



Analysis of Packaging Raw Material Requirements in Inventory Management PT. XYZ

Mentari Larasati¹, Sugiyono Madelan², Ahmad Badawi Saluy³

¹⁾ Universitas Mercu Buana, Jakarta, Indonesia, mentari24.larasati@gmail.com

²⁾ Universitas Mercu Buana, Jakarta, Indonesia, sugiyono.madelan@mercubuana.ac.id

³⁾ Universitas Mercu Buana, Jakarta, Indonesia, ahmad.badawi@mercubuana.ac.id

Corresponding Author: Mentari Larasati¹

Abstract: This study aims to determine the grouping of packaging raw material inventory and inventory planning that can minimize the total inventory cost of packaging raw materials at PT. XYZ. The population in this study is secondary data in the form of purchasing, production, and supply of packaging raw materials with sample data as much as the period January 2020 - December 2020. Data analysis methods used Minitab software and POM QM. The results show that the EOQ method can save the total inventory cost of fast moving-vital product in 2021 is Rp. 143,066 with the total number of requests being 1,227,214 pcs higher than the company's current method.

Keywords : Packaging raw materials, Forecasting, Economic Order Quantity (EOQ), Reorder Point, Safety Stock, Total Inventory Cos

INTRODUCTION

PT. XYZ is a manufacturing company engaged in FMCG. Products produced by PT. XYZ belongs to the category of cosmetic products. which is located in Cikarang, Indonesia. To produce these products requires the availability of adequate packaging raw materials in a timely manner. It is important for companies engaged in FMCG manufacturing to be able to maintain raw material supplies for smooth production processes to meet dynamic consumer demands.

However, when planning sales or forecast which can not be predicted easily, which have broad impact on the planning of procurement of raw materials packaging to meet the production schedule. Thus, there is a buildup of inventory in anticipation of inappropriate customer demand, or a shortage of inventory. That is because currently the company simply purchases raw materials based on the average usage of the previous 3 months. In the end, it has an impact on

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In the end, it has an impact on the financial sector with disrupted cash flow due to inefficiency in procurement and purchasing of packaging raw materials. In Figure 1. it can be seen that shows unfavorable conditions for one type of packaging raw material. The condition is based on the development of the last one year.

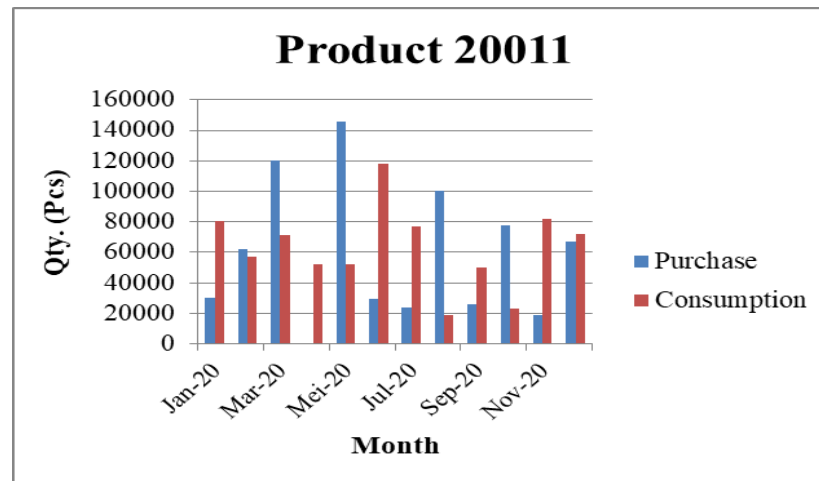


Figure 1. Data One of Product Packaging Raw Material)

(Source: PT. XYZ 2020)

Research Problem Formulation

From the above information it can be calculated as follows :

1. How to classify the packaging raw materials of PT. XYZ?
2. How is the inventory planning method that can minimize costs and can be applied to packaging raw material inventory management at PT. XYZ?

Research Objectives

1. Determine the appropriate grouping of packaging raw material supplies at PT. XYZ.
2. Determine the level of order that is economical for packaging raw materials using an inventory planning method based on the amount of packaging raw material needs and the costs incurred in inventory management of packaging raw materials.

LITERATURE REVIEW

Inventory

Inventory is an important factor in the smooth operation of the company's operations to achieve the company's desired target. Inventory is product stored in closed warehouses, open fields, or other storage places, either in the form of raw materials, semi-finished product, finished product and product used for operational purposes (Hudori and Tarigan, 2019) .

Purpose of Inventory (Afianti and Azwir, 2017) :

- a. Eliminate the risk of delay due to the arrival of the ordered product not on time.
- b. Eliminate the risk when the product arrives in bad condition
- c. Easy to get the product when the item is not on the market.

- d. Maintain the smoothness and stability of the product production process.
- e. Achieve optimal use of production machinery.
- f. Improving the level of service to customers by fulfilling wishes and providing availability of product.
- g. Making the amount produced not only based on the number of products sold.

Inventory Cost Type

There are costs that must be incurred in inventory control (Russell and Taylor, 2011).

- a. Carrying cost or Holding cost
Costs incurred for keeping product in inventory. Storage costs are linear with the level of inventory during a certain period.
- b. Ordering cost
Costs assigned to suppliers for purchasing products. The cost of ordering is linear with the number of products ordered. However, if in one order the product in large quantities and the number of ordering frequencies is reduced, then the ordering cost will be reduced.
- c. Stockout cost
Costs incurred as a result of unavailability of product when there is demand. Determining these costs can be said to be more difficult than holding or ordering costs, so their determination often uses subjective estimates.

FSN Classification in Inventory Management

FSN is a grouping of product into Fast Moving, Slow Moving, and Non Moving. FSN classification method can be generated based on the turnover ratio (Mitra et al., 2015) and based on consumption ratio of the product (Nadkarni and Ghewari, 2016).

$$\text{Turnover Ratio} = \frac{\text{Annual Demand}}{\text{Average Inventory}}$$

$$\text{Consumption Rate} = \frac{\text{Total Issued Qty.}}{\text{Total Period Duration}}$$

VED Classification in Inventory Management

VED classification as a method to assess the critical level of raw materials used. VED is a grouping of product into Vital, Essential, and Desirable (Vaisakh et al., 2013). This classification is obtained from the results of discussions with sections directly related to the handling of raw materials.

Forecasting

Forecasting is the science of estimating (predicting) future conditions (Heizer et al., 2014). In general, this forecasting method consists of two approaches. They are :

1. Qualitative Forecasting

Forecasting method that uses factors such as decision-making intuition, emotions, personal experiences, and value systems from events or experiences in the past.

2. Quantitative Forecasting.

Forecasting method that uses valid data in the past.

The conditions for using data in the past are:

- a. There is information in the past.
- b. There is information that can be processed into numerical data.
- c. It can be assumed that aspects of past data patterns have the same opportunities in the future.

There are two main types of forecasting models in quantitative forecasting (Russell and Taylor, 2011):

a. Time series

That use the basis of forecasting in the form of time. Where, the time parameter used as the basis for the analysis is historical (past) demand data.

b. Causal model

That uses analysis of the pattern of relationships between other variables that influence it (correlation or cause and effect methods).

Economic Order Quantity (EOQ)

According to Riyanto (2010:78) in Rizky et al., (2016) states that the EOQ method is the quantity of product that can be obtained with minimal costs. EOQ method can be formulated with the following formula (Heizer et al., 2014):

$$EOQ = Q^* = \sqrt{\frac{2 \times P \times D}{S}}$$

Note :

- Q* = The optimal number of units ordered for each time you place an order.
P = Cost each time you place an order (Ordering Cost)
D = Demand rate per planning time horizon

There are several assumptions needed to maintain a basic EOQ model (assume that the unit of time is one year for convenience and clarity):

- a. Demand must be decisive and occur at a steady, unchanging rate.
- b. If a demand for multiple sizes (eg, Q units) occurs, ordering and preparation costs are also incurred.
- c. The waiting time for each request should be zero.
- d. No shortage.
- e. Cost per unit, Year of inventory seized can be determined (h).

Safety Stock

Safety stock aims to overcome the occurrence of stock shortages by knowing how much safe stock must be available. (Heizer et al., 2014). The following is the calculation of safety stock (Heizer et al., 2014)

$$Safety\ Stock = Z\sigma_{dLT}$$

Note :

Z = Number of standard normal deviations

σ_{dLT} = Standard deviation of demand during lead time

Re-Order Point (ROP)

ROP is a point limit for the number of reorders including the demand needed and required during a certain period, for example an addition (Russell and Taylor, 2011). The following is the calculation of Re-Order Point (Heizer et al., 2014):

$$ROP = (d \times L) + \text{Safety Stock}$$

Note :

d = Daily demand

L = Order lead time, or number of working days it takes to deliver an order

Total Inventory Cost

In general, the inventory model aims to minimize total costs. Costs that have a very significant influence are ordering costs and storage costs. The following is the calculation of Total Inventory Cost (Heizer et al., 2014):

$$TC = \frac{D}{Q} \times S + \frac{Q^*}{2} \times H$$

Note :

D = Annual demand for inventory items (in units)

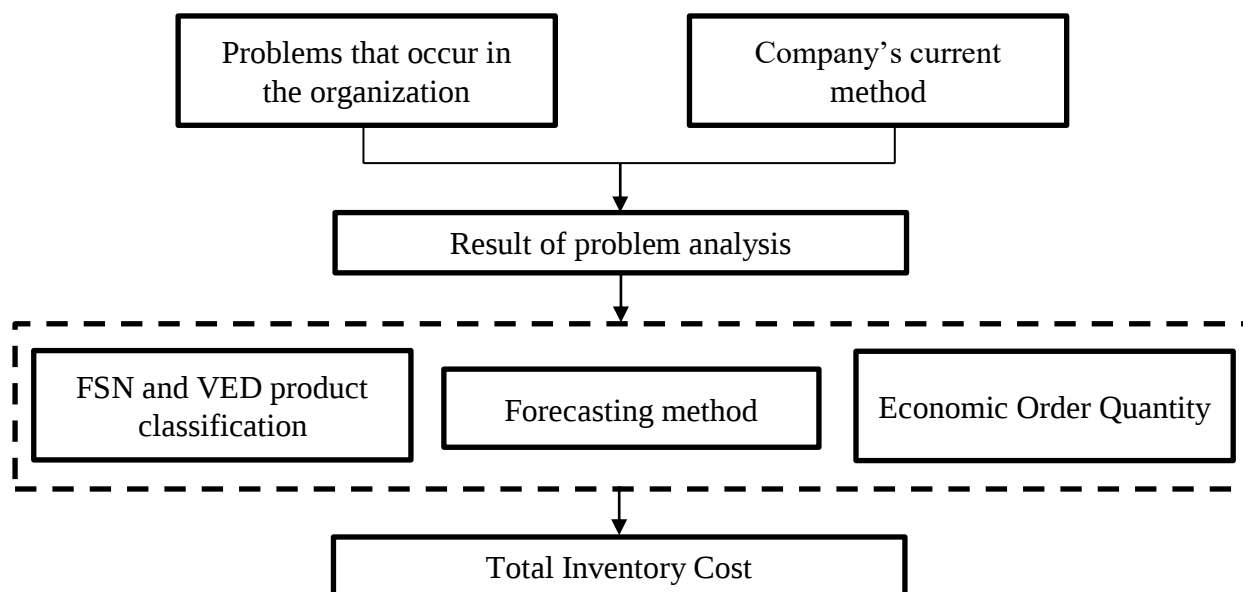
Q = Number of units per order

Q* = Optimum number of units per order (EOQ)

H = Holding Cost

S = Setup Cost or Ordering Cost

Framework



RESEARCH METHODS

Research Design

This study uses a quantitative descriptive research design. The purpose of descriptive research is to provide explanations or descriptions to researchers regarding the results of the data studied to obtain accurate forecasting methods. According to Arikunto (2005:12) in Putra (2015) it is stated that descriptive research only describes what it is about a certain variable, without being intended to test hypotheses.

Population and sample

The population in this study is secondary data in the form of data on purchases, production, and stock of some type packaging raw materials since 2000 until now. The research sample used was the purchase, production, and inventory of packaging raw materials from January 2020 to December 2020. The sampling technique used was to take the company's monthly data from January 2020 to December 2020.

Sources of Data

This research is a research with the application process of secondary data from the company, namely purchase, production and inventory data for packaging raw materials in January 2020 – December 2020, which are related to the problem being studied and primary data to obtain expert opinion. Figure 2. shows examples of packaging raw materials used, such as bottles, roll sachets, etc.



Figure 2. Examples of Packaging Raw Materials in PT.XYZ

FINDINGS AND DISCUSSION

Data Processing

The object that examined is the inventory of packaging raw materials in the PT. XYZ. Packaging raw materials are sent by the supplier and will be used by the production department. In Table 1. it can be seen that shows sample data on purchases, production, and stock of some type packaging raw materials in 2020 obtained from the business of PT. XYZ

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Table 1. Sample Data for Packaging Raw Materials January 2020-December 2020

Product	Purchase (Pcs)	Consumption (Pcs)	Stock (Pcs)
Product 20008	2,429,596	(2,514,159)	1,178,467
Product 20011	675,071	(754,580)	699,382
Product 22747	330,206	(335,484)	222,668
Product 23043	200,000	(100,889)	573,337
Product 22943	42,780	(343)	790,668

(Source: Data processing company, 2020)

The table above explains that there is a purchase condition that exceeds from consumption for production, which will result in overstock. Based on the sample, it can be seen that there is an imbalance between one of the variables, namely purchase and consumption. So, there will always be problems in inventory.

CFSNVED Matrix

This is very useful for companies to know the types of packaging raw materials that need or general purchasing control and also their placement strict. In Table 2. it can be seen that VED Classification Results on Types of Fast Moving Packaging Raw Materials.

Table 2. VED Classification Results on Types of Fast Moving Packaging Raw Materials

Fast Moving-Vital (FV)	Fast Moving-Essential (FE)	Fast Moving-Desirable (FD)
Product 20013	Product 23027	Product 23020
Product 20008	Product 22116	Product 23021
Product 20011	Product 22901	Product 23018
	Product 22892	Product 23064
	Product 22893	
	Product 22747	

(Source: Data Processing)

Based on the table above, this research was only conducted on the types of packaging raw materials which are included in the Fast Moving-Vital category.

Calculation of demand using forecasting method

Based on historical data, three products have seasonal data patterns. Thus, the forecasting methods used winter method and moving average (Baroto, 2002). Then, choose the forecasting method that produces the smallest error value. Figures 3 to 5 show the Root Mean Square Error (RMSE) of the forecasting method.

Table 3. RMSE for Product 20008

Method	Coefficient	RMSE
Single Exponential Smoothing	0,1	76
Double Exponential Smoothing	(0,1;0,1)	77

Triple Exponential Smoothing (Winter) Multiplicative	(0,7;0,2;0,2)	0
Moving Average	3	56

Table 4. RMSE for Product 20011

Method	Coefficient	RMSE
Single Exponential Smoothing	0,2	58
Double Exponential Smoothing	(0,1;0,2)	54
Triple Exponential Smoothing (Winter) Multiplicative	(0,9;0,2;0,2)	2
Moving Average	3	45

Table 5. RMSE for Product 20013

Method	Coefficient	RMSE
Single Exponential Smoothing	0,1	40.97
Double Exponential Smoothing	(0,1;0,2)	41.3214
Triple Exponential Smoothing (Winter) Multiplicative	(0,9;0,9;0,2)	0
Moving Average	3	29

Based on the table above, it can be concluded that the forecasting method for product 20008, product 20011 and product 20013 is the Winter Multiplicative Method.

Ordering Cost and Holding Cost

Ordering cost for each order is Rp. 24,883. Holding cost is 10% of the purchase price of product. In Table 6. it can be seen that holding cost which are included in the Fast Moving-Vital category.

Table 6. Holding Cost

Product	Unit Cost (Rp/Pcs)	Holding Cost (Rp)
Product 20013	214.99	21.50
Product 20008	698.72	69.87
Product 20011	486.80	48.68

(Source: Data processing company, 2020)

Estimated Demand in 2021

In Table 7. it can be seen that comparison demand of the Company's method with the forecast Method. The forecast results for demand in 2021 using the forecasting method are greater than using the company's current method. This calculation use Microsoft Excel and software Minitab.

Table 7. Estimated Demand 2021

Product	Demand 2021 (Pcs)	
	Forecast Method	Company Method
Product 20013	3,591,220	2,959,767
Product 20008	2,508,312	1,834,894
Product 20011	724,437	802,095
Total	6,823,969	5,596,755

(Source: Data Processing)

Result of Economic Order Quantity (EOQ)

In Table 8. It can be seen comparison Economic Order Quantity based on demand that result of forecasting method and company's current method.

Table 8. Economic Order Quantity

Product	Economic Order Quantity (Pcs)	
	Forecast Method	Company Method
Product 20013	91,173	82,771
Product 20008	42,259	36,144
Product 20011	27,208	28,630
Total	160,641	147,544

(Source: Data Processing)

Result of Safety Stock

In Table 9. It can be seen comparison safety stock based on demand that result of forecasting method and company's current method.

Table 9. Safety Stock

Product	Safety Stock (Pcs)	
	Forecast Method	Company Method
Product 20013	199,659	201,062
Product 20008	151,520	151,893
Product 20011	42,681	44,464
Total	393,860	397,419

(Source: Data processing company)

Result of Reorder Point

In Table 10. It can be seen comparison reorder point based on demand that result of forecasting method and company's current method. This calculation use software POM QM.

Table 10. Reorder Point

Product	Reorder Point	
	Forecast Method	Company Method
Product 20013	755,443	659,121
Product 20008	420,268	348,489
Product 20011	117,425	127,220
Total	1,293,135	1,134,830

(Source: Data processing company)

Total Inventory Cost

In Table 11. It can be seen comparison Total Inventory Cost based on demand that result of forecasting method and company's current method. This calculation use software POM QM.

Table 11. Total Inventory Cost

Product	Total Inventory Cost (Rp)	
	Forecast Method	Company Method
Product 20013	4,292,669	4,322,833
Product 20008	10,591,250	10,617,320
Product 20011	2,078,565	2,165,397
TOTAL	16,962,484	17,105,550

(Source: Data processing company)

Based on the table above, total inventory cost generated by the EOQ method based on demand forecasting method is more efficient than using the company's current method.

CONCLUSION AND RECOMMENDATION

Conclusion

Based on the objectives that have been determined in this study and the results of the research described in chapter 4, it can be concluded that:

1. Fast moving-Vital classification consists of 3 types, namely product 20013, product 20008, and product 20011. Fast Moving-Essential consists of 6 types, namely product 23027, product 22116, product 22901, product 22892, product 22893, and product 22747. Fast Moving-Desirable consists of 4 types, namely product 23020, product 23021, product 23018, and product 23064. The types of packaging raw materials which are included in Fast moving-Vital are then carried out by inventory planning.
2. The results show that the EOQ method can save the total inventory cost in 2021 of Rp. 143,066 with the total number of requests being 1,227,214 pcs higher than the company's current method.

Suggestion

For the Company

1. There needs to be a grouping of types of packaging raw materials to make it easier to control inventory.

2. Estimated product demand using the forecasting method that has the smallest error.
3. It is necessary to calculate the number of economical orders, safety stock, and reorder points to minimize the total cost of inventory incurred.

For Further Researchers

1. There is a need for forecasting calculations using other forecasting methods and other software to obtain the smallest error value.
2. It is necessary to compare the error method generated in the forecasting method.
3. Calculating safety stock by determining the optimal service level value in an effort to reduce potential product loss, but can minimize total inventory costs.

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