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Inventory Control Analysis of Manual Hospital Bed Assembly Units PI-108MS, PI-208MS, PI-308MS with the EOQ (Economic Order Quantity) Method at PT. XYZ

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Abstract*— The purpose of this study is to determine the warehouse capacity of PT. XYZ in storing hospital bed supplies can use the EOQ(Economic Order Quantity) method to determine the warehouse capacity in hospital bed supplies. The EOQ method seeks to achieve minimum inventory levels, lower costs and better quality. The EOQ method in the company will be able to minimize the occurrence of out of stock so that it does not interfere with the process and is able to save inventory costs incurred by the company. February showed that the company assembled 230 units, selling 151 units. Meanwhile, to avoid excess units, the number of assembly that must be done is 4,425 with the purchase of 2 units, Safety Stock 74.34 units and ROP 151 units. The calculation uses the EOQ method which shows that the safety stock that must always be available at PT. XYZ for unit inventory is as much as 230 units, meaning the company must have an inventory of 74.34 units in order to anticipate a shortage of units during the grace period without hampering the assembly process..

Keywords: Inventory control, EOQ (Economy Order Quantity), safety stock

I. INTRODUCTION

Covid19 /corona Virus is an infectious disease caused by the SARS-Cov-2 virus, the surge in COVID-19 patients in Indonesia is increasing, resulting in high visits of COVID-19 patients in every hospital and an increase in the occupancy rate of hospital beds or Bed Occupancy Rate (BOR) [1]; [2]; [3]. The impact of the surge in COVID-19 patients has been felt by many hospitals in Indonesia [4]; [5]; [6]; [7].

PT XYZ is a medical device assembly company, namely hospital mattresses and as an importer of medical devices from abroad, such as hospital furniture, operating theaters, surgical lamps, hospital waste treatment, radiology imaging, medical supply systems, etc.

PT XYZ also collaborates with the Industrial Mechanical Engineering Academy (ATMI) in producing beds, mattresses and stretchers from the Platinum Inspiration brand in Kendal, one of the Platinum Inspiration brand products is the PI-108MS, PI-208MS, PI-308MS hospital beds.

The purpose of this study is to find out the optimal unit inventory using the EOQ method which is more optimal if used by PT XYZ in storing hospital bed supplies using the Economic Order Quantity method. Inventory of hospital beds that are calculated for inventory capacity are only hospital beds PI-108MS, PI-208MS, PI-308MS. Primary data includes purchasing units from suppliers, sales to consumers, total ordering budget from suppliers, percentage of storage costs per unit hospital bed and details of storage costs from February 2020 to January 2021. Demand forecasting for February 2020 to January 2021 uses EOQ (Economic Order Quantity).

Based on the results of the research analysis above, it states that the application of the Economic Order Quantity (EOQ) method is appropriate and efficient. Therefore, with PT XYZ's policy of requiring safety stock which is in line with the EOQ concept, the author will apply the EOQ method to determine the optimal order quantity, safety stock and reorder point.

II. RESEARCH METHODS

Economic Order Quantity is a technique for procuring raw material supplies in a company that determines how many economical orders for each one, setting the order time with a predetermined frequency and when to order again [8]; [9]; [10]; [11].

2.1 Identification of problems

Problem identification contains steps to determine the problems that exist in the company. Identification of the problem in this study is inventory control for the assembly of hospital bed units PI-108MS, PI-208MS, PI-308MS, which must be considered so that there is no shortage of unit inventory, so that it will not hinder the production process.

2.2 Formulation of the problem

Based on the description of the background problems experienced by PT XYZ, a research problem can be formulated, namely how to optimize unit inventory control with the EOQ method at PT XYZ?

2.3 Data collection

The process of data collection is done by collecting primary data and secondary data.

1. Primary Data

Namely data collected by individuals directly from the object under study and for the benefit of the study concerned which can be in the form of interviews and observations, [12]; [13]; [14]. The research data was obtained by observing, observing and interviewing directly at PT XYZ Kendal.

2. Secondary Data

Secondary data from this study is data obtained from parties related to research, namely in the form of unit inventory data, unit ordering costs, storage costs, as well as other data related to this study[15];[16];[17]; [18].

3. Data processing

Data processing consists of requests for hospital bed units PI-108MS, PI-208MS, PI-308MS from February 2020-2021 based on historical data requests, and calculating unit inventory control in February 2020 - January 2021 using the EOQ method. The data needed for the EOQ method are unit assembly, ordering costs and unit storage costs. The final step is to carry out an inventory cost analysis using the EOQ method [19]; [20]; [21]; [22].

III. RESULT AND ANALYSIS

The data collected is historical data on the assembly of hospital bed units PI-108MS, PI-208MS, PI-308MS, unit inventory data for 2020-2019, purchasing costs, ordering costs, and storage costs.

Research object

1. PI 108 MS
   Single crank manual hospital bed, with rigid construction and sophisticated finishing to meet market demands and provide customers with high quality hospital beds.
2. PI-208 MS
   Two-crank manual hospital bed, with rigid construction and soft lining. Equipped with state-of-the-art features such as a hip washbasin, for ergonomics and patient comfort.
3. PI-308 MS
   Three-crank manual hospital bed, with rigid construction and sophisticated finish. Equipped with state-of-the-art features such as a hip sink, for ergonomics and patient comfort.

Assembly and Sales

The data obtained from the company regarding assembly and sales, in February 2020 – January 2021 is presented in table 1. below:

Table 1. Hospital Bed PI Manual Assembly

Month	Unit Name	Assembly	Sale
February	PI 108 MS	50	0
	PI 208 MS	20	0
	PI 308 MS	160	151
March	PI 108 MS	10	0
	PI 208 MS	370	360
	PI 308 MS	20	16
April	PI 108 MS	10	0
	PI 208 MS	10	40
	PI 308 MS	50	50
May	PI 108 MS	20	0
	PI 208 MS	50	40
	PI 308 MS	160	153
June	PI 108 MS	15	0
	PI 208 MS	200	198
	PI 308 MS	100	85
July	PI 108 MS	100	80
	PI 208 MS	10	2
	PI 308 MS	50	41
August	PI 108 MS	150	140
	PI 208 MS	50	40
	PI 308 MS	40	30
September	PI 108 MS	150	140
	PI 208 MS	20	0
	PI 308 MS	40	34
October	PI 108 MS	10	1
	PI 208 MS	10	10
	PI 308 MS	160	160
November	PI 108 MS	0	0
	PI 208 MS	230	220
	PI 308 MS	150	146
December	PI 108 MS	90	90
	PI 208 MS	120	120
	PI 308 MS	40	39
January	PI 108 MS	10	0
	PI 208 MS	130	126
	PI 308 MS	31	31

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Based on table 1 it can be seen that in February PT XYZ assembled 230 units of Hospital Bed PI 108 MS, PI 208 MS, and PI 308 MS, in March assembled 400 units, in April assembled 110 units, For the total annual assembly carried out by PT XYZ is 2876 units, with sales of 2543. PT XYZ carries out the assembly process continuously, inventory is very important in the assembly process.

1. The cost of ordering consists of shipping costs
   Ordering costs are costs related to efforts to obtain unit raw materials issued by PT XYZ Company until the unit raw materials are received.

   Table 2. Shipping Cost Details

No	Month	Shipping Costs
1	February	Rp. 10.810.000
2	March	Rp. 17.475.000
3	April	Rp. 10.435.000
4	May	Rp. 19.800.000
5	June	Rp. 30.250.000
6	July	Rp. 11.900.000
7	August	Rp. 21.270.000
8	September	Rp. 11.040.000
9	October	Rp. 11.845.000
10	November	Rp. 40.450.000
11	December	Rp. 25.725.000
12	January	Rp. 13.700.000

2. Storage Costs
   Are costs incurred by PT XYZ for storing units for a certain period of time. The amount of storage costs is influenced by the number of inventory units. Storage costs per period will be greater if the number of inventory units is higher.

   Table 3. Percentage of Storage Cost, Price Per Unit, Storage Cost

Unit Name	Price (IDR) Each unit)	% Save Cost	Storage Fee
PI108MS	9.675.000,	5%	483.750
PI208MS	10.670.000	5%	533.500
PI308MS	14.753.000	5%	737.650

Table 4. Details of Storage Fees

No	Month	Warehouse Administration Fee
1	February	Rp. 3.683.500
2	March	Rp. 4.000.000
3	April	Rp. 4.000.000
4	May	Rp. 4.000.000
5	June	Rp. 4.000.000
6	July	Rp. 4.500.000
7	August	Rp. 4.500.000
8	September	Rp. 4.500.000
9	October	Rp. 5.000.000
10	November	Rp. 5.000.000
11	December	Rp. 5.000.000
12	January	Rp. 5.000.000
Amount		**Rp. 53.183.500**

The analysis used to determine the number of orders that can generate savings with economical purchases, PT XYZ can use the Economic Order Quantity (EOQ) method. With the EOQ method, it can be seen that the most economical number of assemblies that must be done at the time of purchase. According to PT XYZ, the total assembly in 2020 is 2,876 units.

February EOQ

PI 108 MS

$$EOQ\ atau\ Q *= x = \frac{\sqrt{2\ D\ S}}{H}$$

$$= \sqrt{\frac{2\ x\ 50\ x 10.810.000}{483.750}}$$

$= \sqrt{2.234}$

= 47,265 per unit (rounded to 47 units).

While the order frequency is as follows: $\frac{10.810.000}{2.234}$ = 4,838 is rounded to 5.

PI 208 MS

$$EOQ\ atau\ Q *= x = \frac{\sqrt{2\ D\ S}}{H}$$

$$= \sqrt{\frac{2\ x\ 20\ x 10.810.000}{533.500}}$$

$= \sqrt{810}$

= 28,46 per unit (rounded up to 28 units).

While the order frequency is as follows: $\frac{10.810.000}{810}$ = 13,345 is rounded up to 13.

PI 308 MS

$$EOQ\ atau\ Q *= x = \frac{\sqrt{2\ D\ S}}{H}$$

$$= \sqrt{\frac{2\ x160\ x10.810.000}{737.650}}$$

$= \sqrt{4.689}$

= 68,476 per unit (rounded up to 68 units).

While the order frequency is as follows: $\frac{10.810.000}{4.689}$ = 2,305 is rounded up to 2.

Determination of Safety Stock

Safety Stock is extra inventory carried out to provide insurance against fluctuations in demand. Security stock or Safety Stock is useful for protecting companies from the risk of running out of units and delays in receiving units.

February:

Safety Stock = (230 – 76,66) x 1 = 153.34 Unit.

PI 108 MS: Safety Stock = (50 – 76,66) x 1= - 26.66

PI 208 MS: Safety Stock = (20 – 76,66) x 1= - 56.66

PI 308 MS: Safety Stock = (160 – 76,66) x 1= 83.34

Reorder Point Determination

Reorder point or reorder point is a method of determining when PT XYZ will reassemble so that the receipt of the ordered units can be on time. Because when placing an order for a unit, the unit cannot be received immediately that day.

February:

ROP PI 108 MS = (1x 50)+ 74,34 = 124.34 Units.

ROP PI 208 MS = (1x 20) + 74,34 = 94.34 units.

ROP PI 308 MS = (1x 160) + 74,34 = 234.34 units.

Based on the Reorder point (ROP) calculation above, it can be seen that unit inventory is used every month, so that the amount of inventory decreases, and when the unit supply reaches the reorder point (ROP), that is PI 108 MS 124 units, PI 208 MS 94 units, PI 308 MS 234 units, PT XYZ has to reorder as many as economic orders (EOQ), namely 66 units. Orders must be made before the unit inventory in the warehouse runs out, because it takes a lead time of about 2 days from the time of order until the unit arrives at the PT XYZ company warehouse. To see more clearly the calculation of PT XYZ unit inventories for the period February 2020 - January 2021, they are as follows:

Table 5. EOQ, Safety Stock, Reorder Point.

Month	**EOQ**	***Safety Stock***	***Reorder Point***
February	2.234, 810.496, 4.689	-26.66, -56.66, 83.34	124, 94, 234
March	722.4, 24.238, 947.603	-123.33, 236.66, -113.33	236, 596, 246
April	431.421, 1.955, 1.414	-26.66, 13.34, 13.34	24, 64, 64
May	1.637, 3.711, 8.589	-56.66, -26.66, 83.34	96, 126, 236
June	1.875, 22.680, 8.201	-90, 95, -5	108, 293, 193

July	4.919, 446.110, 1.613	46.67, -43.33, -3.33	126, 126, 76
August	13.190, 3.986, 2.306	70, -30, -40	140, 110, 100
September	6.846, 892.221, 322.642	80, -50, -30	220, 80, 110
October	489.715, 444.048, 5.138	-50, -50, 100	110, 110, 260
November	0, 34.877, 16.450	-253, -23, 103	93, 323, 243
December	9.572, 11.572, 697.485	6.67, 36.67, 43.33	126, 146, 76
January	566.408, 6.676, 1.151	-47, 73, 26	79, 199, 1000

Judging from the results above, it shows that there is a relationship between EOQ, Safety Stock, and Reorder Point of merchandise during the period February 2020 - January 2021 as follows:

Februari

PI 108 MS = $\sqrt{2 \text{ x } 50 \text{ x } 10.810.000 \text{ x } 483.750}$ = 7.231.415,836

PI 208 MS = $\sqrt{2 \text{ x } 20 \text{ x } 10.810.000 \text{ x } 533.500}$ = 1.518.833,105

PI 308 MS = $\sqrt{2 \text{ x } 160 \text{ x } 10.810.000 \text{ x } 737.650}$ = 15.973.975,33

February 2020 showed that the company assembled 230 units of PI 108 MS 50 units, PI 208 MS 20 units, PI 308 MS 160 units, and sold PI 308 MS 151 units. Meanwhile, to avoid excess units, the number of assemblies that must be carried out according to EOQ PI 108 MS 2,234, PI 208 MS 810,496, PI 308 MS 4,689 with a frequency of purchasing PI 108 MS units 5 times, PI 208 MS 13 times, PI 308 MS 2 times, Safety Stock PI 108 MS -26.66, PI 208 MS -56.66, PI 308 MS 83.34 units and ROP PI 108 MS 126.67 units, PI 208 MS 126.67 units, PI 308 MS 234 units.

Calculation of TIC Value (Total Inventory Cost) Inventory Unit Assembly According to EOQ

Total inventory cost / Total Inventory Cost is the amount of inventory costs that must be incurred by the company. The following is the total cost of inventory / TIC in February 2020 - January 2021.

VI. CONCLUSION

From the results of the study it was found that the number of assemblies in February 2020 showed that the company assembled 230 units of PI 108 MS 50 units, PI 208 MS 20 units, PI 308 MS 160 units, and sold PI 308 MS 151 units. Meanwhile, to avoid excess units, the number of assemblies that must be carried out according to EOQ PI 108 MS 2,234, PI 208 MS 810,496, PI 308 MS 4,689 with a frequency of purchasing PI 108 MS units 5 times, PI 208 MS 13 times, PI 308 MS 2 orders in 1 month , if averaged in one month the optimal number of orders using the EOQ method is 5, 13, 2. From the number of orders it is known that the use of the EOQ method is more efficient in February of 47, 28.68 units, PT XYZ's Safety Stock (SS) using the EOQ method in February 2020 was PI 108 MS -26.66, PI 208 MS -56.66, PI 308 MS 83.34 units.

PT XYZ must place an order again (Reorder Point) when the inventory level in 2020 is ROPPI 108 MS 126.67 units, PI 208 MS 126.67 units, PI 308 MS 234 units. The total inventory cost (TIC) for PI 230 using the Economic Order Quantity (EOQ) method in February 2020 for PI 108 MS, PI 208 MS, PI 308 MS is Rp. 72,314,158, Rp. 15,188,331 IDR. 15,973,975. Then there is an inventory (TIC*) savings if using the Economic Order Quantity (EOQ) method of Rp. 150,508,133.4 in February 2020. So saving inventory using the EOQ method is much more efficient than inventory costs using company policy.

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