Applied Accounting and Management Review (AAMAR)
E-ISSN 2962-097X ; P-ISSN 2987-9981
Volume 3, Issue 2, Oktober 2024, Page No: 80-89

ANALYSIS OF THE APPLICATION OF EOQ AND POQ METHODS IN THE RAW MATERIAL INVENTORY CONTROL SYSTEM AT GRIYA BATIK MAS PEKALONGAN CITY

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Abstract: Griya Batik Mas is a batik making industry still using conventional methods as its inventory control system. Purchases of fabric raw material supplies are carried out routinely with the same order quantity every month without taking into account the quantity required. To find out whether the method used has produced the best costs, a comparison is carried out by applying the Economic Order Quantity (EOQ) and Period Order Quantity (POQ) methods. Data collection methods through interviews, observation, and documentation with comparative and efficiency analysis. The results of this research show that there is a difference in inventory costs with savings in total inventory costsThe application of the Economic Order Quantity (EOQ) method is greater than that of the method Period Order Quantity(POQ) for the Griya Batik Mas inventory control system, which is Rp7,450,721 for the four types of fabric, with an order frequency of 5 times in 1 year.

Keywords: Economic Order Quantity (EOQ), Period Order Quantity (POQ), Inventory Control System

INTRODUCTION

Introduction

Pekalongan City is included in the Central Java region which is the center of most batik craftsmen and trade on the island of Java. Batik has become the main source of livelihood for its people to the point where Pekalongan City is known as the city of batik(Hayati, 2012). Griya Batik Mas is one of the businesses in the batik making industry which is quite well known in Pekalongan City. However, being located in the Pekalongan City area means that this business cannot be separated from intense competition between other batik making industries. Based on the results of interviews that have been conducted, it is known that there are several obstacles experienced in maintaining the quality and quantity of production so that it remains able to compete with other batik making industries. The obstacles experienced include purchasing raw materials concentrated in one supplier, warehouse capacity, and limited skilled workers who are able to analyze or manage raw material supplies appropriately. So the inventory management system implemented is still conventional, meaning that inventory purchases are carried out routinely but do not take into account the quantity needed and the use of raw materials is still based on previous experience.

Many of the obstacles experienced by Griya Batik Mas stem from problems with raw materials. The amount of inventory needed by each industry or factory varies from one another, depending on the amount of production, the type of industry and the production process therein.(Assauri, 2018), mSo there needs to be good inventory management.Therefore, Griya Batik Mas must be able to estimate its raw material inventory to anticipate excess or shortage of raw materials for the company's smooth production and to increase the efficiency of raw material purchasing costs. The inventory control system can be carried out by applying existing

methods, including the Economic Order Quantity (EOQ) and Period Order Quantity (POQ) methods. With constant product demand, Griya Batik Mas can carry out calculations using the EOQ method because the need for fabric raw materials tends to be stable within 1 product year. On the other hand, the POQ method can help companies minimize recurring ordering costs.

Therefore, based on the problems that exist at Griya Batik Mas, this research will apply the Economic Order Quantity (EOQ) and Period Order Quantity (POQ) methods in determining the order quantity and best order period which is expected to provide considerations regarding the fabric raw material inventory control system. which should be applied to Griya Batik Mas. So the author conducted this research with the title "Analysis Application Of Eoq And Poq Methods In The Raw Material Inventory Control System At Griya Batik Mas, Pekalongan City"

Research Purposes

The purpose of this research is to find out how the inventory control system is implemented at Griya Batik Mas, Pekalongan City, applying the Economic Order Quantity (EOQ) and POQ (Period Order Quantity) methods, as well as to analyze the comparison between the results of applying the EOQ and POQ methods with the existing method. Griya Batik Mas uses in its inventory control system.

LITERATURE REVIEW

Inventory is a stock of materials that is deliberately stored with the aim of facilitating the production flow and meeting customer demand(Schroeder, 2000). The types of stock consist of several types, such as raw materials, components, goods in process, finished goods, and MROor Maintenance, Repair and Operating supplies(Chatfield, 2020). Inventory has several important functions in meeting company needs, such as avoiding the risk of delivery delays, the risk of price increases, as well as providing services to customers with the availability of the goods they need.

Inventory Management

Inventory management is an activity carried out by a company to manage its inventory of goods (raw materials and auxiliary materials) starting from planning, implementation, coordination and inventory control.(Julyanthry et al., 2020). Companies are required to be able to have an appropriate and efficient inventory control system, because the problem that often occurs in companies related to inventory is the uncertainty of consumer needs.Inventory control system to determine the level of inventory that must be maintained, order time, and the size of the order that must be placed to ensure the right inventory is available in quantity and time.

Inventory Cost

The costs that need to be identified as a basis for calculating total inventory costs, namely(Herjanto, 2001):

1. Order Fee, these costs are closely relatedwith the activity of ordering necessary goods until the goods ordered have been received at the warehouse. Types of ordering costs consist of elements of telephone costs, transportation costs, goods inspection costs, and others.Ordering costs can be calculated using the following formula(Schroeder, 2000):

$$TOC = S\left(\frac{D}{Q}\right)$$

Information:
TOC = Total Ordering Cost

S = Setup Cost or Cost per Order (Order Cost)
D = Demand(Annual request)
Q = Quantity(order quantity)

2. Storage Fees, these costs are related to storage activities in the warehouse, which consist of several elements such as warehouse rental costs, electricity costs, wages and salaries for warehouse staff, and others.Ordering costs can be calculated using the following formula(Schroeder, 2000):

$$TCC = C_r(\frac{Q}{2})$$

Information:
C_r = Storage Quantity
Q = Order Quantity

So the Total Inventory Cost is TIC = TOC + TCC

Economic Order Quantity(EOQ)

EOQ is one of the most commonly used inventory control techniques. The EOQ approach is designed to achieve a balance between ordering costs and holding costs so as to minimize inventory costs(Chatfield, 2020).

Safety Stock (SS),by knowing the economic quantity (Q), there is still a possibility of a stockout, so it is necessary to have a number of materials as a safety stock.The following is the safety stock formula (Herjanto, 2001):

Safety stock or SS = Zσ, with σ as the standard deviation, and Z as the value from the standard deviation table for the deviation in this case 5%

Period Order Quantity(POQ),This method is based on calculations and assumptions of the EOQ method by changing the number of orders into the number of order periods. This will produce the required number of material ordering intervals.

Reorder Point (ROP),pointto determine the required reorder point Q (from the EOQ calculation), by means of(Herjanto, 2001):

ROP = (L×) + SS, with L as lead time or waiting time, and D as annual demand and SS as safety stock.

RESEARCH METHODOLOGY

Based on its nature, this research is descriptive research with quantitative analysis carried out with the aim of creating an objective picture or description of a condition that is used to solve and answer the problems that have been faced. In this research, the object observed is the supply and control of the supply of fabric raw materials at Griya Batik Mas, Pekalongan City. Data collection methods were carried out by interviews, observation and documentation.

Data Analysis Method

1. **Economic Order Quantity(EOQ),using the formula(Schroeder, 2000):**

$$EOQ = \sqrt{\frac{2SD}{C_r}}$$

Information :

S = Order costs
D = Demand (amount of raw materials needed)
C_r = Holding Cost

If EOQ has been determined then the next step is to determine the frequency of orders to find out how many times a year orders are made, and the interval between re-orders made by means of (Herjanto, 2001):

Order frequency or F = $\frac{D}{Q}$
With D = Annual demand and Q = Order quantity

$$T = \frac{Number\ of\ Working,days\ in\ a\ year}{Order\ Frequency}$$

2. Period Oeder Quantity (POQ). Using the formula (Herjanto, 2001):

$$POQ = = \sqrt{\frac{2S}{DH}}$$

S = Ordering Cost
D = Average need for goods
H = Holding Costs

By calculating the total cost of inventory according to Henmaldi in(Fithri & Sindikia, 2016)are as follows :

Total Cost POQ = Order cost + Holding cost or (F X S) + (($\frac{Q}{2}$ + SS) X Holding Cost)

RESULTS AND ANALYSIS

Use of Raw Materials

The following is data on the use of raw materials at Griya Batik Mas, Pekalongan City during 2023:

Table 1 Use of Fabric Raw Materials at Griya Batik Mas in 2023

Month	Inventory Type			
	Prime Cotton Fabric	Primissima Cotton Fabric	Dobby Fabric	Viscose Fabric
January	9264	480	240	96
February	9264	480	240	96
March	9846	530	290	146
April	9846	530	290	146
May	9264	480	240	96

June	9264	480	240	96
July	9264	480	240	96
August	9264	480	240	96
September	9264	480	240	96
October	9264	480	240	96
November	9264	480	240	96
December	9264	480	240	96
Amount	112332	5860	2980	1252
Average	9361	488	248	104

Source: Data processed, 2024

Raw material prices

The price of raw materials is set per meter of fabric. Therefore, the cost of purchasing raw materials for fabric is influenced by the quantity of goods ordered. The following is the calculation of purchase costs according to the set prices:

Table 2 Purchase Prices for Fabric Raw Materials at Griya Batik Mas in 2023

Inventory Type	Purchase Quantity (meters) (1)	Unit Price (Rp) (2)	Purchase Cost (Rp) (3)= (2) x (1)	Order Frequency
Prime Cotton Fabric	112,332	15,200	1,707,446,400	12 times
Primissima Cotton Fabric	5,860	22,000	128,920,000	12 times
Dobby Cloth	2,980	24,000	71,520,000	12 times
Viscose Fabric	1,252	24,000	30,048,000	12 times
Total	122,424		1,937,934,400	

Source: Data processed, 2024

Ordering Costs

Ordering costs are closely relatedwith the activity of ordering necessary goods, in ordering raw materials for fabric at Griya Batik Mas there are two types of costs incurred in connection with the order made, namely petrol costs and transportation costs, as below:

Table 3 Total Cost of Ordering Raw Materials for Griya Batik Mas

Information	Inventory type			
	Prime Cotton Fabric	Primissima Cotton Fabric	Dobby Fabric	Viscose Fabric

Telephone Fee (Rp)	243,184	18,354	10,184	4,278
Freight Cost (Rp)	17,074,464	1,289,200	715,200	300,480
Total ordering cost (Rp)	17,317,648	1,307,554	725,384	304,758
Booking fee per frequency (Rp)	1,443,137	108,963	60,449	25,397

Source: Primary data, processed (2024)

Holding Cost

Holding costs are costs that arise related to storage activities in the warehouse. There are 2 storage costs that occur when procuring fabric raw materials at Griya Batik Mas, namely electricity costs and labor costs. With details that can be seen in Table 4 below:

Table 4 Total Storage Costs for Griya Batik Mas Raw Materials

Information	Inventory Type			
	Prime Cotton Fabric	Primissima Cotton Fabric	Dobby Cloth	Viscose Fabric
Salary Costs (Rp)	41,235,480	3,112,200	1,726,920	725,400
Electricity Cost (Rp)	182,690	13,788	7,651	3,214
Total holding costs (Rp)	41,418,170	3,125,988	1,734,571	728,614
Holding Cost/meter/year(Rp) = $Hn\ st\ /\ va\ nvnt$	737	1067	1164	1164

Source: Data processed, 2024

Application of Economic Order Quantity (EOQ) and Period Order Quantity (POQ) calculations

Based on the table based on raw material usage, ordering costs and storage costs, calculations can be made using the EOQ and POQ methods as follows:

Table 5 Application of EOQ and POQ Method Calculations

Inventory type	D (meters)	F Griya Batik Mas (Time)	S (Rp)	H or Cr (RP)	EOQ Quantity (meters)	F EOQ (Time)	POQ quantity (meters)	F POQ (Time)

Prime Cotton Fabric	112,332	12	1,443,137	737	20,974	5	50,059	2
Primissima Cotton Fabric	5,860	12	108,963	1067	1,094	5	2,661	2
Dobby Cloth	2,980	12	60,449	1164	556	5	1,328	2
Viscose Fabric	1,252	12	25,397	1164	234	5	558	2

Source: Data processed, 2024

Description:
D = Average need for goods
F = Frequency of orders
S = Ordering costs
H or Cr = Storage costs

Next, the Safety Stock calculation is carried out using the Excel formula

a. The Z value can be found using the excel formula =NORMSINV(95%)
b. Standard deviation (σ) =STDEV(raw material usage in one year)

By knowing the safety stock for each type of fabric raw material inventory, as well as the EOQ and POQ quantities, the Total Inventory Cost (TIC) for each fabric can be calculated as follows:

Table 6 Calculation of Total Inventory Cost EOQ Method

Information	Prime Cotton Fabric	Primissima Cotton Fabric	Dobby Cloth	Viscose Fabric
Frequency (times)	5	5	5	5
EOQ quantity (meters)	20,974	1094	556	234
S (Rp)	1,443,137	108,963	60,449	25,397
H or Cr (Rp)	737	1067	1164	1164
Order Fee (Rp)	7,729,017	583,654	323,791	136,037
Storage Fee (Rp)	7,729,017	583,654	323,791	136,037
Total Inventory Cost (Rp)	15,458,034	1,167,308	647,582	272,074

Source: Data processed, 2024

Table 6 Calculation of Total Inventory Cost POQ Method

Information	Prime Cotton Fabric	Primissima Cotton Fabric	Dobby Fabric	Viscose Fabric
Frequency (times)	2	2	2	2
EOQ quantity (meters)	50,059	2661	1,328	558
Safety Stock(SS)	372	32	32	32

S (Rp)	1,443,137	108,963	60,449	25,397
H or Cr (Rp)	737	1067	1164	1164
Order Fee (Rp)	3,238,399	244,513	135,648	56,991
Storage Fee (Rp)	18,720,559	1,427,113	810.144	362,004
Total Inventory Cost (Rp)	21,958,958	1,671,626	945,792	418,995

Source: Data processed, 2024

Discussion

Based on the results of the analysis that has been carried out regarding the Griya Batik Mas raw material inventory control system with an inventory control system using the method Economic Order Quantity (EOQ) and Period Order Quantity (POQ) obtained the following results:

Table 7 Percentage of Savings Total Inventory Cost

Fabric Type	Total Inventory Cost (TIC)		
	Griya Batik MasMethod (Rp)	EOQ Method(Rp)	POQ Method(Rp)
Prime Cotton Fabric	58,735,818	15,458,034	21,959,305
Primissima Cotton Fabric	4,433,542	1,167,308	1,671,626
Dobby Cloth	2,459,955	647,582	945,792
Viscose Fabric	1,033,372	272,073	418,995
Amount	66,662,687	17,544,997	24,995,718
Savings		49,117,690	41,666,969
% Savings		74%	63%

Source: Processed data, 2024

Based on Table 7 above, it is known that by applying the EOQ and POQ methods, TIC savingsof 74% and 63% occur. These savings occurred due to the reduction in the number of ordering frequencies after implementing the EOQ and POQ methods. The frequency of original orders using the Griya Batik Mas method occurred from 12 times to 5 times with the EOQ method and2 times with the POQ method. Reducing the number of

orders placed frequently reduces orderingcosts and storage costs. This is because the less often orders are made, the shipping costs and telephone costs used will decrease because they are used less frequently, and vice versa. Meanwhile, storage costs also decrease because the average inventory stored decreases, and inventory enters the warehouse less frequently, so handling costs also decrease.

CONCLUSION

Based on the results of calculations and analysis that have been carried out regarding the Griya Batik Mas inventory control system with an inventory control system that applies the Economic Order Quantity (EOQ) method and the Period Order Quantity (POQ) method. The following are some conclusions obtained from the results of the calculations and comparisons that have been carried out:

1. The inventory control system at Griya Batik Mas Pekalongan City still uses conventional methods,WhereInventory purchases are carried out routinely with the same order quantity every month without taking into account the amount needed and the use of raw materials is still based on previous experience for the four types of fabric raw material inventory owned, namely prime cotton fabric, primissima cotton fabric, dobby fabric and viscos fabric. .
2. The application of the Economic Order Quantity (EOQ) and Period Order Quantity (POQ) methods in the Griya Batik Mas Pekalongan City inventory control system shows that the frequency of orders being made was 5 times with a total quantity of 22,858 meters using the EOQ method and 2 times with a total quantity of 54,606 meters using the EOQ method. POQ method. Apart from that, from the calculation results using the EOQ and POQ methods, it is known that Griya Batik Mas, when ordering its fabric raw materials, needs to pay attention to certain reorder limits. Orders must be placed again (reorder points) when the number of prime cotton fabrics available in the warehouse reaches 762 meters, 52 meters for primissima cotton fabric, 42 meters for dobby fabric, and 36 meters for viscos fabric.
3. From the results of the comparative analysis that has been carried out, it is known that there has been a decrease in the total inventory costs incurred, the quantity ordered, and the frequency of orders. Total inventory cost savings also occur, whereThe application of the Economic Order Quantity (EOQ) method is greater than that of the methodPeriod Order Quantity(POQ) on the Griya Batik Mas inventory control system with a differenceTotal Inventory Cost(TIC)namely Rp7,450,721 for the four types of fabric, with an order frequency of 5 times in 1 year.Apart from that, taking into account the warehouse capacity you have, thenThe Economic Order Quantity (EOQ) method is considered more appropriate for use as an inventory control system at Griya Batik Mas, Pekalongan City.

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