= \mu_{PmtSEDANG \text{ medium demand}} \cap \mu_{PsdBANYAK \text{ many inventory}} \\ &= \min(0,43;0,12) \\ &= 0,12 \end{aligned}$$

**Rule Composition**

Fuzzy set solution obtained by making a composition between all the rules by taking the maximum value of the rule called the Max method.

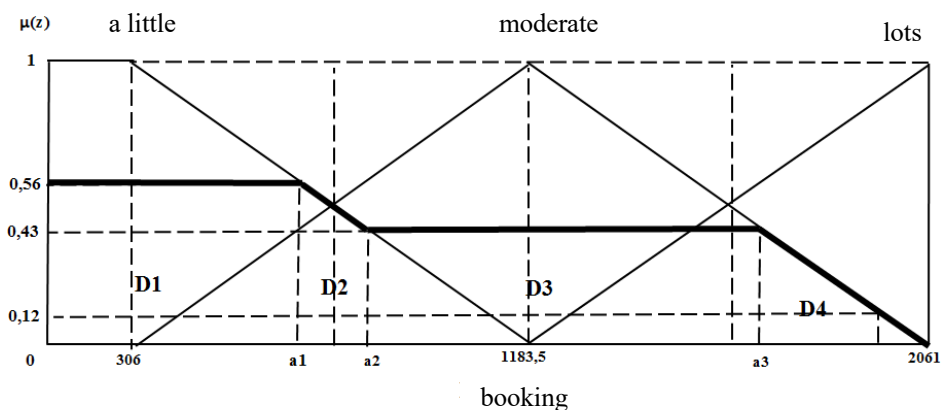


Figure 4. Composition Results Area

The area of the composition of the rules divided into five parts, namely D1, D2, D3, and D4 then look for the values a1, a2, and a3.

$$\begin{aligned} \frac{1183,5-a1}{1183,5-306} &= 0,56 \\ a1 &= 692.1 \end{aligned}$$

$$\frac{1183,5-a_2}{1183,5-306} = 0,43$$

$$a_2 = 806,1$$

$$\frac{2061-a_3}{2061-1183,5} = 0,43$$

$$a_3 = 1683,6$$

The membership function for the results of Fuzzy composition is as follows:

$$\mu_{Pmsbooking}(z) \begin{cases} 0,56 & ; z \leq 692,1 \\ \frac{(1183,5-z)}{1183,5-306} & ; 692,1 \leq z \leq 806,1 \\ 0,43 & ; 806,1 \leq z \leq 1683,6 \\ \frac{(2061-z)}{(2061-1183,5)} & ; 1683,6 \leq z \leq 2061 \end{cases}$$

**DEFUZZIFICATION**

The input of the Defuzzification process is a set of Fuzzy obtained from the composition of Fuzzy rules, while the resulting output is a number in the Fuzzy set domain. The method used for Defuzzification is the Centroid method. To determine the value of crisp z, it is done by dividing the area into 4 parts D1, D2, D3, and D4 with their respective areas as A1, A2, A3, and A4 and Calculating the Moment of the area against the degree of Fuzzy membership of each M1, M2, M3 and M4. Finding the midpoint by the Centroid method by calculating the area of the moment and the area of the area, as follows:

$$z^* = \frac{\int_0^{692,1} (0,56)z \, dz + \int_{692,1}^{806,1} \frac{(1183,5-z)}{(1183,5-306)}z \, dz + \int_{806,1}^{1683,6} (0,43)z \, dz + \int_{1683,6}^{2061} \frac{(2061-z)}{(2061-1183,5)}z \, dz}{\int_0^{692,1} (0,56) \, dz + \int_{692,1}^{806,1} \frac{(1183,5-z)}{(1183,5-306)} \, dz + \int_{806,1}^{1683,6} (0,43) \, dz + \int_{1683,6}^{2061} \frac{(2061-z)}{(2061-1183,5)} \, dz}$$

$$z^* = \frac{792814}{902,4}$$

$$z^* = 878,5 \approx 879 \text{ Meter}$$

Manual calculation of the Fuzzy Mamdani method for January the first week of 2019 with input of the total demand for parachute cloth 666 meters and input of the total inventory of parachute cloth by 126 meters produces an output prediction of the optimal order of parachute fabric raw material from the results of 879 meters.

Table 2. Predicted Results of Amount of Order of Fuzzy Mamdani raw materials

No.	Month	Week	Demand of Raw Material (Meters)	Stock of Raw material (Meters)	Ordering Raw Materials (Meters)	
					CV. Pinus Bag's Specialist	Fuzzy Mamdani
1	January	1	666	126	771	879
2		2	846	105	1071	1020
3		3	486	225	531	438
4		4	1791	45	1881	1440
5	February	1	621	90	621	853
6		2	1408,5	0	1476	1750
7		3	733	67,5	733,5	1000
8		4	396	0,5	441	561
9	March	1	1971	45	2061	1740
10		2	666	90	771	895
11		3	306	105	306	418
12		4	756	0	846	1030

**Calculate the Accuracy of Predicted Amounts of Raw Material Orders**

Based on prediction data obtained from the first week of January 2019 to the fourth week of March 2019, it is determined the extent of the accuracy of predictions using MAE (Mean Absolute Error) and MAPE (Mean Absolute Percentage Error).

**MAE (Mean Absolute Error)**

Table 3. MAE (Mean Absolute Error)

No.	Month	Week	F <sub>t</sub> (Actual Meter Data)	A <sub>t</sub> (Meter Prediction)	F <sub>t</sub> -A <sub>t</sub> (Error Meter)	F <sub>t</sub> -A <sub>t</sub>
1	January	1	771	879	-108	108
2		2	1071	1020	51	51
3		3	531	438	93	93
4		4	1881	1440	441	441
5	February	1	621	853	-232	232
6		2	1476	1750	-274	274
7		3	733,5	1000	-266,5	266,5
8		4	441	561	-120	120
9	March	1	2061	1740	321	321
10		2	771	895	-124	124
11		3	306	418	-112	112
12		4	846	1030	-184	184
Total						2326.5

$$\begin{aligned}
 MAE &= \frac{1}{n} \sum_{t=1}^n |F_t - A_t| \\
 &= \frac{2326.5}{12} \\
 &= 193,8 \text{ meter}
 \end{aligned}$$

**MAPE (Mean Absolute Percentage Error)**

Table 4. MAPE (Mean Absolute Percentage Error)

No.	Month	Week	F <sub>t</sub> (Actual Meter Data)	A <sub>t</sub> (Meter Prediction)	F <sub>t</sub> -A <sub>t</sub> (Error Meter)	$\frac{F_t - A_t}{A_t}$
1	January	1	771	879	-108	0,14
2		2	1071	1020	51	0,04
3		3	531	438	93	0,17
4		4	1881	1440	441	0,23
5	February	1	621	853	-232	0,37
6		2	1476	1750	-274	0,18
7		3	733,5	1000	-266,5	0,36
8		4	441	561	-120	0,27
9	March	1	2061	1740	321	0,15
10		2	771	895	-124	0,16
11		3	306	418	-112	0,36
12		4	846	1030	-184	0,21
Total	2,64					

$$\begin{aligned}
 MAPE &= \frac{1}{n} \sum_{t=1}^n \left| \frac{F_t - A_t}{A_t} \right| \times 100\% \\
 &= \frac{2,64}{12} \times 100\% \\
 &= 22 \%
 \end{aligned}$$

**DISCUSSION**

**The Result of Ordering of Parachute Fabric Raw Materials**

The results of data processing using the Fuzzy Mamdani method obtained prediction of the optimal number of parachute fabric raw materials orders in January the first week of 2019 to March the fourth week of 2019 there are differences in the number of orders between CV. Pine Bag's Specialist and processing results of Fuzzy Mamdani method. The difference in the number of bookings is seen every week for three months.



In January, the first week of ordering parachute fabric raw materials made by CV. The Pine Bag's Specialist is 771 meters smaller than the predicted number of raw materials ordered by the Fuzzy Mamdani method by 879 meters. Number of ordering raw materials CV. Pine Bag's Specialist in January the second week of 1071 meters is greater than the predicted number of Fuzzy Mamdani bookings of 1020 meters. Number of ordering raw materials CV. Pine Bag's Specialist in January the third week of 531 meters was greater than the predicted number of Fuzzy Mamdani method bookings of 438 meters. Number of ordering raw materials CV. Pine Bag's Specialist in January the fourth week of 1881 meters was greater than the predicted number of raw material orders for the Fuzzy Mamdani method by 1440 meters.

In February, the first week of ordering parachute fabric raw materials made by CV. The Pine Bag's Specialist is 621 meters smaller than the predicted number of raw materials ordered by the Fuzzy Mamdani method by 853 meters. Number of ordering raw materials CV. Pine Bag's Specialist in February the second week was 1476 meters smaller than the predicted number of Fuzzy Mamdani bookings of 1750 meters. Number of ordering raw materials CV. Pine Bag's Specialist in February the third week was 733.5 meters smaller than the predicted number of bookings for the Fuzzy Mamdani method by 1000 meters. Number of ordering raw materials CV. Pine Bag's Specialist in February the fourth week was 441 meters smaller than the predicted number of raw material orders for Fuzzy Mamdani method by 561 meters.

In March, the first week of ordering parachute fabric raw materials made by CV. The Pine Bag's Specialist of 2061 meters is greater than the predicted number of raw material orders for the Fuzzy Mamdani method by 1740 meters. Number of ordering raw materials CV. Pine Bag's Specialist in March the second week was 771 meters smaller than the predicted number of Fuzzy Mamdani bookings of 895 meters. Number of ordering raw materials CV. The Pine Bag's Specialist in March the third week was 306 meters smaller than the predicted number of Fuzzy Mamdani method reservations by 418 meters. Number of ordering raw materials CV. Pine Bag's Specialist in March the fourth week was 846 meters smaller than the predicted number of raw material orders for Fuzzy Mamdani method by 1030 meters.

### Results of Evaluation Amount of Ordering Parachute Fabric Raw Materials

The results of the evaluation of predictive data on the amount of ordering raw materials Fuzzy Mamdani Method with actual data ordering the number of raw materials for parachute fabric CV. Pine Bag's Specialist which is used to support raw material inventory control decisions in conditions of uncertain demand formed from January the first week of 2019 to March the fourth week of 2019 obtained an average absolute error (MAE) value of 193.8 meters, and the average percentage of absolute error (MAPE) of 22%. According to [5] MAPE is at a value of 20% -50% indicating the level of accuracy of the prediction of the amount of ordering raw materials for parachute fabric with Fuzzy Mamdani said to be reasonable and acceptable.

### CONCLUSION

From the results of data processing and discussion conducted, the following conclusions can be drawn:

1. Calculation results of raw material inventory control using the Fuzzy Mamdani method that is done manually, obtained prediction of the number of parachute fabric ordering materials in January the first week of 2019 with a large demand for parachute fabric raw material of 666 meters and 126 meters inventory produces predictions of the number of material orders parachute raw cloth for 879 meters.
2. The evaluation results between the prediction of the amount of ordering parachute fabric raw materials with Fuzzy Mamdani with the actual data ordering fabric raw materials CV. Pine Bag's Specialist from January the first week of 2019 until March 2019 is known to have an average absolute error (MAE) of 193.8 meters with an average percentage of absolute error (MAPE) of 22% so it is considered reasonable to make predictions parachute fabric raw material orders in conditions of uncertain demand in the CV. Pine Bag's Specialist.

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