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THE CONTROL OF RAW MATERIAL SUPPLY WITH THE METHOD OF ECONOMIC ORDER QUANTITY ON HERBAL FOOD AND BEVERAGES

Oleh : Hendrawati (Azzahra University)

Abstract

The purpose of this research is to know the quantity of economic purchasing, safety inventory, reorder point, maximum inventory, and total inventory cost. Inventory has a great effect on the cost aspects of a company. If a company has too much inventory, it will be very detrimental because the company requires huge investment costs to keep this inventory, but, the lack of inventory also will have an impact on the production process, so, it can be detrimental to the company. The focus of this research is only in an analysis of raw material inventory control which use EOQ (Economic Order Quantity). The sampling technique in this research is purposive sampling. According to Notoatmodjo (2010), purposive sampling is a sampling based on a particular consideration such as the characteristics of the population or characteristics that have been known previously. This study uses Economic Order Quantity (EOQ) to determine the optimal amount of inventory. With this method, the company can know how many orders which are fixed and when to reorder inventory; beside that, the company know the maximum inventory. This study uses data of Wenny's honey inventories of raw materials in 2014. Based on the calculation of the total cost of inventory before EOQ and the results of inventory planning with EOQ method which uses the application method of EOQ, the amount of inventory, the total cost, and the production process can be optimized.

Keywords: *Economic Order Quantity*

1. INTRODUCTION

The current economy has grown rapidly along with the rapid development of Science and Technology (IPTEK) which is increasingly sophisticated so that competition among companies becomes increasingly tight. With the increasingly tight competition, every company needs to establish the control of raw material inventory properly so that the company can run its operational activities to achieve the desired goals. With the raw material inventory policy applied in the company, the cost of inventory is expected to be minimized. The analysis of "Economic Order Quantity (EOQ)" can be used to minimize the cost of the inventory (Pamungkas, 2011).

According to Heizer and Render (2011), Economic Order Quantity (EOQ) is one of the oldest and widely recognized inventory

control techniques. This inventory control method answers 2 (two) important questions, namely when to order and how much to order (Oki, Manado, Management, Economy, & Ratulangi, 2016).

The Economic Order Quantity (EOQ) method seeks to achieve the lowest possible inventory level, lower cost, and better quality. Planning method Economic Order Quantity (EOQ) in a company will be able to minimize the occurrence of out of stock so that the production process within the company is not disrupted and able to save inventory costs due to the efficiency of raw material inventory in the company concerned. In addition, the company will be able to reduce storage and space savings (warehouse and work space) and solve problems that arise from the amount of inventory that accumulate so that companies can reduce the risks that arise with

the application of Economic Order Quantity (EOQ) method (Pamungkas, 2011).

Tri Pamungkas and Aftoni Susanto (2011) say that Economic Order Quantity (EOQ) is actually the most economical volume or amount of purchases to be executed on every purchase. To meet that requirement, it can be taken into account the fulfillment of needs (purchase) the most economical of a number of goods that will be obtained by purchase using minimal cost (Pamungkas, 2011).

Previous research on control of raw material inventory by Economic Order Quantity (EOQ) method is Yuliyana, Topowijono, and Sudjana (2016). Yuliyana, Topowijono, and Sudjana (2016) stated that UD. Sumber Rejo Kandangan Kediri need to determine Economic Order Quantity (EOQ), safety stock, reorder point, and optimal inventory amount for the smoothness of production process because the company has not determined the optimal amount of raw material purchase and delivery time of raw materials which is uncertain so that the amount of raw material inventory exceeds the needs of raw materials used for the production process and result in high raw material inventory costs (Yuliana, Topowijono, & Sudjana, 2016).

a. Stock

To get a quality production, the company must be careful in every production process in order to get a quality product. One of the important things a company must have in the production process is how to manage inventory because inventory is one of the most expensive assets for many companies (Andira, 2014).

Merchandise inventory is a very important element in determining the cost of goods sold in trading companies, both retail companies and large trading companies. Inventories affect the balance sheet and income statement. In the balance sheet of a trading company, inventory is often a very large part of the overall current assets owned

by the company. In the income statement, inventory holds a vital role in determining the results of a company's operations for a period (Maria, 2014).

Understanding inventory according to some experts are:

According to the Indonesian Institute of Accountants (IAI) in the Statement of Financial Accounting Standards (PSAK) No.14 (2007: 14.3), inventories are assets: 1) available for sale in the ordinary course of business; 2) in the production process and or in the journey; or, 3) in the form of materials or supplies for use in the production or service process. (Munir, 2006).

According to Hongren et al translated by Muhamad (2009: 216), inventory is all merchandise possessed by the company and is expected to be sold in the normal course of the company's operations (Lisa & Supiandi, n.d.).

According to the Statement of Financial Accounting Standards (PSAK) No.14 (Indonesian Institute of Accountants, 2015: 14.2), inventories are assets available for sale in ordinary business, in the process of producing such sales or in the form of materials or in the form of equipment for use in the process production or purchase of services (Lisa & Supiandi, n.d.).

Keown (2010: 312) describes several common types of inventories based on the production process as follows:

- 1) Inventories of Raw Materials (Raw Materials)

Inventories of raw materials consist of basic materials purchased from other companies for use in company production operations.

- 2) Work-in-Process Inventory

The inventories of semi-finished goods include semi-finished goods requiring additional work or further processing prior to becoming finished goods

- 3) Finished Goods

Inventories of finished goods include goods that have been completed the

production process but not yet sold by the company, and still in the warehouse (Lisa & Supiandi, n.d.).

The types of inventory can be grouped into inventories of raw materials, in-process goods, finished goods, and spare parts (Sudana, 2011: 225). (Yuliana et al., 2016)

In accounting, there are two kinds of methods in inventory recording, they are:

1) Perpetual Method

Each purchase and sale of goods is recorded in the inventory account and also on the cost of sales account. Thus, the amount of goods available for sale and the amount sold is reported in the inventory record continuously (Reeve, 2009: 282).

2) Periodic Method

Recording in a physical method or also called a periodic method, the cost of sales account is calculated by subtracting the remaining goods at the end of the period from the goods available for sale during the period. The remaining goods at the end of the period are calculated by performing a physical calculation of the remaining inventory. In the periodic method, the inventory record does not indicate the amount available for sale or the amount sold for a certain period (Reeve, 2012: 282). (Lisa & Supiandi, n.d.).

b. Raw Materials / Raw Material Inventory

Any company that carries out production activities will require a supply of raw materials. With the availability of raw material inventory, an industrial company is expected to make the production process in accordance with the needs or consumer demand, expedite the company's production activities, and avoid the shortage of raw material inventory (Pamungkas, 2011).

According to M. Alan Jayaatmaja (2010: 9), raw materials are materials used in

the production process during the period (Mulyadi, 2009).

According to Fredy Rangkuti (2007: 425), raw material inventory is raw material inventory which has an important position in the company because the raw material inventory has a very big influence on the smoothness of production ("No Title," 2012).

According to Kholmi and Yuningsih (2009: 26), raw materials are materials that mostly form semi-finished products (finished goods) or into the form of a product that can be traced to the product (Mulyadi, 2009).

Control of raw materials held in the company of course cultivated to support the activities that exist within the company. Integration of the entire implementation of existing activities within the company will support the creation of good raw material control in the company (Pamungkas, 2011).

Gitosudarmo (2008: 272) says that the raw materials should be planned as good as possible so that the objectives are achieved, appropriate quantities, quality, timely, and exact costs with the arrangement of raw materials that have two main aspects such as provision and use (Yuliana et al., 2016).

c. Economic Order Quantity (EOQ)

Economic Order Quantity (EOQ) was one of the first classical models introduced by FW Harris in 1915, but better known by the Wilson method because in 1934 the EOQ method was developed by Wilson (Sofyan, 2013: 54) (Yuliana et al., 2016).

Johar Arifin (2007: 51) says Economic Order Quantity (EOQ) is the quantity or quantity of goods purchased with minimal cost or often said to be the optimal amount of purchases (Ii & References, 2003).

According Riyanto (2011: 78), Economic Order Quantity (EOQ) is the quantity of goods that can be obtained with a minimal cost or often said as the optimal number of purchases.(Beautiful, 2017).

Heizer and Render (2011: 92) defines the quantity of economic orders (Economic Order Quantity) is one of inventory control

techniques that minimizes the total cost of ordering and storage. This technique is relatively easy to use but is based on several assumptions:

- 1) The number of requests is known, constant and independent.
- 2) The waiting time is a time between ordering and receiving of orders is known and constant.
- 3) Acceptance of inventory is instantaneous and completed entirely (inventory of an order comes in one group at a time).
- 4) No quantity discount available.
- 5) Variable costs are only a fee for setting up or making an order (setup fee) and the cost of storing inventory within a certain time (storage fee).
- 6) Out of stock (shortage of inventory) and can be completely avoided if ordering is done at the right time (Indah, 2017).

The number of economical orders is a method that will assist the management in making decisions so that the procurement of investment in the company is not excessive and there will be no shortage with the optimal amount. There are several assumptions in the EOQ method according to Heizer and Render (2011: 92), namely:

- 1) Total fixed purchase
- 2) Lead time constant
- 3) Goods ordered are always available
- 4) No discount
- 5) The cost of making an order and the cost of storing inventory is variable cost within a certain time
- 6) Reservations are made at the appropriate time to avoid stock out (Yuliana et al., 2016)

2. RESEARCH METHOD

According to Sugiyono (2012: 29), descriptive method is a method used to describe or analyze a research result but not

used to make wider conclusions. Non-statistical analysis and quantitative descriptive methods can be used to analyze the research data obtained. With this method, research data is organized, interpreted, described, and analyzed.

The result is compared to the policy applied by the company if the company uses the Economic Order Quantity (EOQ) method. The sample used in this study are two types of financial statements, namely profit / loss and balance sheet (financial position report) for the period of 2009 - 2013.

The data analysis tool used to analyze the data of this research are:

1. Purchase Analysis of Raw Materials

To be able to determine the optimal number of orders or purchases each time the order, there needs to be a calculation of Economic Order Quantity (EOQ) and the optimal quantity of purchases. The steps are as follows:

a. Determination of Economical Order Quantity (EOQ)

The formulation used to determine Economic Order Quantity (EOQ) is:

$$EOQ = \frac{\sqrt{2 S \cdot D}}{H}$$

Information:

EOQ = Amount of Economical Optimal Purchase

D = Request Estimated Per Period of Time

S = Booking Fee

H = Cost of Storage per Year

b. Determination of Frequency of Purchase (I)

The formulations used to determine the frequency of purchase (I) are

: "I" = "R" / "EOQ"

Information:

I = Frequency of Booking

R = Number of Raw Materials Required

EOQ = Amount of Economical Optimal Purchase (Pamungkas, 2011)

2. Safety Stock

Companies need to make calculations to determine the most optimal safety stock. To determine the size of the security stock, the steps are as follows:

Determination of Standard Deviation
Deviation standard formula:

$$\sigma = \sqrt{\frac{\sum(X - \mu)^2}{n}}$$

Information:

σ = Standard Deviation

X = Real Usage

μ = Average of Usage

n = Number (Number of Data)

b. Determination of safety stock

Safety supply formula:

Safety Stock = SD x Z Safety Stock = deviation standard amount of the needs level x 1,65
--

Information:

SS : Safety Stock

SD : Standar Deviasi

Z: The value of $\alpha = 5\%$ is seen in the normal distribution table (Indah, 2017).

3. Point of Reorder (Reorder Point)

Reorder point can be determined by specifying usage during lead time plus the use during certain period as safety stock. This can be formulated as follows:

Reorder point = usage during lead time + safety stock
Usage during lead time = lead time x raw material usage (Pamungkas, 2011).

4. Maximum Inventory

The maximum inventory calculation is required by the company so that the existing inventory amount is not excessive so that there is no waste of working capital. To determine the maximum inventory size, the formula used is as follows:

Maximum Inventory = EOQ + Safety Stock
--

(Yuliana et al., 2016).

5. Total Cost of Raw Material Inventory (TIC)

This calculation is used to determine the total cost of inventory consisting of the cost of purchasing raw materials, storage costs, and ordering costs. The formula is:

$$TIC = \sqrt{2DSH}$$

Information:

TIC = Total Inventory Cost per Year

D = Number of Requests

S = Cost of Storage

H = Ordering Fee (Pamungkas, 2011)

2. RESEARCH RESULT

A. Comprehensive Budget

Comprehensive budgeting consists of:

1) Sales Forecasting

Sales forecasting is a way of measuring or estimating business conditions in the future. The honey sales data of Sari Bunga Alam (SBA) in 2009 - 2013 can be seen in table 1 below:

Table 1
Sales Data of SBA Honey in 2009 - 2013 (bottle unit)

Year	Jenis Produk				Total (bottle)
	SBA 100 ml (bottle)	SBA 250 ml (bottle)	SBA 350 ml (bottle)	SBA 650 ml (bottle)	
2009	54.837,00	38.787,00	78.507,00	30.420,00	202.551,00
2010	71.942,00	49.780,00	106.506,00	41.253,00	269.481,00
2011	69.136,00	43.442,00	102.548,00	33.521,00	248.647,00
2012	70.503,00	40.587,00	36.182,00	32.693,00	179.965,00
2013	79.476,00	49.586,00	43.456,00	43.780,00	216.298,00
Total	345.894,00	222.182,00	367.199,00	181.667,00	1.116.942,00
Average	69.178,80	44.436,40	73.439,80	36.333,40	223.388,40
Percentage	30,97	19,89	32,88	16,26	100,00

Source: PT.Inti Kiat Alam

Sales forecasting of Sari Bunga Alam (SBA) honey in 2014 with least square method can be seen in table 2 below:

Table 2
Sales forecasting of SBA honey with Least Square Method

Year	Sales (Y)	X	X ²	XY
2009	202.551,00	-2	4	- 405.102,00
2010	269.481,00	-1	1	-269.481,00
2011	248.647,00	0	0	0
2012	179.965,00	1	1	179.965,00
2013	216.298,00	2	4	432.596,00
Total	1.116.942,00		10	- 62.022,00

Sales Forecasting of 2014:

$$\begin{aligned}
 Y &= 223.988,4 + -6.202,20 (3) \\
 Y &= 223.988,4 + -18.606,6 \\
 &= 205.381,8
 \end{aligned}$$

2) Sales Budget

The sales budget products of Sari Bunga Alam (SBA) honey in 2014 can be seen in table 3 below:

Table 3
Sales Budget 2014 on the basis of Product Type

Year	Unit	SBA 100 ml 30,97 %	SBA 250 ml 19,89 %	SBA 350 ml 32,88 %	SBA 650 ml 16,26 %	Total Sales budget
2014	Botlet	63.607	40.850	67.530	33.395	205.382

3) Production Budget

After the sales budget is arranged, the next step is to arrange the production budget. The production budget is a detailed plan of the number of units of products to be produced over the next period which includes plans on the type (quality), time (when) the production will be carried out (Haaruman, 2007).

Inventory turnover rate of 2013 = 30.8 or 31 times

Inventory turnover rate of 2014 = 31

Average inventory = 6,625.23 or 6,625 bottles

Average inventory of 2014 = (Starting 2014 + Final inventory of 2014 Prepayment) / 2

$6.625 = (8,532 + \text{final inventory of 2014}) / 2$

$6.625 \times 2 = 8.532 + \text{final inventory of 2014}$

$13,250 = 8,532 + \text{Final inventory of 2014}$

$\text{final inventory of 2014} = 13,250 - 8,532 = 4,718 \text{ bottles}$

Production plan of 2014 as follows:

Sales plan for 2014 = 205,382 bottles

Final inventories in 2014 = 4,718 bottles

Goods available for sale = 210,100 bottles

The initial inventory of 2014 = 8,532 bottles

Production plan for 2014 = 201,568 bottles

Production budget per product type which is based on the stability of inventory can be seen in table 4 below:

Table 4
Production Budget as per Product Type on the basis of Stability of inventory

Description	Unit	SBA 100 ml	SBA 250 ml	SBA 350 ml	SBA 650 ml	Amount
		30,97%	19,89%	32,88%	16,26%	
Sales Budget	Bottle	63.607	40.850	67.530	33.395	205.382
Final Inventories	Bottle	1.461	938	1.551	767	4.718
Available Goods	Bottle	65.068	41.789	69.081	34.162	210.100
Initial Inventory	Bottle	2.642	1.697	2.805	1.387	8.532
Production Budget	Bottle	62.426	40.092	66.276	32.775	201.568

4) Raw Material Budget

Budget of honey raw materials of wenny which is needed to make products of SBA can be seen in table 5 below:

Table 5
Raw Material Budget of Wenny Honey

Production Budget	Unit	SBA 100 ml	SBA 250 ml	SBA 350 ml	SBA 650 ml	Raw materials needs of Wenny's honey
		@150 gram	@400 gram	@500 gram	@850 gram	
		@ Rp 13,5	@ Rp 13,5	@ Rp 13,5	@ Rp 13,5	
		30,97%	19,89%	32,88%	16,26%	
201.568	Bottle	62.426	40.092	66.276	32.775	
	gram	9.363.841	16.036.750	33.137.779	26.219.965	84.758.336
	kg	9.364	16.037	33.138	26.220	84.758
	Rp	126.411.859	216.496.126	447.360.019	353.969.533	1.144.237.538

The Budget of Raw materials Purchase of Wenny's honey per product type can be seen in table 6 below:

Table 6
The Budget of Raw materials Purchase of Wenny's honey per product type

Description	Unit	SBA 100 ml	SBA 250 ml	SBA 350 ml	SBA 650 ml	Amount
		30,97%	19,89%	32,88%	16,26%	
Raw materials needs	kg	26.249.657	16.858.433	27.868.541	13.781.705	84.758.336
Final Inventories	kg	3.540.800	2.274.024	3.759.170	1.859.006	11.433.000
Available Raw materials	kg	29.790.457	19.132.457	31.627.711	15.640.711	96.191.336
Initial Inventories	kg	4.552.900	2.924.029	4.833.689	2.390.383	14.701.000
Raw Material Purchase	kg	25.237.557	16.208.428	26.794.022	13.250.329	81.490.336

B. Purchase of Raw Materials

Wenny's honey raw materials which are purchased from supplier of Mrs Wenny's who has been a partner all these years. Purchasing data of Wenny's honey raw material in 2014 obtained from the company can be seen in table 7 below:

Tabel 7
Purchasing data of Wenny's honey raw material in 2014

Month	Raw Materials Purchase (kg)	Price/kg (Rp)	Purchase Price (Rp)
Jan-14	10.800,00	13.500	145.800.000
Feb-14	12.650,00	13.500	170.775.000
Mar-14	12.482,00	13.500	168.507.000
Apr-14	16.206,00	13.500	218.781.000
Mei-14	18.363,00	13.500	247.900.500
Jun-14	14.400,00	13.500	194.400.000
Jul-14	14.504,00	13.500	195.804.000
Agust-14	9.180,00	13.500	123.930.000
Sep-14	11.173,00	13.500	150.835.500
Okt-14	19.154,00	13.500	258.579.000
Nop-14	14.465,00	13.500	195.277.500
Des-14	10.800,00	13.500	145.800.000
Total	164.177,00		2.216.389.500
Average	13.681,42		184.699.125

Source : PT. Inti Kiat Alam

Based on the table 7 above, the total purchase of raw materials of Wenny's honey during the year of 2014 as much as

164,177.00 kg or monthly average as much as 13.681.42 kg. Thus, the cost incurred to purchase raw materials of Wenny's honey

during the year of 2014 amounted to Rp 2,216,389,500 with raw material price of Rp 13,500 per kg.

C. The Use of Raw Materials

Most of the raw materials available in warehouse are used for production process

and some are stored as the next production reserves or reserves in case any time there is difficulty in getting raw materials in the market. Data on the use of raw materials of Wenny's honey can be seen in table 8 below:

Table 8
Data of Raw Material of Wenny's Honey in the Year of 2014

Month	Raw Materials use (kg)	Price/kg (Rp)	Use Cost (Rp)
Jan-14	11.353,00	13.500	153.265.500,00
Feb-14	14.295,00	13.500	192.982.500,00
Mar-14	15.109,00	13.500	203.971.500,00
Apr-14	15.842,00	13.500	213.867.000,00
Mei-14	16.537,00	13.500	223.249.500,00
Jun-14	17.624,00	13.500	237.924.000,00
Jul-14	11.572,00	13.500	156.222.000,00
Agust-14	12.834,00	13.500	173.259.000,00
Sep-14	13.717,00	13.500	185.179.500,00
Okt-14	13.586,00	13.500	183.411.000,00
Nop-14	11.466,00	13.500	154.791.000,00
Des-14	13.500,00	13.500	182.250.000,00
Total	167.435,00		2.260.372.500,00
Rata – Rata	13.952,92		188.364.375,00

Source : PT. Inti Kiat Alam

Based on the table 8 above, the total use of raw materials of Wenny's honey during the year 2014 as much as 167,435.00 kg or monthly average as much 13,952.92 kg. Thus, the cost incurred for the use of raw materials during the year 2014 amounted to Rp 2,260,372,500 with the raw material price of Rp 13,500 per kg.

D. Booking Fee/Cost

The booking fee consists of examination fees, contract administration fees and raw material acceptance fees. Data on the cost of ordering raw materials of wenny's honey in 2014 can be seen in table 9 below:

Table 9
Details of Booking Fee of Wenny's honey Raw Material in 2014.

No	Fees Types	Amount (Rp)
1	Inspection Fees	2.400.000,00
2	General Administration Fee	4.800.000,00
3	Raw Material Admission Fee	2.400.000,00
Amount		9.600.000,00

Source: PT. Inti Kiat Alam

The Table 9 above shows a booking fee of Rp 9,600,000.00.

E. Percentage of Storage Cost

The storage cost required for further analysis is taken into account in the percentage of inventory value. The amount of inventory value is the amount of raw materials ordered and the price of raw materials. The two items are variable costs

whose amount depends on the amount of raw material each time of the order. The cost of storing raw materials of Wenny's honey by 10% of the value of inventory. Data on the cost of storing raw materials of Wenny's honey can be seen in table 10 and table 11 below:

Table 10
Percentage of Save Cost, Price per Unit and Storage Cost

Year	Save Cost (%)	Price per kg (Rp)	Storage Cost per kg (Rp)
2014	10%	13.500	1.350

Tabel 11
Details of Raw Material Storage of Wenny's Honey

No	Types of Storage Cost	Amount (Rp)
1	Warehouse Administration Fee	2.400.000,00
2	The cost of the Bonded Capital in Inventory	146.109.375,00
3	Reserve Costs for Likelihood of Damage to Goods in Stock	5.540.973,75
4	Arrangement Cost	2.400.000,00
Amount		156.450.348,75

Source: PT. Inti Kiat Alam

The amount of raw material usage, ordering cost and storage cost in 2014 can be seen in table 12 below:

Table 12
The Use of Raw Material, Booking Cost and Storage Cost in Year of 2014.

Year	Use of Raw Material			Booking Cost (Rp)	Storage Cost (Rp)
	Amount(kg)	Price /kg	Total Cost (Rp)		
2014	167.435,00	13.500	2.260.372.500	9.600.000	156.450.348,75

F. Determination of Economic Order Quantity (EOQ) and Frequency of Purchasing of Raw Materiala.

- Determination of Economic Order Quantity (EOQ)

The quantity of economic purchases or Economic Order Quantity (EOQ) in 2014 can be calculated as follows:

$$EOQ = \sqrt{\frac{2 S \cdot D}{H}}$$

$$EOQ = \sqrt{\frac{2 \times 167.435,00 \times 9.600.000}{1.350}}$$

$$EOQ = 48.798,54 \text{ kg}$$

The optimal amount of raw material purchase every time of order in 2014 amounted to 48,798.54 kg.

- Purchase Frequency Determination

The frequency of purchasing raw materials of wenny's honey in 2014 can be calculated as follows:

$$I = \frac{R}{EOQ}$$

$$I = \frac{167.435,00}{48.798,54}$$

$$I = 3,43 \text{ times} / 3 \text{ times}$$

With the recycle order is = $360 / 3,43$
 = 104.96 days / 105 days
 = 15 weeks

3. CONCLUSION

The purchase quantity of Wenny's honey raw materials when the calculation using EOQ method as much as 48.798.54 kg and the frequency of purchase is 3.43 times / 3 times in one period (1 year) or every 105 days it must have a recycle order.

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