Planning of Raw Material Requirements for Cough Medicine Using Mrp Method at PT XYZ

Nurul Ramadhani[1], Meri Prasetyawati[2*], Leola Dewiyani[3]

[1,2,3]*Department of Industrial Engineering, Faculty of Engineering, Universitas Muhammadiyah Jakarta*
Jl. Cempaka Putih Tengah 27 Jakarta Pusat 10510
meri.prasetyawati@umj.ac.id

ABSTRACT

Cough medicine products are new products released by PT XYZ at the end of 2017 and unexpectedly received a positive response from consumers. The advantages of this cough medicine are that it has no side effects of drowsiness and contains herbal ingredients, namely anise oil which has the ability to treat digestive disorders after taking cough medicine. However, due to soaring market demand, the company has not been able to adjust to the company's conditions, such as the stock of raw material supplies for producing cough medicine is often unstable. In the material requirement, the material is calculated using the economic order quantity method, the period order quantity and the company method. The results that will be used in planning and scheduling inventory requirements for the production of cough medicine products in the calculation of MRP with lot sizing techniques and the company's method are concluded that the best method is Period Order Quantity with a total cost of Rp. 61,193,700. This method was chosen because it minimizes the cost of material control compared to other lot sizing methods.

Keywords: Material Requirement Planning, Period Order Quantity, Cough Medicine.

1. Introduction

PT XYZ is a pharmaceutical company that produces drugs and cosmetics in Indonesia, which specializes in contract development and manufacturing organization or better known as CDMO. For manufacturing companies, the products produced are required to always be able to satisfy consumers by providing maximum product quality and timely completion of consumer orders. In meeting large customer needs, good production planning is needed, ineffective production lines result in bottlenecks at work stations, to achieve work efficiency, the bottle neck process must be minimized [1]. PT XYZ produces types of tablets, capsules, syrups, etc. The medicinal product that is the hallmark of PT XYZ is syrup product. There are three types of syrup preparations produced based on their function,

namely ulcer medicine products, cough medicine products and itching medicine products. The average data on the demand for syrup preparations that are most often ordered by consumers within a year are 1628 bottles of itching medicine, 1861 bottles of cough medicine and 1719 bottles of ulcer medicine. So it can be concluded that cough medicine products are the best-selling syrup preparations on the market. Information obtained from sales forecasting will provide a useful picture of the prospect of product demand in the market, whether or not the sales prospects of a product are basically not only based on the ability or use of forecasting methods but the production planning process that determines product quality [2]. As a result of soaring market demand, companies must meet market needs appropriately and quickly. Good inventory control can increase company productivity.

Website : jurnal.umj.ac.id/index.php/icecream

Productivity is a comparison between output and input, if the output produced is large with inputs that are fixed or smaller than before, the company's productivity has increased [3]. High demand fluctuations result in deliveries often experiencing delays and higher operating costs if there is no proper distribution planning [4].

So far, the PPIC section in planning material requirements does not use certain methods but is based on forecasting calculations from the marketing department. The author takes data on demand for cough medicine and stock of cough medicine product supplies.

Table 1. Stock of cough medicine products

Cough medicine	Stock of cough medicine products in bottles											
	1	2	3	4	5	6	7	8	9	10	11	12
Stock	1850	1612	1810	1828	1956	1629	1920	1710	1957	1853	1746	1954
Request	1710	1725	1626	1920	1854	1880	1689	1589	1860	1922	1910	1810
Last Stock	140	-113	184	-92	102	-251	231	121	97	-69	-164	144

Source: PPIC Plant

Based on the data above, it is found that the stock and demand are not balanced. The cause of this can happen because companies often experience excess raw materials to produce cough medicine products due to lack of accuracy in planning and controlling raw materials.

To solve problems faced by the company due to not being able to control the stock of raw materials, the author uses the MRP (Material Requirement Planning) method to plan material requirements based on the needs of finished goods. The main input of MRP is the optimal lot size or order size. In a company that supplies raw materials, it needs to be calculated, controlled, planned so that the production process remains smooth and stable without any delays in the delivery of finished goods or an increase in raw material costs, the right method

for this problem is material requirements planning [5].

2. Material and Methods

a. Types of Data and Information
Primary data include stock data for cough medicine products, actual inventory data, ordering costs and storage costs

Secondary data include the number of requests, supply and stock of cough medicine products and Bill of Materials (BOM) of cough medicine products

b. Method of collecting data
Data collection methods in this study were carried out in the following ways: [1] Direct interviews with the company in accordance

with the object under study. [2] Direct observations of the research objects.

c. Data Processing Method
Data processing and analysis methods used in this study are:

• Calculating Demand Forecast
The researcher refers to the demand for the product where the data pattern of the demand for the product is a seasonal pattern. Therefore, the forecasting method used is the Moving Average Forecasting method and the Single Exponential Smoothing Forecasting Method. All forecasts are calculated using minitab software and POM-QM for Windows.

• Measuring Forecasting Error
The accuracy of the forecasting method can be measured by comparing the predicted value with the actual value under study. To calculate the error value the following functions is used: Mean Squared Error (MSE), Average Absolute Percentage Error (Mean Absolute Percentage Error = MAPE), Average Absolute Deviation (Mean Absolute Deviation = MAD)

• Determine the best lot sizing technique using the Material Requirement Planning (MRP) method. The lot sizing technique of the Material Requirement Planning (MRP) method used in this study is Economic Order Quantity (EOQ) and Period Order Quantity (POQ).

3. Results and Discussions

a. Forecasting Calculation
The forecast used for this research is short-term forecasting where this forecast is used to make decisions in terms of whether or not overtime is needed, work scheduling and others. Forecasting method used for this research is objective forecasting with intrinsic method where this method is only based on historical

demand. This method is only suitable for short-term forecasting. The intrinsic method will be represented by time series analysis. The time series analysis used in this study is the Moving Average and Single Exponential Smoothing. The reason for choosing these two methods is because the demand data pattern is a seasonal pattern.

b. Comparing forecasting error values

Table 2 Comparison of Error Values

Metode	Software	MAD	MSD	MAPE
Moving Average	Microsoft excel	114,05	17527,38	6,51
Single Exponensial Smoothing		103	14500	5,871
Moving Average	Minitab	114,1	17527,4	6,5
Single Exponensial Smoothing		99,1	13094,4	5,7
Moving Average	POM QM for Windows	114,064	17527,4	6,518
Single Exponensial Smoothing		104,223	14887,6	5,915

(source: calculation results)

From the results of forecasting with a horizontal pattern, namely Moving Average and Single Exponential Smoothing, it can be seen that the single exponential smoothing method has the smallest error results so that it can be concluded that the single exponential smoothing method is the right method for forecasting the data.

c. Comparison of Forecasting Results
From the results of forecasting with the single exponential smoothing method, it can be seen that the three softwares get the same forecasting results so that it can be concluded that the three software are suitable to calculate forecasting results.

d. MRP method calculation
The Material Requirement Planning method used is the EOQ, POQ and company methods.

Website : jurnal.umj.ac.id/index.php/icecream

Table 3 Comparison of forecasting results

Period	Forecast Results		
	Microsoft Excel	Minitab	POM QM For Windows
25	1830,97	1830,97	1830,95
26	1830,97	1830,97	1830,95
27	1830,97	1830,97	1830,95
28	1830,97	1830,97	1830,95
29	1830,97	1830,97	1830,95
30	1830,97	1830,97	1830,95
31	1830,97	1830,97	1830,95
32	1830,97	1830,97	1830,95

33	1830,97	1830,97	1830,95
34	1830,97	1830,97	1830,95
35	1830,97	1830,97	1830,95
36	1830,97	1830,97	1830,95

The following is a list of material requirements based on the Bill of Material. Droserae 9,2 kg, Serphylli 12,8 kg, Thymi 8,6 kg, Primulae 7,4 kg, Althaeae 9,8 kg, Eucalyptus Oil 800 L, Anise Oil 920 L, Bottle packaging 1600 unit, Outer packing / Cardboard 1600 unit
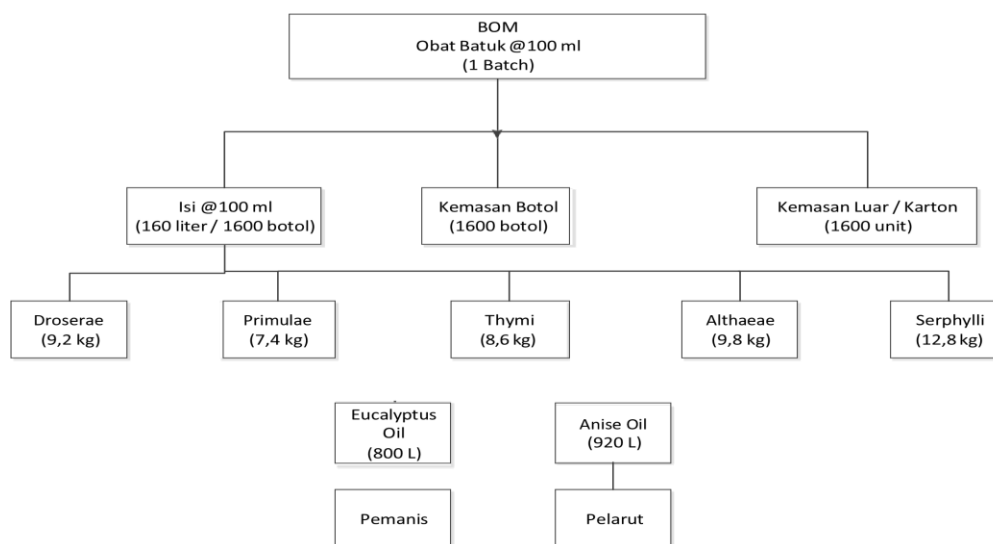

Figure 1. Bill of Cough Medicine Materials

[1] Total Cost of Cough Medicine by EOQ
After calculating the MRP using the EOQ method, the calculation results for all cough medicine product materials are as presented in table 4:

Table 4. Total Cost of Cough Medicine by EOQ Method

Material List	Order Fee	Inventory	Total cost
Cough medicine	Rp7.500.000	Rp4.059.600	Rp11.559.600
Outer packing / Cardboard	Rp7.500.000	Rp4.505.400	Rp12.005.400
Bottle packaging	Rp7.500.000	Rp4.505.400	Rp12.005.400
Droserae	Rp7.500.000	Rp4.627.800	Rp12.127.800
Serphylli	Rp7.500.000	Rp4.627.800	Rp12.127.800
Thymi	Rp7.500.000	Rp4.627.800	Rp12.127.800
Primulae	Rp7.500.000	Rp4.627.800	Rp12.127.800
Althaeae	Rp7.500.000	Rp4.627.800	Rp12.127.800
Eucalyptus Oil	Rp7.500.000	Rp4.627.800	Rp12.127.800
Anise Oil	Rp7.500.000	Rp4.627.800	Rp12.127.800
TOTAL	Rp75.000.000	Rp45.465.000	Rp120.465.000

[2] Total Cost of Cough Medicine by POQ Method

After calculating the MRP using the Period Order Quantity method, the calculation results for all cough medicine product materials are as presented in table 5 :

Table 5. Total Cost of Cough Medicines by Period Order Quantity Method

Material List	Order Fee	Inventory	Total cost
Cough medicine	Rp5.625.000	Rp4.943.700	Rp10.568.700
Outer packing / Cardboard	Rp5.625.000	Rp0	Rp5.625.000
Bottle packaging	Rp5.625.000	Rp0	Rp5.625.000
Droserae	Rp5.625.000	Rp0	Rp5.625.000
Serphylli	Rp5.625.000	Rp0	Rp5.625.000
Thymi	Rp5.625.000	Rp0	Rp5.625.000
Primulae	Rp5.625.000	Rp0	Rp5.625.000
Althaeae	Rp5.625.000	Rp0	Rp5.625.000
Eucalyptus Oil	Rp5.625.000	Rp0	Rp5.625.000
Anise Oil	Rp5.625.000	Rp0	Rp5.625.000
TOTAL	Rp56.250.000	Rp4.943.700	Rp61.193.700

Data Source: Calculation Results

e. Comparison of EOQ Method, POQ and Company Method

Based on the calculation of Material Requirement Planning (MRP) with the EOQ, POQ and company methods, the results are presented in table 6:

Table 6. Comparison of EOQ, POQ and Company Methods

Method	Order fee	Storage Cost	Total Cost
EOQ	Rp. 75.000.000	Rp. 45.465.000	Rp. 120.465.000
POQ	Rp. 56.250.000	Rp. 4.943.700	Rp. 61.193.700
Company	Rp. 225.000.000	Rp. 0	Rp. 225.000.000

Data source: Calculation results

Based on the results of the calculation of material requirements (MRP) using the EOQ, POQ, company methods, this study will used the minimum result in planning and scheduling requirements for the production of cough medicine products. From the results of the total cost, it can be seen that the EOQ method obtained a total inventory cost of Rp. 45,465,000 and a total cost of ordering Rp. 75,000,000 with a overall cost of Rp. 120,465,000. In the POQ method, the total cost of inventory was Rp. 4,943,700 and the total cost of the ordering is Rp. 56,250,000 with the overall cost of Rp. 61,193,700. Then by using the company's method, the total cost of inventory is Rp. 0 and the total cost of ordering is Rp. 225,000,000 with an overall cost of Rp. 225,000,000. Because of its lowest inventory cost, then the POQ method is the method chosen to plan and schedule the need for cough medicine supplies in PT. XYZ

4. Conclusion

Based on the results of the research conducted, it can be concluded that the results of the MRP calculation using the lot sizing EOQ, POQ and company methods, it is found that the best MRP method is POQ with a total inventory cost of Rp. 4,943,700 and a total cost of ordering Rp.

Website : jurnal.umj.ac.id/index.php/icecream

285.693,860 with an overall cost of Rp. the total is Rp. 61,193,700. The application of the Period Order Quantity (POQ) method was chosen because it minimizes costs in material control compared to other lot sizing methods so that stock the supplies of can be continuously controlled.

References

[1] L. W. R. Andres, "Application of theory of constraints as an effort to optimize the production capacity of the city at PT. ABC," *Scientific Journal of Industrial Engineering,* 2017.

[2] I. Wardah. S, "Forecasting analysis of packaged banana chips product sales," *Industrial engineering journal,* pp. 135-142, 2016.

[3] S. A. Al Faritsy, "Increasing company productivity by using six sigma, lean and kaizen methods," *Industrial engineering journal,* pp. 103-116, 2015.

[4] K. I. S. S. Y. Kosasih. W, "Evaluation of the distribution system of small and medium industries using forecasting methods and distribution requirements planning," *Industrial engineering scientific journal,* pp. 139-147, 2017.

[5] P. N. Chandradevi A, "Implementation of material requirements planning by considering lot sizing in controlling raw materials at PT. Phapros Tbk," *Performa,* pp. 77-86, 2016.