

**IMPORTED RAW MATERIAL INVENTORY CONTROL SYSTEM
AS AN EFFORT TO MINIMIZE INVENTORY COST
(A CASE STUDY IN PT APPAREL ONE INDONESIA)**

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ABSTRACT

This study aims to forecast the polyester usage for the upcoming 12 months and to find out the suitable method of imported raw material inventory control in PT Apparel One Indonesia by comparing and analyzing the implementation of JIT concept and EOQ method as well as to determine the safety stock and reorder point in inventory procurement of the company. The data used in this study are secondary data of imported raw material procurement system, the costs associated with raw materials inventory 2015-2016 and other relevant data. Polyester is observed since it is imported fabric raw material which mostly used in the company. The polyester usage predicted by regression is continuously increases per month. The forecasting result can be accepted because the tracking signal value is not more than ± 4 . Whereas, EOQ method is more suitable to be used by the company since the inventory cost is lower than the cost applying JIT concept. It is possible to save 13% or 9,512,693.3 IDR. Moreover, by applying EOQ method, it also determines the reorder point (ROP) and safety stock inventory to guarantee the smoothness of production activities. The company can purchase raw materials when the quantity of inventory is amounted to 375.547 yards (ROP), while the safety stock of polyester fabric is 43,006 yards.

Keywords : *Inventory Control, Forecasting, Just in Time (JIT), Economic Order Quantity (EOQ), Reorder Point (ROP), Safety Stock.*

INTRODUCTION

Along with the development of economy and technology today that demands all sectors of

the business to work more efficiently to face the increasingly tight business competition. This prompts the company to enhance its competitiveness in order to maintain the company's operations continuity to create a great company's profit. Generally, every company focuses on profit-oriented; in order to achieve this goal the company should be able to determine the policy applied that is by controlling the inventory. One of the most important assets in the company is raw material inventory because it is an important factor to ensure a smooth production. However it is undeniable that in the raw materials inventory procurement will raise the risk of improvidence cost since it often affects faults because there will be discontinuation of production due to the lack of raw material to be processed. It is important that by controlling the supply of raw materials, the company can minimize the cost and reduce the investment of raw material inventory as well as allocate it to the other parts of the company. PT Apparel One Indonesia produces sportswear; it is the biggest textile company industry in Semarang. In order to do the production, about 90% of raw materials used by the company are imported raw materials. Surely the procurement of imported raw materials does not spend a little cost. Raw materials procurement policy used by PT Apparel One Indonesia is to purchase raw materials after receiving orders from the buyers, it closes to JIT concept. Moreover the buyer gives only 60 days lead time, consisting of 30 days for order fabric and 15 days for shipment, and the rest is for production process. It is not effective and would be very risky if there is a late delivery. If there is a late delivery, the company must pay more

cost by increasing the working hours of employees to reach production targets with an increasingly short time, automatically it will incur an additional cost that is overtime cost. PT Apparel One Indonesia has been nowadays undergoing problems in procuring the imported raw materials that is fabric and it leads to the discontinuation of production activity for 3 days on 10 – 12 March 2016. While, the raw material mostly used by the company is polyester fabric. PT Apparel One Indonesia has 2 risks in implementing its raw material inventory control that is delay of goods production and late of shipment. The delay of goods production may happen if the arrival of raw materials is not on time schedule. It led to reduce production time. While, to meet the due date of shipping, the company has to alternate the mean of transportation from maritime to airline which does not spend a little cost. The company should conduct a different method which is suitable with the company condition. EOQ is a method which can be applied by the company to determine the optimal number of raw materials to order. The purpose is to determine the total ordering cost that minimizes the total cost; so that the cost of raw material procurement becomes more efficient. By implementing EOQ, the company will be able to minimize the occurrence of out of stock so that it will not disturb the effectiveness of production activities. (Sakkung:2011)

The problem statements of this study are:

- a. How is the forecasting result of polyester fabric raw material usage for the next 12 months (April 2016 to March 2017) in PT Apparel One Indonesia?
 - b. How does the application of JIT concept and EOQ method to control raw materials inventory?
 - c. How many *safety stocks* and *reorder point* should PT Apparel One Indonesia determine?
 - d. How effective is the application of JIT concept and EOQ methods in term of cost and inventory level?
 - e. Which is the suitable method to apply to control imported raw materials inventory in PT Apparel One Indonesia?
- Based on the statement of the problems, the objectives of this study are as follows:
- a. To analyze the forecasting result of polyester fabric raw material usage for the next 12 months (April 2016 to March 2017) in PT Apparel One Indonesia.
 - b. To analyze the application of JIT concept and EOQ method to control raw materials inventory?
 - c. To analyze *safety stocks* and *reorder point* in PT Apparel One Indonesia.
 - d. To analyze the comparison between the inventory control system used by the company in term of cost and inventory level.
 - e. To choose the suitable method to control imported raw materials inventory in PT Apparel One Indonesia.

LITERATURE REVIEW

Inventory. Handoko (2011) stated that inventory is a general term that indicates everything or organizational resources stored in anticipating towards fulfillment of the request.

Raw material. Mulyadi (2010) said that raw material is the material forms the whole of finished products in obtaining raw materials; the company not only spends an amount of purchasing price of raw materials, but also spends the purchasing costs, warehousing and other acquisition costs.

Forecasting. Herjanto (2011) explains that forecasting is known as an estimation process of a variable (incidence) in the future, the estimation is based on the related variable data of previous period.

Economic Order Quantity. Herlina (in Sakkung, 2011) stated that EOQ method is a method to determine how many economical quantity order per order, it is aimed to minimize the raw material inventory cost. In implementing EOQ is must be based on some assumptions.

Those assumptions were based on Heizer and Render (2015) are the number of requests is known, constant, and independent; lead time is the time between ordering and receiving order, it is known and constant; inventories are immediately accepted and completed; no quantity discount; the variable cost is only to order and to store the inventory in a particular time; lack of inventory can be completely avoided by booking on the right time.

Lead time. Herjanto (2003) said that lead time is the different time between ordering time and arrival time.

Safety Stock. Herjanto (2003) explains that safety stock is stocked inventory used to cover the requirement while waiting for the goods arrival.

Reorder Point. Heizer and Render (2015) stated that reorder point is the level of inventories when inventory has reached a particular level, ordering must be done.

Just in Time. JIT method is an inventory strategy where materials are only ordered and received as they are needed in production. The goal of JIT is to reduce costs by saving money on overhead inventory expenses. This method is considered a "pull" approach in manufacturing. When sale activities warrant more production, inventory is "pulled" and more manufacturing supplies are ordered.

RESEARCH METHOD

Variable.

Variables used in this study are forecasting and inventory control. This study will forecast the next 12 months that is April 2016 to March 2017, calculated by using a linear forecasting method refers to the imported fabric raw material usage data in April 2015 to March 2016. In this study, imported raw material inventory control will be calculated using EOQ method.

TABLE 1
RESEARCH VARIABLE AND
OPERATIONAL VARIABLE
DEFINITION

Variable	Scale
Forecasting polyester usage	Ratio
Inventory control:	
Economic order quantity	Ratio
Safety stock	Ratio
Reorder point	Ratio
JIT concept annual cost	Ratio

Source: Adjusted as necessary.

Analysis method.

The methods employed to analyze the data that are forecasting raw material usage, the accuracy of raw material forecasting, EOQ method analysis, safety stock, ROP analysis and JIT method. Forecasting method used in this study is the projection trend method by regression.

$$\hat{Y} = a + bX$$

Source: Herjanto (2003:136)

Noted that:

a = Y value if X = 0

b = the average change of Y to the change per unit of X

X = Independent variable

The accuracy calculation used in this study is absolute deviation average (*Mean Absolute Deviation - MAD*). It can be formulated as follows:

$$MAD = \frac{\sum |Actual - Forecast|}{n}$$

Source: Haizer and Render (2015:126)

To find out the validation of this model, it is using the *tracking signal* and the formula is:

$$Tracking\ Signal = \frac{RSFE}{MAD}$$

Source: Gaspersz (2001:81)

Noted that:

RSFE = Σ (Actual demand in period i + forecast demand in period i).

Otherwise, to determine the total ordering cost that minimizes the total cost is using EOQ method. According to Herjanto (2013) the formula of optimal quantities per order is

$$Q^* = \sqrt{\frac{2 DS}{H}}$$

While, the frequency of economic order is

$$= \frac{D}{Q^*}$$

The total cost of annual inventories using EOQ method is

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

Noted that:

D = The number of necessity goods (units/year)

S = The ordering cost (IDR/ order)

H = Storage cost (IDR/ yard)

Q = The number of ordering (units/ order).

Afterward the number of safety stock can be determined by the following formula:

$$SS = Z\sigma$$

Explanation:

σ = Standard deviation

Z = Service level, 95% determines the value of Z is using MS. excel formula of =NORMSINV (service level), the Z value is under the normal curve 95% that is 1.65. Otherwise, reorder point is determined by adding the usage of during grace period and safety stock:

$$ROP = d \times L + S$$

Explanation:

d = Level of requirement per unit

SS= Safety stock

L = Lead time

(Herjanto, 2003:241)

According to Marc. J. Schenierdejans (in Maharani, 2015) that the formula of total annual inventory cost of JIT method is as follows:

$$T_{jit} = \frac{1}{\sqrt{n}} \times T^*$$

Explanation:

n = Lot quantity of order

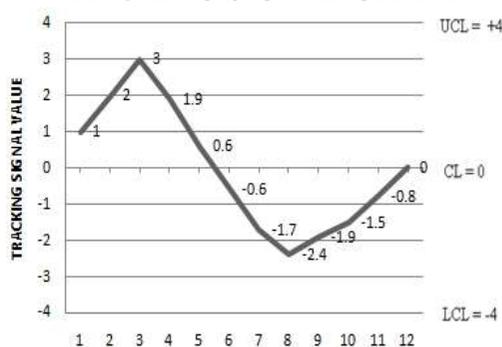
T*= Total inventory cost/year

RESULT AND DISCUSSION

Forecasting.

The polyester usage predicted by regression is continuously increasing per month. In the first 3 months, the usage which is predicted is lower than the last period usage. In July 2016 to November 2016 there will be a greater usage than the last period and the differences are about 17,000yards and 27,000yards. In December 2016 to March 2017 is predicted that there will be a lower usage than the last 2015. Basically, MAD value should be close to 0 (zero), it needs a tracking signal calculation to determine whether or not forecasting has been done. The value of tracking signal obtained can be projected in Figure 1.

FIGURE 1
TRACKING SIGNAL GRAPH



Source: Processed Secondary Data, 2016

It can be viewed from Figure 1 that the tracking signal is in the acceptable range, around UCL (4) and LCL (-4). The third month is the highest positive tracking signal which mean that actual usage is greater than predicted usage. Otherwise, the eighth month is the highest negative tracking signal which means that there will be an actual usage which is lower than the predicted usage. According to George Plossl and Oliver (in Meilani and Saputra, 2013:327) Tracking signal should be maximum ± 4 as a control limit. Based on the calculation of forecasting accuracy, the tracking signal is not more than ± 4 so that the forecasting accuracy can be accepted.

Inventory control. To ensure an adequate inventory to operate the production activities normally the company should apply EOQ method in controlling its raw material inventory. The comparison of inventory control based on the calculations obtained from JIT concept and EOQ method is shown in Table 2.

TABLE 2
COMPARISON OF JIT AND EOQ

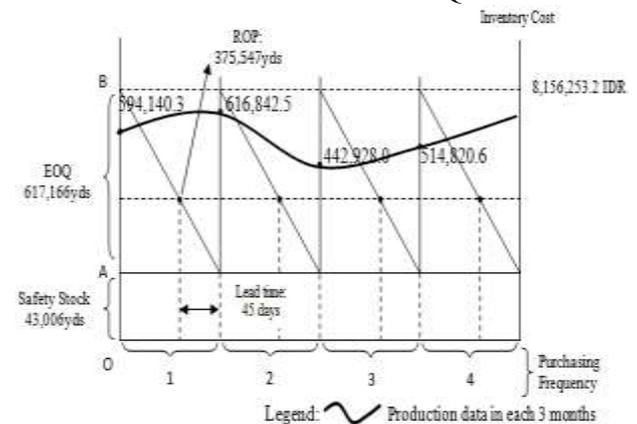
Inventory Control	JIT Concept	EOQ Method
Ordering frequency	18 times	4 times
Quantity per order	123,120 yards	17,166 yards
TC	24,799,806 IDR	32,625,012.7 IDR

Source: Processed Secondary Data, 2016

Table 2 illustrates the comparison of inventory control between using JIT concept and EOQ method. The ordering quantity of EOQ methods is lower than using JIT concept that is 4 times order per year, while the purchase frequency by using JIT concept is 18 times per year. The quantity order of EOQ is calculated better than the method used by the company. The quantity purchase produced by EOQ is greater than the company's actual circumstances which applying JIT concept. The total quantity order must be done by using EOQ method is **617,166** yards while by using JIT is only **123,120** yards per order. In applying EOQ, the risk imposed is smaller than JIT method because EOQ also determines the ROP and safety stock so that it can guarantee the production smoothness. Howard (1978) stated that the company must also take account of the demand and lead time fluctuation, by establishing safety stock. Freddy (in Sakkung, 2015) stated that the EOQ method is a method used to determine the amount of raw materials purchase per order with the lowest cost. According to the calculation of annual cost between JIT and EOQ is by implementing JIT concept, the company spends 42,137,706.0 IDR which is greater than EOQ. It is due to the split

shipment which happened 2 times in April and September 2015. The total annual cost incurred by the company is greater than EOQ. The saving cost obtained by using EOQ is 9,512,693.3 IDR. It means that the implementation of EOQ can minimize inventory cost and maintain the production continuity. According to find out the relation among inventory control using EOQ, ROP, lead time, safety stock, inventory cost and productivity is shown at Figure 2.

FIGURE 2
RELATION AMONG EOQ, ROP, LEAD TIME, SAFETY STOCK, INVENTORY COST AND PRODUCTION QUANTITY



Source: Processed Secondary Data, 2016

The bold line in Figure 2 illustrates the production quantity of the company per 3 months in 2015. According to the calculation, purchasing frequency using EOQ is 4 times per year and the quantity per purchase is 617,166 yards. The annual cost of EOQ is 32,625,012.7 IDR and amounted to 8,156,253.2 IDR per 3 months. It can be seen that when the production done, there is a stock and the cost spent is under the total inventory cost of EOQ.

Implication of research result.

Raw material inventory control should be correctly done by a company, regardless in PT Apparel One Indonesia, because the amount of inventory will affect the production smoothness. PT Apparel One Indonesia implements raw material inventory

control system which closes to JIT concept that is based on the buyer's order with the consideration that it can minimize the inventory costs. But the fact, the application of this method does not work well. Based on the analysis result, JIT concept spends 42,137,706.0 IDR per year as a total inventory procurement with 18 times purchasing frequency per year and 123,120 yards per order as well as 2-time split shipment cost in 2015. The company has to make a split shipment due to the delay of raw material arrival. EOQ results the lower inventory cost than JIT concept with saving cost is 13%. Moreover in applying EOQ also determines ROP and safety stock to guarantee the production smoothness. The company can purchase raw materials when the quantity available inventory amounted to 375.547 yards, while the safety stock is by 43,006yards. It can be concluded that EOQ method is more suitable to be used to minimize the inventory cost and to anticipate the delay of raw material arrival. So that the costs invested by the company will not be wasted and the smoothness of company's production is guaranteed. It is hoped that the future researchers can analyze other inventories not only polyester but also cotton, woven and accessories so that the company can maintain the continuity of the company's operations and create great company's profit.

CLOSING

Conclusion.

According to the analysis result of the raw material inventory control at PT Apparel One Indonesia, there are several conclusions can be made for this research:

- a. The polyester usage predicted by regression continuously increases per month. It is different from the monthly usage of polyester in the last year which is unstable. The forecasting result can be accepted because the tracking signal value is not more than ± 4 . There will be a greater usage than predicted due to the positive value of tracking signal in April

2015 to August 2015. Whereas, there will be a lower usage than predicted due to the negative value of tracking signal in September 2016 to February 2017.

- b. EOQ method is more suitable to be used by PT Apparel One Indonesia due to the results of inventory cost which is lower than JIT concept and the saving cost is 13% or 9,512,693.3 IDR. The company can purchase raw materials when the quantity of inventory which is available in warehouses amounted to 375.547 yards (ROP), while the safety stock of polyester is by 43,006yards. It can be said that production is supported by inventory control system.

Suggestion.

Based on the conclusions of the analysis result of the raw material inventory control at PT Apparel One Indonesia, the writer could give suggestions as follows:

- a. The company should review its applied raw material inventory control system because the actual condition of the company is still going to stock out which raises expense such as split shipment cost and employees overtime cost. EOQ method can be used by the company since the cost of EOQ method is less than the cost incurred by company's method. So that the costs that would be invested to other parts of the company are not wasted and the smoothness of the company's production activity is guaranteed.
- b. The company should determine the amount of safety stock and reorder point, to avoid the risk of stock outs and also the excess of raw materials in order to minimize the inventory cost.
- c. It would be better if the result of this study used by the company to control its raw material inventory system, not only for polyester but also cotton, woven, knit, etc.

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