Cost Efficiency Through the use of the EOQ Method

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ABSTRACT: This study aims to analyze and show how to calculate EOQ and prove that the use of the EOQ method can make inventory costs efficient because the number of purchases is not excessive and not lacking, the frequency of purchases and the exact time of reordering.

The theory underlying this research is the theory of inventory management, especially the EOQ Single Item Method. The analysis technique used is descriptive analysis using the EOQ Single Item method to calculate Optimalization EOQ , purchase frequency (N), and Reorder Point (ROP)

The results showed that inventory cost efficiency can be achieved through the use of the EOQ method which is indicated by the optimalization EOQ, smaller purchase frequency and cheaper inventory costs compared to determining the amount of inventory, purchase frequency, time of order and inventory costs POX'Tempe Business

KEYWORDS: EOQ, Ordering costs, Storage costs, Total Inventory Costs and Efficiency

INTRODUCTION

Background to the research

Every company that is classified as a manufacturing activity definitely requires inventory to be processed into finished goods. This supply is obtained by spending a number of costs which then determines the cost of the product. Inventories that are available in excess or in insufficient quantities have a negative impact on the company. Excess inventory has a negative impact in several ways, namely the binding of large amounts of funds and for a long time can reduce the use of opportunities to carry out other productive businesses. This is supported by the opinion of Sprague and Wacker in Lwiky et. al (2013: 76) that excessive inventory requires storage warehouses which of course creates a financial burden. Excess inventory can also reduce the quality of inventory because it is stored over time. Excess inventory can also cause shrinkage of the inventory weight. Decreasing quality of inventory and shrinking inventory weight is detrimental to the company. Likewise, a shortage of inventory results in a stagnation in the company's production activities due to insufficient or unavailability of inventory which then results in the cessation of production activities and this creates waste which ultimately reduces the company's revenue and profits. Even this shortage of inventory can cause the company to lose customers because customers switch to another company. This situation can occur in large companies and companies that are small and medium-sized Micro Enterprises (MSMEs).

The use of the EOQ method to streamline inventory costs has been carried out by several researchers. Sundarti and Mafuah (2014) with the title Control Analysis Of Tobacco Raw Material Supplies Using EOQ Method to Reach Efficiency Total Cost Of Raw Materials in Pr. Breadfruit The results of his research found that the use of the EOQ method could be far more efficient than the Pr policy. Breadfruit Furthermore, research conducted by Sari, Dur and Husein (2020) with their research entitled Using of EOQ and EPQ Methods in Minimizing Inventory Cost of Crude Palm Oil found that using the EOQ and EPQ methods can streamline the total cost of inventory. Eckert (2007) conducted research on Inventory Management and its effects on customer satisfaction and found that good inventory management creates a positive and significant relationship between customer satisfaction and supplier partnerships, education, employee training and technology so as to create profits.

Based on the findings of several researchers, the researcher considers it necessary to apply the use of EOQ to MSMEs whose presence in Indonesia really helps the country's economy, as stated in kontan.co.id that MSMEs are one of Indonesia's backbones, even because they are crucial in the Indonesian economy, in the G20 presidency, Indonesia 2022 MSME development as a means of alleviating poverty

In this study, Micro, Small and Medium Enterprises (MSMEs) which manage raw materials in the form of soybeans into tahu are appointed as a model for using EOQ to explain cost efficiency. SMEs that produce tempe, the main raw material is

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soybeans. In general, companies are faced with different amounts of raw material usage, making it difficult for companies to determine the amount of purchases, how much to buy, when to buy and what is the total minimum inventory cost.

Furthermore, this study provides a way of calculating EOQ and showing savings or efficiency in inventory costs through the use of the EOQ method. Referring to the results of research on the POX'Tempe Business, it was found that data on purchasing, using soybeans in 2022 is as follows:

Table 1. Data on Purchases, Use of Soybeans by POX'Tempe Business, 2022

Month (2022)	Purchase (kg)	Usage (kg)	Saldo (kg)
January	7,750	7,350	400
February	6,900	6,900	400
March	7,600	7,250	750
April	9,300	9,000	1050
May	9,400	9,500	950
June	9,200	9,400	750
July	7.900	7,900	750
August	7,500	7,450	800
September	7,400	7,400	800
October	6,800	6,900	700
November	6,800	6,800	700
December	7,000	6,900	800

Source: Author's Own Research,2022

Research purposes

This study aims to analyze and demonstrate how to calculate EOQ for inventory cost efficiency:

1. The number of purchases of soybeans at POX'Tempe Business in 2022 and compare them with the number of purchases of soybeans based on calculations using the EOQ method

2. The total cost of supplying soybeans in the POX 'Tempe Business in 2022 and comparing it to the total cost of inventory based on calculations using the EOQ method

3. Efficiency of controlling soybean supply in the POX'Tempe Business, 2022 using the EOQ method. This study aims to analyze raw material inventory control at PT Kayu Lapis Asli Murni in Samarinda in 2017 using the EOQ (Economic Order Quantity) method.

The theory that underlies this research is the theory of Inventory Management, especially with regard to raw material inventory control. Various definitions put forward by experts on inventory management. Some of them are according to Hasanto (2013: 63): "Inventory management is defined as a series of decisions or company policies to ensure the company is able to provide supplies with quality, quantity and time of course".

According to Rusdiana (2014: 377) inventory management is a management carried out by planning, executing and evaluating inventory related to the time of reordering that must be done, the number of items that must be ordered and the average level of inventory that must be maintained.

Komaunakos (2008) argues that managing assets of all kinds can be viewed as an inventory problem, for the same principles apply to cash and fixed assets. This opinion can be interpreted that the management of all assets is seen as a matter of inventory because it adheres to the same principle.

Inventory

Inventory is something that must exist or be owned by the company so that the company's activities can be carried out. Herjanto (2013: 219) defines inventory as materials or goods stored that will be used to fulfill certain purposes such as the production or assembly process, for resale, and for spare parts of an equipment or machine. Inventory can be in the form of raw materials, supporting materials, work in process, finished goods, spare parts.

Furthermore, Herjanto (2013: 15) presents the inventory function for companies as follows:

1. Eliminate the risk of delays in the delivery of raw materials or goods needed by the company.

2. Eliminate the risk of ordering materials that are not good so they must be returned.

3. Eliminate risks to inflation

4. Helping companies store inventory appropriately so that the company can still meet inventory needs even though there are times when these supplies are not available in the market.

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5. Benefit from purchases based on quantity discounts.

6. Provide services to customers with the availability of the necessary goods

Basically, inventory is grouped into 4 types as stated by Heizer and Render (2015: 554) that referring to the production process, inventory is divided into four types, namely:

1. Inventory of raw materials (raw material inventory)

2. Inventory of semi-finished goods (work in process)

3. Inventory for maintenance / repair / operation (maintenance, repair, operating

4. Inventory of finished goods (finished good inventory

Furthermore Rangkuti (2013:16-17) argues that the costs arising from inventory are as follows:

1. Holding Costs, namely costs that vary directly with the quantity of inventory. Storage costs per period will be greater if the quantity of materials ordered is greater or the average inventory is higher.

2. Ordering costs, namely all costs related to inventory ordering activities

3. Setup costs (set-up costs), namely costs incurred because the inventory is self-produced by the company, so setup costs arise (set-up costs) to produce certain components.

Referring to the opinions of these experts, it can be concluded that how important inventory is for a company, so it is important to carry out inventory control. According to Fahmi, (2016: 109) inventory control is the ability of a company to organize and manage every need for goods, both raw goods, semi-finished goods and finished goods so that they are always available properly in stable market conditions.

Inventory control can be done using the EOQ (Economic Order Quantity) method. Fahmi (2013: 247) argues that EOQ (Economic Order Quantity) is a mathematical model that determines the number of items that must be ordered to meet projected demand, with minimal inventory costs.

Quoting Magad and Amos (1989) argued that the key issue to be considered in formulating inventory policy is cost minimization. Therefore, the objective of inventory management is to minimize inventory investment. One benefit of good inventory control is improved managerial efficiency in all functional areas of management.

This opinion shows that the main thing that must be considered is inventory policy in minimizing costs, thus the main goal of inventory management is minimum or optimal inventory investment. Through inventory control, managerial efficiency can be achieved in all management functional areas.

Furthermore, Komaunakos (2008) argues that ordering costs and holding costs mark the transaction approach to inventory management with respect to the EOQ inventory model which has been developed in many decades.

Based on the opinions of these experts, it can be said that the EOQ (Economic Order Quantity) Method also aims to determine the optimal quantity and frequency of purchases. By determining the optimal quantity and frequency of purchases, optimal inventory control will be obtained. Applying the EOQ method in inventory control, companies will be able to reduce storage costs, ordering costs, and resolve problems that may arise from inventory so that companies are able to reduce risks that can arise due to existing inventory in warehouses.

RESEARCH METHOD

Variable Operationalization

The variables and indicators of this research variable can be defined as follows:

1. Supplies are soybeans used for the production of Tempe in the POX's Tempe Business MSME Business in 2022

2. Ordering costs are costs incurred by the the POX's Tempe Business related to the activity of ordering soybeans for making tahu in 2022.

3. Carrying costs are costs that must be incurred by the the POX'sTempe Business related to storing supplies for a certain time.

4. EOQ (Economic Order Quantity) is the number of economical orders for raw materials that must be made by the the POX's Tempe Business in 2022

5. The total cost is the total cost of supplying soybeans for the POX 'Tempe Business in 2022

6. ROP (Reorder Point) is the time to buy back soybeans for making tempeh for the MSME business POX'Tempe Business in 2022

7. Lead time is the waiting time from the time the raw materials are ordered until the raw materials are received POX'Tempe Business

8. Efficiency, namely saving the cost of supplying soybeans in the tempe business of the POX'Tempe Business in 2022 when using the EOQ method.

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Tools Analysis

1.   EOQ

Determine the optimal EOQ (Economics Order Quantity) amount of inventory using the formula from Heizer and Render (2015: 563) as follows:

$$EOQ = Q^* = \sqrt{\frac{2DS}{H}}$$

2.   Holding Costs according to Jay Heizer & Barry Render (2015: 560)

$$\text{Holding Cost } = \frac{Q^*}{2} \times H$$

3. Ordering costs according to Jay Heizer & Barry Render (2015: 560):

$$\text{Ordering Cost } = \frac{D}{Q} \times S$$

4. The frequency of purchases, basically the EOQ method refers to purchases of the same amount in each order according to Deanta in Rifi (2012:40):

$$\text{Estimate Order Frequency } = \frac{D}{Q^*}$$

5.   Total Inventory Cost (TIC) according to Heizer & Render (2015:572) :

$$TIC = \left(\frac{D}{Q} S\right) + \left(\frac{Q}{2} H\right)$$

6.   Reorder Point (ROP) Determining raw materials must be returned to order before running out of stock using the Reorder point formula according to Hudori (2018: 221) is as follows: $ROP = D \times L$

ANALYSIS AND DISCUSSION

Analysis

Purchase of Raw Materials, Use of Raw Materials, Frequency

The following is a table of purchases, usage and frequency of the the POX'sTempe Business Business in 2022

Tabel 2. Soybean Purchasing Data for 2022

No.	Purchase Time	Purchase Amount Soybeans (Kg)
1.	January	**7,750**
	January 4 th 2022	2,750
	January 15 th 2022	2,250
	Januari 27th2022	2,750
2.	February	**6,900**
	February 3th 2022	2,625
	February 16th, 2022	2,225
	February 28th 2022	2,050
3.	March	**7,600**
	March 6th 2022	3,100
	March 19th 2022	2,500
	March 27th 2022	2,000
4.	April	**9,300**
	April 4th 2022	3,800
	April 15th 2022	3,450
	April 26th 2022	2,050
5.	May	**9,400**
	May 2 th 2022	2,300
	May 14th 2022	3,750
	May 26th 2022	3,350
6.	June	**9,200**
	June 3th 2022	3,650
	June 16th 2022	2,200

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	June 24th 2022	3,350	
7.	July	**7,900**	
	July 3th 2022	1,700	
	July 13th 2022	3,200	3,000
	July 28th 2022		
8.	August	**7,500**	
	August 4th 2022	2,150	
	August 15th 2022	2,750	
	August 28th 2022	2,600	
9.	September	**7,400**	
	September2th 2022	1,900	
	September17th 2022	3,500	
	September28th 2022	2,000	
10.	October	**6,800**	
	Oktober2th 2022	2,200	
	Oktober13th 2022	3,100	
	Oktober25th 2022	1,600	
11.	November	**6,800**	
	November2th 2022	2,800	
	November12th 2022	1,800	
	November24th 2022	2,200	
12.	December	**7,000**	
	December2th 2022	3,400	
	December14th 2022	1,700	
	December20th 2022	1,900	
	Purchase Total	93,550 Kg	

Source: Author's own research

Data in table 2 shows that every month purchases are made three times so that in a year the frequency of purchases is 36 times.

Table 3. Data on the Use of Soybeans in 2022

No.	Usage Time	Usage Soybeans (Kg)
1.	January	7,350
2.	February	6,900
3.	March	7,250
4.	April	9,000
5.	May	9,500
6.	June	9,400
7.	July	7,450
8.	August	7,400
9.	September	6,900
10.	October	6,800
11.	November	6,800
12.	December	6,900
Total usage		92,750
Average		7,729 Kg

Source: Author's Own Reseach, 2022

The data in table three shows that the use of soybeans varies each month and in one year uses 92,750 kg of soybeans for making tempe and an average of 7,730 kg every month.

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Ordering Cost of Raw Material

The ordering costs that must be borne by POX'Tempe Business are as follows:

Table 4. Ordering Cost of Soybeans Year 2022

No	Cost Types	Total cost of each order (IDR)	Monthly Purchase Frequency	Monthly cost (IDR)	Annual Purchase Frequency	Total ordering cost(IDR)
1	Transportation cost	100.000	3	300.000	36	3.600.000
2	Telephone cost	10.000	3	30.000	36	360.000
3	Total	110.000		330.000		3.960.000

Source: Author's Own Research, 2022

The data in table 4 shows that the ordering cost of POX's'Tempe Business soybeans in 2022 is IDR 3,960,000 with an average per order of IDR 110,000.

Raw Material Storage Costs

The table for soybean storage costs is as follows:

Table 5. Cost of Soybean Storage in 2022/Year

No.	Cost type	Total (IDR)
1.	Electricity cost	3,600,000
2.	Light bulb	200,000
	Total	3,800,000

Source: Author's Own Research, 2022

The data above explains that the cost of storing soybean raw materials in 2022 is IDR 3,800,000.

Raw Material Inventory Analysis According to the EOQ Method (EconomicOrder Quantity)
1. **Purchase of Optimal Raw Materials**

$$\text{Cost per order} = \frac{\text{total ordering cost}}{\text{Purchase Frequency}}$$
$$= \frac{\text{IRD } 3,960,000}{36}$$
$$= \text{IRD } 110,000/\text{purchase}$$
$$\text{Raw material storage costs} = \frac{\text{total costs storage}}{\text{amount of raw material inventory}}$$
$$= \frac{\text{IDR } 3,860,000}{93,550 \text{ kg}} = \text{IRD } 41 \text{ per kg}$$
$$=$$

The calculation of the economic purchase of soybean raw materials using the EOQ (Economic Order Quantity) method is as follows:

Total purchase per period (D) = 93,700kg

Cost per order (S) = IDR 110,0000

Holding cost per unit per year (H) = IDR 41 per kg

$$Q^* = \sqrt{2DS/CH}$$

$$\sqrt{\frac{(2 \times 92,750) \times (\text{IDR } 110,000)}{\text{IDR } 41}}$$
$$= 22,303 \text{ kg}$$

The calculation above shows that the number of economical purchases of soybean raw materials for POX'Tempe Business using the EOQ method is 22,303 kg.

$$\text{Average Inventory} = \frac{Q^*}{2} = \frac{22,303 \text{kg}}{2}$$
$$= 11,154 \text{ kg}$$

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In the above calculation it is known that the purchase of soybean raw materials obtained from calculations using the EOQ method is as much as 22,422 kg so that the calculation above shows that the average supply of raw materials is 11,154 kg.

2. Inventory Cost Calculation
Ordering Cost

$$\text{Ordering Cost} = \frac{D}{Q} \times S$$

$$= \frac{92,750\text{kg}}{22,303 \text{ kg}} \times \text{IDR } 110,000,/\text{purchase}$$

$$= \text{IDR } 457,450/\text{year}$$

In the calculation above, it is obtained that the total ordering fee that can be issued by POX 's Tempe Business is IDR 457,450

Holding Cost

$$\text{Holding Cost} = \frac{Q^*}{2} \times H$$

$$= \frac{22,303 \text{ kg}}{2} \times \text{IDR } 41/\text{kg}$$

$$= \text{IDR } 457,212/\text{Year}$$

In the calculation above, it is obtained that the total cost of storing soybeans at the Father No'Tempe Business is IDR 457,212

3. Purchase Frequency

$$\text{Purchase Frequency} = \frac{D}{Q^*}$$

$$F = \frac{92,750 \text{ kg}}{22,303 \text{ kg}}$$

$$F = 4 \text{ times}$$

Calculation results show that the Purchase Frequency is 4 times a year.

4. Total Inventory Cost (TIC)

$$\text{TIC} = \left(\frac{D}{Q} S\right) + \left(\frac{Q}{2} H\right)$$

$$\text{TIC} = \left(\frac{92,750 \text{ kg}}{22,303 \text{ kg}} \text{ IDR } 110,000\right) + \left(\frac{22,303\text{kg}}{2} \text{ IDR } 41/\text{kg}\right)$$

$$\text{TIC} = \text{IDR. } 457,450 + \text{IDR } 457,212$$

$$\text{TIC} = \text{IDR. } 914,662.$$

The calculation results show that the total cost of supplying soybeans in the POX'Tempe Business according to the EOQ method is IDR. 914,662.

5. Reorder Point (ROP)

$$\text{ROP} = D \times L$$

$$\text{ROP} = 248 \text{ kg} \times 0 \text{ hari}$$

$$\text{ROP} = 0 \text{ kg}$$

The calculation results show that the reorder point (ROP) can be done every time the supply runs out because there is no waiting time, in this case it can be done every 3 months because the frequency of purchases is 4 times a year.

Discussion

From the results of the calculations that have been carried out, it can be seen that the comparison of soybean supplies between the POX'Tempe Business and calculations using the EOQ method, can be seen from the optimal number of purchases, the frequency of purchasing raw materials and the total cost of material inventory.

The comparison of soybean raw material inventories between company policies and calculations using the EOQ (Economic Order Quantity) method for POX'Tahu Business in 2022 is as follows:

1. The optimal number of orders or purchases of soybeans according to the EOQ is 22,303 kg in the 2022 period, while those made by POX'Tempe Business are uncertain or vary.
2. As a result of the uncertain or fluctuating amount of soybean purchases made by POX'Tempe Business the total cost of inventory was IDR 7,760,000, which far exceeded the calculation of the total inventory cost based on the EOQ method, which

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was only IDR 914,662

3. The number of purchases, the frequency of purchases and the cost of supplying soybeans made by POX'Tempe Business is greater than the calculation using the EOQ method.

The total purchase of raw materials by POX'Tempe Business is 93,550 kg, the total inventory cost is IDR 7,760,000/year and the frequency of purchases is 36 times. While calculations using the EOQ method yield the total purchase of soybean raw materials needed per order of 22,422 kg with a total inventory cost of Rp.917,322 for a year with a purchase frequency of 4 times a year. The results of the analysis show that by using the EOQ method the company is more efficient in inventory management.

These findings support the research findings from Sundarti and Mafuah (2014) that the use of the EOQ method can be much more efficient than the Pr policy. Breadfruit The results of this study also support research conducted by Sari, Dur and Husein (2020) which found that using the EOQ method can streamline the total cost of inventory. Likewise, the results of this study support the findings of Eckert (2007) that good inventory management creates a positive and significant relationship between customer satisfaction and supplier partnerships, education, employee training and technology so as to create profits.

The use of the EOQ Method for MSMEs is able to overcome excess inventory and shortage of inventory. Through the use of the EOQ method, managerial efficiency can be achieved in all functional areas of management as found by Magad and Amos (1989).

UMKM that apply EOQ in carrying out inventory control will make the total cost of inventory efficient because the inventory purchased and stored has been carefully calculated, the frequency of purchases has been determined so that it can reduce or reduce ordering costs. This reduction in ordering costs certainly lowers the total cost of inventory which in turn can reduce the cost of goods sold so that product prices become cheaper and are in demand by buyers and provide benefits for MSMEs to survive and improve from time to time.

The creation of UMKM that work efficiently and effectively makes MSMEs able to become the backbone of the Indonesian economy, especially in relation to poverty alleviation.

CONCLUSION AND RECOMENDATION

Conclusion

1. Based on the inventory model using the economic order quantity (EOQ) method, it shows that the number of purchases or orders is more economical at 22,303 kg which results in ordering costs and storage costs decreasing, so as to minimize costs incurred at POX'Tempe Business and maximize profits obtained.
2. The frequency of purchasing soybean raw materials at POX'Tahu Business when using the EOQ method is only 4 purchases of soybeans in one year, while purchases have been made 36 times in one year, so the total inventory costs incurred by POX'Tempe Business is higher than using the EOQ method with a total inventory cost of Rp. 917,322, - This is because the frequency of purchases has decreased.
3. Inventory cost efficiency can be achieved by using the EOQ method

Recommendation

1. Companies should apply the EOQ method in managing inventory
2. Follow-up research can apply the use of the Multi-Item EOQ method or the EOQ method with Quantity Discounts to several MSMEs or large businesses to prove that inventory cost efficiency can be achieved through the use of the EOQ method.

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