

ANALYSIS OF INVENTORY CONTROL OF RAW MATERIALS FOR BREAD AT LIE MARIANA BAKERY EAST JAKARTA

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ABSTRACT

This study aims to find out how to calculate raw material inventories conventionally and the EOQ (*Economic Order Quantity*) method and find out the comparison of raw material inventory efficiency between company (conventional) calculations and EOQ methods.

This research uses a descriptive quantitative research approach, which is calculated using the *Quantitative Method* (QM) V4 software. The population of this research is the raw material inventory data which is wheat flour and granulated sugar owned by Lie Mariana Bakery from January 2018 to December 2018. The data collection technique uses field research to obtain raw material inventory data.

The results of the study prove that the calculation of raw material inventory using the conventional method is greater than the calculation using the EOQ method. (2) calculations using the EOQ method are more efficient than using conventional methods.

Keywords : Economic Order Quantity, Raw Material Inventory, and Quantitative Method.

1. INTRODUCTION

Background

Every company has a goal to obtain optimal profit profits. Optimal profit gains can be obtained if the company is able to run company management well. Good management has a very important function in making decisions and as a control in the company's activities to run effectively. To achieve a goal, every company is influenced by several factors. One of the factors that influence the achievement of objectives is the smooth production process of a company.

Proper inventory control can meet customer needs while minimizing inventory costs. The purpose of controlling raw material inventory is to reduce operational costs to a

minimum so that the company's performance and profits are more optimal. Operational costs referred to in this case are inventory costs consisting of ordering costs and storage costs. To carry out reliable and trustworthy inventory control, various factors related to inventory must be considered. Determination and classification of costs associated with inventory need to get special attention in making the right decision.

Lie Mariana Bakery is a company engaged in making bread, this company is located on Jl, Kp. Kapitan Klender, Duren Sawit Subdistrict, City of East Jakarta, DKI Jakarta. The main raw materials used in the bread production process are wheat flour and granulated sugar and other supporting materials. In its activities the company carries out the production process based on market demand and based on order requests. The company makes orders based on the actual conditions of raw material inventory in the warehouse and the existence of product orders from consumers, so that unscheduled raw material orders often occur and results in the accumulation of raw materials in the warehouse which increases storage costs. From the available data, the company needs raw materials of 44,725 kg of wheat flour and 20,450 kg of sugar in one year, the company needs an average of 3,727 kg and 1,705 kg in one month. With a lead time of 2 days to overcome the threat of delays in raw materials, safety stock obtained in wheat flour is 196 kg and in sugar sugar is 90 kg, this figure is obtained from the highest usage in one year minus the average usage per month multiplied by a lead time of 2 days . From conventional calculation data, the company experiences excess inventory of raw materials for flour and granulated sugar.

The following is a data inventory of raw materials of wheat flour and granulated sugar that can be conventionally calculated can be seen in table 1.

Table 1. Supplies of Wheat Flour and Granulated Sugar 2018

Month	Wheat Flour (kg)	Granulated Sugar (kg)
January	1425	700
February	1500	725
March	1450	800
April	1425	750
May	1475	875
June	1500	900
July	1550	925
August	1525	975
September	1575	1025
Oktober	1525	1050
November	1500	1050
Desember	1550	1075
Total	18000	10850

Source: Data processed (2018)

The data in the field shows that there is an excess of raw material inventory in companies that implement conventional policies. This conventional method does not produce efficient calculations in managing the company's raw material inventory. This is because companies have not implemented the Economic Order Quantity (EOQ) method.

Based on this background researchers are interested in examining the Economic Order Quantity (EOQ) Method for Controlling Raw Materials. This study uses the research object Lie Mariana Bakery.

Formulation of the problem

1. How to control the inventory of raw materials at Lie Mariana Bakery?
2. How is the calculation of raw material inventory control using the EOQ (Economic Order Quantity) method?
3. Is the calculation of raw material inventory control used by the company more efficient than using the EOQ method?

Literature review

Operation Management

Heizer and Render (2017: 03), Operations management is the activity of creating goods or services through changing inputs into outputs. Meanwhile, according to Stevenson and Chuong (2014: 14) argues that operations management is the management responsible for producing goods or services.

Stock

Heizer and Render (2017: 553), inventory is one of the most expensive assets of many companies, reflecting as much as 50% of the total invested capital. necessary in accordance with the amount and time needed at the lowest possible cost.

Inventory Function

1. To provide a choice of goods in order to meet the anticipated consumer demand and separate the company from fluctuations in demand.
2. To separate several stages from the production process. If a company's inventory fluctuates, additional inventory may be needed in order to separate the production process from the supplier.
3. Take advantage of placing an order with a quantity discount system, because by making purchases in large quantities can reduce shipping costs.
4. Protect companies against inflation and rising prices.

Economic Order Quantity (EOQ)

The optimal number of orders or purchases for one message can be calculated using the Economic Order Quantity (EOQ) method. The Economic Order Quantity (EOQ) method according to Heizer and Render (2017: 563) can be calculated using the following formula:

$$\text{Economic Order Quantity (EOQ)} = \sqrt{\frac{2 \times D \times S}{H}}$$

Information :

EOQ = Economical Order Quantity

S = Order Fee (Rp / Order)

D = Need for Goods (Unit / Year)

H = Storage Fee (Rp / Unit / Year)

Reorder Points

According to Heizer & Render (2017: 567), Reorder Point (Reorder Point) is the level of inventory where when the inventory has reached the level of reorder. Reorder points are used to determine when the company resumes. If there is an error in ordering goods, it will result in stockpiling and inventory depletion. The formula for ROP is stated as follows:

$$\text{Reorder Point (ROP)} = d \times L + ss$$

Information:

d = Average needs / requests per day

L = Waiting Time (days)

ss = Safety Stock

Total Inventory Cost (Total Inventory Cost)

Calculation of total inventory cost (total inventory cost) is used to prove that with the optimal number of raw material purchases, which is calculated using the EOQ method a minimum total raw material inventory cost will be achieved.

The formula for calculating Total Inventory Cost (TIC) according to Heizer and Render (2017: 572), namely:

$$\text{Total Inventory Cost (TIC)} = \sqrt{2 \times D \times S \times H}$$

Information:

TIC = Total Inventory Cost

S = Order Fee (Rp / order)

D = Demand / demand for goods (Unit / year)

H = Storage Fee (Rp / Unit / year)

2. RESEARCH METHOD

Types of research

This type of research used in this study is quantitative. Where the quantitative method is an analysis of calculations of numbers to draw conclusions. In this study the analysis

technique used is the EOQ model. In this analysis will be compared between calculations with the enterprise method with the economic order quantity method (Economic Order Quantity) in minimizing the cost of inventory of bread raw materials.

Place and time of research

The place of this research was conducted at Lie Mariana Bakery. The time to collect data is November 2019.

Data collection technique

To obtain data related to the problem to be investigated, the need for data sources that will provide information with field research and library studies.

1. Field Research

To obtain primary data, a survey was conducted directly to the production site at Lie Mariana Bakery. The purpose of this field research is to obtain accurate data. The data obtained by means of research include:

a. Observation

According to Sugiyono (2016: 145) observation is a more specific data collection technique, observation is done by conducting observation directly at the research location. To obtain original data related to inventory control problems in the company.

b. Interview

According to Sugiyono (2016: 137) interview is a data collection technique, if the researcher or data collector already knows with certainty about what information will be obtained. Therefore, in conducting interviews, data collectors have prepared research instruments in the form of written questions, interviews submitted to parties related to the procurement of goods and company employees who are looking for data about inventory problems faced by the company and with the topics studied so that it is expected to obtain data clearer.

2. Library Research

This technique is used to obtain data in the form of secondary data relating to the research being carried out, secondary data collection techniques through literature study in the form of gathering information consisting of:

1. Company data

- a. Company history and profile
- b. Organizational structure of the company
- c. Raw material requirements
- d. Raw material costs

2. Literature books

3. Internet

- a. Previous research

b. Journals

3. RESEARCH RESULTS

The Need for Wheat Flour Raw Materials

The need for wheat flour is the highest cost and more quantity compared to other raw materials. This is because wheat flour is the main raw material in making bread. The following is a list of purchases for Lie Mariana Bakery wheat flour in 2018.

Table 2. List of Wheat Flour Purchases 2018

No.	Month	Purchase Amount (Kg)	Unit Price (Kg)	Purchase Price
1	January	3.750	Rp. 8.500	Rp. 31.875.000
2	Februayi	3.775	Rp. 8.500	Rp. 32.087.500
3	March	3.700	Rp. 8.500	Rp. 31.450.000
4	April	3.700	Rp. 8.500	Rp. 31.450.000
5	May	3.750	Rp. 8.500	Rp. 31.875.000
6	June	3.800	Rp. 8.500	Rp. 32.300.000
7	July	3.750	Rp. 8.500	Rp. 31.875.000
8	August	3.800	Rp. 8.500	Rp. 32.300.000
9	September	3.775	Rp. 8.500	Rp. 32.087.500
10	Oktober	3.750	Rp. 8.500	Rp. 31.875.000
11	November	3.675	Rp. 8.500	Rp. 31.237.500
12	Desember	3.750	Rp. 8.500	Rp. 31.875.000
Total		44.975	Rp. 102.000	Rp. 382.287.500
Average		3.748		

Source: Data processed (2018)

Based on table 2, it can be seen the number of purchases of wheat flour in June and August is the highest purchase, which is 3,800 kg. That is due to the high level of demand for ordering bread so that the amount of production increases and purchases of raw materials will increase.

The Need for Raw Sugar Materials

Sugar raw material needs are raw materials needed by the company after the raw material for flour in the process of making bread. The following is a list of purchases of sugar raw materials in 2018.

Table 3. Purchase List of Granulated Sugar 2018

	Purchase		
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No	Month	Amount (Kg)	Unit Price (Kg)	Purchase Price
1	January	1.800	Rp.11.900	Rp. 21.420.000
2	February	1.750	Rp.11.900	Rp. 20.825.000
3	March	1.750	Rp.11.900	Rp. 20.825.000
4	April	1.700	Rp.11.900	Rp. 20.230.000
5	May	1.800	Rp.11.900	Rp. 21.420.000
6	June	1.700	Rp.11.900	Rp. 20.230.000
7	July	1.750	Rp.11.900	Rp. 20.825.000
8	August	1.750	Rp.11.900	Rp. 20.825.000
9	September	1.850	Rp.11.900	Rp. 22.015.000
10	Oktober	1.750	Rp.11.900	Rp. 20.825.000
11	November	1.700	Rp.11.900	Rp. 20.230.000
12	Desember	1.800	Rp.11.900	Rp. 21.420.000
Total		21.100	Rp.142.800	Rp. 251.090.000
Average		1.758		

Source: Data processed (2018)

Based on table 3, total purchases of raw sugar is 21,100 kg. The highest purchase was in September of 1,850 kg. So with the sale of bread is high enough to be a guideline for the company in the coming period can prepare the purchase and use of raw materials to be more optimal to avoid losses to the company.

Raw Material Inventory Costs

1. Booking Fees

Ordering costs are the preparation costs for the ordering process for the procurement of raw materials to suppliers. The cost of placing the order until the availability of the ordered raw materials are in the warehouse. The fee for Lie Mariana Bakery in 2018 is Rp. 25,000 for flour raw material and Rp. 20,000 for sugar raw material.

Table 4. List of Ordering Costs for Mariana Mariana Lie Raw Materials

No.	Cost Types	Raw Material	
		Wheat Flour	Granulated Sugar
1	Shipping	Rp. 240.000	Rp. 180.000
2	Telefon	Rp. 60.000	Rp. 60.000
Total		Rp. 300.000	Rp. 240.000
Booking Fees		Rp. 25.000	Rp. 20.000

Source: Data processed (2018)

2. Storage Costs

Table 5. List of Storage Costs

No	Information	%Save Costs	Price (Rp)	Storage Costs
1	Wheat Flour	5%	Rp. 8.500	425
2	Granulated Sugar	5%	Rp. 11.900	595

Source: Data processed (2018)

It is known from the table above that the specified storage costs must be incurred by the company in storing raw materials, storage costs of flour raw materials by 5% and sugar 5% of the price of raw materials. The price of raw materials of flour is Rp. 8,500 / kg, while the price of sugar for raw materials is Rp. 11,900 / kg.

Economic Order Quantity (EOQ) Method

The Economic Order Quantity inventory model is used to calculate the optimal order quantity of raw materials (Q*). Based on calculations using the EOQ method, a total economic cost for raw materials will be obtained. Following are the results of calculations using the POM QM application.

Parameter	Value	Parameter	Value
Demand rate(D)	44725	Optimal order quantity (Q*)	2293.85
Setup/Ordering cost(S)	25000	Maximum Inventory Level (Imax)	2293.85
Holding cost(H)	425	Average inventory	1146.93
Unit cost	8500	Orders per period(year)	19.5
Days per year (D/d)	260	Annual Setup cost	487443.9
Daily demand rate	172.02	Annual Holding cost	487443.9
Lead time (in days)	2	Annual Holding (safety stock)	83300
Safety stock	196	Unit costs (PD)	380162500
		Total Cost	381220700
		Reorder point	540.04 units

Figure 1. Economic Order Quantity (EOQ) Wheat Flour

Source: Data processed (2018)

Figure 1. Shows the optimal order of flour orders of 2,293.85 kg, the maximum inventory level of 2,293.85 kg, the average inventory of 1,146.93 kg, orders per period (Year) of 19.5 times. An annual booking fee of Rp. 487,443.9, annual storage fee of Rp. 487,443.9. For a unit cost of Rp. 380,162,500, the total cost of Rp. 381,220,700 and reorder points of Rp. 540.04 Kg.

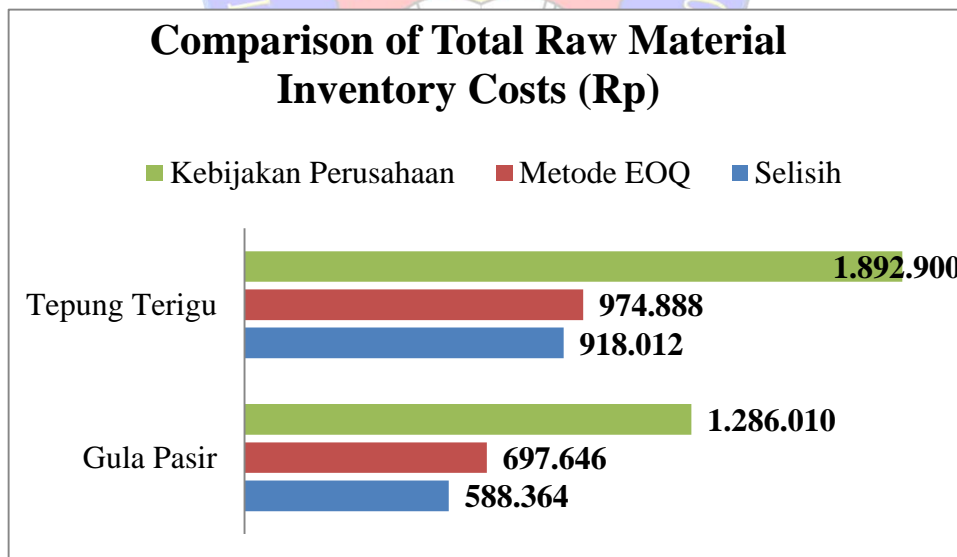
Inventory Results				
Parameter	Value		Parameter	Value
Demand rate(D)	20450		Optimal order quantity (Q*)	1172.51
Setup/Ordering cost(S)	20000		Maximum Inventory Level (Imax)	1172.51
Holding cost(H)	595		Average inventory	586.26
Unit cost	11900		Orders per period(year)	17.44
Days per year (D/d)	260		Annual Setup cost	348823
Daily demand rate	78.65		Annual Holding cost	348823.0
Lead time (in days)	2		Annual Holding (safety stock)	53550
Safety stock	90		Unit costs (PD)	243355000
			Total Cost	244106200
			Reorder point	247.31 units

Figure 2. Economic Order Quantity (EOQ) Granulated Sugar

Source: Data processed (2018)

Figure 2. shows the optimal order quantity of Sugar Palm at 1,172.51 kg, the maximum inventory level of 1,172.51 kg, the average inventory of 586.26 kg, orders per period (Year) of 17.44 times. An annual booking fee of Rp. 348,823, annual storage fee of Rp. 348,823. For a unit cost of Rp. 243,355,000, the total cost of Rp. 244,106,200 and the reorder point is Rp. 247.31 kg.

Figure 3. Comparison of Total Raw Material Inventory Costs



Source: Data processed (2018)

From the picture above, it is known that there is a difference between calculations based on company policy and the Economic Order Quantity method. Difference in total cost of wheat flour Rp. 918,012 and Rp. 588,364 for the difference in the total cost of inventory on sugar.

The difference in total costs shows the inventory costs of each raw material is not optimal. Companies need a control system to minimize the supply of raw materials to run optimally.

4. CLOSING

Conclusion

Based on the analysis and the results of the calculation of total inventory costs in the previous chapter conducted by comparing the calculation of the company policy with the Economic Order Quantity (EOQ) on Lie Mariana Bakery, it can be concluded that the stock of raw materials for flour and sugar that the company did was not optimal and has not shown a minimum inventory cost, with another meaning that the cost of inventory incurred by the company is still greater than using the Economic Order Quantity (EOQ) method. Where the total inventory costs incurred Lie Mariana Bakery for raw materials of Wheat Flour using company policy is Rp. 1,892,900 and the raw material of Granulated Sugar is Rp. 1,286,010 with a frequency of ordering 12 times or once a month. By using the Economic Order Quantity (EOQ) method, the total inventory cost incurred by Lie Mariana Bakery for flour as raw material is Rp. 974,888 with a smaller frequency of 8 times a year and raw materials of granulated sugar of Rp. 697,646 with a frequency of 5 times a year so as to reduce booking fees by 48.50% or Rp. 918,012 for flour and 45.75% raw materials or Rp. 588,364.

Suggestion

1. For Lie Mariana Bakery company management in implementing raw material control, it is better to use the Economic Order Quantity (EOQ) method. With EOQ calculations the company can optimize inventory and can streamline inventory costs.
2. For further research on similar themes, you should use other methods in researching the calculation of controlling raw materials that might produce more efficient results.

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