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Improving Inventory Efficiency: A Case Study on the Application of Economic Order Quantity (EOQ) in Coffee Raw Material Management at PT. Toarco Jaya

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Abstract

This study aims to analyze and optimize the inventory control system of raw coffee bean materials at PT. Toarco Jaya Toraja Utara by applying the Economic Order Quantity (EOQ) model, along with Safety Stock and Reorder Point (ROP) calculations. The research adopts a quantitative descriptive approach using 2023 procurement and inventory data. The analysis reveals that the implementation of the EOQ method significantly reduces total inventory costs from IDR 4,395,696.33 to IDR 3,384,950.59 per year, achieving a cost efficiency of 22.99%. Moreover, the order frequency decreases from nine times to four times per year, indicating improved operational efficiency. The calculated safety stock of 225.88 kg and a reorder point of 516.30 kg further ensure inventory availability and continuity of production. These findings support the adoption of a data-driven inventory strategy, contributing to cost minimization and production reliability.

Keywords: Inventory Management, EOQ, Safety Stock, Reorder Point, Cost Optimization

1. Introduction

Inventory management is a crucial component of operational strategy, particularly in manufacturing industries where the availability of raw materials directly affects production continuity and profitability [1]. Raw material inventory, specifically in agribusiness sectors such as coffee production, plays a vital role in ensuring the stability of production processes and fulfilling market demands [2]. Poor inventory control can lead to either stockouts that disrupt production or excessive inventory that escalates holding costs and waste [3]. For companies engaged in seasonal agricultural commodities, inventory management becomes even more complex due to supply fluctuations influenced by weather, geography, and harvest cycles.

PT. Toarco Jaya Toraja Utara, a premium coffee producer in Indonesia, relies on Arabica coffee beans sourced from both local farmers and its own plantations. Despite the company's robust partnerships and commitment to quality, it faces challenges in maintaining optimal inventory levels due to the seasonal nature of raw material availability. As observed in the 2023 data, monthly procurement volumes fluctuated significantly, causing inefficiencies in inventory handling and increased costs related to storage and ordering. Without a scientific approach to determine order quantities, reorder timing, and buffer stock, the company risks production delays and increased operational costs [4].

The Economic Order Quantity (EOQ) model offers a solution by enabling firms to calculate the most cost-effective quantity of raw material to order, thereby minimizing the total cost of inventory which includes ordering and holding costs [3]. The integration of EOQ, Safety Stock, and Reorder Point (ROP) analysis can help companies like PT. Toarco Jaya optimize their inventory systems and support sustainable production cycles [5], [6]. In the case of PT. Toarco Jaya, implementing the EOQ method reduced annual inventory costs by approximately 23% and decreased order frequency from nine to four times per year, significantly improving operational efficiency.

In the current competitive global market for specialty coffee, maintaining consistent quality and supply is essential. PT. Toarco Jaya's success hinges not only on superior bean quality but also on the reliability of its supply chain and cost efficiency [7]. The absence of a structured inventory control method exposes the company to risks of

overstocking, understocking, and increased financial pressure. Therefore, this research is crucial in addressing the inefficiencies in inventory management by offering a data-driven approach through the EOQ model. The findings of this study are expected to provide empirical support for managerial decision-making and serve as a practical reference for similar agro-industrial firms aiming to enhance their inventory practices.

2. Research Methods

2.1 Research Problem Statement

Inventory control is a critical element in ensuring the continuity of production processes, particularly for companies in the agribusiness sector with seasonal raw material supplies. PT. Toarco Jaya Toraja Utara, a company that processes Arabica coffee beans, has experienced challenges in managing its raw material inventory effectively. Fluctuations in procurement quantities and the lack of a systematic ordering approach have resulted in inefficiencies, including high inventory holding costs and risks of stockouts.

Based on these conditions, the study aims to address the following research problems:

1. How can the company determine the most economical order quantity for raw coffee bean inventory to minimize total inventory costs?
2. What is the appropriate level of safety stock required to mitigate the risk of production disruption due to raw material shortages?
3. When is the optimal time for the company to reorder raw materials to ensure uninterrupted production?

These questions are intended to guide the analysis of the current inventory system and to evaluate whether the application of the EOQ, Safety Stock, and Reorder Point methods can enhance the efficiency and effectiveness of inventory control at PT. Toarco Jaya Toraja Utara.

2.2 Research Design

This research adopts a quantitative descriptive design [8], which aims to analyze empirical data related to the company's inventory management system. The approach emphasizes numerical analysis to determine optimal inventory levels, order frequency, and cost efficiency [9], [10]. The descriptive method is used to provide a clear overview of the current inventory control practices at PT. Toarco Jaya and to evaluate the potential improvements achievable through the implementation of EOQ, Safety Stock, and Reorder Point (ROP) models [11].

2.3 Population and Sampling Technique

The population in this study comprises all procurement and inventory records of raw coffee beans at PT. Toarco Jaya Toraja Utara for the fiscal year 2023. These records include data on the volume of purchases, storage costs, order frequency, and sourcing methods from both plantations and local farmers. A purposive sampling technique was applied to select data that are directly related to inventory control [12], [13]. This includes monthly procurement volumes, unit storage costs, and procurement intervals. The purposive approach ensures that the sample provides focused and relevant insights into the company's operational inventory challenges [14], [15].

2.4 Research Location and Time

The research was conducted at PT. Toarco Jaya Toraja Utara, located in North Toraja Regency, South Sulawesi, Indonesia. The company is a key player in the production and export of premium Arabica coffee. The research period extended from November 2024 to February 2025, during which primary and secondary data were collected. Primary data collection involved structured interviews and field observations, while secondary data were obtained from the company's internal documentation, including procurement logs, inventory reports, and cost records.

2.5 Data Analysis Technique

The study utilizes the Economic Order Quantity (EOQ) method as the core analytical tool to determine the optimal order size that minimizes total inventory costs, which comprise ordering and holding costs [3]. The Safety Stock calculation is applied to determine the minimum quantity of buffer inventory required to prevent production delays due to unexpected demand or supply fluctuations. In addition, the Reorder Point (ROP) method is used to identify the precise inventory level at which new orders should be placed to maintain uninterrupted operations. These

analytical techniques are integrated to assess the cost-effectiveness of the company's current inventory system and to propose a more efficient alternative supported by empirical data.

Economic Order Quantity (EOQ)

EOQ is used to determine the most economical order quantity so that total inventory costs (ordering costs and holding costs) are minimum [3].

$$EOQ = \sqrt{\frac{2 \times D \times OC}{CC}} \dots\dots\dots(1)$$

Where:

- EOQ = Economic Order Quantity (optimal order quantity per period)
- D = Demand or raw material needs per year (units/year)
- OC = Ordering Cost (ordering cost per order)
- CC = Carrying Cost or Holding Cost per unit per year (storage cost)

Reorder Point (ROP)

ROP is used to determine when a company should reorder to avoid raw material shortages [16].

$$ROP=(d \times L)+SS \dots\dots\dots(2)$$

Where:

- ROP = Reorder Point
- d = Average daily requirement (units/day)
- L = Lead time (order waiting time, in days)
- SS = Safety Stock

3. Results and Discussions

This section presents the findings of the study based on quantitative analysis of the inventory data collected from PT. Toarco Jaya Toraja Utara in the year 2023. The analysis focuses on addressing the research questions concerning the determination of the most economical order quantity, appropriate safety stock, and optimal reorder point for raw coffee bean inventory.

To determine the optimal order size, the Economic Order Quantity (EOQ) formula was applied. Based on the data, the annual demand for coffee beans was 81,317.90 kg, with an ordering cost of Rp 400,000 per order and a carrying cost of Rp 176.13 per kg per year. The calculation yielded an EOQ of 19,218.58 kg, indicating that the company should order this quantity of raw materials each time to minimize the total inventory cost.

The order frequency based on EOQ is approximately 4.23 times per year, which is a significant reduction from the company's current practice of ordering nine times annually. This reduction not only lowers the administrative and logistical burden but also results in considerable savings in ordering costs.

In terms of cost efficiency, the total ordering cost using EOQ is Rp 1,692,466.35, and the holding cost is Rp 1,692,484.24. The total inventory cost using the EOQ model is therefore Rp 3,384,950.59 per year, which is approximately Rp 1,010,745.74 (22.99%) lower than the company's existing cost of Rp 4,395,696.33.

To avoid production delays due to stockouts, a safety stock of 225.88 kg was calculated based on the company's daily demand and a one-day lead time. Accordingly, the reorder point (ROP), which determines when the company should place a new order, was calculated as 516.30 kg. This ensures that new inventory arrives just in time to replenish stocks before they run out, accounting for both expected usage and buffer inventory.

These results directly address the research problems stated earlier. The EOQ model provides a clear answer to the first question by determining the most economical purchase quantity. The calculation of safety stock offers a strategy to buffer against supply fluctuations, thereby answering the second question. Lastly, the reorder point calculation gives a precise metric for determining the timing of orders, fulfilling the third objective of the research.

In conclusion, the implementation of EOQ, Safety Stock, and ROP at PT. Toarco Jaya Toraja Utara can significantly enhance the efficiency and effectiveness of inventory control. It reduces costs, optimizes stock levels, and ensures production continuity—key factors in maintaining competitive advantage in the premium coffee market.

Table 4.1. Results of EOQ, Safety Stock, and Reorder Point Analysis

Parameter	Value
Total Demand (D)	81,317.90 kg
Ordering Cost (OC)	Rp 400,000
Carrying Cost (CC)	Rp 176.13/kg/year
Economic Order Quantity (EOQ)	19,218.58 kg
Order Frequency per Year	4.23 orders/year
Total Ordering Cost	Rp 1,692,466.35
Total Holding Cost	Rp 1,692,484.24
Total Inventory Cost (EOQ)	Rp 3,384,950.59
Safety Stock	225.88 kg
Reorder Point (ROP)	516.30 kg

Source: Primary data Processed (2025)

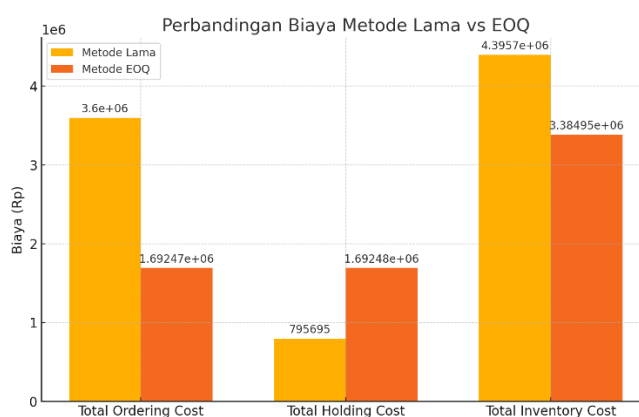


Figure 4.1 Comparison of Old Method Cost vs EOQ

4. Conclusion

This study aimed to optimize raw material inventory management at PT. Toarco Jaya Toraja Utara by applying the Economic Order Quantity (EOQ) method, Safety Stock, and Reorder Point (ROP) techniques. The primary objective was to reduce inventory costs while ensuring the continuity of production processes. The results show that the application of the EOQ method significantly reduced total inventory costs by approximately 22.99%, from IDR 4,395,696.33 to IDR 3,384,950.59 annually. The frequency of orders also decreased from nine to four orders per year, which not only reduced ordering costs but also streamlined inventory management.

The analysis of Safety Stock and Reorder Point further enhanced the inventory control system by addressing potential stockouts. By calculating a safety stock of 225.88 kg and a reorder point of 516.30 kg, the company can ensure timely replenishment of inventory, thus preventing production disruptions. These findings confirm that the EOQ method, when applied with complementary strategies like Safety Stock and ROP, can optimize inventory management in a cost-effective manner, which aligns with the research objectives. The hypothesis that applying EOQ would reduce inventory costs and improve operational efficiency is therefore accepted. The results provide compelling evidence for PT. Toarco Jaya Toraja Utara to adopt the EOQ method and integrate Safety Stock and

ROP in their inventory practices. This approach will not only reduce costs but also increase the reliability of their production processes, ultimately contributing to the company's competitiveness in the global coffee market. However, this study has some limitations. The data used was limited to the year 2023, and the analysis does not account for potential fluctuations in market demand or changes in supply chain dynamics. Future research could expand the scope to include data from multiple years and examine the impact of market variables such as price volatility and seasonal demand on inventory management practices.

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