

Implementation of Economic Order Quantity (Eoq) In Inventory Management: A Case Study of Chopfee Coffee Shop

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Abstract

Inventory management is a critical aspect of operational success for businesses, including the food and beverage industry. This study aims to analyze the application of the Economic Order Quantity (EOQ) method to optimize raw material inventory management at Chopfee, a coffee shop business. This research adopts a quantitative descriptive approach to systematically collect and analyze data. Data were gathered from Chopfee's internal records, including information on ordering costs, storage costs, and the quantity of supplies used for operations. The EOQ method was employed to determine the optimal order quantity to minimize inventory-related costs. The findings indicate that Chopfee currently uses conventional methods for inventory management. By implementing the EOQ method, inventory costs could be reduced from IDR 2,392,357 to IDR 677,170, representing a 71.7% cost reduction (IDR 1,715,186). This demonstrates the potential for significant cost savings and profit optimization through improved inventory management practices. The study highlights the importance of adopting the EOQ method to address inefficiencies in inventory management, enabling Chopfee to enhance long-term profit margins while better aligning with customer demand and operational constraints. This research provides actionable insights into the benefits of integrating the EOQ method for inventory management in small-scale businesses within the food and beverage sector, offering a pathway for enhanced efficiency and profitability.

Keywords: Economic Order Quantity, Inventory Management, Reorder Point, Coffee.

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1. Introduction

Inventory management activities have become an essential part of business operations. The availability of inventory and raw materials significantly affects production stability, particularly production costs. Companies must ensure product availability to anticipate increased sales of goods [1]. Therefore, product control activities, such as inventory checks and the separation of defective goods, are crucial to prevent potential adverse events [2]. On the other hand, companies are also compelled to minimize unnecessary costs. Consequently, companies face the challenge of optimizing raw material availability to maintain production stability [3].

This phenomenon also occurs in the café business in Indonesia. The growth of the coffee café industry in Indonesia has driven the sector to manage its business processes at a higher level, including inventory management. One of the main challenges faced by café businesses in planning optimal inventory management is regulating the quantity of inventory. Excess raw materials can lead to expiration issues, which may result in financial losses for business owners.

Chopfee is a coffee shop established in 2019 in Cibubur, Depok. As a business in the food and beverage sector that sources raw materials such as coffee, toppings, and additional flavorings from various regions, Chopfee also faces inventory

challenges. These challenges include ensuring the availability of raw materials at the right time and in the right quantities. The company's business growth is supported by the significant development of the culinary industry in Indonesia. This has impacted the frequency of raw material purchases, which occur three to four times monthly for each type of raw material. The procurement of raw materials is carried out through orders placed with suppliers, all of whom are local suppliers.

The management of raw material inventory at Chopfee is still conducted using simple methods based on market demand. This approach occasionally leads to either shortages or surpluses of raw materials, which can disrupt the production process. One effort to optimize inventory management at Chopfee is by implementing the Economic Order Quantity (EOQ) method. This inventory model, proposed by Harris (1913), aims to minimize total costs, including holding and ordering costs without experiencing the shortages. The purpose of utilizing this model is to determine the optimal order quantity and inventory levels that maximize company profits [5]. The application of this model can reduce total company costs [6]. The EOQ model is an example of a Push Inventory System [1].

Various studies of EOQ application in coffee shop have been conducted. EOQ has been applied with continuous review in order to find the optimum supply of ingredients in café [7], [8], [9]. It also has been

applied in optimizing the inventory management in SMEs such as in Kafe La Jom [10]. All of the studies shows that the application of EOQ can effectively reduce the inventory cost and optimizing the inventory management of the company.

Therefore, this study focuses on Chopfee to address issues related to inventory discrepancies that may affect customer satisfaction by applying the EOQ in its inventory management. The objective of this research is to achieve optimal raw material inventory levels while minimizing storage and inventory management costs. To achieve this goal, the study analyzes raw material inventory management by applying the Economic Order Quantity (EOQ) method. The EOQ method is an inventory management technique aimed at minimizing total ordering and holding costs, thereby optimizing the company's expenditures on inventory [11]. Furthermore, this method is also designed to address issues regarding the minimum order quantity required by suppliers.

2. Research Method

This research is applied research. The type of data used is secondary data obtained from Chopfee's management. The data used is primary data from the raw material purchases made by the Chopfee coffee shop during February to December 2023.

2.1. Economic Order Quantity (EOQ)

EOQ determines the optimal purchase quantity to minimize the costs of acquiring raw materials [12]. This study will use the EOQ model based on Hansen & Mowen (2007), which can be calculated using the following formula:

$$EOQ = \sqrt{\frac{2 \cdot D \cdot OC}{CC}}$$

Where:

- EOQ: Economic Order Quantity
- D: Estimated raw material usage per period
- OC: Ordering cost
- CC: Carrying cost

In applying this model, several assumptions are used. First, the raw material demand must be known with certainty, constant, and unaffected by other factors. Second, the lead time, which is the waiting time between ordering and receiving the goods, must be known and constant. Third, raw materials must be received on time and in full. Fourth, researchers must ensure that no discounts are given due to reduced inventory levels. Fifth, variable costs consist only of ordering and carrying costs for stored goods. Lastly,

timely ordering and receiving raw materials can avoid stockouts [2].

2.2. Calculation of Total ordering Cost (TOC)

Total ordering cost (TOC) refers to the costs incurred each time raw materials are ordered and delivered to the destination. ordering cost can be calculated using the following formula:

$$TOC = \frac{D}{Q} \times OC$$

- Q : Average raw material demand
- D : Raw material demand during one period
- OC : Ordering cost

To calculate the average quantity of raw material demand, the following formula is used:

$$Q = \frac{D}{F}$$

Where:

- Q : Average raw material demand
- D : Raw material demand during one period
- F : Frequency of ordering per period

2.3. Calculation of Total Carrying Cost (TCC)

Total carrying cost is the cost incurred due to stored inventory [12]. Based on Hansen & Mowen (2007), the formula for total carrying cost is as follows:

$$TCC = \frac{Q}{2} \times CC$$

Where:

- Q : Average raw material demand
- D : Raw material demand during one period
- CC : Carrying cost

2.4. Calculation of Total Inventory Cost (TIC)

Total inventory cost (TIC) is the total cost incurred by the company [13]. TIC is used to determine the total cost incurred by the company, including purchasing costs, ordering costs, and carrying costs. According to TIC can be calculated using the following formula:

$$TIC = TOC + TCC$$

Where:

- TIC : Total Inventory Cost
- TOC: Total Ordering Cost
- TCC: Total Carrying Cost

2.5. Calculation of Safety Stock

Safety stock refers to additional inventory kept as a buffer to handle fluctuations in demand [6,14]. Determining the amount of safety stock should involve statistical analysis, considering the deviation between ideal raw material quantities and actual conditions [14], [15]. Safety stock is useful in protecting the company from the risk of running out of raw materials, delays in supply, and unexpected demand surges [3]. According to safety stock can be calculated as follows [6]:

$$\text{Safety Stock} = \text{Lead time} \times (\text{maximum} - \text{average usage})$$

2.6. Calculation of Reorder Point

The reorder point (ROP) is a component of the EOQ model calculation. ROP identifies the optimal time to place an order for raw materials to avoid stockouts [6]. In practice, ROP calculation must be done accurately and promptly, considering both order timing and order quantity [16]. Problems may arise if a company does not calculate ROP correctly; delays in placing ROP will lead to material shortages, while placing ROP too early will incur additional transportation costs [17]. According to [6], ROP can be calculated using the following formula:

$$\text{ROP} = \text{Rate of usage} \times \text{Lead time} + \text{safety stock}$$

2.7. Calculation of Reorder Time

Reorder time calculation helps management determine the optimal timing for reordering raw materials. According to the reorder time for raw materials using the Economic Order Quantity model can be calculated as follows [12]:

$$T = \frac{n}{F}$$

Where:

- T : Reorder time
- n : Number of working days in one period
- F : Frequency of raw material ordering

3. Result and Discussion

3.1. Estimated Raw Material Usage

The raw materials used for producing beverages at Chopfee Coffee Shop consists of coffee beans, milk, sugar, flavor syrups. The estimated usage of coffee beans in one month is 8 to 10 kilograms. The total usage of coffee beans during the 11 months of 2023, based on the shop owner's explanation, is 78 kilograms. The estimated monthly usage of other raw materials is as follows: 2 kg of sugar, 45 liters of fresh milk, and 2 bottles of each flavor syrup (caramel, hazelnut, and vanilla). The total usage of raw materials during the 11 months of 2023 is 47 kg of sugar, 576 liters of milk, and 24 bottles of each flavor syrup. The breakdown of the raw material usage at Chopfee

Coffee Shop during February to December 2023 can be seen in Table 1.

Table 1. Raw Material Usage

Raw Material	Unit	Use	Cost per Unit	Total Cost
Beans	Kilogram	78	175,000	13,650,000
Milk	Carton	48	200,000	9,600,000
Sugar	Kilogram	47	17,000	799,000
Vanilla Syrup	Bottle	24	110,000	2,640,000
Hazelnut Syrup	Bottle	24	110,000	2,640,000
Caramel Syrup	Bottle	24	110,000	2,640,000

3.2. Inventory Cost

The inventory costs for raw materials at Chopfee Coffee Shop consist of ordering costs and holding costs. Ordering costs arise from the shipping of raw materials from suppliers to Chopfee Coffee Shop's location. The ordering costs for coffee beans, fresh milk, and flavor syrups include the shipping fees.

1) Ordering Cost

The ordering cost for sugar is the fuel cost incurred to obtain sugar from a nearby wholesale distributor. The ordering cost for coffee beans is IDR 30,000 for the delivery of two kilograms of coffee beans from the coffee supplier. The ordering cost for fresh milk is IDR 20,000 for the delivery of two cartons of fresh milk using a pick-up truck. The ordering cost for flavor syrups is IDR 20,000 for three bottles (one bottle of each flavor), which results in an ordering cost of IDR 6,667 per bottle for the delivery of vanilla, hazelnut, and caramel syrups from the supplier.

2) Holding Cost

Holding costs are incurred for storing raw materials before they are used in the production process. The holding costs for raw materials include warehouse rent, electricity costs, container storage, and the use of a showcase chiller fridge to maintain the quality of each raw material so that they remain fresh and hygienic. Houseblend coffee beans are stored in a container purchased by the coffee shop owner for IDR 100,000. This container is placed in a room that is part of the coffee shop, and the electricity cost is allocated for the storage of the coffee beans. According to an interview with the shop owner, the electricity token used at Chopfee Coffee Shop is IDR 200,000, which is recharged every ten days, resulting in a monthly electricity cost of IDR 600,000. Electricity costs for the air conditioner and lights are allocated proportionally across all raw materials. Sugar and fresh milk are stored in a showcase chiller, with electricity costs allocated based on the wattage used by the

chiller. The electricity cost for storing one kilogram of sugar is IDR 3,084.41, while the electricity cost for one liter of fresh milk is IDR 3,176.94. The inventory costs for raw materials at Chopfee Coffee Shop are summarized in Table 2.

Table 2. Raw Material Inventory Costs

Raw Material	Ordering Cost per Order	Holding Cost per Unit	Total Inventory Cost
Beans	30,000.00	4,361.48	34,361.48
Milk	20,000.00	6,256.37	26,256.37
Sugar	5,000.00	6,163.84	11,163.84
Vanilla Syrup	6,667.00	3,079.43	9,746.10
Hazelnut Syrup	6,667.00	3,079.43	9,746.10
Caramel Syrup	6,667.00	3,079.43	9,746.10

3.3. Inventory Order

The amount of raw materials ordered by Chopfee Coffee Shop fluctuates in response to increased demand during specific periods. As noted by the shop's owner, the typical monthly target for coffee bean procurement ranges between 6 to 8 kilograms; however, this increases to approximately 10 kilograms during holiday seasons such as Eid and Christmas.

3.4. Lead Time

Lead time, defined as the duration required for raw materials to reach the production site after placing an order, varies depending on the supplier and the type of material. For coffee beans, the lead time is typically three days, as they are usually consumed within ten days, though delivery can range from two to three days depending on supplier workload. Fresh milk and flavor syrups generally have a lead time of two days, while sugar, sourced directly from a nearby wholesale distributor, has a lead time of less than one day, often arriving on the same day as the order is placed. These variations reflect the procurement practices described by the coffee shop owner.

3.5. EOQ Calculation

1) Total Inventory Cost (TIC) Calculation

Based on the data obtained, the average ordering of raw materials at Chopfee Coffee Shop over February to December 2023 period is shown in Table 3. The data indicates that milk accounts for the largest average order quantity, at 24 liters. This is reasonable as milk is the primary ingredient in the coffee beverages served at Chopfee Coffee Shop.

Table 3. Average Raw Material Order Quantities

Raw Material	Raw Material Demand (D)	Order Frequency (F)	Q = D/F	Average Order Quantity
Beans	78 Kg	37 times	78/37	2.108 Kg
Milk	576 Ltr	24 times	576/24	24 Ltr
Sugar	47 Kg	47 times	47/47	1 Kg
Vanilla Syrup	24 Btl	24 times	24/24	1 Btl
Hazelnut Syrup	24 Btl	24 times	24/24	1 Btl
Caramel Syrup	24 Btl	24 times	24/24	1 Btl

Based on the average order quantities, the total ordering cost (TOC) for raw materials at Chopfee Coffee Shop before implementing EOQ is shown in Table 4. The data reveals that coffee beans account for the highest total ordering cost, amounting to IDR 1,110,300, with an ordering cost of IDR 30,000 per order. Meanwhile, the lowest ordering costs are associated with flavored syrups, amounting to IDR 160,000 or IDR 6,667 per order.

Table 4. Total Ordering Costs

Raw Material	Raw Material Demand (D)	Average Demand (Q)	Total Ordering Cost
Beans	78 Kg	2.108 Kg	1,110,300
Milk	576 Ltr	24 Ltr	480,000
Sugar	47 Kg	1 Kg	235,000
Vanilla Syrup	24 Btl	1 Btl	160,000
Hazelnut Syrup	24 Btl	1 Btl	160,000
Caramel Syrup	24 Btl	1 Btl	160,000

Based on the data obtained, the total carrying costs for each raw material at Chopfee Coffee Shop before implementing EOQ are shown in Table 5. The data indicates that fresh milk incurs the highest carrying cost, amounting to IDR 75,076.44. This is due to the relatively large quantity of fresh milk and the need for a chiller to store it. Meanwhile, the lowest carrying costs are associated with flavored syrups, as their storage costs are primarily limited to electricity expenses, excluding the chiller.

Table 5. Carrying Costs

Raw Material	Average Demand (Q)	Total Carrying Cost
Beans	2.108 Kg	4,597.24
Milk	24 Liters	75,076.44
Sugar	1 Kg	3,081.92
Vanilla Syrup	1 Btl	1,539.72
Hazelnut Syrup	1 Btl	1,539.72

Caramel Syrup	1 Btl	1,539.72
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Based on previous data, the total cost of ordering raw materials for Chopfee Coffee Shop before implementing the EOQ method is shown in Table 6. The highest inventory costs were associated with coffee beans and fresh milk, amounting to IDR 1,114,597 and IDR 555,076, respectively. These two raw materials are the main ingredients for Chopfee’s business operations. Meanwhile, the lowest total inventory cost was for flavored syrups of various types, each costing IDR 161,540.

Table 6. Total Ordering Costs

Raw Material	TOC	TCC	TIC
Beans	1,110,300	4,597.24	1,114,597.24
Milk	480,000	75,076.44	555,076.44
Sugar	235,000	3,081.92	238,081.92
Vanilla Syrup	160,000	1,539.72	161,539.72
Hazelnut Syrup	160,000	1,539.72	161,539.72
Caramel Syrup	160,000	1,539.72	161,539.72
Total			2,392,357.06

Based on previous data, the total cost of ordering raw materials for Chopfee Coffee Shop before implementing the EOQ method is shown in Table 6. The highest inventory costs were associated with coffee beans and fresh milk, amounting to IDR 1,114,597 and IDR 555,076, respectively. These two raw materials are the main ingredients for Chopfee’s business operations. Meanwhile, the lowest total inventory cost was for flavored syrups of various types, each costing IDR 161,540.

2) EOQ Calculation

Based on the data collected, the optimal order quantity for Chopfee’s raw materials using the EOQ method is presented in Table 7. For coffee beans, the optimal order quantity is 32.75 kg per order. For fresh milk, the optimal order quantity is 60.68 liters per order. Sugar requires an optimal quantity of 9.18 kg per order, while flavored syrups need 11 bottles per order.

Table 7. Calculation of Optimal Order Quantity

Raw Material	EOQ	Pre-EOQ Order Quantity
Beans	32.75 Kg	2.108 Kg
Fresh milk	60.68 ltr	24 ltr
Sugar	9.18 Kg	1 Kg
Vanilla Syrup	10.61 btl	1 btl
Hazelnut Syrup	10.61 btl	1 btl
Caramel Syrup	10.61 btl	1 btl

These quantities represent significant increases compared to the order quantities before applying the EOQ method. Coffee bean orders increased from 2.108 kg to 33 kg per order. Fresh milk orders increased from

24 liters to 61 liters per order. Sugar orders rose from 1 kg to 9 kg per order, and flavored syrup orders increased from 1 bottle to 11 bottles per order.

Table 8. Calculation of Optimal Order Frequency

Raw Material	EOQ (Q*)	Frequency (F)	Pre-EOQ Frequency
Beans	32.75 kg	2	37
Fresh milk	60.68 ltr	9	24
Sugar	9.18 kg	5	47
Vanilla Syrup	10.61 btl	2	24
Hazelnut Syrup	10.61 btl	2	24
Caramel Syrup	10.61 btl	2	24

Based on the optimal order quantities obtained using the EOQ method, the optimal order frequencies are presented in Table 8. A significant reduction in order frequency is observed across all raw materials. Coffee bean orders reduced from 37 times to only 2 times within 11 months. Fresh milk orders reduced from 24 times to 9 times, sugar orders reduced from 47 times to 5 times, and flavored syrup orders reduced from 24 times to 2 times.

Table 9. Reorder Points

Raw Material	Days (n)	Frequency (F)	Reorder Time (T)	ROP
Beans	334	2	140	0.70 kg
Fresh milk	334	9	35	3.45 ltr
Sugar	334	5	59	0.16 kg
Vanilla Syrup	334	2	136	0.16 btl
Hazelnut Syrup	334	2	136	0.16 btl
Caramel Syrup	334	2	136	0.16 btl

Based on the frequency of raw material ordering, the reorder time for each raw material is detailed in Table 9. The reorder time for coffee beans is 140 days, while for fresh milk, it is 35 days. The reorder time for sugar and all flavored syrups is 59 days and 136 days, respectively. In addition to using time intervals, Chopfee Coffee Shop can also conduct a reorder point analysis to determine the appropriate time to reorder. Using the available data, the reorder points for each raw material are summarized in Table 9. Coffee beans should be reordered when inventory levels drop to 700 g. Fresh milk should be reordered when remaining inventory is 3.44 liters. Sugar should be reordered when inventory levels reach 0.16 kg, and flavored syrups should be reordered when inventory levels drop to 0.16 bottles. An easy way to create layouts is to use this guide directly.

Table 10. Total Inventory Costs Using EOQ

Raw Material	TOC	TCC	TIC
Beans	71.434,81	71.434,81	142.869,61

Milk	189.833,32	189.833,32	379.666,65
Sugar	28.307,23	28.307,23	56.614,46
Vanilla Syrup	16.336,58	16.336,58	32.673,17
Hazelnut Syrup	16.336,58	16.336,58	32.673,17
Caramel Syrup	16.336,58	16.336,58	32.673,17
Total			677.170,22

After applying the EOQ method, the total ordering costs for each raw material, as shown in Table 10, experienced significant reductions. The ordering cost for coffee beans decreased substantially, from IDR 1,110,300 to just IDR 71,435. Similarly, reductions in ordering costs were observed for other raw materials. The ordering cost for fresh milk decreased from IDR 480,000 to IDR 189,833. For sugar, the ordering cost declined from IDR 235,000 to IDR 28,307. Lastly, the ordering cost for all flavored syrups fell from IDR 160,000 to IDR 16,337.

Meanwhile, the total carrying costs for each raw material, as shown in Table 10, increased significantly. The carrying cost for coffee beans rose from IDR 4,597 to IDR 71,435. Similar increases in carrying costs were observed for other raw materials. The carrying cost for fresh milk increased from IDR 75,076 to IDR 189,833. For sugar, the carrying cost rose from IDR 3,082 to IDR 28,307. Lastly, the carrying cost for all flavored syrups increased from IDR 1,540 to IDR 16,337.

Therefore, after implementing the EOQ method, the total inventory costs for each raw material were determined. The highest inventory cost is currently attributed to fresh milk, amounting to IDR 380,000. Meanwhile, the smallest total inventory cost is associated with each flavored syrup, totaling IDR 32,673.

Table 11. Total Inventory cost before and after EOQ

Raw Material	TIC Before EOQ	TIC After EOQ
Beans	1.114.597,24	142.869,61
Milk	555.076,44	379.666,65
Sugar	238.081,92	56.614,46
Vanilla Syrup	161.539,72	32.673,17
Hazelnut Syrup	161.539,72	32.673,17
Caramel Syrup	161.539,72	32.673,17
Total	2.392.357,06	677.170,22

Table 11 above shows the difference in total inventory costs between the inventory policy of Chopfee Coffee Shop's owner and the economic order quantity (EOQ) inventory control method from February to December 2023, amounting to IDR 1,715,186. The application of the EOQ inventory control method enables a cost saving of IDR 1,715,186, or 71.70%, compared to the

inventory costs incurred by Chopfee Coffee Shop without employing the EOQ method.

4. Conclusion

Chopfee Coffee Shop currently employs conventional methods for managing raw material inventory. Based on the results of this study, implementing the economic order quantity (EOQ) method can reduce inventory costs by IDR 1,715,186, representing a 71.7% decrease from the original cost of IDR 2,392,357 to IDR 677,170. Therefore, to optimize long-term profit margins, it is recommended that Chopfee adopts the EOQ method for managing its raw material inventory

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