

Analysis The Implementation Of Economic Order Quantity Method In Controlling The Inventory Of Raw Materials For Screen Printing T-Shirts At Raxgacloth Printing

Mohammad Irvan¹, Diah Ayu Septi Fauji²

^{1,2}University of Nusantara PGRI Kediri, Jl. KH. Ahmad Dahlan No.76, Mojoroto, Kediri City, East Java, 64112, Indonesia

irvangea01@gmail.com^{1*}, septifauji@unpkediri.ac.id²

*corresponding author

Article Information

Submission date 11 Desember 2023
Revised date 30 Desember 2023
Received date 8 Maret 2024

Abstract

Research aim : This research aims to determine the optimal amount of raw materials for screen printed t-shirts at Raxgacloth Printing using the Economic Order Quantity (EOQ) method so as to minimize inventory costs such as ordering costs and storage costs.

Design/Method/Approach : This research uses a quantitative descriptive approach with data processing assisted by the POM QM application. The data used in this research is from December 2022 to November 2023.

Research Finding : The research results show that controlling the inventory of t-shirt raw materials based on Raxgacloth Printing's policy resulted in 6,423 t-shirt units at a cost of Rp. 6,427,847 with an order frequency of 180 times a year. Meanwhile, by calculating raw material inventory using the Economic Order Quantity method, more optimal results were obtained, including purchasing raw materials for only 1,542 units of t-shirts at a cost of Rp. 380,425 and order frequency 4 times a year. For Safety Stock 36 units were obtained and Reorder Point was 74 units.

Keywords: Raw Materials Inventory T-shirts, Economic Order Quantity

1.Introduction

Inventory management is one of the most important components of a business. Companies will find it difficult to control and fulfill customer demand if there is no good inventory management. Whether using a company's fulfillment services or shipping products yourself, it's important to know where inventory is and where it's going[1].

A good company must be able to maintain the supply of raw materials so that the production process runs smoothly and most importantly can meet consumer demand[2]. To run industrial processes well, inventory management is necessary. This is done to avoid inventory shortages or inappropriate orders if the required items are not available[3].

Inventory management involves the application of various methods designed to optimize the management of goods or materials within a company. One of the main methods

of Inventory Management is Economic Order Quantity (EOQ). This method helps businesses optimize ordering costs by achieving optimal purchasing quantities through reducing inventory costs[4]. Second is the Just In Time (JIT) Method, in operating a Just In Time production system or JIT production system, accuracy is required in production planning, starting from the schedule for purchasing production materials, the schedule for receiving production materials, the production implementation schedule, the product preparation schedule to the delivery schedule for finished products[5]. Next is the ABC Method, The ABC Method allocates overhead costs to objects such as products and services which identifies the resources, activities and costs required to produce the product[6].

Inventory control is an important part of the management process, namely determining when and how many units should be ordered for a particular item. Therefore, Inventory control that is carried out appropriately can minimize costs and maximize company profits[7]. Previous research concluded that inventory management plays an important role in increasing customer satisfaction in all industries[1]. Meanwhile, other research concludes that control of raw materials is very important to produce a smooth production process[8]. Based on the conclusions of previous research, researchers want to focus on controlling raw material inventories using the Economic Order Quantity Method.

One business that has had positive developments along with the development of globalization is the fashion business. Fashion business is a business that operates in the clothing sector, whether it is something worn on the body or something that beautifies the body's appearance . Fashion products are goods produced from a production process in the form of t-shirts, clothes, trousers, bags, shoes, other accessories that can support the wearer's appearance. For people who think creatively, fashion products can be turned into products that have high added value, such as plain t-shirts that can be added with images according to customer requests. This can be called screen-printed t-shirts or t-shirt screen printing. Screen printing is a design that can be painted, cut, or patterned[9].

Raxga cloth is a home-based business engaged in manufacturing, production and services with an address at Dsn. Pulorejo Ds. Kedungrejo District. Tanjunganom District. Nganjuk, East Java. The product produced by Raxga cloth is a plain t-shirt to which an appropriate design is then added consumer demand for the surface of t-shirts.

Based on observations and interviews with the owner of Raxga cloth, it is known that during production system activities, Raxga cloth experienced difficulties related to providing raw materials for plain t-shirts. Raxga cloth still often experiences shortages and excess supplies of raw materials, which can affect delays in the production process and large inventory costs.

Table 1. Requirements and Stock of Raw Materials

No	Month	Material	Requirements	Stock
1	December	Shirt	530	312
2	January	Shirt	402	500
3	February	Shirt	759	635
4	March	Shirt	410	540
5	April	Shirt	330	485
6	May	Shirt	364	300

7	June	Shirt	710	350
8	July	Shirt	464	520
9	August	Shirt	624	350
10	September	Shirt	515	350
11	October	Shirt	802	470
12	November	Shirt	513	410

Source: Raxgacloth Printing

So based on the table above, it is said that Raxgacloth's control of raw material supply is not optimal. this can cause difficulties in providing raw materials at Raxgacloth. Because if Raxgacloth experiences a shortage of raw material supply, the production process will be hampered and the company's profits will be reduced because it cannot meet consumer needs. Meanwhile, if the company experiences excess raw material inventory will give rise to inventory with high costs, both in terms of capital tied up and the operation and administration of the inventory itself[10].

To respond to these conditions, Raxgacloth must have an appropriate raw material inventory control strategy, so that the production process is not hampered and can meet consumer demand. An appropriate raw material inventory control strategy will also help Raxgacloth not incur significant inventory costs and the quality of raw materials is always maintained. Therefore, researchers are interested in conducting research at Raxgacloth Printing related to controlling raw material inventories using the Economic Order Quantity Method. It is hoped that this research will provide suggestions and recommendations for improvements that are useful for business actors in controlling raw material inventories in the future.

1.1. Statement of Problem

Based on the description above, managing the inventory of screen printed t-shirt raw materials at Raxgacloth Printing raises several problems that require serious attention. One of the main problems that needs to be solved is the lack of effectiveness in determining the optimal order quantity. Uncertainty in predicting inventory needs, especially in the face of fluctuations in market demand, can result in overstock or stock shortages which can harm the company's operational and financial efficiency. In addition, unoptimized storage and inventory management problems can increase overall inventory costs.

1.2. Research Objectives

The research objective of inventory control for screen printed t-shirt raw materials using the EOQ (Economic Order Quantity) method at Raxgacloth Printing is to increase the efficiency and effectiveness of inventory management in order to achieve more optimal operations. This research aims to identify the optimal inventory level of screen printed t-shirt raw materials that can minimize total inventory costs, including storage costs and ordering costs. By implementing the EOQ method, this research also aims to reduce the risk of stock shortages and overstock which can disrupt the smooth production process.

2. Method

This research uses a quantitative descriptive approach. Quantitative descriptive research is research that describes variables as they really are, supported by numerical data generated

from actual conditions[11]. The research was conducted using interviews and observations for approximately 1 month with data used from December 2022 to November 2023.

The subject of this research is Raxgacloth Printing, while the object of research is the supply of raw materials for screen printed t-shirts. Some data analysis techniques use the help of the POM-QM application. Data analysis is carried out through many stages, namely the data analysis stage according to company policy, the data analysis stage according to the Economic Order Quantity (EOQ) method, the data analysis stage based on order frequency, the data analysis stage using the Safety Stock (SS) Method, the data analysis using Reorder Point (ROP) and finally a comparative data analysis was carried out between controlling the inventory of t-shirt raw materials according to company policy with the Economic Order Quantity Method.

3 . Results and Discussion

3.1 Results

The raw material used in Raxgacloth Printing is t-shirts. In determining inventory, Raxgacloth Printing is still experiencing difficulties due to uncertain consumer demand. The following is data on the need for raw materials for Raxgacloth Printing t-shirts from December 2022 to November 2023.

Table 3.1 Data on Raw Material Needs December 2022-November 2023

No	Month	Number of units	Unit price	Total price(Rp)
1	December	530	40.000	21.200.000
2	January	402	40.000	16.080.000
3	February	759	40.000	30.360.000
4	March	410	40.000	16.400.000
5	April	330	40.000	13.200.000
6	May	364	40.000	14.560.000
7	June	710	40.000	28.400.000
8	July	464	40.000	18.560.000
9	August	624	40.000	24.960.000
10	September	515	40.000	20.600.000
11	October	802	40.000	32.080.000
12	November	513	40.000	20.200.000
	Amount	6,423	40.000	256.920.000
	Average	535		21.410.000

Source: Raxgacloth Printing

From the data table for raw material requirements from December 2022 to November 2023, the total raw material requirement is 6.423 units with an average requirement of 535 units. Meanwhile, the total costs incurred to meet raw material needs are Rp. 256.920.000 with an average expenditure on raw material requirements of Rp. 21.410.000.

Analysis in accordance with Raxgacloth Printing Policy

Data on Average Raw Material Purchases

$$\text{Average Purchase} = \frac{\text{unit material requirements per year}}{\text{order frequency}}$$

$$= \frac{6.423}{180}$$

$$= 37 \text{ pcs}$$

The average purchase of Raxgacloth Printing raw materials is 37 pcs or the equivalent of Rp. 1.480.000 in each order

Setup/Ordering Costs

Based on the results of the interview, the costs of ordering supplies at Raxgacloth are divided into several types of costs. These types of costs include Wifi costs and transportation costs. The following is a detailed breakdown of order fees at Raxgacloth Printing:

Table 3.2 Ordering Costs

Fee Type	Price	Per year
Wifi	350.000	4.200.000
Transportation	20.000	3.600.000
Amount	370.000	7.800.000

Source: Raxgacloth Printing

So based on the table above, the ordering costs for each order per year can be calculated as follows:

$$\text{Cost per ordering} = \frac{\text{total order cost}}{\text{order frequency}}$$

$$= \frac{7.800.000}{180}$$

$$= 43.000$$

From the calculation of ordering costs for one order of raw materials at Raxgacloth Printing, it is obtained Rp. 43.000 in one order.

Holding Cost

These costs include costs incurred due to storage of raw material goods. Usually stored in a storage warehouse located at the company and not far from the production site so that maintenance costs are not too high.

Table 3.3 Storage Costs

Raw Material Storing Costs	Price	Per year
Electricity	90.000	1.080.000
Labor	50.000	600.000
Amount	140.000	1.680.000

Source: Raxgacloth Printing

To calculate Holding Costs in one year as follows:

$$\begin{aligned}
 \text{Holding Cost Per Unit} &= \frac{\text{amount of storage costs per year}}{\text{amount of raw material required}} \\
 &= \frac{1.680.000}{6.423} \\
 &= 262
 \end{aligned}$$

So, the cost of storing raw t-shirt materials at Raxgacloth Printing is Rp. 262 per unit

Order Frequency

For the frequency of orders for t-shirt raw materials at Raxgacloth Printing, based on the results of interviews, it was found that the number of orders per month was 15 times, so that in a year there were 180 orders for raw materials.

Total Inventory Cost

Total inventory costs include ordering costs and holding costs. Therefore, the total inventory costs from Raxgacloth Printing in connection with ordering and storage can be determined through the following calculation:

$$\begin{aligned}
 TC &= \frac{6.423}{37} 43,000 + \frac{37}{2} 262 \\
 &= \text{Rp. } 6.427.847
 \end{aligned}$$

So, the total inventory costs incurred by Raxgacloth Printing are Rp. 6.427.847.

Analysis Using the Economic Order Quantity Method

Calculation Data Using Economic Order Quantity

From raw material inventory data from December 2022 – November 2023, it can be calculated using the Economic Order Quantity Method. Here are the calculations:

$$EOQ = \sqrt{\frac{2 \cdot D \cdot S}{H}}$$

Information:

- Q = Optimal number of units per order (EOQ)
- D = Annual demand in units of inventory items
- S = Setup or order costs for each order
- H = Storage or storage costs per unit per year

Is known:

D = 6.423
 S = 43.000
 H = 262

Solution:

$$= \sqrt{\frac{2(6.423)(43.000)}{262}}$$

$$= 1.452$$

So through calculations using the Economic Order Quantity Method, the optimal quantity per order is obtained, namely 1.452 units.

Order Frequency

Calculation of the frequency of ordering t-shirt raw materials at Raxgacloth Printing can be calculated as follows:

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

Information:

F = Frequency of orders in one year
 D = Total raw material requirements for one year
 Q = Number of orders for raw materials per order

Is known:

D = 6.423
 Q = 1.453

Solution:

$$F = \frac{6.423}{1.452}$$

$$= 4$$

So, the frequency of orders is obtained 4 times in one year

Safety Stock

In raw material inventory, unexpected events sometimes occur, such as delays in raw material inventory because suppliers experience delivery problems, as well as unavailability

of supplier inventory when production suddenly runs out of stock. Therefore, Raxgacloth Printing requires a guaranteed source of raw materials. Safety stock itself can be calculated as follows:

$$\text{Average sales per day (d)} = \frac{\text{Requirement}}{\text{Effective days worked}}$$

$$\text{Safety Stock} = d \times L$$

Information:

- SS = Safety stock
- d = Average sales per day
- lead time = The time required to receive an order

Is known:

- d = 6.423
- Effective days worked = 341

$$\begin{aligned} \text{Average Sales Per Day (d)} &= \frac{\text{Requirement}}{\text{Effective days worked}} \\ &= \frac{6.423}{341} \\ &= 19 \end{aligned}$$

$$\begin{aligned} \text{Safety Stock} &= d \times L \\ &= 19 \times 2 \\ &= 36 \text{ units} \end{aligned}$$

So, the safety stock that must be provided by Raxgacloth Printing is 36 units

Reorder Point

Reorder point (ROP) is the point where a product/goods in the warehouse must be replenished before stock runs out. The following is the calculation of the Reorder Point:

$$\text{ROP} = d \times L + \text{SS}$$

Information:

- ROP = Reorder point
- L = Lead time or waiting time
- d = Average usage per day
- SS = safety stock

Is known:

- L = 2 days

$$d = 19$$

$$SS = 36$$

Solution:

$$= 19 \times 2 + 36$$

$$= 74 \text{ units}$$

So, the Reorder Point obtained is 74 units

Total Inventory Cost

Total Inventory Cost (TIC) is the total inventory cost incurred for economic orders/Economic Order Quantity. Here are the calculations:

$$TC = \frac{D}{Q}S + \frac{Q}{2}H$$

Information:

TC = Total inventory cost

Q = Number of items per order

D = Annual demand for supplies in units per year

S = Order cost for each time you place an order

H = Storage costs per unit per year

Is known:

$$Q = 1.452$$

$$D = 6.423$$

$$S = 43.000$$

$$H = 262$$

Solution:

$$TC = \frac{6.423}{1453} 43.000 + \frac{1453}{2} 262$$

$$= 380.425$$

So, Total Inventory Cost is Rp. 380.425

Comparative Analysis Between Company Policy and the EOQ Method

Table 3.4 Comparison between company policies and the EOQ method

No	Information	company policy	EOQ method	Difference
1	Purchase of raw materials	6,423	1.542	4.880

2	Purchase frequency	180	4	176
3	Safety stock	-	36 units	36 units
4	Reorder point	-	74 units	74 units
5	Total cost	6.427.847	380.425	6.047.422

Source: Processed Data

Based on the table comparison, it was obtained that purchases of raw materials using the policy from Raxgacloth Printing amounted to 6.423 units. While purchases of raw materials using the EOQ method amounted to 1,542 units. Therefore, a difference of 4.880 units is obtained. The order frequency from the Raxgacloth Printing policy is 180 times, while the order frequency from the EOQ method is 4 times. Therefore, the difference between the two is 176 times the Order Frequency. Then the Total Cost of the company policy is Rp. 6.427.847. While the Total Cost of the EOQ Method is Rp. 380.425. So it can be concluded that the difference in Total Cost is Rp. 6.047.422.

3.2 Discussion

In determining the amount of inventory, Raxgacloth Printing determines it based on consumer demand. This will of course increase inventory costs quite significantly. From December 2022 to November 2023, the number of t-shirt raw materials needed at Raxgacloth Printing will be 6.423 units in 180 Order Frequencies in one year. Meanwhile, ordering costs such as Wifi and transportation costs are Rp. 43.000 in one order. Meanwhile, the storage costs themselves are Rp. 262 per unit. So, the total cost for the policy from Raxgacloth Printing is Rp. 6.427.847.

Calculations using the EOQ method resulted in optimal raw material purchases of 1.452 units with an Order Frequency of 4 times a year. Safety Stock obtained was 36 units and for Reorder Point 74 units. Total Cost is obtained with only Rp. 380.425.

The difference between purchasing raw materials from the Raxgacloth Printing policy and the Economic Order Quantity Method is 4.880 units. The difference between the Order Frequency is 176 times with the Raxgacloth Printing policy of 180 times and the EOQ Method only 4 times in one year. The difference in total costs is Rp. 6.047.422 with details of the total costs of the Raxgacloth Printing RP policy. 6.427.847. While the total cost details using the EOQ method are only Rp. 380.425.

4. Conclusion

The application of the Economic Order Quantity Method is more optimal than Raxgacloth Printing's policy. Controlling the inventory of t-shirt raw materials based on Raxgacloth Printing policy produced 6.423 units of t-shirts at a cost of Rp. 6.427.847 with an order frequency of 180 times a year. Meanwhile, by calculating raw material supplies using the Economic Order Quantity Method, more optimal results were obtained, including purchasing only 1.542 units of t-shirt raw materials at a cost of Rp. 380,425 and order frequency 4 times a year. The difference between the Raxgacloth Printing Policy and the Economic Order Quantity Method for purchasing raw materials is 4.880 units. for the Order Frequency difference of 176. The difference in Total Cost is Rp. 6.047.422. For Safety Stock, 36 units were obtained and Reorder Points were 74 units.

Research on t-shirt raw material control at Raxgacloth Printing provides significant contributions in various aspects of science, practice and policy. Scientifically, this research provides an in-depth understanding of the process of controlling t-shirt raw materials, including risk identification and innovative mitigation strategies. The novelty of this research lies in a holistic approach that utilizes the latest technology such as big data analysis using applications which of course makes analysis easier. In practice, the results of this research can be directly applied by Raxgacloth Printing to improve raw material management. Meanwhile, in a policy context, the findings of this research can provide a basis for improving regulations. Thus, this research not only creates new understanding in the scientific field, but also provides practical solutions and supports the formation of sustainable policies in the Raxgacloth Printing screen printing business.

While research into t-shirt raw material inventory control at Raxgacloth Printing provides valuable insight, several limitations need to be noted. First, this research may be limited to the internal context of Raxgacloth Printing, so generalizing the results to the global textile industry context may need to be done with caution. In addition, the research focus may not include certain aspects of the raw materials supply chain, such as global risk management, sustainability, or integration with external suppliers. Therefore, to complement this research, a relevant research agenda could include further exploration of leveraging advanced technologies such as blockchain to increase supply chain transparency, and analysis of the impact of global risks on raw material supplies. Furthermore, research can expand geographic and industry coverage to provide a more holistic picture of inventory control challenges in a global context and diverse industries. By identifying and addressing these limitations, future research can provide a more comprehensive and sustainable view of raw material inventory control in the textile industry.

References

- [1] Durohman H, Kaltum U, Farras JIF. Apakah Manajemen Persediaan Berpengaruh pada Kepuasan Pelanggan: Tinjauan Sistematis Literatur. *J Ekon dan Bisnis* 2023;XIII:139–53. <https://doi.org/https://doi.org/10.24198/jebi.v13i1.2112>.
- [2] Famelga Clea Putri. Analysis of Inventory Management with the EOQ Method in Optimizing Fabric Inventory at XYZ Stores. *J Ind Syst Eng Manag* 2023;2:32–7. <https://doi.org/10.56882/jisem.v2i1.13>.
- [3] Chotimah C, Hanum F, Abdussalam. Efektivitas Manajemen Persediaan Bahan Baku Dan Biaya Produksi Menurut Perspektif Ekonomi Islam. *J Sharia Financ Bank* 2023;01:1–11. <https://doi.org/https://doi.org/10.55757/cashless.v1i1.232>.
- [4] Arsyad Sumantika, Ganda Sirait, Elva Susanti, Elsyia P. L. Tarigan. Determination of Economic Value using the EOQ and ROP Approaches in the Raw Material Control System. *Formosa J Appl Sci* 2023;2:1051–64. <https://doi.org/10.55927/fjas.v2i6.4323>.
- [5] Lase JB, Zai KS, Lase NK. Implementation of Just in Time (Jit) System in Planning and Controlling Inventory Management of Raw Materials At Cv. Utama. *J EMBA* 2022;10:1234–8. <https://doi.org/https://doi.org/10.35794/emba.v10i4.43950>.
- [6] Baviga R. Penerapan Metode Activity-Based Costing System Dalam Menentukan

-
- Besarnya Tarif Jasa Rawat Inap. *Bussman J Indones J Bus Manag* 2021;1:371–401.
<https://doi.org/10.53363/buss.v1i3.20>.
- [7] Zulaikhok Nuraini, Hartirini W, Mutmainah. Pentingnya Perencanaan dan Pengendalian Persediaan Bahan Baku Paving Dengan Metode Economic Order Quantity (EOQ) Untuk Optimalisasi Laba 2023:122–32.
<https://doi.org/http://dx.doi.org/10.54131/jbma.v10i2.168>.
- [8] Mufaridah E, Suhartini F. Pentingnya Pengendalian Supply Bahan Baku Dalam Aktivitas Proses Produksi Pada Rumah Sustainable Assembly Pada Industri Rumah Di Jabon Sidoarjo. *J Ilmu Manaj Advant* 2018;2:246–53.
<https://doi.org/10.30741/adv.v2i1.288>.
- [9] Anita Nur Hijannah, Arsa, Sri rahma. Analysis of the Factors Influencing Consumer Purchase Interest in Printing and Screen Printing Businesses at Sepakatea Advertising Broni Jambi City. *Formosa J Appl Sci* 2023;2:1271–86.
<https://doi.org/10.55927/fjas.v2i6.4700>.
- [10] Atnafu D, Balda A. The impact of inventory management practice on firms' competitiveness and organizational performance: Empirical evidence from micro and small enterprises in Ethiopia. *Cogent Bus Manag* 2018;5:1–16.
<https://doi.org/10.1080/23311975.2018.1503219>.
- [11] Sugiyono. *Metode Penelitian Kuantitatif, Kualitatif, dan R&D*. Bandung: CV. Alfabeta. 2017.