

ANALYSIS OF THE APPLICATION OF FIFO AND EOQ METHODS IN RAW MATERIAL INVENTORY CONTROL AT PT. XYZ

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Abstract

This study aims to analyze the application of the FIFO (First In First Out) and EOQ (Economic Order Quantity) methods in controlling the inventory of fresh milk raw materials at PT. XYZ. The research method used was a mixed-methods approach. The results show that the application of the FIFO method has been successful and effective in preventing raw material spoilage because inventory is used in the order in which it was received. Meanwhile, the EOQ calculation results indicate an optimal order quantity of 492,610 units with an order frequency of 3 times over 10 months, as well as total inventory costs of Rp 1,008,737,900. Compared with the company's existing method, EOQ has proven to be more efficient in reducing inventory costs. Thus, the combination of FIFO and EOQ can improve the effectiveness of inventory control and cost efficiency at the company.

Keywords: First In First Out, Economic Order Quantity, and Inventory Control

1. Introduction

In general, a company is established with the aim of obtaining profit or financial gain. The business activities implemented by companies vary depending on the type of business. Unlike service-sector businesses, manufacturing companies generate profits by transforming raw materials into semi-finished or finished goods. The procurement of raw materials has a major influence on the manufacturing process.

This research was conducted at a company engaged in supplying food raw materials to provide raw materials for related businesses in Batam. The company first determines the needs of the relevant businesses. The company's management of raw material inventory in response to client demand follows agreements and cooperation contracts.

A key component of its operations is maintaining an adequate supply of raw materials, which determines distribution efficiency and the ability to meet consumer demand. Suboptimal inventory control can lead to delivery delays, stock shortages, and increased storage costs. Therefore, companies require a good inventory control system so that operational processes can

run effectively and efficiently.

Table 1. Raw Material Inventory Data at PT. XYZ in 2024

Month	Purchases (pcs)	Sales (pcs)
March	130160	115865
April	126800	123740
May	126800	122854
June	126800	125400
July	126240	127600
August	129600	130964
September	129040	135865
October	126240	128654
November	126240	127633
December	139600	140300
Total	1287520	1278875

Source: PT. XYZ

Based on Table 1 above, it can be seen that in March the company overstocked, while in July the company purchased fewer goods than the demand. Therefore, the company has a storage warehouse because shortages frequently occur in the warehouse inventory.

According to the author's initial interview at PT. XYZ, the raw material control system is still at an early stage and does not yet use organized inventory records. The interview results in Table 2 show that inventory control is still conducted in a basic manner, and the company does not yet have specific records related to raw material inventory. In addition, the company experiences problems such as delays in the arrival of goods and discrepancies between the quantity of goods received and the quantity ordered because the raw materials are still in the delivery process. There is also no fixed schedule for purchasing raw materials, as the company only restocks when inventory begins to run low. The observation checklist results show that the raw material inventory control system at PT. XYZ obtained a total score of 72%, categorized as "Fairly Effective." The control activities as well as information and communication components obtained the highest score of 100%, categorized as "Very Effective." This indicates that the company already has inventory control procedures and information communication processes that operate well. Meanwhile, the risk assessment component obtained a score of 80%, categorized as "Fairly Effective," meaning that the company has been able to identify inventory

risks, although improvements are still needed in their management. However, the control environment and monitoring components obtained scores of 40%, categorized as "Less Effective." This situation highlights the continuing need to improve inventory management processes, particularly in monitoring raw material inventory.

Table 2. Observation Checklist

Component	Yes	No	Total	Score	Category
Control Environment	10	15	25	40%	Less Effective
Risk Assessment	20	5	25	80%	Fairly Effective
Control Activities	25	0	25	100%	Very Effective
Information and Communication	25	0	25	100%	Very Effective
Monitoring	10	15	25	40%	Less Effective
Total	90	35	125	72%	Fairly Effective

Source: Personally processed data

To improve inventory management and minimize damage caused by prolonged storage, Rahman and Novianty (2022) recommend the use of the FIFO (First In First Out) approach, which is an inventory system in which goods that enter first are issued first. One of the cost-flow assumptions underlying FIFO is that goods entering first must be issued first. The first-in, first-out (FIFO) principle states that this always occurs. The application of the FIFO method is particularly important for raw materials with a specific shelf life so that raw material quality can be maintained and the risk of product damage can be minimized. By applying FIFO, older goods are used before newer goods, resulting in more organized inventory turnover.

Companies can reduce ordering and storage costs by using the Economic Order Quantity (EOQ) approach to determine the economical quantity of raw materials to be procured (Andini et al., 2022). To keep inventory costs as low as possible, it is recommended that the optimal inventory quantity be ordered each time, which is known as EOQ.

Raw material inventory control is very important for improving business efficiency, according to previous research. According to research conducted by Rahayu and Yulistiani (2019), the FIFO approach using barcodes and labels to identify manufacturing operators

facilitates efficient and effective raw material management. With management approval, the investigation also revealed differences between company estimates and estimates using the EOQ approach, creating opportunities for organizations to improve efficiency by coordinating efforts across marketing, PPIC, warehouse, and purchasing departments.

2. Literature Review

Inventory

All raw materials, components, and process materials available for use in manufacturing, as well as finished goods and services available to meet customer demand, are collectively known as inventory (Daud, 2017). To monitor raw materials, it is necessary to consider economic order quantity, purchasing costs, ordering costs, and storage costs (Sofyan Assauri, 2008).

According to Irham Fahmi (2016:109), inventory management is a method used by a business to ensure that raw materials, work-in-process commodities, and finished goods are always available, regardless of market behavior. Organizations can better manage their storage costs and ensure the safety of their goods by using an inventory management system designed to plan, monitor, and control inventory levels.

Inventory Control

Mulyawan (2015:224) states that inventory control is a form of supervision carried out to maintain smooth production or to meet customer demand economically.

The following expenditures are important to consider when determining inventory levels:

- a. Purchasing cost, namely the total costs associated with purchasing goods or services, including taxes, shipping costs, unforeseen costs, and other expenses.
- b. Ordering cost, starting from placing an order with a vendor or supplier until the goods arrive at the warehouse or the manufacturing process is organized at the factory. These costs include transportation and receiving costs, as well as administrative costs associated with ordering.
- c. Inventory-carrying cost, which consists of actual and opportunity costs associated with storing goods, representing the total cost incurred to store inventory. Warehouse rent, taxes, handling, insurance, employee costs, damage, expiration, depreciation, taxes, and security are examples of costs included in this category.
- d. Shortage cost is a cost arising from insufficient inventory and the inability to meet demand. Stock shortages can lead to order cancellations and significant sales losses, which in turn may

cause damage to the company's reputation, loss of profits, and even loss of the business itself.

e. Set-up cost, or setup cost, is the cost paid to initiate the product manufacturing process or prepare an order, whether through machine preparation or product preparation itself. Costs related to personnel preparation, communication, equipment and supplies preparation, scheduling, and costs associated with idle equipment are all part of setup costs.

FIFO (First In First Out)

The FIFO (First In First Out) method is defined as an inventory valuation method in which goods purchased first are the first goods to be used or sold (Sembiring, 2019).

In accounting, the FIFO model is classified as a perpetual inventory system because the FIFO technique ensures that old stock is depleted and the remaining inventory stays fresh. The advantage of the FIFO method lies in the reported data. When inventory goods are issued or sold, the process of recording the goods report corresponds to the actual goods data in the warehouse.

Companies often use the FIFO approach because it is easy to calculate and implement and is effective in preventing inventory damage (Tampubulon, 2019). In addition, it is also recommended by the government.

Regardless of the type of goods being sold, the FIFO approach to inventory management can be effective. The first goods purchased are the goods that are actually issued first. For companies that value inventory using the FIFO method, the recorded inventory value reflects the increasing prices of goods.

Economic Order Quantity (EOQ)

Among the many well-known and long-established inventory management methods, EOQ stands out. When and how much to order are two important considerations addressed by this inventory management strategy (Heizer and Render, 2011:68).

Minimizing inventory costs is the objective of the EOQ method, which seeks to identify the economical quantity for each order. Hansen and Mowen (2005) discuss the reasons behind raw material inventory management based on EOQ principles:

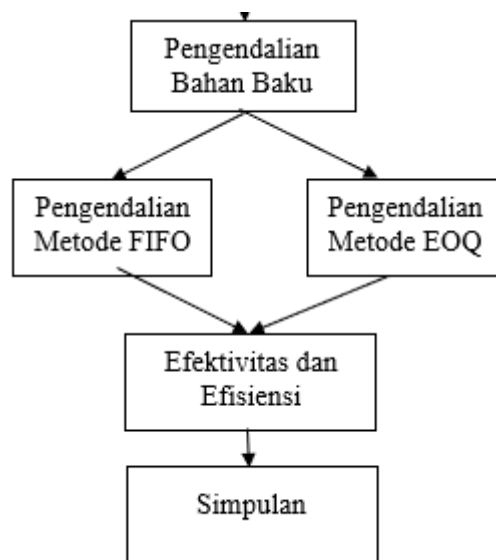
- a. Attempting to meet client demand while dealing with unpredictable demand.
- b. Managing unproductive production facilities due to machine breakdowns, damaged raw materials, raw material shortages, or delays in raw material delivery.

- c. Generating revenue from sales.
- d. Protecting against potential future price increases.

According to Nafarin (2009:256), as cited in Agustina C. (2017), an alternative definition of Economic Order Quantity (EOQ) is the optimal purchasing quantity, or the amount of products that can be purchased at the lowest cost.

As stated by Heizer and Render (2011), EOQ has existed for a long time and remains a popular inventory control method.

Conceptual Framework



Gambar 1. Conceptual Framework

Sumber: Personally processed data (2024)

The raw material inventory required by PT. XYZ must be considered in terms of valuation and control. Raw material valuation uses the FIFO method, in which raw materials that enter inventory first are prioritized for issuance to prevent expiration. For raw material control, the EOQ method is used to control the quantity of demand and available inventory as well as the goods that need to be ordered, thereby reducing company costs.

3. Research Method

Research Location and Object

The location of this research is PT. XYZ. The object of this research is the inventory control system at PT. XYZ.

Research Subjects

The research subjects at PT. XYZ were employees and the director of PT. XYZ. Interviews were conducted with 5 (five) informants who provided the information required for the research. The informants in this study were:

1. Director : 1 Person
2. Company Staff :
 - a. Office : 2 People
 - b. Field : 2 People

Data Collection Techniques

The data collection techniques used in this research were:

- a. Observation

Basrowi (2012) states that observation is a technique conducted through careful observation and systematic recording of the results of the observations. In this study, the researcher observed inventory control activities at PT. XYZ.

- b. Interview

Interviews in this study were conducted with business owners and employees related to inventory control at PT. XYZ. Interviews are used as a data collection procedure when researchers need to identify problems that should be investigated and, furthermore, when researchers need to obtain more in-depth information from respondents and when the number of respondents is small (Sugiyono, 2022). The interviews were conducted with warehouse staff responsible for stock-taking and field data collection staff to gather information regarding the general description of the raw material inventory control system used at PT. XYZ. Primary data, such as inventory data, can be obtained through this approach at PT. XYZ.

- c. Literature Study

The literature study was conducted by collecting data from books, journals, the internet, and various types of information related to the theories discussed in this research.

Data Analysis Method

The problem analysis process in this research uses three stages to understand a predetermined problem within a specified scope or limitation, as follows:

1. Identify Stage

This stage is used to identify and formulate problems occurring within the predetermined scope. The scope of this research concerns inventory control at the company.

2. Understand Stage

Using appropriate data collection methods, such as observation and interviews, this stage explores current issues in greater depth.

3. Analyze Stage

Weaknesses in the existing system can be identified during this stage. Additional information regarding what the researcher needs to collect, evaluate, conclude, and recommend can also be obtained.

Data collection and processing use the following methods:

a. EOQ Method

The Economic Order Quantity (EOQ) can be calculated using the following formulas:

$$EOQ = \frac{\sqrt{2SD}}{H}$$

1) Calculating the costs that must be incurred

$$TC = (H \times Q/2) + (S \times D/EOQ)$$

2) Calculating Order Frequency

$$D / EOQ$$

3) Calculating Reorder Point

$$ROP = L \times D / \text{Working days per year}$$

The explanations of the variables are as follows:

EOQ : Optimal purchasing quantity

S : Ordering cost per order

D : Demand

H : Holding cost

TC : Total Cost

ROP : Reorder Point

L : Safety Stock

b. FIFO Method

As an inventory valuation method, the FIFO (First In, First Out) approach ensures that the goods purchased first are also the first goods used or sold (Sembiring, 2019). In

accounting, the FIFO model is classified as a perpetual inventory system because the FIFO technique ensures that old stock is depleted and the remaining inventory remains fresh. The advantage of the FIFO method lies in the reported data. When inventory goods are issued or sold, the process of recording the goods report corresponds to the actual goods data in the warehouse.

4. Results and Discussion

A. FIFO Method in Inventory Control

With the assistance of purchase prices obtained from the raw material purchasing department, it is very important to consider how raw materials are used to calculate the selling price of products. PT. XYZ's inventory control is shown in Table 6 below.

Table 6. Raw Material Inventory Stock

Month	Purchases	Usage	Ending Stock	Price	Total
March	150145	115865	34280	19.000	651.320.000
April	153096	123740	29356	19.000	557.764.000
May	155356	122854	32502	19.000	617.538.000
June	157321	125400	31921	19.000	606.499.000
July	157182	127600	29582	19.000	562.058.000
August	158983	130964	28019	19.000	532.361.000
September	155768	135865	19903	19.000	378.157.000
October	146753	128654	18099	19.000	343.881.000
November	145128	127633	17495	19.000	332.405.000
December	153143	140300	12843	19.000	244.017.000
Total					4.826.000.000

Sumber: Personally processed data

Based on Table 6, the ending stock of raw material inventory at PT. XYZ changes every month according to the quantity of raw materials purchased and used. With this ending inventory stock data, the company can determine the amount of inventory still available in the warehouse and use it as a basis for making decisions regarding raw material purchases for the following period to prevent shortages or inventory accumulation..

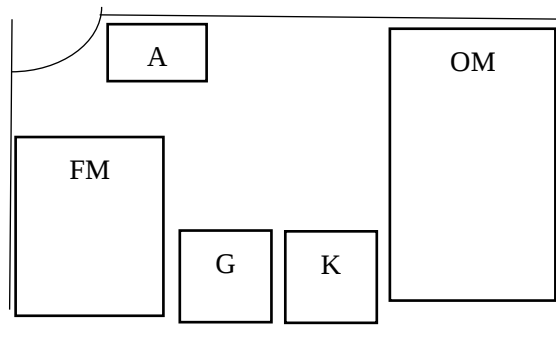
FIFO Implementation Process

At PT. XYZ, raw materials are utilized using the FIFO (First In, First Out) method. The data stored in the stock cards and the program used by the company demonstrate this in the administration process of its raw material warehouse.

Table 7 Stock Card (Color Code)

Month		Name	Color
January	July	Red	
February	August	White	
March	September	Yellow	
April	October	Blue	
May	November	Green	
June	December	Orange	

Figure 1 Warehouse Layout



Description :

A = Admin Area

FM = Fresh Milk

G = Sugar

K = Coffee

OM = Processed Food

B. EOQ Method in Inventory Control

Inventory Costs

Inventory costs at PT. XYZ can generally be divided into two categories: ordering costs and holding costs. Ordering costs consist of unloading and delivery costs, while holding costs are costs incurred to handle storage.

1. Ordering Costs

Table 3. Ordering Costs

Type of Cost	Total Cost
Delivery Cost	1000/pcs
Unloading Cost	400/pcs

Sumber: Personally processed data

Based on Table 3, ordering costs consist of a delivery cost of Rp 1,000/pcs and an unloading cost of Rp 400/pcs, resulting in a total ordering cost of Rp 1,400/pcs.

2. Holding Costs

For storage costs, the company determines a holding cost of 10% of the value of the goods. Since the price of the goods is Rp 19,000, the holding cost is Rp 1,900.

Inventory Control Based on the Company's Actual Conditions

Ordering Cost/year = Delivery frequency × Ordering cost/order

$$2024 = 10 \times 180.252.800 = 1.802.528.000$$

Holding Cost/year = Average inventory × Holding cost

$$2024 = 89343,75 \times 1.900 = 169.753.125$$

Table 4. Total Inventory Costs Based on the Company's Actual Conditions

Year	Ordering Cost/year (Rp)	Holding Cost/year (Rp)	Total Inventory Cost (Rp)
2024	1.802.528.000	169.753.125	1.972.281.125

Sumber: Personally processed data

Inventory Control Analysis Using the EOQ Method

The EOQ method enables a company to determine the most economical order quantity with constant demand and lead time.

$$EOQ = \frac{\sqrt{2(180252800)(1278875)}}{1900}$$

$$EOQ = 492.610 \text{ pcs}$$

Table 4. Optimal Ordering

Year	Demand (D)	Ordering Cost (S)	Holding Cost (H)	EOQ (Q*)
2024	1.278.875	180.252.800	1.900	492.610

Sumber: Personally processed data

Based on the EOQ calculation results in Table 4, the optimal order quantity is 492,610 units.

After determining the optimal order quantity, the purchasing frequency is determined. The order frequency is 3 times.

Total inventory cost is the sum of total ordering costs and holding costs.

Table 5. Total Inventory Costs Using the EOQ Method

Year	Ordering Cost/year (Rp)	Holding Cost/year (Rp)	Total Inventory Cost(Rp)
2024	540.758.400	467.979.500	1.008.737.900

Sumber: Personally processed data

Therefore, using the EOQ method, the inventory cost incurred in 2024 was Rp 1,008,737,900. In theory, under the EOQ method, ordering costs should be equal to holding costs. If there is a difference, this is due to rounding in the calculation of ordering frequency. The same applies to the calculation of ordering and holding costs.

Discussion

a. Analysis of FIFO Implementation

Based on the study conducted at PT. XYZ, the FIFO (First In First Out) system is highly beneficial for tracking the supply of raw milk. This is clearly reflected in the warehouse management system, which strictly follows the principle of using raw materials according to the order in which they were received. Given the characteristics of fresh milk raw materials, which are perishable and have a limited shelf life, the application of the FIFO method is highly relevant and crucial for maintaining product quality. By using this method, the company is able to minimize the risk of damage, spoilage, and expiration of raw materials, which could otherwise result in financial losses.

Furthermore, observations and interviews revealed that stock recording processes demonstrate that, operationally, FIFO is not only applied physically in the issuance of goods but is also supported by an adequate recording system. Therefore, information regarding inventory positions can be obtained more accurately and in real time.

Aspect	Condition Before FIFO	Condition After FIFO	Impact
Expired Goods	Stock accumulation	Significantly decreased	Losses reduced
Customer Satisfaction	Many complaints about rejected goods	Complaints decreased drastically	Customer satisfaction increased
Stock Recording	Irregular	More organized and consistent	Stock is easier to control
Goods Arrangement	Disorganized and irregular	New goods at the back, old goods at the front	Easier to control

Table 6

The implementation of the FIFO (First In First Out) method has had a positive impact on inventory management. After FIFO was implemented, the amount of expired goods decreased significantly, resulting in reduced company losses. Customer satisfaction also increased because complaints caused by rejected goods decreased drastically. In addition, stock recording became more organized and consistent, making inventory control easier. The arrangement of goods in the warehouse also became more orderly by placing older goods at the front and newer goods at the back, making the issuance of goods more effective and consistent with FIFO principles. Overall, the implementation of FIFO has been proven to improve inventory management efficiency, minimize losses, and improve the quality of customer service.

However, although the FIFO method has been implemented well operationally, there are still several weaknesses in the overall inventory control system. One of the main weaknesses lies in the planning of raw material order quantities. The company still uses a simple approach, namely ordering based on monthly requirements without considering optimal economic calculations. This has the potential to cause overstock or understock conditions, which can ultimately increase storage costs or even disrupt operational continuity.

This finding is supported by the observation checklist results, which show that the control environment and monitoring aspects remain in the less-effective category, each with a score of 40%. This indicates that although control activities and information systems are operating very well, the company still needs to improve supervision and evaluation of the inventory policies implemented.

b. Analysis of EOQ Implementation

Based on the analysis using the Economic Order Quantity (EOQ) method, the optimal quantity for ordering raw materials is 492,610 pcs, with an ordering frequency of 3 times during a 10-month period. These results indicate a fairly significant difference compared with the ordering policy currently implemented by the company. In other words, the company has not fully implemented efficiency principles in determining the quantity of raw materials to purchase.

The EOQ approach has proven to be more efficient in terms of costs. By using the EOQ method, total inventory costs amounted to Rp 1,008,737,900, meaning that the company effectively reduced ordering and holding costs. The EOQ approach achieves this by determining the optimal order quantity while balancing ordering and holding costs.

In addition, EOQ provides other benefits, namely helping the company determine a more planned ordering frequency and reducing the risk of stockouts. By calculating the reorder point (ROP) and safety stock, the company can ensure that inventory remains available when needed without having to maintain excessive stock levels.

When analyzed more comprehensively, the combination of FIFO and EOQ provides complementary solutions for inventory control. The FIFO method plays a role in maintaining inventory quality and turnover at optimal levels, while the EOQ method functions to optimize order quantities and reduce inventory costs. By integrating these two methods, the company can not only improve cost efficiency but also maintain raw material quality and operational continuity.

However, to implement both methods optimally, the company needs to make several adjustments, such as improving its inventory planning system, strengthening the monitoring function, and improving coordination among related departments such as warehousing, purchasing, and management. Without the support of an integrated management system, the benefits of implementing EOQ and FIFO will not be optimal.

Thus, the results of this study show that although PT. XYZ has successfully implemented the FIFO method, there is still significant potential to improve inventory control efficiency through consistent implementation of the EOQ method. The integration of these two methods is believed to have a positive impact on company performance, both operationally and financially.

5. Closing

Conclusion

Based on the results of the research conducted at PT. XYZ as described above, it can be concluded that:

1. The implementation of the FIFO method in raw material inventory control has been carried out well. The company uses an inventory issuance system based on the order in which goods enter the warehouse, thereby minimizing the risk of raw material damage and expiration, particularly for fresh milk products.
2. The implementation of the EOQ method shows that the optimal order quantity is 492,610 pcs, with an ordering frequency of 3 times over 10 months. These results indicate that the company has not fully used economic calculations in determining raw material order quantities.
3. In terms of effectiveness, the FIFO method has proven effective in maintaining inventory quality and turnover, while the EOQ method is more effective in improving inventory cost efficiency. The combination of these two methods can provide more optimal inventory control, both in terms of quality and cost.

Suggestions

The following are several suggestions from the author for the business based on the research described above:

1. The business should reevaluate its current practices related to raw material inventory.
2. To minimize raw material costs, the business should establish safety stock, reorder points, and maximum inventory levels to prevent shortages and excess raw materials.
3. Instead of using manual techniques, the company should use the EOQ approach to calculate the overall cost of raw material inventory. This method can save money on raw material inventory.

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