



Determination of the Inventory of Cassava Raw Materials UD Rezeky Baru Medan Based on the Economic Order Quantity (EOQ) Method

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Abstract. The need for an inventory control system basically arises because of problems faced by the company in the form of excess or shortage of company inventory. The EOQ (Economic Order Quantity) method is one of the inventory control methods used to determine the number of economic orders, namely the number of orders that meet the minimum total inventory cost. The purpose of this study was to determine the optimal amount of cassava raw material inventory at UD Rezeky Baru with the EOQ method and the comparison of the total cost of raw material inventory between costs according to the company and costs according to the EOQ method. Based on the results of calculations using the EOQ method, the optimal number of orders for cassava raw materials in 2019 is 18.722,62 kg. The total cost of raw material inventory using the EOQ method is Rp. 1.497.809,00, while according to the company, it is Rp. 9.467.640,00. The company can save on inventory costs by Rp. 7.969.830,00.

Keyword: EOQ (Economic Order Quantity) Method

Abstrak. Kebutuhan akan sistem pengendalian persediaan, pada dasarnya muncul karena adanya masalah yang dihadapi perusahaan berupa kelebihan atau kekurangan persediaan perusahaan. Metode EOQ (Economic Order Quantity) adalah salah satu metode pengendalian persediaan yang digunakan untuk menentukan jumlah pesanan ekonomis, yaitu jumlah pesanan yang memenuhi total biaya persediaan minimal. Tujuan dari penelitian ini adalah untuk menentukan jumlah persediaan bahan baku singkong yang optimal pada UD Rezeky Baru dengan metode EOQ dan perbandingan biaya total persediaan bahan baku antara biaya menurut perusahaan dan biaya menurut metode EOQ. Berdasarkan hasil perhitungan menggunakan metode EOQ diperoleh jumlah pemesanan bahan baku singkong yang optimal pada tahun 2019 adalah 18.722,62 kg. Biaya total persediaan bahan baku menggunakan metode EOQ sebesar Rp1.497.809,00 sedangkan menurut perusahaan yaitu

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sebesar Rp9.467.640,00. Perusahaan dapat menghemat biaya persediaan sebesar Rp7.969.830,00..

Kata Kunci: *Metode EOQ (Economic Order Quantity)*

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1. Introduction

Forecasting Inventories are defined as goods stored for use or sale in future periods [1]. In order to avoid shortages of raw materials and inventories as needed, how to anticipate them, the company needs a method of inventory control. Inventory control is an effort made by the company in providing the goods needed for the production process to be fulfilled optimally so that the production process runs smoothly and reduces the risk that will occur [2].

UD Rezeky Baru is one of the trading businesses in the city of Medan which is engaged in industry that uses cassava as a raw material in the manufacture of cassava chips. Inventory control of cassava raw materials carried out by this company is still not optimal, where there are still shortages and excess supplies of raw materials.

To anticipate the obstacles that occur, the Economic Order Quantity (EOQ) method can be used. Researchers raised the EOQ method because this method is more popular and is more often applied in various companies [3]. In addition, this method can answer questions about conditions that often occur in the company, namely determining the amount of inventory that is in accordance with the company's needs so that it can avoid losses that occur in the company due to the lack of precise inventory control applied [4].

2. Related Work

2.1 Definition of Inventory

Inventories are materials, parts provided, and materials in process contained in the company for the production process, as well as finished goods or products that are provided to meet demands from consumers or customers at any time [5].

2.1.1 Inventory Function

The main function of inventory is as a buffer, liaison between the production and distribution processes to obtain efficiency [6].

2.1.2 Inventory Types

To accommodate the existing inventory, companies must maintain 4 types of inventory, namely [7].

1. Raw material inventory
2. Inventory of semi-finished materials

3. MRO (*Maintenance Repair Operating*)
4. Finished goods inventory

2.1.3 Inventory Cost

A variety of costs need to be taken into account when evaluating inventory issues. The cost of the inventory is based on the relevant economic parameters with the following types of costs [8]:

1. Purchase Cost
2. Order Cost/Setup Cost
3. Carrying Cost/Holding Cost
4. Stockout Cost

2.1.4 Inventory Control Purpose

The purpose of detailed inventory control can be stated as an effort to [9]:

1. Take care not to let the company run out of inventory so that it can result in the cessation of production activities.
2. Ensure that the formation of inventory by the company is not too large or excessive.
3. Keeping purchases on a small scale can be avoided as this will result in too large an order cost.

EOQ calculation can be calculated by the formula:

$$Q^* = \sqrt{\frac{2DS}{H}} \quad (1)$$

Information:

D = The number of requests in a certain period

H = Storage fee per order

S = Ordering fee per order

Q^* = Economic quantity of goods per order (EOQ) (Kg)

In addition to the EOQ formula, there are several formulas to support the calculation of inventory costs, including:

1. Available average \pm average inventory = $\frac{Q^*}{2}$
2. Estimated number of orders = $\frac{D}{Q^*}$
3. Annual booking fee = $\frac{D}{Q^*} \cdot S$
4. Annual storage fee = $\frac{Q^*}{2} \cdot H$
5. Purchase Cost = Price per unit x D
6. Total Inventory Cost = Purchase cost + Annual ordering cost + annual holding cost

3. Methodology

3.1. Data source

The data used in this study are primary data and secondary data. The data obtained in the form of cassava demand data and data on cassava operational costs in January 2019 to December 2019 at UD Rezeky Baru Medan which is located at Jl. Eastern Student Gg. Coconut No. 19, Medan, North Sumatra.

3.2. Research Stages

The stages in conducting this research are:

1. Preliminary Study, at this stage what is done is to observe and research the location of a place that has the potential as a place of research.
2. Literature study, this stage is done by looking for information related to research so that it can be used as a supporter in carrying out research.
3. Problem Formulation, after carrying out the second stage, the next step is to determine the formulation of the problem, so that this research can run according to the solution to be achieved.
4. Determination of Research Objectives, based on the formulation of the problem that has been determined, the next step is to determine solutions to overcome these problems.
5. Data collection, this research uses data collection methods: online interviews, documentation, and literature study
6. Data Processing Method
Based on the data that has been obtained, then data processing is carried out.

4. Result and Discussion

4.1 Amount of Cassava Raw Material Demand Data

Table 1. Total Demand for Cassava Raw Materials in 2019

No.	Month	Demand(Kg)
1	January	97.198
2	February	96.560
3	March	93.459
4	April	101.832
5	May	109.240
6	June	118.776
7	July	91.028
8	August	125.811
9	September	159.198
10	October	118.776
11	November	131.070
12	December	159.198
	Amount	1.402.146
	Average	116.845,5

Source: UD Rezeky Baru Medan

4.2 Cost of Ordering Cassava Raw Materials

Table 2. Cost of Ordering Cassava Raw Materials in 2019

Fee Type	Cost (Rp) / order
Administration and general fee	10.000
Amount	10.000

Source: UD Rezeky Baru Medan

4.3 Cassava Raw Material Storage Cost

Table 3. Cassava Raw Material Storage Costs in 2019

Storage Cost Percentage (%)	Raw material prices per kg (Rp)	Storage Fee per kg (Rp)
5	1.600	80

Source: UD Rezeky Baru Medan

Total inventory cost at UD Rezeky Baru in 2019 is 9.467.640.

4.4 Testing the Normality of the Data with the Lilliefors Test

a. Average demand for cassava raw materials:

$$\bar{x} = 116.845,5$$

b. Standard deviation of demand for cassava raw materials:

$$s = 23.687,14$$

Table 4. Deviation of Raw Material Demand

No.	x	\bar{x}	$(x - \bar{x})$	$(x - \bar{x})^2$
1	97.198	116.845,5	-19.647,5	-386.024.256,25
2	96.560	116.845,5	-20.285,5	-411.501.510,25
3	93.459	116.845,5	-23.386,5	-546.928.382,25
4	101.832	116.845,5	-15.013,5	-225.405.182,25
5	109.240	116.845,5	- 7.605,5	-57.843.630,25
6	118.776	116.845,5	1.930,5	3.726.830,25
7	91.028	116.845,5	-25.817,5	-666.543.306,25
8	125.811	116.845,5	8.965,5	80.380.190,25
9	159.198	116.845,5	42.352,5	1.793.734.256,25
10	118.776	116.845,5	1.930,5	3.726.830,25
11	131.070	116.845,5	14.224,5	202.336.400,25
12	159.198	116.845,5	42.352,5	1.793.734.256,25
Amount	1.402.146			6.171.885.031

Table 5. Lilliefors Normality Test for Cassava Raw Material Demand Data in 2019

No.	x_i	z_i	$F(Z_i)$	$S(Z_i)$	$ F(Z_i) - S(Z_i) $
1	97.198	-0,83	0,2033	0,3333	-0,1300
2	96.560	-0,86	0,1949	0,0833	0,1116
3	93.459	0,99	0,1611	0,2500	-0,0889
4	101.832	-0,63	0,2643	0,4166	-0,1523
5	109.240	-0,32	0,3745	0,5000	-0,1255

6	118.776	0,08	0,5319	0,6666	-0,1347
7	91.028	-1,09	0,1379	0,1666	-0,0287
8	125.811	0,38	0,6480	0,5833	0,0647
9	159.198	1,79	0,9633	1	-0,0367
10	118.776	0,08	0,5319	0,6666	-0,1347
11	131.070	0,60	0,7257	0,8333	-0,1076
12	159.198	1,79	0,9633	1	-0,0367

From Table 5 it can be seen that:

$$L_{count} = \text{Max } |F(Z_i) - S(Z_i)| = 0,1523.$$

$L_{table} = L_{\alpha}(n)$, obtained from the Lilliefors Normality Test table with a significant level of $\alpha = 0,05$ and $n = 12$, score $L_{\alpha}(n) = L_{(0,05)(12)} = 0,242$

Obtained $L_{count} < L_{table}$, so H_0 is accepted. From the Lilliefors Normality Test, it can be concluded that the data on the demand for cassava raw materials at UD Rezeky Baru Medan in the January-December 2019 period followed a normal distribution. Thus, the calculation with inventory control can be done using the Economic Order Quantity method.

4.5 Calculating Standard Error (SE)

The standard deviation value of the demand for cassava raw materials is 23.687,14, so that by using the standard error formula (SE), it is obtained: 6.837,88.

4.6 Determination of Economic Orders with the Economic Order Quantity (EOQ) Method

Obtained the result of the formula $Q^* = 18.722,62$ kg. so that the reorder cycle of cassava raw materials using the Economic Order Quantity method in 1 year is:

$$F = \frac{D}{Q^*} = \frac{1.402.146}{18.722,62} = 74.890 \approx 75 \text{ times/year}$$

4.7 Determination of the Amount of Safety Stock

The company expects a stockout of only 5% and when viewed from the normal distribution table, the value obtained if the expected error is only 5%, the safety factor (Z) value used is 1.65.

Then the result is obtained: = 39.083,78 kg.

4.8 Determination of Reorder Point (Reorder Point)

The data obtained from the company shows that the lead time data is $\frac{1}{2}$ hari, so $L = \frac{0,5}{365}$. Then the result is obtained: $ROP = 1.920,75$ Kg.

4.9 Determination of Total Inventory Cost (Total Inventory Cost)

Based on the Economic Order Quantity method, the total cost of cassava raw material inventory is UD Rezeky Baru Medan sustenance is Rp. 1.497.809,00.

Table 6. Calculation of Cassava Raw Material Costs by Economic Order Quantity (EOQ) Method in 2019

EOQ	Order Fee (Rp)	Saving Fee (Rp)	Total Order Cost (Rp)	Total Storage Cost (Rp)	Total Inventory Cost (Rp)
Q^*	S	H	$\frac{D}{Q} S$	$\frac{Q}{2} H$	$\frac{D}{Q} S + \frac{Q}{2} H$
18.722,62	10.000	80	748.904,8	748.904,8	1.497.809

The comparison of the Total Inventory Cost (TIC) of inventories by company with the Total Inventory Cost (TIC) based on the Economic Order Quantity (EOQ) method can be seen in the following table:

Table 7. Comparison of the Company's Cassava Raw Material Costs with the Economic Order Quantity (EOQ) Method in 2019

TIC Company (Rp)	TIC EOQ (Rp)	Difference (Rp)
9.467.640	1.497.809	7.969.830

There is a significant difference in total inventory costs between TIC Company with TIC_{EOQ} is the difference Rp7.969.830,00. The reason can be seen from the comparison of the two formulas. In the Economic Order Quantity formula, the optimal number of orders (EOQ) in one order can be calculated first so that the number of orders frequency in one year or period can be calculated.

5. Conclusions

Based on the data analysis and discussion that has been carried out, the conclusions that can be drawn in this study are as follows: Based on the Lilliefors Normality Test, it is known that the demand data for cassava raw materials in 2019 is normally distributed. The number of orders for economical cassava raw materials is 18.722,62 kg with a frequency of ordering 75 times a year. Total safety stock is 39.083,78 kg. The reorder point for cassava is carried out when the inventory level of cassava raw materials in the warehouse reaches 1.920,75 kg. The total cost of cassava raw material inventory issued by the company in 2019 was Rp9.467.640,00 while based on the Economic Order Quantity (EOQ) method the costs incurred were Rp1.497.809,00 so there was a difference in costs of Rp7.969.830,00 from the cost raw material inventory by company.

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