**Impact Factor (SJIF): 4.714** **E-ISSN: 2583-1615**

International Journal of Research in Academic World

**Received**: 20/December/2022 **IJRAW:** 2023; 2(1):90-93 **Accepted:** 24/January/2023

# Paper Raw Material Inventory Management at Swadaya Mandiri Company Using Economic Order Quantity (EOQ)

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**Abstract**

One of the most significant things in representing the performance of a company is the ideal inventory. This research is a quantitative research that looks at how Swadaya Mandiri Company applies the Economic Order Quantity or EOQ method to control raw material supplies. Swadaya Mandiri Company is a cardboard printing manufacturing company. Based on the research, the results show that in 2022, the best quantity of paper raw material inventory using the EOQ approach is 360 reams with a frequency of 8 times, a safety stock of 20 reams, and a reordering point (ROP) when the inventory in the warehouse remains 60 reams with a total annual cost of IDR. 3,345,000. Compared to the company's current policy, using the EOQ approach to paper raw material inventory is more efficient.

**Keywords:** Inventory, EOQ, efficiency

## 1. Introduction

One of the most important parts of a trading and manufacturing business is inventory. Inventory management is very important because the amount of inventory in the company's warehouse has an impact on the production process and its efficiency. Every business, especially manufacturing and trading companies, must make well-informed purchasing decisions to ensure that raw materials are available in sufficient quantities and operations function smoothly (Wahyudi, 2015) [13]. To avoid shortages or excesses of raw materials, companies must also calculate appropriate inventory levels. In terms of procuring raw materials, there are various options available, including the EOQ method (Hillier & Lieberman, 2010) [4] (Blumenfeld, 2009) [1]. EOQ is a mechanism for reducing the total cost of inventory at the order level. For raw material supplies with a fixed level of demand, this method is usually used. This EOQ method cannot be used perfectly if demand is not constant. If demand follows a seasonal rhythm, or if a machine breaks down, this situation will occur (Fahmi Sulaiman, 2015) [2].

Swadaya Mandiri Company is a manufacturing company engaged in paper-based printing whose main activity is producing various shapes and motifs of food cardboard. In order to meet its raw material needs, Swadaya Mandiri Company purchases paper raw materials continuously without accurate calculations and results in excess inventory every month.

This company policy causes a large inventory stock due to irregular orders. So, the formulation of the problem in this study is how much inventory, reorder point and total cost of paper raw materials are ideal by calculating EOQ at Swadaya Mandiri Company? This study aims to determine the minimum amount of raw material inventory that must be stored in the warehouse and when to order paper raw materials.

## 2. Literarure Review

### Inventory Management

Inventory management is part of the inventory system to achieve minimum costs. Related matters are the number of orders, the time of reordering, the number of units of raw materials to be ordered, the average inventory level (Suryanto & Sadjiarto, 2016) [11]. Inventory management aims to serve customers, anticipate demand fulfillment, maximize purchasing efficiency, minimize inventory costs, and maximize profits. Excessive inventory stock will cause an increase in inventory costs, while a small inventory will result in an increase in ordering costs and excessive order frequency (Septiawan & Panday, 2021) [10]

Operations management is the starting point for inventory management tasks. This operating plan outlines the requirements needed to ensure smooth production, as well as details on how much inventory to hold and spend and when to buy it.

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**Inventory Benefits**

**There are several benefits of inventory, which are as follows (Rorim Panday, 2021) [9]**

- Minimizing the risk of late receipt of the required raw material orders;
- Reducing the possibility that the ordered material will be defective and must be returned.
- Reducing the risk of inflation which affects the increase in material prices;
- As a reserve raw material so that the company is not stranded if the required material is not available in the market;
- Profiting from purchases; and
- Ensuring that customers are satisfied with the availability of the goods they need.

**Economic Order Quantity (EOQ) Model**

EOQ is the most cost-effective method of controlling the quantity of raw materials at each purchase frequency (Rorim Panday;Novita Wahyu;DewiSri;Cahyadi Husadha, 2020) [9]. To cope with demand, the most cost-effective purchases can be considered, such as a variety of items that can be purchased at the lowest possible cost. In addition, EOQ is one of the most well-known inventory control techniques (Heizer, J., & Render, 2014) [3]. This EOQ method answers the question of when to order and how much to order (Septiawan & Panday, 2021) [10] (Yopan Maulana, 2018) [15].

Safety stock, determination of reorder points, maximum inventory or maximum inventory determination, and calculation of total inventory cost or total inventory cost are all included in the calculation (Taufiq & Slamet, 2014) [12]. The following are the steps in determining the ideal purchase amount or EOQ (Rorim Panday; Hernawati, 2015) [8]:

- Determine the ideal number of purchasing units
- Determining safety stock
- Define ROP
- Determination of maximum inventory stock
- Calculation of the total cost of inventory

The costs that must be considered by the company, among others (LaForge, 2012) [5];

**a) Purchase Costs:** Purchase cost is the production cost per unit for goods purchased from outside the company, or the price per unit for items made within the company.

**b) Order Cost/Setup Cost:** Order cost or Setup cost is if the item is produced within the company, the cost associated with the purchase order from the supplier.

**c) Carrying Cost/Holding Cost:** Holding costs or carrying costs are costs incurred in purchasing inventory, maintenance, and physical storage facilities.

**d) Stockout Cost:** The cost of inventory shortages from outside and within the company

**EOQ Model formula (Yani, Putri, & Nefri, 2018) are as follow**

a) EOQ or Q

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

b) Purchase Frequency

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

c) Safety Stock or SS
SS = (Maximum Usage – Average usage) x Lead Time

d) Reorder Point or ROP
ROP = (LT x AU) + SS

e) Total Inventory Cost or TIC
The formula of the total cost of inventory (TIC) is

$$:\left(\frac{D}{Q}S\right)+\left(\frac{Q}{2}H\right)$$

**Note:**
**D:** Total demand in One year
**S:** Ordering cost
**H:** Holding cost
**LT:** Lead time
**AU:** Average usage unit

**Assumptions in EOQ Model**

**This Method is Quite Easy to Implement and Must be Based on Several Assumptions (R. Panday, Rachmat, & Navanti, 2020) [6]**

a) Constant usage rate for applied inventory items
b) The lead time for purchases is known and constant
c) There are Lead times
d) The estimated usage demand for one year is known
e) Unit purchase price (or production cost)
f) Does not fluctuate for the time period concerned
g) There are sufficient resources available to purchase any reasonable amount

## 3. Method

This research was conducted at Swadaya Mandiri Company which is located on Jl. Caringin no 18 Bekasi City. This company produces cardboard with paper as its main raw material. Direct interviews with the warehousing and manufacturing divisions are also part of this research. Followed by processing quantitative descriptive data. Data was collected by researching and directly observing the operations at Swadaya Mandiri Company. Literature reviews of journals and research publications that are relevant to the topic are also used to obtain data.

## 4. Result and Discussion

Production activities carried out at Swadaya Mandiri Company start with ensuring the availability of raw materials. Quite a lot of raw materials are needed, but the most needed are: paper, ink, glue and plastic packing. Suppliers who have subscribed to the company send the required materials. Suppliers who ship for various businesses. If the company contacts a supplier to increase inventory, they will come. This inventory is usually added three to four days before the inventory in the warehouse runs low. The paper used in production activities is duplex paper with a size of 90 x 120cm and a weight of 400gr which was ordered from PT Dayasa. Orders are placed in reams. Acquisition of paper raw materials in 2022 is described in the table below:

**Table 1:** Use of Raw Materials in 2022

| Month | Duplex paper(reams) |
|---|---|
| January | 250 |
| February | 200 |

| | |
|---|---|
| March | 210 |
| April | 300 |
| May | 310 |
| June | 200 |
| July | 220 |
| August | 275 |
| September | 200 |
| October | 200 |
| November | 290 |
| December | 200 |
| Total | 2855 |
| Average | 237,9=238 |

Every month, the number of orders for raw materials varies. The month of May has the largest number of orders. Production activities are implemented in a shift system from 8 am to 4 pm, from 4 pm to 12 pm and from 12 to 8 am. The production activity is to produce various food boxes and patterned cakes.

**Ordering Cost**
The cost of ordering paper raw materials by the company for a year is IDR 11,130,000 per year for 53 orders. So for 1 time ordering it costs IDR 210,000.

**Holding Cost**
The holding cost of paper raw materials in 1 year can be seen in the table below:

**Table 2:** Details of holding cost

| S. No | Type Activities | Amount |
|---|---|---|
| 1 | Warehouse cost | IDR 12.000.000 |
| 2 | Electricity cost | IDR 1.908.750 |
| 3 | Labor cost | IDR 12.500.000 |
| Total | | IDR 26.408.750 |

The storage cost for 1 year is IDR 26,408,750 and the cost for 1 ream of paper in 1 year can be calculated as follows:
Total storage costs: total raw materials
IDR 26,408,750:2,855 reams = IDR 9,250/ream/year.
So, the storage cost per ream per year is IDR 9,250

**Total Cost (TC) base on Company policy**
The overall costs incurred by the company as a result of its policy are as follows:
TC = Total ordering cost + Total holding cost
TC = IDR 11.130.000 + IDR 26.408.750
TC = IDR 37.538.750

**Calculation of order quantity with EOQ**

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

$$EOQ = \frac{\sqrt{2 \times 2.855 \times 210.000}}{9250} = \sqrt{129.632}$$

$$= 360 \text{ ream}$$

**Frequency Purchasing**

$$F = \frac{D}{EOQ} = \frac{2.855}{360} = 7, 9 \text{ or } 8 \text{ order times}$$

**Safety Stock**
SS = (Maximum usage – Average usage) x LT
Maximum usage per day= 15 ream
Total work day in 1 year = 300 days
LT = 4 days
Average usage 1 day= 2855: 300= 9,51= 10 ream
SS = (15 – 10) x 4
SS = 20 ream

**Reorder Point**
ROP = (LT x AU) + SS
ROP = (4 X 10) + 20
ROP = 60 ream

**Total Inventory Cost (TIC) EOQ**
TIC = 360/2 * IDR.9250 + 8*IDR.210.000= IDR. 3.345.000

**Comparison**

**Table 3:** Comparison between company Policy and EOQ

| S.No | Comparison Objeact | Company Policy | EOQ |
|---|---|---|---|
| 1 | Average purchasing | 238 ream | 360 ream |
| 2 | Frequency Order | 12 times | 8 times |
| 3 | Safety Stock/SS | - | 20 ream |
| 4 | Reorder Point | - | 40 ream |
| 5 | Total Inventory Cost | IDR 37.538.750 | IDR 3.345.000 |

## 5. Conclusion and Recommendation

**Conclusion**
Paper raw material in 2022 is 360 reams, while the average actual order is 238 reams. Swadaya Mandiri Company in 2022 made 12 orders, in the EOQ calculations orders could only be made 8 times. According to calculations using the EOQ model, there are 20 reams of safety stock, and reorder points can be made when there are 60 reams of stock in the warehouse. The actual total cost per year is Rp. 37,538,750, while in the EOQ calculation, the total cost per year is only Rp. 3,345,000.

**Recommendation**
For Swadaya Mandiri Company, it would be nice to review the raw material supply policy carefully. Because the results of the study found that the policies used were less effective and efficient in controlling inventory and minimizing inventory costs. Companies should consider implementing the EOQ method because the total costs is more efficient than the total costs of company policies that have been implemented.

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