Inventory Optimization Analysis Using the Economic Order Quantity (EOQ) Method at Pabrik Kerupuk Citra

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Abstract: This study aims to analyze the optimization of raw material inventory at the home industry Pabrik Kerupuk Citra, focusing on the optimization of Economic Order Quantity (EOQ), safety stock, lead time, and reorder point during the 2022 to 2024 period. The data used include annual demand, ordering costs, and holding costs, with the assumption of a three-day lead time and a 95% service level. The calculation results show that EOQ values increased each year, amounting to 1,837 kg in 2022, 1,673 kg in 2023, and 1,722 kg in 2024. This increase reflects adjustments to the dynamics of costs and raw material needs. In addition, safety stock also rose from 77.9 kg (2022) to 82.6 kg (2024), in line with the growth in daily demand. Nevertheless, the short lead time allows the company to maintain inventory efficiency with an optimal level of security. The reorder point was calculated proportionally to the raw material requirements, highlighting the importance of a timely reordering system. This study concludes that implementing the EOQ method integrated with the management of safety stock and reorder point can improve inventory cost efficiency and ensure a smooth production process. Strategic recommendations include regular monitoring of cost variables, demand, and delivery accuracy, as well as the implementation of an automated inventory control system.

Keywords: Inventory Optimization, Economic Order Quantity, Cost Accounting

INTRODUCTION

In the business world, particularly in the small and medium-scale manufacturing industry sector, inventory management plays a crucial role in maintaining operational continuity and cost efficiency. One of the critical aspects of operational management is how a company regulates the quantity and timing of raw material orders to ensure smooth production without delays or excess stock. Poorly managed inventory can lead to two major issues: overstocking and stockouts, both of which negatively affect costs and customer satisfaction (Heizer & Render, 2016).

Pabrik Kerupuk Citra, located in Serang, Banten, is one of the home industries engaged in the production of traditional snacks, particularly crackers. These crackers have relatively stable demand and are distributed across various regions, from local markets to areas outside the region. However, this business still faces challenges in optimally managing raw material inventory, such as tapioca flour, cooking oil, and seasoning ingredients. It is often found that raw material purchases are made without proper planning, leading to inefficiencies in storage costs and the risk of material shortages during high demand periods (Gaspersz, 2005).

To improve the efficiency and effectiveness of inventory management, one approach that can be applied is the Economic Order Quantity (EOQ) method. EOQ is one of the classical techniques in inventory management aimed at determining the most economical order quantity—that is, the purchase amount that minimizes the total inventory cost, which includes ordering and holding costs. By using EOQ, companies can determine how frequently and in what quantity they should order raw materials to optimize operational costs related to inventory (Gaspersz, 2005).

The application of EOQ at Pabrik Kerupuk Citra is particularly relevant given their limited capital and warehouse capacity. Through this approach, business owners are expected to plan raw material procurement more rationally, based on historical usage data and production needs. Additionally, this analysis can provide guidance in making strategic decisions such as order frequency, ideal delivery times, and buffer stock requirements to anticipate market demand fluctuations.

Nevertheless, to effectively implement the EOQ method, it is necessary to understand various cost components, such as fixed ordering costs per purchase, holding costs per unit of goods, and estimated annual demand. In the context of small businesses like Pabrik Kerupuk Citra, another challenge is the lack of systematic financial recordkeeping, which often hinders data-based decision-making. Therefore, this study also aims to determine the optimal inventory quantity to be maintained by Pabrik Kerupuk Citra to improve cost efficiency and inventory security, thereby achieving the company's profit and revenue goals.

RESEARCH METHOD
This research employs a case study approach on Pabrik Kerupuk Citra with the following methods:
1. Data Collection: Data were obtained through observation, interviews with the logistics department, and analysis of the company's inventory reports.
2. Analytical Method: A quantitative approach using Economic Order Quantity (EOQ) calculations to determine the optimal order quantity, along with descriptive analysis to evaluate the effectiveness of the current inventory system.

RESULT AND DISCUSSION
Economic Order Quantity (EOQ) Calculation
Pabrik Kerupuk Citra places raw material orders on a weekly basis, amounting to 48 orders per year. The data analyzed covers the period from 2022 to 2024.

Table 1. Demand and Inventory Cost Data

Year	Annual Demand (Kg)	Booking Fee per Order (Rp)	Storage Fee per Kg per Year (Rp)
2022	68.000	25.000	1.000
2023	70.000	30.000	1.500
2024	72.000	35.000	1.700

Formula used:

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

With:
- D: Annual demand (Kg)
- S: Order fee per order (Rp)
- H: Storage fee per unit per year (Rp)

EOQ Calculation Results
Year 2022: EOQ = √(2 × 68,000 × 25,000 / 1,000) = 58,310 Kg
Year 2023: EOQ = √(2 × 70,000 × 30,000 / 1,500) = 52,916 Kg
Year 2024: EOQ = √(2 × 72,000 × 35,000 / 1,700) = 54,449 Kg

Table 2. Order Quantity and Estimated Cost

Year	EOQ (Kg)	Number of Orders per Year	Estimated Total Inventory Cost (Rp)
2022	58.310	1.166	58.305
2023	52.916	1.323	79.377
2024	54.449	1.322	92.552

Calculation of Lead Time, Safety Stock, and Reorder Point

Assumptions used:
- Lead time (LT): 3 days
- Working days per year: 250 days
- Daily demand: d = D / 250
- Standard deviation of daily demand: σd = 10% × d
- Service factor (Z): 1.65 (for a 95% service level)

Formulas:
Safety Stock = Z × σd × √LT
Reorder Point (ROP) = (d × LT) + Safety Stock

Table 3. Reorder Point (ROP) Calculation Results

Year	Daily Demand (Kg)	Daily Std Deviation (Kg)	Safety Stock (Kg)	Reorder Point (Kg)
2022	272	27,2	77,9	893,9
2023	280	28,0	80,3	920,3
2024	288	28,8	82,7	946,7

Based on the analysis conducted in this study, the EOQ method shows that the ordering frequency increased from approximately 1.17 times in 2022 to around 1.32 times per year in 2023–2024. This indicates that more frequent raw material purchases could lead to increased production and sales. However, it is recommended that Pabrik Kerupuk Citra limit its orders to around 9–10 times a year, or about once every 1–2 months, to achieve a balance between ordering costs and holding costs.

With a lead time of three days, the company should maintain a smaller safety stock to reduce storage costs and the capital tied up in inventory. However, this short lead time requires a faster and more efficient procurement and logistics process. If the lead time can be further shortened, the company would gain more flexibility and save on inventory costs without risking raw material shortages.

The high reorder point in line with demand indicates the need for the company to routinely monitor inventory levels. Orders should be placed when stock approaches the ROP to avoid raw material shortages during the lead time. An automated inventory control system or a visual reorder alert can be very helpful in ensuring timely ordering.

CONCLUSION
This study demonstrates that optimal inventory management can improve operational efficiency and reduce storage costs. The implementation of the EOQ model has proven effective in significantly lowering holding costs. Therefore, the company is advised to:
1. Recognize that the EOQ model is effective in finding the optimal balance between ordering frequency and storage costs.
2. Ordering too infrequently (e.g., once per year) leads to significantly higher holding costs.
3. Ordering too frequently (e.g., twice per month) results in a considerable increase in ordering costs.
4. By following the EOQ approach, the company can minimize total inventory costs and manage stock more efficiently.

REFERENCES
[1] Gaspersz, V. (2005). Production planning and inventory control for manufacturing and services. Jakarta: Gramedia Pustaka Utama.
[2] Mulyadi. (2015). Akuntansi biaya (Edisi ke-5). Jakarta: Salemba Empat.
[3] Hansen, D. R., & Mowen, M. M. (2009). Managerial accounting (8th ed.). South-Western Cengage Learning.
[4] Heizer, J., & Render, B. (2016). Operations management (11th ed.). Pearson Education.
[5] Putra, A. R., & Lestari, D. (2020). Analisis pengendalian persediaan bahan baku dengan menggunakan metode EOQ pada UMKM Keripik Singkong di Kabupaten Sleman. Jurnal Ilmiah Manajemen, 8(2), 112–121.
[6] Yamit, Z. (1999). Manajemen persediaan. Yogyakarta: Ekonisia.

[7] Yuliana, S., & Firmansyah, D. (2018). Penerapan metode EOQ untuk efisiensi pengadaan bahan baku pada industri makanan tradisional. Jurnal Manajemen dan Bisnis, 5(1), 33–41.