ANALYSIS OF RAW MATERIAL INVENTORY CONTROL FOR FROZEN FOOD BUSINESS USING EOQ (ECONOMIC ORDER QUANTITY) METHOD CASE STUDY IN PT TANABE FOOD

ANALISIS PENGENDALIAN PERSEDIAAN BAHAN BAKU PADA USAHA MAKANAN BEKU DENGAN MENGGUNAKAN METODE EOQ (*ECONOMIC ORDER QUANTITY*) STUDI KASUS DI PT TANABE FOOD

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Diterima 24 Oktober 2025/ Disetujui 8 Desemebr 2025

ABSTRACT

One of the challenges faced by PT Tanabe Food is the imbalance between the required and available raw material inventory. This study aims to determine whether the Economic Order Quantity (EOQ) method can optimize raw material procurement according to market demand, while minimizing ordering and storage costs. Data were collected through interviews, observations, and documentation of the company's purchasing and inventory records. The data were processed using the EOQ formula and business analysis. Based on calculations using the EOQ method, the optimal raw material usage per period is approximately 56,952.5 kg, with an ordering frequency of between 12 and 13 times, a safety stock of 430.3 kg, a reorder point of 860.6 kg, and a total inventory cost of IDR5,356,168. In contrast, the company's current policy results in raw material usage per period of 61,964 kg, with an ordering frequency of 96 times, no safety stock, and uncertainty at the reorder point, resulting in a total inventory cost of IDR87,281,408. These results indicate that the use of the EOQ method can significantly reduce total inventory costs and provide better control over order quantity, order frequency, and stock availability. Therefore, PT Tanabe Food is recommended to adopt the EOQ method to improve inventory management efficiency, minimize the risk of stockouts or excess stock, and support more efficient and cost-effective production planning.
Keywords : *production cost; purchasing; reorder point; safety stock*

ABSTRAK

Salah satu tantangan yang dihadapi oleh PT Tanabe Food adalah ketidakseimbangan antara persediaan bahan baku yang dibutuhkan dan yang tersedia. Penelitian ini bertujuan untuk mengetahui apakah metode *Economic Order Quantity* (EOQ) dapat mengoptimalkan pengadaan bahan baku sesuai dengan permintaan pasar, sekaligus meminimalkan biaya pemesanan dan penyimpanan. Data dikumpulkan melalui wawancara, observasi, dan dokumentasi catatan pembelian dan persediaan perusahaan. Data diolah dengan menggunakan rumus EOQ dan dianalisis bisnisnya. Berdasarkan perhitungan menggunakan metode EOQ, penggunaan bahan baku yang optimal per periode adalah sekitar 56.952,5 kg, dengan frekuensi pemesanan antara 12 hingga 13 kali, stok pengaman sebesar 430,3 kg, titik

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pemesanan ulang di angka 860,6 kg, dan total biaya persediaan sebesar Rp5.356.168. Sebaliknya, kebijakan perusahaan yang diterapkan saat ini menghasilkan penggunaan bahan baku per periode sebesar 61.964 kg, dengan frekuensi pemesanan mencapai 96 kali, tanpa adanya stok pengaman, dan ketidakpastian pada titik pemesanan ulang, sehingga total biaya persediaan mencapai Rp87.281.408. Hasil ini menunjukkan bahwa penggunaan metode EOQ dapat secara signifikan mengurangi total biaya persediaan dan memberikan kontrol yang lebih baik terhadap jumlah pesanan, frekuensi pemesanan, serta ketersediaan stok. Oleh karena itu, PT Tanabe Food disarankan mengadopsi metode EOQ untuk meningkatkan efisiensi pengelolaan persediaan, meminimalkan risiko kehabisan stok atau kelebihan stok, serta mendukung perencanaan produksi yang lebih efisien dan hemat biaya.
Kata kunci : biaya produksi, pembelian, titik pemesanan ulang, stok pengaman

INTRODUCTION

Raw material inventory plays a critical role in the supply chain, particularly in the agroindustrial sector such as the frozen food industry, where production heavily depends on the timely availability of perishable inputs. Therefore, every company needs to implement an appropriate control system so that raw materials remain available when needed (Sulistyowati and Huda, 2021). A well-managed inventory system helps maintain a balance between production capacity and raw material supply, which is crucial for operational stability. Thus, if the raw material inventory system is good and precise (neither less nor more), it will minimize the costs incurred (Daud, 2017). Improving raw material inventory control is a strategic necessity for enhancing efficiency and competitiveness in agroindustrial businesses.

Inventory is one of the common problems often faced by SMEs, including PT. Tanabe Food. PT. Tanabe Food, which is located in Pasir Putih Village, Sawangan District, Depok City. This business focuses on processing raw materials to create finished or ready-to-eat products. Fluctuations in revenue each year varies amd product sales require PT. Tanabe Food to implement a proper raw material inventory. The average daily income of PT. Tanabe Food is from 2.5 million- 3 million (90 million/month). During the COVID-19 pandemic, the monthly revenue turnover increased dramatically by 400% in otak otak ikan product. This condition makes PT. Tanabe Food require a qualified raw material inventory system.

Fluctuating consumer demand, paying attention to the proper raw material inventory, adjusting the purchase time to the production process, and determining the amount of raw material purchases according to factory needs are necessary. So far, the frozen food business has been running using traditional methods only, namely placing orders with estimates without proper planning (Mu'alifah et al., 2023). The weakness of the traditional method is the inaccuracy of raw material inventory with production scheduling, hampering the production process with results that do not meet the operating target (Caronge, 2019). The traditional inventory method poses significant challenges that impact cost, efficiency, and customer satisfaction. Overstocking often occurs due to poor visibility, tying up capital in excess inventory and increasing storage costs. Understocking, on the other hand, leads to missed sales and disappointed customers due to unfulfilled demand. One inventory method that is quite simple and can be implemented in the company is EOQ (Economic Order Quantity). This method is well-suited for inventory management in small and medium enterprises (SMEs) due to its simplicity and cost effectiveness. The EOQ method aims to help companies maintain economic raw material expenditure costs when ordering. In addition, Adzaky et al. (2024) states that companies can determine the adequate ordering time and how much raw material needs to be ordered each time if using the EOQ method. On the other hand, the advantage of the EOQ method is that it can avoid

shortages and accumulation of raw material inventory in the warehouse so that the production process in each company will not be disrupted (Jaber and Peltokorpi, 2025).

The Economic Order Quantity (EOQ) method is one of the methods that can be applied to inventory control, this method is able to minimize the occurrence of out of stock so that it can save storage costs and ordering costs. The EOQ method analysis can calculate how much safety stock the company must provide to avoid inventory shortages, and find the reorder point that the company must do. Previous research on pork inventory control using the EOQ method by Luswiantini et al. (2023) conducted at PT. XYZ provides sufficient raw materials and there is no shortage of inventory so that there is no delay in orders, and can increase cost efficiency. Another research using the EOQ method conducted by Cahyadewi et al., (2020) regarding Body Scrub Powder inventory control at CV. Denara Duta Mandiri, the highest total inventory cost savings were in plastic raw materials of 58.94%. There is still a lack of studies that explore the implementation of EOQ in small scale frozen food businesses in Indonesia, which often face unique challenges such as limited storage capacity, fluctuating demand, and constrained capital. Therefore, this study will applied EOQ to improve raw material inventory control in PT. Tanabe Food. According to Susanto (2018) applying the EOQ method in the company can minimize the cost of expenses when ordering raw materials for a year. This is because, applying the EOQ, the ordering and storage costs for a year will be the same, so the company does not need to calculate the planning of ordering raw materials every time. Therefore, the EOQ method is important in the company's progress. Based on the description above, the general objective of this study is to analyze the proper control of raw material inventory at PT Tanabe Food (frozen food) using the EOQ method to improving cost efficiency.

METHODS

This research was conducted at PT. Tanabe Food in Pasir Putih Village, Sawangan District, Depok City. This research uses transaction data and raw material inventory data of PT. Tanabe Food SMEs from July 2022 to June 2023. In addition, primary data was obtained through observations and interviews with the owner operations or production manager, purchasing staff, warehouse staff, and sometimes suppliers to gather insights on inventory management, procurement practices, and supply chain challenges. The research flow is presented in Fig 1.

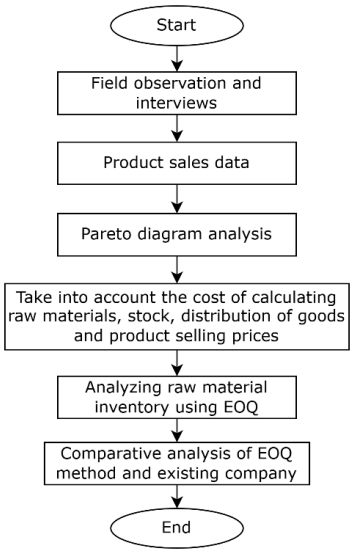

Fig 1. Research flow raw material inventory control using EO

a. Pareto Diagram Analysis
This research begins with the analysis and calculation of products at PT Tanabe Food. Furthermore, understanding how each product contributes to the total sales and maximizing the business strategy using the Pareto Chart. The data processed is the production and sales data of 7 PT. Tanabe Food products (bakso tahu walik sapi dan ayam 500 gram; bakso tahu walik sapi 400 gram; bakso tahu walik sapi dan ayam 300 gram; otak otak ikan, chicken roll, dan cilok sapi) per month from July 2022 to June 2023. Pareto Chart determines the products that have the most influence on total sales based on the 80/20 principle, which is about 80% of the results are generated by 20% of the leading causes (Marshall, 2013). The 80% result is then analyzed because it already represents the number of products sold by knowing the product's raw materials. The results of the Pareto chart analysis are continued by calculating the inventory of raw materials using the EOQ method.

b. Economic Order Quantity (EOQ)
There are several calculation steps for inventory analysis using EOQ data as follows (Chopra & Meindl, 2016) :

1. Controlling raw material inventory with the calculation of EOQ

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

Description:
EOQ : Optimal purchase quantity
S : Ordering cost per order
D : Raw material usage per year
H : Storage cost per unit

2. Safety Stock (SS)
SS = average delay of material per day x raw material requirement per day
   a) The average delay refers to the lead time variability, which was measured by calculating the average number of days of delivery delay based on supplier performance records over the past 6 months.
   b) The raw material requirement per day was obtained by dividing the total monthly raw material usage by the number of operational days in a month, under the assumption that daily demand is relatively constant.
3. Reorder Point
Reorder Point = (d x L) + SS
Description:
d : raw material requirements during lead time
L : Lead time
SS : Safety stock
4. Total Inventory Cost

$$TIC = D/Q \; . \; S + Q/2 \; . \; H$$

Description:
TIC : Total inventory cost
D : Total raw material usage
Q : Quantity
S : Ordering cost each time
H : Storage cost

RESULT AND DISCUSSION

Pareto Diagram Analysis

PT. Tanabe Food has seven products that have been widely distributed and are still being produced today. The amount of consumer demand each year is always different. This also happened in December 2022-November 2023; four products' percentage levels were higher than the other three. The leading product category with the highest demand is at a cumulative percentage of 80%, each of which can be taken for research because it meets the 80% Pareto diagram criteria. This theory according by The Pareto Principle By J.M. Juran that 80-20 rule can applied in various situation for improving business productivity especially in this research 80% total sales caused 20% efficiency in management including inventory and product (Dunford et al., 2014). The explanation of the Pareto diagram is a diagram used to identify and sort from the highest to the smallest value. Pareto diagrams are also used to help management quickly so that researchers can determine which products need attention first (Chopra and Meindl, 2016). All products that fall into the 80% percentage can be continued for calculations in this study. These products include Bakso Tahu Walik Sapi and Chicken (500 grams) with a sales contribution of 20.85%, Bakso Tahu Walik Sapi (400 grams) at 20.22%, Bakso Tahu Walik Sapi and Chicken (300 grams) at 17.54%, Otak-Otak Ikan at 12.68%, and Chicken Roll at 12.28%. The calculation results highlight that these five products represent 80% of the highest sales for the year 2022-2023. Therefore, this research focuses on these five key products, as illustrated in the Pareto diagram of PT Tanabe Food in Fig. 2.

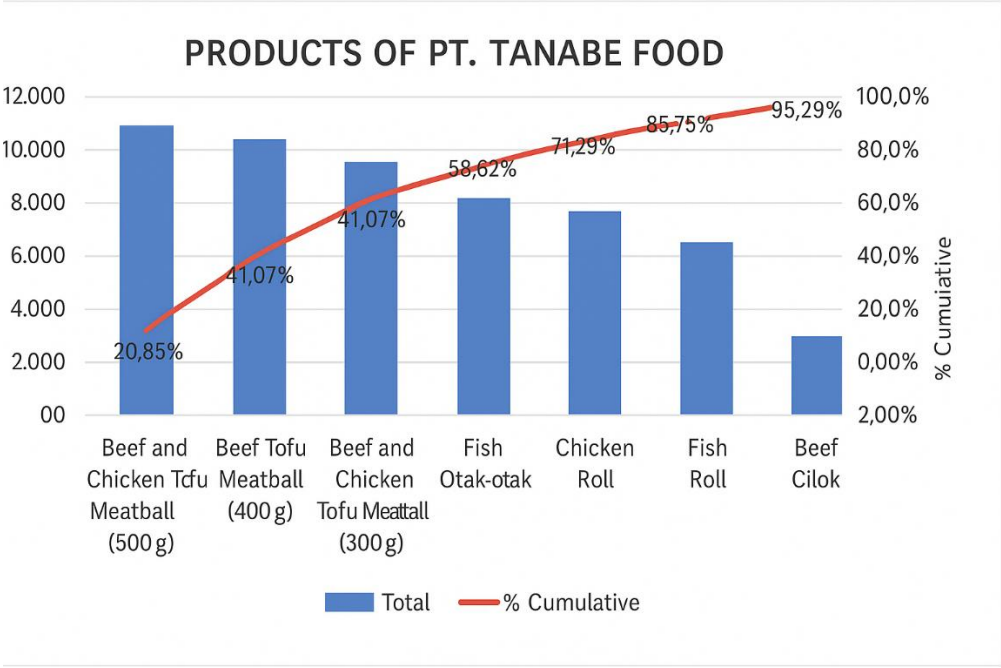

Fig 2. Pareto Diagram of PT. Tanabe Food

Business Process

The raw material inventory process at PT. Tanabe Food begins with ordering raw materials from suppliers, followed by quality and quantity checks conducted by employees. These materials are then stored in the warehouse before entering the production stage and eventually being distributed as finished products. The company's business activities are structured into four main parts: procurement and handling of raw materials, processing into finished products, product sales, and distribution to

consumers. However, inefficiencies such as overstocking, understocking, and delays in procurement have been observed in these stages, indicating a need for improved inventory control. Implementing the EOQ method at each step can help simplify ordering schedules, reduce holding costs, and ensure raw materials are available in optimal quantities to support continuous production and timely delivery. The business process of PT. Tanabe Food is illustrated in Fig. 3.

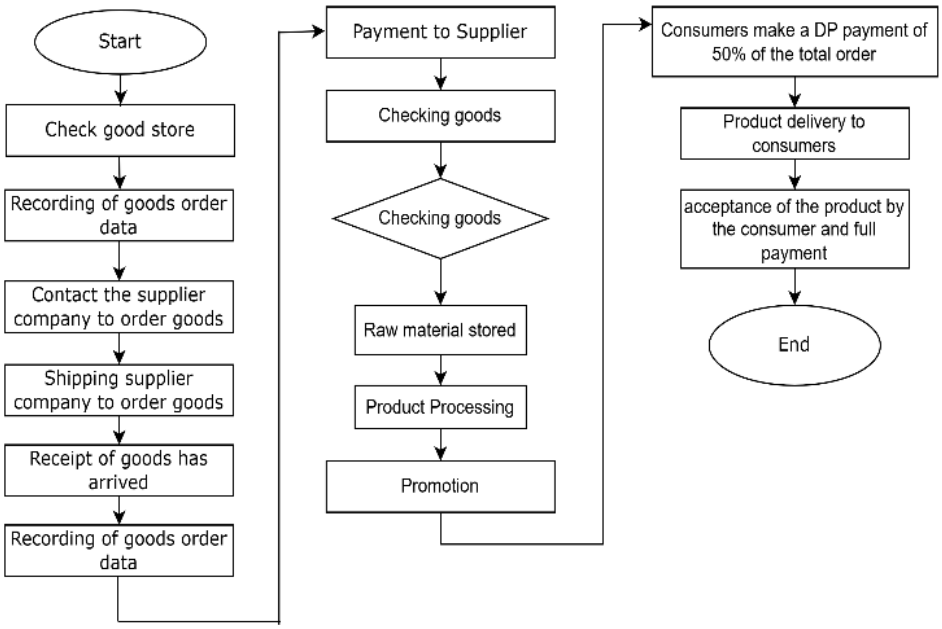

Fig 3. Flowchart of Business Process at PT. Tanabe Food

Raw Material Inventory Control at PT. Tanabe Food Using EOQ

Based on interviews with the owner and production staff of PT. Tanabe Food, the company operates as a sole proprietorship, founded and managed by a single individual. As a small scale business specializing in frozen food production using raw materials such as chicken, beef, and wheat flour, inventory decisions are often made directly by the owner without formalized systems. The company currently procures raw materials twice a week, or approximately eight times a month, from various suppliers in Depok. This informal decision-making structure may lead to inefficiencies such as inconsistent order quantities and excess stock, as seen in the accumulation of raw material surplus in mid-2023. Table 1 According to Irfan Fahmi (2016), the EOQ (Economic Order Quantity) method offers a systematic approach to determine optimal order quantities, which could assist SMEs like PT. Tanabe Food in cost efficient inventory decisions.

Storage and Ordering Costs

Storage costs refer to expenses incurred to maintain raw material inventory in good condition, including electricity, labor, warehouse maintenance, and property tax (Verencia, 2022). Meanwhile, ordering costs are expenses related to raw material procurement, varying based on order frequency, and include telephone, administrative, and transportation costs (Herman, 2022). Based on direct observations at PT Tanabe Food, these costs play a crucial role in the company's inventory management.

Table 1. Raw Material Procurement Data

No	Month	Amount (kg)	Usage (kg)	Remainder (kg)
1	Desember 2022	5,148	5,130	18
2	Januari 2023	5,070	5,050	20
3	Februari 2023	5,084	5,070	14
4	Maret 2023	5,114	5,094	20
5	April 2023	5,214	5,200	14
6	Mei 2023	5,254	5,250	4
7	Juni 2023	5,280	5,180	100
8	Juli 2023	5,240	5,140	100
9	Agustus 2023	5,400	5,100	300
10	September 2023	5,172	5,150	22
11	Oktober 2023	5,346	5,300	46
12	November 2023	5,318	5,300	18
	Total	62,640	61,964	676

Note: This table shows the total amount of raw materials used per month, which is the sum of various types of raw materials used in production.

Table 2. Storage and Ordering Costs

No	Ordering Cost (per year)	Amount (IDR)
1	Telephone cost	2,256,000
2	Administration cost	600,000
3	Transportation cost	18,000,000
	Total cost	20,856,000
No	Storage Cost (per year)	Amount (IDR)
1	Electricity cost	7,200,000
2	Labor cost (3 employee)	57,600,000
3	Warehouse maintenance cost	600,000
4	PBB Cost	1,000,000
	Total cost	66,400,000

Source: the results of an interview with the owner of PT. Tanabe Food

The company incurs a total annual ordering cost of IDR 20,856,000. This cost is composed of three main elements: telephone expenses amounting to IDR 2,256,000, administrative expenses of IDR 600,000, and transportation costs totaling IDR 18,000,000, which form the largest portion of the ordering activities. These components reflect the operational efforts required to coordinate and execute the procurement of raw materials throughout the year. In addition, the annual storage cost reaches IDR 66,400,000. This figure includes several expense categories, such as electricity costs of IDR 7,200,000, labor wages for three warehouse employees amounting to IDR 57,600,000, warehouse maintenance expenses of IDR 600,000, and property tax of IDR 1,000,000. Labor costs represent the most significant share, highlighting the intensive human involvement required in managing warehouse operations. Overall, the comparison between ordering and storage costs shows that storage activities demand a substantially higher financial commitment, driven primarily by labor and facility upkeep. This insight is important for evaluating inventory management efficiency and identifying opportunities for cost optimization.

Existing Raw Material Inventory Costs of the Company

Based on Company Policy The company policy applied in raw material inventory certainly adjusts the number of consumer orders. The number of orders received and the raw material inventory will increase, and if there is a decrease in orders, the company will reduce the level of raw material

inventory. Another reason for the fluctuating raw material inventory is the company's lack of storage. Therefore, the cost of raw material inventory the company issues is IDR 87,281,4408.

Raw Material Inventory Costs using EOQ

Based on calculations using the EOQ method, PT. Tanabe Food can order a raw material inventory of 5,011.5 kg/ year. The data includes the total consumption of raw materials such as chicken, beef, wheat flour, and others, but it is not broken down by each type of raw material. Therefore, the numbers shown in the Table 1 represent the total raw material usage for all types combined during the specified period. The raw material inventory required by the company is adjusted to an economic calculation so that the costs incurred will be as minimal as possible (Lahu et al., 2017). The purchase frequency obtained during the calculation is 12 times purchases a year. The raw material required at PT. Tanabe Food using EOQ is 56,952.5 kg. The difference with company policy is slightly different. In the calculations applied by the company, uncertain estimates are 61,964 kg, with a very high purchase frequency of 96 times orders a year. By adopting EOQ method, PT. Tanabe Food could not only reduce the number of purchase frequency by 77,78% but also lower transportation expenses and better planning of storage space to accomodate more optimal inventory levels. According to (Claassen et al., 2024), companies with a small frequency of purchases and consistently carrying out will save on costs. In addition, the company will save raw material inventory space because the amount of raw material inventory has been done optimally (no less and no more**).** The safety stock obtained during the calculation is 430.3 kg. So far, there is no minimum stock limit for the production process. When there is a shortage of raw materials, the company will use the remaining safety stock without a clear inventory. The remaining raw materials are obtained if the company has excess stock in the previous month. Taleizadeh (2014) explains the companies must apply safety stock according to consumer needs and demand so that the production process runs smoothly. This is also to avoid a shortage of raw materials during production, especially if there is uncertain or unpredictable consumer demand based on orders.

The safety stock calculation that was previously known, the reorder point required by PT. Tanabe Food, is 860.6 kg. The company has been reordering raw materials using only estimates, so the amount of raw materials is uncertain. This lack of precision can result in either stockouts or overstocking, which increases inventory cost, holding cost and risks spoilage, particularly for perishable goods. According to Jambak et al. (2017), companies that implement calculations at the right reorder point will help monitor inventory items so that when ordering raw materials again, the raw materials will arrive on time. The inventory costs PT. Tanabe Food incurred using storage and ordering costs, are IDR 5,356,168, the cost is much different from the calculation based on company policy. The inventory cost before using EOQ is IDR 87,281,408, but when the company applies the calculation with EOQ, the company gets the costs incurred smaller than before (Ratnani et al., 2024).

The cost efficiency achieved by the company through the implementation of the EOQ method is IDR 81,925,240, representing a significant reduction that contributes directly to improved profitability. The cost efficiency incurred by the company is IDR 81,925,240. This cost efficiency is quite high for the company's benefits. Therefore, calculations with EOQ are very influential for the company's progress in getting high profits, so companies must properly apply this calculation method (Fithri at al., 2019). Based on existing calculations, the company will experience a decrease in profit if it cannot control the correct supply of raw materials; therefore, PT. Tanabe Food needs to pay attention to the smooth supply of raw materials according to the EOQ method.

Comparison of EOQ and Existing Methods

During production, PT. Tanabe Food plans raw material inventory according to company policy.

The raw material inventory planning process is only by estimation without proper planning and according to company needs (Robby and Shah, 2020). Estimates for the raw material inventory usually wait for the raw materials to run out or for just a few to be left; this is done because the company does not have a significant raw material storage area. Besides that, there is often an unexpected frequency of consumer demand has resulted in the company being unable to overcome these problems (Chopra & Meindl, 2016). A comparison of the calculation of raw material inventory for the EOQ and existing methods is presented in Table 3.

Table 3. Comparison of raw material inventory calculations of EOQ and existing methods

No.	Component	Existing Company	EOQ Method
1	Raw material Usage per period	61,964 kg	56,952.5 kg
2	Frequency of purchase	96 times	13 times
3	*Safety stock*	-	430.3 kg
4	*Reorder point*	Uncertain goods	860.6 kg
5	The total cost of raw material inventory	IDR 87,281,408	IDR5,356,168

Table 3 explains that the total use of raw materials at PT. Tanabe Food based on company policy is 61,964 kg, which, when ordering raw materials, has a purchase frequency of 96 times in one year. The company also does not have safety stock, and when making a reorder, point only with estimates; the goods that come are uncertain. This makes the cost of raw material inventory incurred by the company huge, which is worth IDR 87,281,408.

Calculations using the EOQ method produce significant differences; the company can use raw materials per period of 56,952.5 kg, whereas the frequency of purchasing raw materials is only 13 times a year. The company can also apply a safety stock of 430.3 kg and a reorder point of 860.6 kg, and the total cost of raw material inventory issued is IDR 5,356,168. Based on the calculations that have been carried out, the comparison of the total cost of raw material inventory between company policies and using the EOQ method is IDR 81,925,240. The difference in the costs incurred before using the EOQ method is huge. On the other hand, applying the EOQ method at PT. Tanabe Food is very helpful for the company's progress and profits every period, especially with the minimized raw material inventory; the cost expenditure will be lower (Ratnani et al., 2024). This can also be seen in previous studies that compared calculations using the EOQ method with calculations based on company policies (Michel, 2014). Several previous studies have demonstrated the effectiveness of the Economic Order Quantity (EOQ) method in improving inventory planning across different industries. For example, Simbolon and Yoga (2024), find out what types of fresh fruit raw materials have the highest demand, to find out the planning and calculation of raw material demand inventory at PT. XYZ Unit Denpansar. Research results, fresh fruit raw materials of watermelon with optimal quantity results of 375 kg for seven orders, pineapple 443 kg for nine orders, while papaya 392 kg for eight orders. Meanwhile, research by Wikantari et al (2018), using the EOQ method for planning Chitato product orders at PT. Kembar Putra Makmur, shows that the highest Chitato inventory is the Beef Barbeque flavor with a purchase frequency of 20 orders in one year. Similarly, at PT. Semen Baturaja, EOQ helped reduce inventory costs for cement bag raw materials by over IDR 5 million compared to existing company practices. The study has explained that by applying the EOQ method to the company, the company will get higher profits when compared to the application of calculations

based on company policy (Fithri et al., 2019). While these studies highlight EOQ's benefits in reducing costs and improving order planning, they primarily focus on large or medium-scale enterprises with relatively stable supply chains. In contrast, the present study contributes a unique perspective by applying EOQ in a small scale frozen food business where resource limitations, uncertain demand, and manual decision-making present more complex challenges. This research not only confirms EOQ's cost-saving potential but also expands its relevance to the agroindustrial field.

CONCLUSIONS

The comparison of total raw material inventory costs shows a substantial difference IDR 87,281,408 under the company's current approach versus only IDR 5,356,168 using the EOQ method. This result can reduce the frequency of raw material orders from 96 times to 13 times in one year. This is because PT. Tanabe Food now has safety stock, which it did not have before. The application of the EOQ method not only reduces operational costs but also enhances decision making accuracy, ensures timely raw material availability, and supports production continuity as critical factors for business sustainability. However, this study is limited by its focus on a single case with static demand assumptions and does not considering for external factors such as seasonal variability or supply chain disruptions. Future research should incorporate dynamic modeling and evaluate EOQ performance under fluctuating demand and lead time scenarios. Overall, this study contributes to agroindustrial operations research by demonstrating the practical value of EOQ implementation in small frozen food businesses and highlights its potential to strengthen supply chain efficiency.

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