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Analysis Of Multi Item Raw Material Inventory Supply Using The Economic Order Quantity Method

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ABSTRACT

Raw material inventory control has a positive impact to support the smooth production process in increasing company profits, one of which is the production of chicken feed at PT. Mabar Feed Indonesia. This study aims to determine the economic order quantity of multi-item chicken feed raw material inventory, and to compare the control of multi-item chicken feed raw material inventory used by companies with the control of multi item chicken feed inventory using the EOQ method. In this study to analyze the data first used the normality test data with the Lilliefors test where the data is normally distributed. The total cost of raw material inventory according to PT Mabar Feed Indonesia is Rp. 5.853.471.202,0 the cost is greater than the cost obtained by the EOQ method, which is Rp. 2.560.673.953,9 and savings can be made of Rp. 3.292.797.248,1 of the cost of raw material inventory according to PT. Mabar Feed Indonesia.

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1. INTRODUCTION

Inventory is goods or raw materials that are stored and used to meet future needs or current needs. Inventories can be in the form of raw materials, auxiliary materials, processed goods, and finished goods.

PT. Mabar Feed Indonesia is a company engaged in the animal feed industry, chicken, meat and laying. Other production produced by PT. Mabar Feed Indonesia in the form of shrimp and other animal feed. PT. Mabar Feed Indonesia produces two types of main chicken feed products namely concentrate feed and complete feed. Where these two types are grouped based on the types of broilers and laying eggs and the age of the chicken. The main raw materials used in this production process are corn, wheat seeds, Argentin soybean meal, round soybeans, corn gluten, USA soybean meal, palm oil cake, bran, rock flour, and meat flour. The company is located on Jl. Slaughterhouse No.44 Medan North Sumatra.

Companies must determine the optimal inventory policy due to problems of excess and lack of inventory. For total costs to be minimal, optimization in inventory is needed based on the determination of order size. This involves making decisions about how many orders must be ordered to meet demand and inventory needs so that no out of stock occurs. In determining the order frequency with a certain total, it will affect the order time as well as the amount of the order fee is influenced by the order frequency,

therefore it requires maximum consideration, while the amount of the storage cost is influenced by the inventory (Rosnani, 2007).

Excess and lack of inventory will result in company losses. So, it takes a method to optimize the inventory of materials or goods in the company. Then the method the writer must use in this study is the Economic Order Quantity (EOQ) method. EOQ is a mathematical method that functions as optimizing inventory costs.

2. RESEARCH METHODE

2.1 Inventory

Inventory is goods or materials that are stored and will be used to meet certain objectives, or inventories of materials or goods that are awaiting their use in an assembly system (Assauri, 2004).

2.2 Inventory Control

Inventory control aims to determine a policy in an order, when the material will be ordered and how much must be ordered economically so that demand can be fulfilled. (Rosnani, 2007).

2.3 Economic Order Quantity Method

The EOQ method is one of the oldest and simplest inventory control techniques. This method was first discovered by Ford W. Haris in 1915. This method aims to minimize the total cost of inventory as well as to produce economical inventory by carrying out cost efficiencies. Consists of two types of inventory costs that are calculated in using the Economic Order Quantity method, namely (Taylor, 2001):

a. Carrying Cost

Storage costs are costs incurred due to saving an item.

$$TH = \frac{Q}{2} \times H \tag{1}$$

Where:

TH = Total storage costs

Q = Optimal order quantity

H = Storage costs

b. Booking Fees

$$TS = \frac{D}{Q} \times S \tag{2}$$

Where:

D = Amount of inventory per year

S = Ordering fee

TS = Total cost of the orde

2.4 Total Inventory Costs

In calculating the total inventory costs, it aims to prove that with the optimal amount of raw material purchases, which is calculated by the EOQ method will achieve a minimum total inventory cost (Murdifin, 2012):

$$TIC = \frac{D}{Q} S + \frac{Q}{2} H \tag{3}$$

2.5 Calculating Optimal Inventory (Q

$$Q = \sqrt{\frac{2DS}{H}} \tag{4}$$

2.6 Safety stock

Safety stock is a stock in anticipation of material shortages and uncertainty of demand

$$SS = \sigma \times Z \tag{5}$$

Where:

Z = Safety factor used by the company

SS = Safety stock

σ = Standard deviation of needs

2.7 Lilliefors Normality Test

Lilliefors normality test functions to calculate whether the data generated are normally or not normally distributed so that it can be used in parametric statistics, so it can be assumed that the samples obtained can represent the population, then the results of the research conducted have been generalized to the population.

1. Value of Data $x_1, x_2, x_3, ..., x_n$ used as a standard number $z_1, z_2, z_3, ..., z_n$ by using the formula:

$$z_1 = \frac{x - \bar{x}}{s} \quad (6)$$

Where :

s = Standard deviation of the sample

$\bar{x}$ = Sample average

In calculating the average sample from observations using the following formula:

$$\bar{x} = \frac{\sum_{i=1}^{n} x_i}{n} \quad (7)$$

In calculating the standard deviation (s) of a sample it uses the formula:

$$s = \frac{\sqrt{\sum_{i=1}^{n} (x - \bar{x})^2}}{n-1} \quad (8)$$

2. Calculating opportunities $F(Z_i) = P(z \le z_i)$ by using a standard distribution list.
3. Calculate proportions $z_1, z_2, z_3, ..., z_n$ which is smaller than or equal to z_i If this proportion is stated by $S(z_i)$, then:

$$S(z_i) = \frac{banyaknya z_1, z_2, z_3, ..., z_n \le z_i}{n} \quad (9)$$

4. Calculate the difference between $F(z_i)$ with $S(z_i)$ namely:

$$\left|F(z_i) - S(z_i)\right| \quad (10)$$

5. Calculate the maximum price between $\left|F(z_i) - S(z_i)\right|$ namely:

$$L_{hitung} = \max\left\{\left|F(z_i) - S(z_i)\right|\right\} \quad (11)$$

6. Hypothesis testing:

Hypothesis:

H_1 :Samples come from populations not normally distributed

H_0 : Samples come from normally distributed populations

Decision making criteria are:

$$\text{If L} = \begin{cases} \le \text{L}_{\alpha(n)} : \text{then } H_0 : \text{received} \\ > L_{\alpha(n)} : \text{then } H_1 : \text{rejected} \end{cases}$$

Data Sources and Research Variables
In this study, using secondary data provided by PT. Mabar Feed Indonesia in 2018. The data used in this problem is the amount of raw material for chicken feed, the amount of raw material used for chicken feed, the cost for ordering chicken feed, and the cost for storing chicken feed raw material.

Research procedure
The stages or steps used in this study are:
1. Gather references
2. Retrieving data at PT. Mabar Feed Indonesia
3. Test the Normality of Data with the Normality Test of Lilliefors
4. Calculate the quantity of ordering multi-item raw materials for each order using the (EOQ) method.
5. Determine stock safety
6. Determine the total inventory cost of raw materials (Total Inventory Cost) using the EOQ method
7. Comparing the total cost of inventory of multi item feed ingredients for chicken poultry in the company with the total cost of inventory of multi item feed raw materials with EOQ.
8. Make conclusions and suggestions

3. RESULT AND ANALYSIS

3.1 Test Normality of Data With Lilliefors Test
Data on the use of raw materials for chicken feed at PT. Mabar Feed Indonesia is tested normally by using the Lilliefors Normality test. The results of testing the data with the Lilliefors normality test for corn raw materials are as follows:
Table 3.1 Normality Test Data on Corn Raw Material Usage in 2018

No	X_i	Z_i	$F(Z_i)$	$S(Z_i)$	$\lvert F(Z_i)-S(Z_i)\rvert$
1	6.406.410,6	0,90	0,8159	0,9167	0,1008
2	6.288.472,0	0,78	0,7823	0,6667	0,1156
3	6.392.734,5	0,88	0,8106	0,7500	0,0606
4	4.700.763,4	-0,89	0,1867	0,3333	0,1466
5	4.128.755,5	-1,50	0,0668	0,0833	0,0165
6	6.851.101,7	1,37	0,9147	1,0000	0,0853
7	4.835.793,9	-0,76	0,2177	0,4167	0,1990
8	6.391.440,0	0,89	0,8133	0,8333	0,0200
9	4.429.449,0	-1,19	0,1177	0,1667	0,0490
10	5.562.540,0	0,01	0,5040	0,5000	0,0040
11	5.982.298,0	0,45	0,6736	0,5833	0,0903
12	4.659.863,0	-0,94	0,1736	0,2500	0,0764

Source: Data Processing Results, 2019

From Table 3.1 it can be seen that:
$L_0 = Max\left|F(z_i) - S(z_i)\right| = 0{,}1990$

$L_0 = L_{\alpha(n)}$, obtained from the Lilliefors normality test table with a real level

$\alpha = 0{,}05$ and $n = 12$

$L_{\alpha(n)} = L_{(0{,}05)(12)} = 0{,}2420$

$L_{hitung} < L_{tabel}$, so H_0 accepted, from the Lilliefors normality test it can be concluded that data on the use of corn raw materials in 2018 come from normally distributed populations. Then, inventory control calculations can be done by the EOQ method.

And so on until the end of finding the results of Lilliefors normality test for raw materials of wheat seeds, Argentin soybean meal, bran, round soybeans, meat flour, stone flour, corn gluten, USA soybean meal, and palm oil cake.

EOQ calculation
Determine the economical ordering of corn supplies

$$Q = \sqrt{\frac{2DS}{H}}$$

$$Q = \sqrt{\frac{2(66.629.621,6)(17.982.322,00)}{420,00}}$$

$$= 2.388.619,157 \text{ Kg/ pesan}$$

With the required order frequency is

$$F = \frac{D}{Q}$$

$$= \frac{66.629.621,6}{2.388.619,157}$$

$$= 27,89461912 \text{ (28 kali/tahun)}$$

And so on until the end found EOQ raw materials for wheat seeds, Argentin soybean meal, bran, round soybeans, meat flour, stone flour, corn gluten, USA soybean meal, and palm oil cake.

Determination of Safety Stock
In determining the results of the safety stock, a standard deviation is needed σ from the use of all raw materials for the period 2018 as well as a safety factor Z calculations used by the company. PT. Mabar Feed expects a stock out around 15% then $z = 1.04$
Safety stock for corn raw materials

$$SS = \sigma \times Z$$

$$SS = 947.534,68 \times 1,04$$

$$= 985.436,07 \text{ Kg}$$

And so on until the end found the results of safety stock for raw materials of wheat seeds, Argentin soybean meal, bran, round soybeans, meat flour, stone flour, corn gluten, USA soybean meal, and palm oil cake.

Determination of Total Cost of Raw Material Inventory (TIC)
Calculation of the total cost of inventory of raw materials for chicken feed using the EOQ method
Total Inventory Cost (TIC) for corn raw material

$$TIC = \frac{D}{Q} \times S + \frac{Q}{2} \times H$$

$$= \frac{66.629.621,6}{2.388.619,157} \times 17.982.322,00 + \frac{2.388.619,157}{2} \times 420,00$$

$$= 501.610.023,00 + 501.610.023,00$$

$$= 1.003.220.046,00$$

Calculation of total inventory costs at PT. Mabar Feed Indonesia with the following formula:
Total Inventory Cost (TIC) for corn raw material

$$TIC_{per} = (\overline{D} \times H) + (n \times S)$$

$$TIC_{per} = (5.552.468,5 \times 420,00) + (12 \times 17.982.322,00)$$

$$= 2.332.036.756,00 + 215.787.864,00$$

$$= 2.547.824.620,0$$

And so on until the end of finding the results of TIC according to EOQ and the company for raw materials of wheat germ, Argentin soybean meal, bran, round soybeans, meat flour, stone flour, corn gluten, soybean meal USA, and palm oil cake.

Based on the above calculation, the results of economic order (EOQ), lots of safety stock, and the result of total raw material inventory costs can be seen in the following table:

Table 3.2 Economic Orders According to EOQ 2018

No	Bahan Baku	EOQ (Kg)	Frekuensi Pembelian	Total Biaya Persediaan (Rp)	*Safety Stock* (Kg)
1	Jagung	2.388.619,16	28	1.003.220.046,0	985.436,07
2	Biji Gandum	354.381,07	11	124.033.375,6	128.022,95
3	BKK Argentin	1.181.327,10	18	295.331.774,0	370.843,99
4	Dedak Katul	475.534,82	28	309.097.632,1	163.357,61
5	KK Bulat	373.921,68	19	188.830.446,8	169.442,19
6	Tp. Daging	315.414,26	26	205.019.269,6	69.500,99
7	Tp. Batu	214.907,46	31	202.013.008,2	56.520,09
8	Corn Gluten	360.326,98	12	54.049.047,3	53.162,08
9	BKK USA	2.595.336,16	6	90.836.765,7	638.797,51
10	BK Sawit	183.838,73	11	88.242.588,6	59.921,5

The comparison of calculations made by PT. Mabar Feed Indonesia with calculations using the Economic Order Quantity method which can be seen in the following table:

Table 3.3 Comparison of Raw Material Cost of PT. Mabar Feed Indonesia with the 2018 EOQ Method

No	Bahan Baku	TIC Perusahaan	TIC Metode EOQ
1	Jagung	2.547.824.620,0	1.003.220.046,0
2	Biji Gandum	181.954.021,8	124.033.375,6
3	BKK Argentin	542.378.819,8	295.331.774,0
4	Dedak Katul	777.202.581,7	309.097.632,1
5	KK Bulat	359.010.519,1	188.830.446,8
6	Tp. Daging	495.507.569,0	205.019.269,6
7	Tp. Batu	564.818.042,0	202.013.008,2
8	Corn Gluten	80.359.185,0	54.049.047,3
9	BKK USA	174.621.583,8	90.836.765,7
10	BK Sawit	129.894.260,0	88.242.588,6
	Total	5.853.471.202,0	2.560.673.953,9

Based on the results of the calculation of EOQ table 3.3, the results obtained from the total total inventory costs are smaller than the results of the total cost of supplies that have been incurred by the company. The total cost of raw material inventory according to PT. Mabar Feed Indonesia amounted to Rp. 5.853.471.202,0 whereas according to EOQ is Rp. 2.560.673.953,9 and savings can be made 56,3% yes it is Rp. 3.292.797.248,1 of the cost of raw material inventory according to PT. Mabar Feed Indonesia.

4. CONCLUSIOON

Based on the results of data processing supplies of chicken feed raw materials at PT. Mabar Feed Indonesia using the EOQ method the following conclusions can be obtained:

From the results of the calculation, the control of chicken feed raw material inventory is based on the EOQ method with an economical order, namely corn 2,388,619.16 kg at a frequency of 28 orders per year, for wheat seeds 354,433.17 kg at a frequency of 11 times an order per year, Argentin soybean meal 1,186,968.97 kg at a frequency of 18 orders per year, Katak 475,534 , 82 kg at a frequency of 28 orders per year, round soybeans 373,921.68 kg at a frequency of 19 orders per year, meat flour 315,414.26 kg at a frequency of 26 orders per year, stone flour 214,907.46 kg at a frequency of 31 times orders per year, corn gluten 360,326.98 kg at a frequency of 12 times an order per year, USA soybean meal 2,595,336.16 kg at a frequency of 6 orders per year, palm oil cake 183,838.73 kg at a frequency of 11 times an order per year .

By using the EOQ method a very significant difference in inventory costs is obtained. The company can save costs for raw materials for chicken feed in 2018 amounting to Rp. 3,292,797,248,1.

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