# The Comparison of Total Inventory Cost

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**Abstract:** The purpose of this study is to compare the calculations of raw material's inventory planning and control of a company based on actual calculation by the company compare to the theoretical calculation of Economic Order Quatity (EOQ). Rahayu Ltd. (the name of the compan is replaced according to company 's request) is the object of this research which is a company that engaged in the field of aluminum smelting that is fused recycling of any types of scrap or junk or trash that is made from aluminum, for example: beverage cans cookware, license plate number, wire and others that located in Gresik (East Java) from 2007-2012. Research method that will be used in this study is qualitative that observe the data by using the methods of EOQ and Safety Stock (SS) as well as supporting data from the company's marketing department warehouse and the purchasing department of raw materials while the unit of analysis is the sales data as well as the purchase of raw material inventory stock data from the marketing department the warehouse and the purchasing department of the company. The results of his research in that there can be significant differences between the calculations based company with EOQ then the conclusion is more efficient if the company will do the calculation and control of raw materials by using EOQ Method because it can save the cost of raw materials inventory as compared to the calculation using the company.

**Key words:** Economic order quatity, raw material, inventory, holding cost, ordering cost

## INTRODUCTION

By seeing the condition of today's business environment the success of a company's marketing is not solely seen from the success of planning marketing or business marketing that has been made. With the maturity of planning and marketing strategies in the face of possible competition will be able to create a company to become superior. All companies both companies that produce goods and services both small and large companies essentially have the same goal which is to obtain maximum profit. In order to achieve these objectives, the company must optimize business to achieve maximum benefit the way is to press the various costs that arise one of which is to reduce inventory costs among other costs to inventory control of raw materials capital and production machines, so what has been the goal of the company will be achieved.

Base on the conditions earlier then there needs to be regulation of the amount of inventory both raw materials and finished goods, so that the needs of production processes and customer needs can be met. The main purpose of this inventory control is that the company always has a supply of the right amount at the right time and in the specification or quality of which has been determined, so that business continuity can be secured (undisturbed). In order to use raw materials more effectively and efficiently we need a planning and control of raw materials. Efforts to achieve these objectives can not be separated from economic principles example, we need to press the cost incurred in minimum amount. Both supplies are too much or too little because it will lead to cost of overruns inventory (carrying cost) later. With good planning and control will affect the quality of the raw material, so expect no more raw materials stored too long in storage it also becomes ineffective spending because of the investment that is embedded in the inventory is too large. So, when the inventory is too little will cause the costs due to lack of inventory (stock out cost) such as high prices for buying in small parties disruption of the production process unavailability of finished goods to customers. As a result of this, all will affect the marketing of these products. If the company have an unadequate inventory of products as a result of the shortage of raw material will affect the three possibilities those are:

- Consumers can suspend the purchasing (if needs are not urgent). This will lead to delays in the company's opportunity to earn a profit
- Consumers buy from a competitor and returned to the company (if it is an urgent need and still loyal). This will cause a loss opportunity to benefit during the lack of inventory

- Customer loyalty is lost and this is the most problematic. If customers buy from competitors and customers continue to move into a competitor it means we lose customers in the long term

In addition to the above cost, there is also a cost that known as an ordering cost; the costs that incurred in connection with ordering activities, since the placement of the order to the availability of materials/goods in the warehouse. These costs include: telephone charges mailing costs adminisrasi and order placement expenses supplier selection costs the cost of transporting and unloading receiving and inspection costs of materials/goods.

A company in Gresik that is Rahayu Ltd. (the name of the compan is replaced according to compan's request) which is precisely located in the middle of Mojo village approximately 30 min from Surabaya (East Java) is engaged in the business of smelting aluminimum trying to do the earlier calculation whisch is to plan the planning and inventory control of raw material that has been done but only according to company calculations only not compared with the calculation of inventory planning and control of other raw materials. Overview of the company's aluminum smelting Rahayu Ltd. (the name of the compan is replaced according to compan's request) is a private company founded by Mr. Ferry Tantono in 2000 engaged in the smelting of aluminum is melted recycling of all types of scrap or junk or trash that is made from aluminum for example: beverage cans cookware license plate number wire and others. All aluminum scrap material is heated and molded into aluminum ingots and forms the basis of all the new stuff that is made of aluminum, for example: door frames or windows of the house, a new pan, engine, car engines and others. Along with the development of the company then in 2007, start reaching the automotive industry market higher layer that becomes the first vendor companies such as Astra Otoparts OIM Ltd. Limited Honda rospect Motor Enkei Indonesia. At this time, Rahayu Ltd. (the name of the compan is replaced according to compan's request) growing very rapidly where the types of products continues to grow and develop the marketing area to the outside Java.

From Table 1 data shown the percentage of increasing and decreasing of the company's raw materials are so high per-year, until needed for more accurate

Table 1: Needs of raw material

| Years | Need of raw material (kg) | Differece (%) |
|---|---|---|
| 2007 | 2,474,240 | - |
| 2008 | 2,881,581 | 16.46 |
| 2009 | 1,132,990 | -60.68 |
| 2010 | 1,815,266 | +60.22 |
| 2011 | 1,584,014 | -12.74 |
| 2012 | 2,070,465 | +30.71 |

calculations for planningand inventory control of raw materials and this became a problem for the company considering the setup is always identical to the place/location of storage.

**Problem identification:** Raw materials, inventory's planning and control is part of the operational management interest in an enterprise which consequently may affect the company's marketing. In relation to the earlier, the formulation of the problem can be structured as follows:

- How inventory of raw material's planning and control to extrapolate Economic Order Quatity (EOQ) from year 2007-2012?
- Which is more profitable for calculating Economic Order Quatity (EOQ) calculation according to enterprise policy in terms of the handling of raw materials?

**Scope of the study:** Limiting research on the issue only to the cost of raw material inventories includes:

- The calculation of the cost of inventory ordering frequency waiting time safety stock and reorder point determination
- The study period from 2007 until 2012

**The purpose of the study:** The purpose of this study is as follows:

- To find planning and inventory control of raw materials by using the calculation of Economic Order Quatity (EOQ) from 2007 until 2012
- To determine the planning and monitoring of raw materials inventory of the most profitable among the calculation of Economic Order Quatity (EOQ) with the calculation according to the company policy in terms of control of raw materials

**Literature review**
**Definition of inventory:** Stevenson (2010) said that inventory is a vital part of business not only for inside the organization but it also contribute to customer satisfaction. According Render *et al.* (2012) stated that inventory is one of the most expensive and important assets to many companies representing as much as 50% of total invested capital. Stevenson (2010) also said that good inventory management is important for the successful operation of most businesses and their supply chain. Poor inventory management hampers operations diminishes customer satisfaction and increases operating cost.
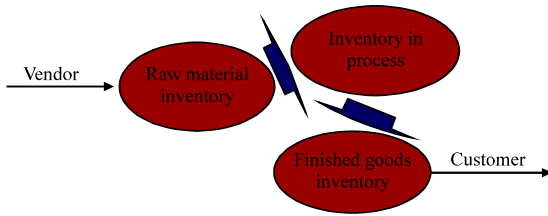
Fig. 1: Inventory flow chart



Fig. 2: Inventory EOQ model

The term inventory is a general term that indicates everything or organizational resources are stored in anticipation of the fulfillment of the request. Inventory is one of the most active element in the company's operations are continuously acquired, modified which then resold. Inventory value should always be recorded classified by the type and then made a detailed inventory of each type in a period. Figure 1 of common stock in a company's finished product.

**Assumption of economic order quantity:** EOQ Model is relatively easy to use but according to Render *et al.* (2012) there are some important assumptions to follow before using EOQ:

- Demand is known and constant
- The lead time (the time between the placement of the order and the receipt of the order) is known and constant
- The inventory from an order arrives in one batch at a point in a time
- The purchase cost per unit is constant throughout year. Quantity discounts are not possible
- The only variable costs are ordering cost and holding or carrying cost. The holding cost per unit per year and the ordering cost per order are constant throughout the year
- Orders are placed so that stockouts or shortage is avoided completely

Mallick (2013) also stated some assumptions of EOQ such as:

- Precise knowledge of demand of items and there uses rate are also assumed to be constant
- Delivery of units ordered is virtually instantaneous
- Price per unit ordering and carrying costs are all assumed to be constant regardless of order quantity

The purpose of this EOQ Method is to determine the number of economically every time the reservation, so that minimize the total cost of inventory in which each book then there are 2 kinds of costs that must be
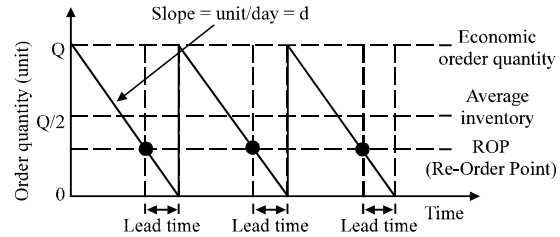
considered, namely the cost of ordering and holding costs. According Herjanto (2007), EOQ is one of the classic models but most of the inventory control techniques and the most widely used today because it is easy to use (Fig. 2). To calculate the Economic Order Quantity (EOQ) can be conducted by the fomula of:

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

Where:
Q* = Optimal number of items per order in units/orders
D = Annual demand goods inventory in units/year
S = The booking fee for each order
H = The cost of storage per unit/year
F = Frequency booking
Q = The distance of time between orders (in/day)
TC = Total cost of inventory

**Safety stock:** This safety stock will be used if the company's raw material shortages or delays in the arrival of raw materials that have been ordered by the company. With the safety stock the production process is not interrupted and can be expected to continue to run smoothly.

**Inventory cost:** According Ahyari (2006) the costs that incurred by the company in relation to the inventory in a company composed of three kinds namely ordering cost, holding cos and fixed costs of inventory.

**Ordering cost:** Ordering costs are costs that directly related to the activities of the order made by the company. The factor that calculated on the ordering cost is how much time the order is made and how many units are ordered in each time ordering. Some examples of the cost of ordering among other things:

- The preparation of purchase cost
- The cost of invoicing
- The cost of the expedition and administration
- Unloading raw material costs calculated for each time of purchase
- Ordering costs related to the frequency of purchase

The ordering cost is often referred to as the cost of preparation purchase or set up cost or procurement cost. In principle, these cost will be calculated on the basis of frequency of purchase is carried out within the company.

**Holding cost:** A cost to be borne by the company in relation to the raw material stored in the company. The cost of such storage is often called sebaai carrying cost or holding cost. Some examples of storage costs among others:

- Cost savings and raw materials
- Insurance costs of raw materials
- Cost of raw material damage in storage
- Maintenance costs of raw materials
- Cost packing back
- The capital costs for raw materials investment
- The cost of storage losses
- The cost-per-unit rental building unit of raw material
- Risk of disuse of raw material
- Other costs associated with the amount of raw materials that are stored in the company concerned

**Fixed cost of inventory:** All costs arising from the supply of raw materials in the company that is not associated with either the frequency or the number of units purchased store in the company. Some examples of fixed costs of inventory among others:

- The cost of renting warehouse per-period
- Salary per-period of warehouse keeper
- The cost of unloading raw materials per-unit
- The cost of other supplies that are not related to the frequency and amount

## MATERIALS AND METHODS

The research method used in this study are qualitatively the observation data by using the method of EOQ and Safety Stock (SS) as well as supporting data from companies in the marketing department the warehouse and the purchase of raw materials. Research methods EOQ and SS is done in order to compare the results for the minimization of inventory of raw materials in order to support the smooth running of the company marketing the finished product.

**Unit analysis:** Unit of analysis that will be examined in this study is a data of sales, purchase and stock data of inventories of raw materials derived from the marketing department the warehouse and the purchase of the company.

**Time horizontal:** The approach of this study will be conducted with the longitudinal data collection on an ongoing basis. This research was conducted through the data collection process and a long time against a particular group of research subjects (fixed) and observed and followed in accordance with the continuous period.

## RESULTS AND DISCUSSION

**Comparison of the total inventory cost calculation according to company and according to the EOQ calculation in 2012:** Comparative analysis to determine the cost of raw material inventories held company more efficient or not compared with the calculation according to the formula Economic Order Quatity (EOQ). The total cost of inventory in quantity according to the calculation of the company (2012):

- Raw materials requirement (known) = 2,070,465 kg
- Order frequencies = 48 times
- Quantity/order = 2,070,465/48 = 43,135 kg
- Ordering cost (Telephone cost = IDR. 30 000 000)
- The cost of transportation and loading and unloading has been entered into the cost of raw materials

Holding cost/kg (calculated by 10% of the price of per kg per type of stuff):

| | | |
|---|---|---|
| Machine and others (hard) | = 40%×1,600 | = IDR. 640 |
| Pots and others (soft) | = 40%×1,600 | = IDR. 640 |
| Can | = 5%×1,350 | = IDR. 68 |
| Abu taen gram | = 5%×1,000 | = IDR. 50 |
| Pure aluminum | = 10%×2,200 | = IDR. 220 + |
| Total holding cost per kg | | = IDR. 1 618 |

Calculation of minimum safety stok is 50% of the ordering cost:

| | |
|---|---|
| Holding cost | = 1\2×43,135×IDR. 1,618 |
| | = IDR. 34,896,215 |
| Ordering cost | = IDR. 30,000,000 |
| Fixed cost of raw material | = IDR.33, 489,771,375+ |
| | = IDR. 33,554,656,806 |

The total cost of inventory in quantity according to the calculation of EOQ (2012); where:

| | |
|---|---|
| Material required (known) | = 2,070,465 kg |
| Ordering cost | = IDR. 30,000,000/48= IDR. 625,000 |
| Holding cost | = IDR. 1,618 kg$^{-1}$ |

So, the value of EOQ can be calculated by:

$$EOQ = Q^* = \sqrt{\frac{2(2,070,465)(625,000)}{1,618}} = 39,994.45 \approx 39,995 kg$$

Table 2: The cost of raw materials and save charges in 2012

| Type of raw material | Percentage | Quantity (kg) | Price/kg (IDR) | Raw material cost (IDR) | Q/order (kg) |
|---|---|---|---|---|---|
| Machine, drum, drill (Hard) | 40 | 828,186 | 16,000 | 13,250,976,000 | 17,254 |
| Frying pan, plate, elbow (Soft) | 40 | 828,186 | 16,000 | 13,250,976,000 | 17,254 |
| Cans | 5 | 103,523 | 13,500 | 1,397,563,875 | 2,157 |
| Abu, Taen, Gram | 5 | 103,523 | 10,000 | 1,035,232,500 | 2,157 |
| Pure aluminum | 10 | 207,047 | 22,000 | 4,555,023,000 | 4,314 |
| Total | 100 | 2,070,465 | - | 33,489,771,375 | 43,135 |

Table 3: Comparison of the frequency of the company according to the company and the calculation of EOQ years 2007-2012 (in times)

| Years | Compay calculation (times) | EQ calculation (times) | Difference (times) |
|---|---|---|---|
| 2007 | 48 | 73 | 25 |
| 2008 | 48 | 79 | 31 |
| 2009 | 48 | 43 | 5 |
| 2010 | 48 | 52 | 4 |
| 2011 | 48 | 47 | 1 |
| 2012 | 48 | 52 | 4 |

Method of calculating in years 2007-2011 same with the year of 2012

Table 4: Cost comparison of the total cost of inventory according to company and EOQ years 2007-2012 (in IDR)

| Years | Compay calculation | EQ calculation | Difference |
|---|---|---|---|
| 2007 | IDR.39,832,553,333 | IDR.39,827,591,167 | IDR.4,962,167 |
| 2008 | 50,788,337,585 | 50,780,319,161 | 8,018,424 |
| 2009 | 16,935,183,076 | 16,934,951,428 | 231,648 |
| 2010 | 27,122,652,302 | 27,122,508,219 | 144,083 |
| 2011 | 24,684,075,427 | 24,684,058,836 | 16,591 |
| 2012 | 33,489,771,375 | 33,554,627,330 | 64,855,955 |

EOQ calculation for the year 2007-2011 the same way to 2012

$$F\left(Order\,frequencies\right) = \frac{2,070,456}{39,995} = 51.77 \approx 52 \text{ times}$$

With the inventory cost:

Holding cost = 1\2×39,995×IDR. 1,618 = IDR. 32,355,955

Ordering cost = 52×IDR. 625 000 = IDR. 32,500,000

Fixed cost of inventory = IDR.33,489,771,375+

= IDR. 33,554,627,330

Based on the earlier, the EOQ calculation frequency 52 times with the most efficient quantity per order is 39,995 kg and the total inventory cost is IDR. 33,554,627,330. When compared with the calculations have been done the company where it is a company policy then found a difference of IDR. 64,855,955 (IDR. 33,554,627,330-33,489,771,375).

Based on Table 2-4, it can be analyzed that the company would be more efficient to perform the calculation and control of raw materials using Economic Order Quatity (EOQ) because it can save the cost of supply of raw materials compared with calculations using the company's policy.

## CONCLUSION

From the earlier calculation and linked to the aims of this study it can be some conclusions namely:

- Based on calculations using the EOQ Method the importance of the ordering frequency at 52 times the quantity of the most efficient per-order is 39,995 kg and the total inventory cost is IDR. 33,554,627,330
- There is a significant difference between the calculation using the calculation of the company with the theoretical calculations the Economic Order Quantity (EOQ). From 2007-2011, there is a significant difference which is cheaper to use EOQ calculation method while for the year 2012 alone there were difference calculations for IDR.64,855,955, so it would be more efficient if the company uses the EOQ calculation

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