International Journal of Advanced Science and Technology
Vol. 29, No. 9s, (2020), pp. 2195-2203

Cost and Quantity Inventory Analysis in the Garment Industry: A Case study

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Abstract

This study aims to evaluate how effective and efficient inventory is in the fashion industry by using the EOQ method. This research is a quantitative study of WKB companies. The data used in this study are data for 2017 and 2018 covering the number of purchases and use of raw materials, data on ordering costs, data on holding costs, raw material prices, and Lead time. The results of this study indicate that, the level of frequency of purchases made more than 100 times resulting in high ordering costs. By using the EOQ method inventory becomes more effective and efficient, with order frequency being 15 times a year and ordering costs being less. The number of efficient inventories for one order based on EOQ in 2017 is 647 kg and in 2018 is 809 kg. For inventory costs using the EOQ method in 2017, the cost will be IDR 594,867.69 per year and in 2018 the cost will be IDR 612,956.26 per year. Costs that can be saved after using EOQ in 2017 are IDR 10,811,247.31 or 94.78%. Costs that can be saved after using EOQ in 2018 will cost IDR 11,066,168.74 or 94.75%.

Keywords: *Inventory, Economic Order Quantity.*

I. Back Ground

Every large or small production company or trading company needs inventory to minimize the risk of not being able to fulfill the customer's wishes. Material inventory (raw materials, semi-finished materials, finished products) is a major factor in the company in supporting the smooth production process and company operations (Fahmi Sulaiman, 2015) (Mukesh Bhagoria, 2010)(Yusuf, 2003), role to meet production and operating targets, has an important function for the company when there are more demand and demand is irregular/changing (Pujawan & Silver, 2008), late arrival of goods, the existence of defective goods when the goods arrive and or damage during the production process. Inventory control and inventory records are very necessary for every company (Gonzalez & González, 2010)(Winston, 2004) (Yousefli & Ghazanfari, 2012), whether the company has been maximized in managing inventory in achieving production targets or poor warehouse management in the procurement of goods. If this happens, then the impact will affect other areas ranging from targets that are not achieved, reduction of employee work hours due to running out of goods to be processed, until the decline in profits of companies that should get more sales ultimately not achieved.

WKB convection company is one of the micro-business companies engaged in fashion, which is located in the city of Jakarta, established in 2013, which produces clothing and pants, which consists of various types, and various kinds of models. The production process is carried out, the production is sold directly to consumers and based on consumer orders (*job order*). This company is a micro company that is developing its markets in the islands of Java, Sumatra, and Kalimantan by collaborating with business partners.

In this article, we will discuss only 30s of cotton fabric production material, as the main material of production, because the products that are ordered are shirts. All this time the goods ordered and stored are in the form of 30s of cotton cloth, then processed into t-shirts. Every month WKB uses raw materials for cotton fabric as much as 700-1000 kilograms, and production depends on the number of orders (*job order*). Ordering and shipping costs are IDR 20,000 per order. WKB orders an average of 900 kilograms in 1 month, which is transported by car for every 1-time order. The lead time for shipping raw materials to the WKB company is 1 day.

WKB orders only based on the estimated remaining stock, and the target number to be produced. If the stock is running low or there is not enough production demand, then the order is returned to the supplier so that the order frequency becomes irregular and the order cost can be large.

ISSN: 2005-4238 IJAST

Inventory planning that has been done by WKB can be called using the "try and error" method, so it can be said to be less efficient. The frequency of bookings made by WKB is on average 9-12 times per month. This has resulted in a high order fee, which is IDR. 180,000-IDR.240,000 per month, and if totaled, the costs incurred in the amount of IDR. 2,160,000-IDR.2,880,000 per year for ordering 30s of cotton fabric raw materials.

Based on the above problems, and inventory management evaluation will be carried out using the Economic Order Quantity (EOQ) method so that it can be known:

1. Is the inventory method implemented by the company efficiently and effectively?
2. Is using the EOQ method, inventory will be more effective in terms of implementation and efficiency in terms of cost?
3. How much is an efficient inventory for one order based on EOQ?
4. What is the cost of inventory if using the EOQ method?
5. How much can save after using EOQ?

II. Literature review

EOQ Formula	$\text{EOQ atau } Q = \sqrt{\frac{2DS}{H}}$	EOQ or Q^*: Optimal order amount (in units) D: Number of demand per year (in units). S: Ordering cost. H: Holding cost per unit. N: Frequency of orders for one year
Frequency Formula	$N = \frac{D}{Q^*}$	
Total Holding cost	$TCC = \frac{Q}{2}H$	TCC: total holding cost TOC: total ordering cost Q: EOQ H: ordering cost D: demand S: holding cost
Total Ordering Cost	$TOC = \frac{D}{Q}S$	
Total Cost	$TC = TOC + TCC$	TC: Total cost ROP: Reorder point L: Lead time d: rate of need per day SS: safety stock
Reorder Point	$ROP = (Lxd) + SS$	
Standard deviation	$\text{Standart Deviasi} = \sqrt{\frac{\sum(x-\bar{x})^2}{n}}$	X: The number of goods needed $\bar{x}$: Average amount of goods

Safety Stock	$SS = Sd \times Z$ or $SS = Sd \times 1,65$	needed n: Amount of data SD: Standard deviation Z: Safety factor

Inventories are assets of a company, whether in the form of raw materials, or in the form of being processed, or in the form of finished goods. Excess or lack of inventory will adversely affect the company's financial performance, such as the circulation of money or capital that is not good, the existence of unemployed labor, the possibility of damaged products, disruption of the production process (Yopan Maulana, 2018).

By carrying out inventory control can reduce costs and simultaneously meet customer needs. With an inventory that is too small, resulting in delays in the production process due to shortages of stock, so that the delay in meeting the demand that impacts the company does not make a profit because of lost selling opportunities (Lin & Chen, 2011)

Determining the amount of inventory for merchandise to be resold or raw materials for processing is part of the company's decision (Yuliana, Topowijono, & Sudjana, 2016).

Economic Order Quantity

EOQ is one of the inventory management models, to determine the number of goods / raw materials with minimal costs, or as an optimal number of purchases (Kalaiarasi, 2011). The EOQ method strives to achieve the lowest possible inventory levels, at a low cost. (Yuliana et al., 2016) (Yopan Maulana, 2018) (Saragi & Setyorini, 2014) (Fahmi Sulaiman, 2015).

The EOQ model as one of the tools that are easily adjusted according to company needs, as a basis for decision making. EOQ is a form of business management by the company especially the production and inventory department to always create a stable operation in various conditions (Fahmi Sulaiman, 2015).

According (Heizer, J., & Render, 2014) (Hillier & Lieberman, 2010) (Blumenfeld, 2009) (Onawumi, Oluleye, 2011) (Birbil, Bulbnul, J.B.G.Frenk, n.d.) (Tibrewala & Kleinstein, 2000) to determine the amount of economic order, use the following formulas:

Table -1: The formula of Economic Order Quantity

In general, the use of EOQ, to reduce costs and minimize the number of orders. The use of the EOQ method must meet the following assumptions (Maisuriya & Bhathawala, 2013)(Heizer, J., & Render, 2014)(Hillier & Lieberman, 2010):

- The amount of material/goods is fixed / unchanged in one period.
- Material is always available and easy to obtain.
- Material/goods prices are fixed.
- Relatively fixed lead time.
- All orders are sent at the same time.
- Material items/goods are one type and do not depend on other materials/items.
- Ordering and holding costs are fixed

Prior Research

Research on EOQ has been carried out by (Mathew, 2013) (Rorim Panday; Hernawati, 2015) (Emmanuel Adjin Okwabi, 2014) (Al-salamah, 2011) (Ameli, Mirzazadeh, & Shirazi, 2008) (Rezaei & Salimi, 2012), which in all research when used the EOQ method in inventory management on each

research object, has been proven to reduce total inventory costs and minimize reordering and optimize ordering frequency.

III. Methodology

This research is quantitative. Research data obtained from interviews and secondary data from company reports that include:

a) Data on the number of purchases and uses of raw materials in 2017 and 2018
b) Ordering cost data in 2017 and 2018
c) Data on inventory costs in 2017 and 2018
d) Price of raw materials in 2007 and 2018
e) Lead time in 207 and 2018.

In the study of calculations conducted using the EOQ method. The raw material used is 30s cotton fabric. From the results of calculations using EOQ, then a comparison is made between inventory costs based on EOQ and inventory costs that have been carried out for 2017 and 2018. Besides comparing the frequency of orders and the number of orders for a one-time order, compared between calculations using EOQ with those already carried out in 2017 and 2018.

IV.Result and Analysis

Calculation of ordering cost and inventory costs

a. Ordering cost
Ordering costs, in the form of transportation cost to spend from the company to the supplier, amounting to IDR. 20,000 per purchase.

b. Inventory cost.
Inventory cost consist of two kinds:

1) Salary of employees and warehouse employees is only one person because the warehouse is small with few items, where the salary of the warehouse employee who works as a stock check and records is IDR. 8,400,000 / year.

2) Warehouse electricity costs
Electricity cost = number of lamps x the amount of wattage used (in kwh) x lights on per day x electricity rates

- For 2017
  Electricity cost /day = 6x25 (0,025kw) x 10 hour x IDR1034= IDR.1.551/day
  Electricity cost /year =IDR.1.551 x 365 = IDR.566.115/year
- For 2018
  Electricity cost /day = 6x25 (0,025 kw) x 10 hours x IDR.1352 = IDR.2.025
  Electricity cost / year = IDR.2.025 x 365 = IDR.739.125/year
  so it can be calculated for holding costs, as follows:

1) 2017:=IDR. 8.400.000 +IDR. 566.115=IDR.8.966.115
2) 2018:= IDR. 8.400.000 +IDR.739.125 =IDR.9.139.12
3) **Calculation of raw material usage**

In every shirt sale, counts are used per ball, per ball containing 25 kg of clothing. 1 kg of material is equal to 3.5 meters, and 3.5 meters is the same as 3 shirts. Thus 1 ball for 75 shirts.
WKB convection on average consumes 30 kg of cotton fabric per day. The number of t-shirts is :

1) 2017, 30 kg = 105 meter= 90 shirts /day
2) 2018, 40 kg = 140 meter= 120 shirts /day

Purchase and Demand data for cotton fabrics 30 s

Below is a table of purchases recorded with monthly data as follows:

Table 2 Purchases data in 2017

Month	**Amount of Purchasing**	**Amount of Transaction**	**Ordering cost**	**Amount of Demand**
	(Kg)	**(Frequency)**	**(IDR)**	**(Kg)**
JANUARY	720	9	180,000	810
FEBRUARY	720	9	180,000	720
MARCH	720	9	180,000	810
APRIL	800	10	200,000	810
MAY	880	11	220,000	810
JUNE	960	12	240,000	810
JULY	720	9	180,000	810
AUGUST	720	9	180,000	810
SEPTEMBER	880	11	220,000	810
OCTOBER	720	9	180,000	810
NOVEMBER	960	12	240,000	810
DECEMBER	960	12	240,000	810
TOTAL	**9,760**	**122**	**2,440,000**	**9,630**

Based on the table above, the total purchases in 2017 amounted to 9,760kg, while the total demand was 9,630kg

Table 3 Purchasing Data in 2018

Month	Amount of Purchasing	Amount of Transaction	Ordering cost	Amount of demand
	(Kg)	(Frequency)	(IDR)	(Kg)
JANUARY	950	10	200,000	1,040
FEBRUARY	855	9	180,000	960
MARCH	950	10	200,000	1,040
APRIL	855	9	180,000	1,040
MAY	1,045	11	220,000	1,040
JUNE	1,235	13	260,000	1,040
JULY	1,140	12	240,000	1,040
AUGUST	855	9	180,000	1,040
SEPTEMBER	1,045	11	220,000	1,040
OCTOBER	855	9	180,000	1,040
NOVEMBER	1,140	12	240,000	1,040
DECEMBER	1,140	12	240,000	1,040
TOTAL	**12,065**	**127**	**2,540,000**	**12,400**

Based on the table above, total purchases in 2018 amounted to 12,065kg, while total demand was 12,400kg

ISSN: 2005-4238 IJAST

Actual inventory cost

The actual inventory costs incurred by the company in 2017 and 2018 can be seen in detail at the table below.

Table 4 Total inventory costs for 2017 and 2018

	2017	2018
Ordering Cost (IDR)	2,440,000	2,540,000
Holding Cost (IDR)	8,966,115	9,139,125
Total Inventory cost (IDR)	11,406,115	11,679,125

Total inventory costs in 2017 amounted to IDR.11,406,115. Total inventory costs in 2018 amounted to IDR.11,679,125.

The following are the results of the EOQ calculations for 2017 and 2018.

Table. 5 Calculation of EOQ in 2017 and 2018

The raw material for 30s cotton fabric	2017	2018
Demand (kg)	9.630	12400
Ordering cost (IDR)	20.000	20000
Holding cost (IDR)	918.66	737.03
EOQ(kg)	647.54	809.19
Frequency	14.87~ 15	15.32~15
Ordering cost (TOC)/ per-year (IDR)	297,433.85	306,478.13
Holding cost (TCC) /Year (IDR)	297,433.85	306,478.13
Total inventory cost (TC) (IDR)	594,867.69	612,956.26
Standard deviation	216	279
Service level (95%)	1.644	1.644
Safety stock (Kg)	357	460
Lead time (day)	1	1
Demand average EOQ /month (kg)	54	67,43
Re-order time (kg)	411	528

The holding costs for 2017 IDR 918.66 are obtained from electricity costs for 2017 amounting to IDR. 566,115 plus employee salary costs during 2017 IDR.8,400,000 then divided by 9,760 kg warehouse capacity. Holding costs in 2018 IDR.737.03 obtained from electricity costs during 2018 of IDR. 739,125 plus employee salary costs during 2018 IDR.8,400,000 then divided by 12400kg warehouse capacity.

The total inventory cost for 2017, for one order, using the EOQ formula is IDR.594,867 obtained from the sum of the order costs IDR.297.433 and holding costs IDR.297.433. 2017 reorder point (ROP) is 411kg.

The total inventory cost of 2018, for one order, using the EOQ formula, the cost to IDR 612,956 is obtained from the sum of the ordering costs of IDR. 306,478.13 and a holding fee of IDR 306,478.13. The reorder point (ROP) of 2018, obtained 528kg.

Table 6 Difference in costs before and after the calculation of EOQ in 2017

TC actual	TC EOQ	TC difference	Percentage
11,406,115	594,867.69	10,811,247.31	94.78%

The total cost before the EOQ calculation is IDR 11,406,115 and after the calculation using the EOQ, the fee will be IDR. 594,867.69, so that by using the EOQ method the company can save costs by IDR. 10,811,247.31 with a percentage reduction in costs of 94.78%.

Table 7 Difference in costs before and after the 2018 EOQ calculation

TC actual	TC EOQ	TC difference	Percentage
11,679,125	612,956.26	11,066,168.74	94.75%

The total cost before the EOQ calculation is IDR 11,679,125 and after the calculation using the EOQ, the cost will be IDR. 612,956.26, so that by using the EOQ method the company can save costs by IDR. 11,066,168.74 with a percentage reduction in costs of 94.75%. With the results of the analysis above, the EOQ method can be proposed for use in other raw materials and can also be used in other similar garment businesses, both large and small.

V. Conclusions

Based on the results of research that has been conducted on the raw material inventory of WKB convection companies, and focusing on ordering 30 s cotton fabrics, the following conclusions can be obtained:

a. Orders made by the company are inefficient and ineffective because the purchase frequency is more than 100 times which results in large ordering costs.

b. By using the EOQ method inventory can be said to be more efficient and effective, with ordering frequency being 15 times a year automatically ordering costs being less.

c. The amount of efficient inventories for one order based on EOQ in 2017 is 647 kg and in 2018 is 809 kg.

d. The cost of inventory using the EOQ Method in 2017 is IDR.594,867 per year and in 2018 is IDR612,956 per year.

e. Costs that can be saved if using EOQ in 2017 is IDR 10,811,247 or as much as 94.78%.

f. Costs that can be saved if using EOQ in 2018 is IDR 11,066,169 or 94.75%.

VI. Recommendation

Because it has been proven that using the EOQ method can increase the effectiveness and efficiency in the procurement of goods, it is better for the WKB convection to use the EOQ method for the following year

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