

INVENTORY POLICY PLANNING FOR STARTER PACK OF PT XYZ IN JABOTABEK REGION USING PROBABILISTIC METHOD : P MODEL (PERIODIC REVIEW) WITH VARIANT DEMAND

Shauly Tiominar Rebecca, Budi Sulisty², Efrata Denny S. Yunus³

^{1,2,3} Bachelor Degree of Industrial Engineering, Faculty of Engineering, Telkom University

¹shauly.rebecca@gmail.com, ²budiyayo@gmail.com, ³efratadenny@gmail.com

Abstract

PT XYZ is the largest cellular telecommunications company in Indonesia. One of their products are starter pack. Starter pack is a package that designed to serve the start of a service, it contains many items that have been predetermined to be used according to the rules. Starter pack can be considered as the initial identity before performing communication. Starter pack contains a SIM card that will be used by the mobile phone user with bonus of phone credit, some basic rules such as how to reload your phone credit and checking the credit.

In fulfilling the needs of its customers, PT XYZ divides the distribution of starter packs into 10 regions, namely Sumbagut, Sumbagsel, Sumbagteg, Jabotabek, West Java, Central Java, East Java, Balinusra, Borneo and Sulmarija. In order to fulfill the demand of starter pack, PT XYZ has a problem in inventory at Jabotabek region, there are inventory stock that not approach the sales, which causes too much inventory in the warehouse. The amounts of starter packs are available in the warehouse always exceeds the number of sales, resulted in a buildup of inventory in the warehouse. Excess inventory occurs because the determination of the amount of inventory is not good because in determining the amount of inventory, PT XYZ just do a prediction by looking at the amount of current inventory, demand planning and seeing the demand pattern of earlier periods. In order a starter pack to the central warehouse, PT XYZ, Jabotabek region order the starter pack on Monday in every week. PT XYZ have a policy that the service level must be 99.9983% without back order. This excess inventory can caused companies must spend a considerable cost. Based on these problems, a starter pack inventory management becomes one of the things, that is important for companies to be able to minimize inventory costs that must be spent by the company. In order to improve inventory policy of Starter pack, PT XYZ needs to be optimized in several ways, including amount of the maximum and minimum stock in inventory in order to minimize the total cost of inventory.

Inventory policy planning in this research is using the P model (periodic review) with variant demand to make a good policy in PT XYZ when determine an inventory.

Using P model (periodic review) with variant demand method this research can make an inventory policy with safety stock, maximum inventory, optimum quantity order and time for ordering while in the existing condition the company did not have and can minimize total inventory cost of stater pack as 32% or Rp.158.375.229 from existing condition. Carrying cost have saving Rp 158.497.769 or 24% from existing condition without shortage cost because in proposed condition does not experience a shortage inventory. In proposed condition order cost more expensive than the existing condition as Rp. 122.537.

Key word: P model (periodic review), Inventory Policy, Telecommunication Company in Indonesia

1. Introduction

PT XYZ is the largest cellular telecommunication company in Indonesia. One of their products is starter pack. Starter pack is a package that designed to serve the start of a service. It contains many items that have been predetermined to be used according to the rules. Starter pack can be considered as the initial identity before performing communication. Starter pack contains a SIM card that will be used by the mobile phone user with bonus of phone credit, some basic rules such as how to reload your phone credit and checking the credit.

In fulfilling the needs of its customers, PT XYZ divides the distribution of starter packs into 10 regions, namely Sumbagut, Sumbagsel, Sumbagteg, Jabotabek, West Java, Central Java, East Java, Balinusra, Borneo, Sulmarija. Therefore, PT XYZ must be required a good inventory starter pack, to be able to fulfill the customer needs from 10 regions. In order to fulfill the demand of starter pack, PT XYZ has a problem in inventory at Jabotabek region.

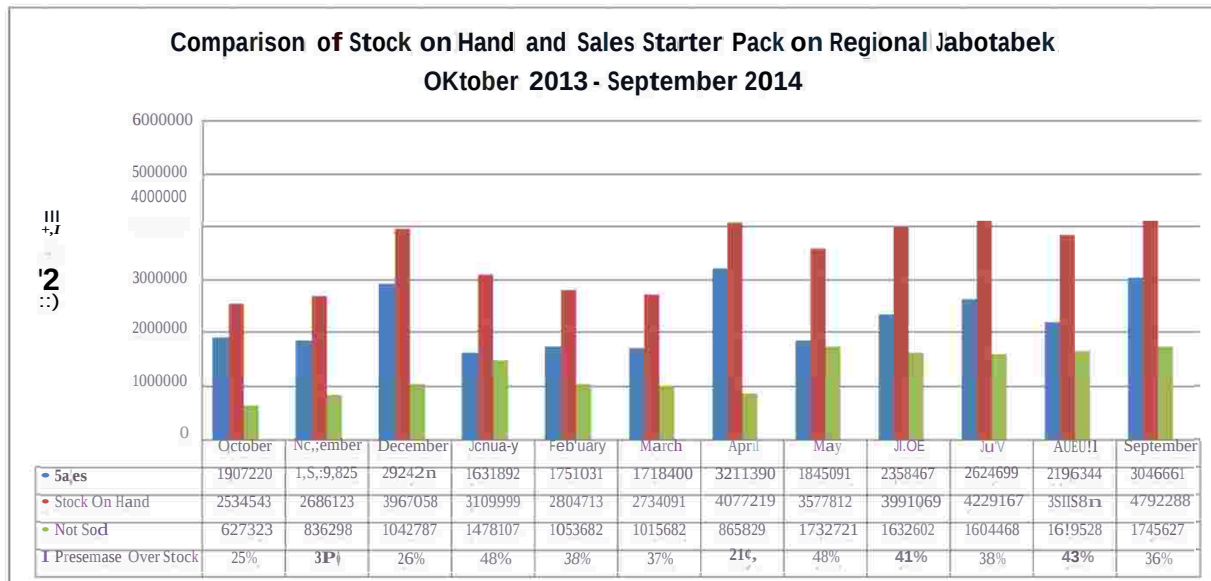


Figure I.1 Comparison Stock on Hand and Sales Starter Pack on Region Jabotabek October 2013 - September 2014

Based on figure above, there are inventories stock that not approach the sales, which causes too much inventory in the warehouse. The amounts of starter packs are available in the warehouse always exceeds the number of sales, resulted in a buildup of inventory in the warehouse. In January and May, PT XYZ has the largest percentage over stock when compared to other months, that is by 48%.

Excess inventory occurs because the determination of the amount of inventory is not good because in determining the amount of inventory, PT XYZ just do a prediction by looking at the amount of current inventory, demand planning and seeing the demand pattern of earlier periods. In order a starter pack to the central warehouse, PT XYZ, Jabotabek region order the starter pack on Monday in every week. This excess inventory can caused company must spend a considerable cost. Based on these problems, a starter pack inventory management becomes one of the things, that important for companies to be able to minimize inventory costs that must be spent by the company. In order to improve inventory policy of Starter pack, PT XYZ needs to be optimized in several ways, including amount of the maximum and minimum stock inventory in order to minimize the total cost of inventory and maximize the value.

This research is dealing with how to approach the inventory stock with demand using inventory policy planning. In this research, PT XYZ has a randomly fluctuates demand. Inventory, with market demand fluctuates randomly that call Probabilistic inventory policy^[3](Ristono, 2009). Therefore this study will focus on Probabilistic inventory policy. Based on the characteristics of the current state in PT XYZ, the company have characteristics that demand variance are probabilistic demand, demand with a normal distribution, time to order constant, the lot every order is not constant, goods came at once at the lead time, utility warehouse high, constant cost orders, checking goods using information systems and the service level must be 99,9983% with out back order.

Characteristics in the PT XYZ, fit with the characteristics that exist in P model (periodic review) which can be used in an inventory that has a probabilistic demand with normal distribution, time to order constant with every order lot is not constant, goods come at the lead time. P model (periodic review) can be used in warehouse that have high utility, to set time to order the goods so the utility of the warehouse are not higher.

Based on characteristics that present in the PT XYZ, fit with the characteristics present in the P model (periodic review) with variant demand, therefore this researched will be solved with P model (periodic review).

I.1 Problems Definition

1. Determine the amount of quantity order at the time of ordering starter pack for PT XYZ Jabotabek region
2. Determine the amount of safety stock which optimal for PT XYZ Jabotabek region
3. Determine the time of ordering (Reorder Point) which is appropriate for PT XYZ Jabotabek region

I.2 Research Objectives

The purpose of the study is based on the formulation of the problem in the above including:

1. Determine the amount of quantity order at the time of ordering starter pack for PT XYZ Jabotabek region
2. Determine the amount of safety stock which optimal starter packs for PT XYZ Jabotabek region
3. Determine the time of ordering (Reorder Point) which is appropriate for PT XYZ Jabotabek region

1.3 Research Limitation

The boundary problem formulated by researcher associated with this research is:

1. This research is limited for inventory policy in Starter pack regular in Jabotabek
2. Demand data used is the historical data of starter pack PT XYZ on Jabotabek region from Oktober 2013 - September 2014
3. During the research conducted, the warehouse of Jabotabek region will be not expanded or moved

2. Literature Review

Inventories become one of the primary key in a company. When a business unit, has a number of extremely slight inventory and are inadequate at the time in need, consequently the user's needs cannot be met, so there will be dissatisfaction from the customer side. This will resulted in losses for the company. Customers who are not satisfied will easily switch to another company that can meet individual needs on time. However, the existence of inventory can be considered as waste and this means that burden for the company in the form of higher cost. It can be said, if the amount of inventory in the warehouse piled up, the company will have extremely high costs.

The term of inventory can be used to mean several different things, such as : ^[4](Tersine, 1994)

1. The stock on hand of materials at a given time (a tangible asset which can be seen, measured, and countabled)
2. An itemized list of all physical assets
3. To determine the quantity of items on hand
4. The value of the stock of goods owned by an organization at a particular time.

In addition, the inventories can be interpreted also as the goods are stored to be used or sold in the past or future periods ^[3](Ristono, 2009). The other definition of inventory is as an asset that includes the company's goods with intent to sell within a certain period of business, or items that are still under construction / production process, or raw materials awaiting use in a production process. ^[2](Rangkuti F. , 2002). It can be said, inventories are a number of raw materials, materials in process and finished goods, provided to meet the demand of consumers every time.

Forecasts of product demand determine how much inventory is needed, how much product to make, and how much material to purchase from suppliers to meet forecasted customer needs. This determines the kind of transportation that will be needed and where plants, warehouses, and distribution centers will be located so that products and services can be delivered on time. Without accurate forecasts, large stocks of costly inventory must be kept at each stage of the supply chain to compensate for the uncertainties of customer demand. If there are shortage inventories, customer not satisfied because of late deliveries and stock out. This is especially harmful in today's competitive global business environment, where customer satisfaction and on-time delivery are critical factors. While accurate forecasts are necessary, completely accurate forecasts are never possible. Hopefully, the forecast will reduce uncertainty about the future as much as possible, but it will never eliminate uncertainty.

Inventory calculations are performed using P model (periodic review) with variant demand as follows ^[1] (Russell & Taylor, 2011) :

1. Calculate the Quantity Order with formula as follows :

$$Q = \bar{d}(t_b + L) + z\sigma\sqrt{t_b + L} - I \dots\dots\dots \text{II.1}$$

2. Calculate the Safety Stock with formula as follows :

$$SS = z\sigma\sqrt{t_b + L} \dots\dots\dots \text{II.2}$$

3. Calculate the Carrying cost with formula as follows :

$$C_c = C_u \times \frac{Q}{2} \dots\dots\dots \text{II.3}$$

4. Calculate the Order Cost with formula as follows:

$$O_c = C_o \times \frac{D}{Q} \dots\dots\dots \text{II.4}$$

5. In calculating the cost of shortages, required cost data showed that inventories having out of stock or shortages. Data costs deficiency occurs when the out of stock. Shortage costs are calculated of the total benefits that can not be obtained

Forecasting will be calculate with Moving Average Methods, as follows ^[1] (Russell & Taylor, 2011):

$$MA = \frac{\sum_{i=1}^n P_i}{n} \dots\dots\dots \text{II.5}$$

3. Research Metodology

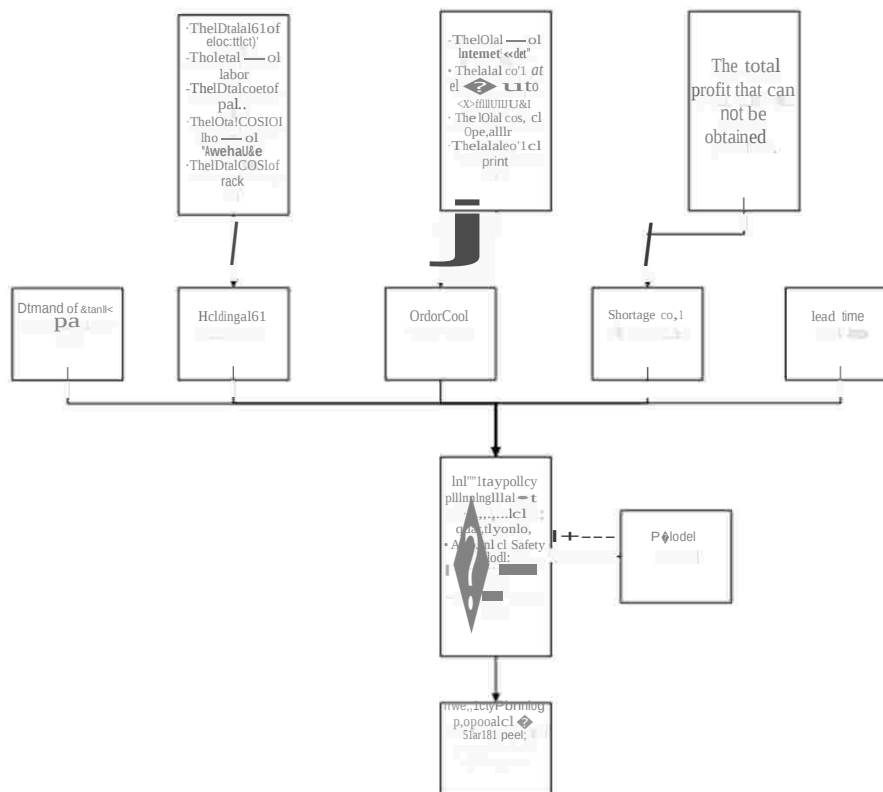


Figure III.1 Conceptual Model

In the first stage, do the normality data test of data demand of starter pack. If the data already has a normal distribution, then the data can be used in calculations. Data used in this study is the data demand, order cost, holding cost, lead time, shortage cost. These data are used to identify the system inventory in PT XYZ to minimize the total cost of inventory. Then, the next step is to do the calculations using probabilistic method: P model (periodic Review) with variant demand which is used to determine the amount of quantity orders, amount of safety stock and time of ordering or reorder point and safety stock.

The results of this study is to obtain the optimum number of orders in each time ordering, the optimum time to perform reordering (reorder point) and safety stock to dampen the fluctuations in need, with a minimum total inventory cost.

4. The Result of Calculations

1. The Comparison of Total Inventory Cost

The results of calculation and analysis conducted by the method P model (periodic review) to provide the proposed condition, related to inventory policy, as follows:

Table IV.1 Comparison Total Inventory Cost of the Proposed and Existing Condition

Comparison the Total Inventory cost of the proposed and Existing state			
Condition	Total carrying cost	The percentage of savings	Retrenchment
Existing State	Rp 647.423.502	32%	Rp 158.375.253
The proposed state	Rp 489.048.249		

The total cost of inventory on the actual condition of PT XYZ Jabotabek region is Rp.647.423.502. While the total cost of inventory in proposed condition using the P model (periodic review) is Rp. 489.048.249. Comparison of the total inventory cost between the proposed condition with the existing condition have savings of Rp. 158.375.253 or savings of 32% from the existing conditions. The ratio of these two conditions is shown in the figure below

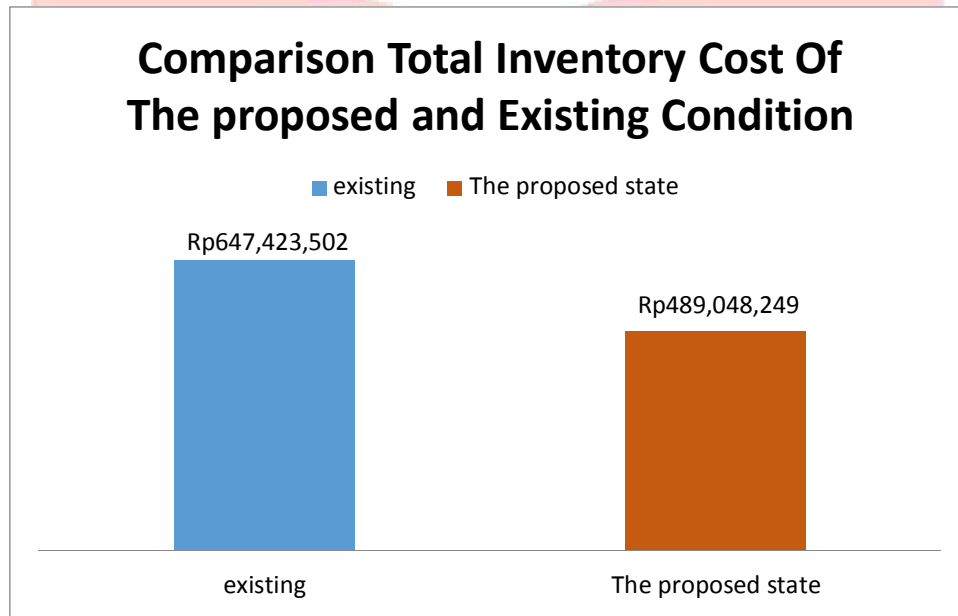


Figure IV.1 Comparison of Total Inventory Cost between Proposed and Existing Condition

Based on the comparison of the total inventory cost between proposed and existing condition have a cost savings of 32%, which can be taken into consideration in PT XYZ Jabotabek region for using P model (periodic review) with variant demand. Using this method need several variable those are carrying cost, order cost and shortage cost.

2. The Comparison of Total Carrying Cost

When calculating the carrying cost there is important parameter such as the carrying per unit and the number of unsold inventory at the end of the inspection interval. The rest of inventory is greatly influenced by the order quantity (Q), when Q is ordered too much, it can be ascertained that the carrying cost will also increase. Below is a table comparing the total carrying cost for inventory starter pack:

Table IV.2 Comparison of Carrying Cost between Proposed and Existing Condition

Comparison of Carrying Cost Between Proposed Condition and Existing Condition			
Condition	Total Carrying Cost	The percentage of savings	Retrenchment
Existing State	Rp 647,219,313	24%	Rp 158.497.769
The proposed Condition	Rp 488,721,544		

Comparison of carrying cost (Cc) in the chart can be seen in the image below:

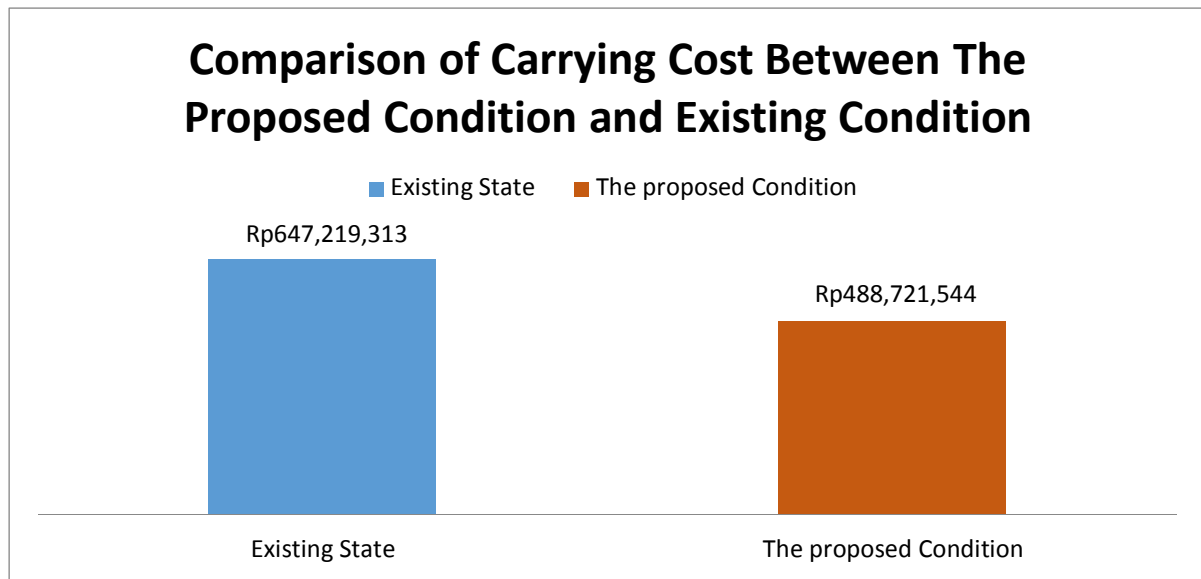


Figure IV.2 Comparison of Carrying Cost between Proposed and Existing Condition

Carrying cost in proposed condition that is Rp.488.721.544, while the carrying cost resulting from the existing condition in PT XYZ Jabotabek region regional is Rp. 647,219,313. In the propose condition with use P model method in PT XYZ Jabotabek region occurs savings 24% or Rp 158.497.769 when compared with the carrying cost on the existing condition. This occurs because number of quantity order in the proposed condition smaller than existing condition. A lower quantity order it will minimize the number of starter packs are stored, so it can minimize the carrying cost.

3. Comparison of Total Order Cost

Order cost arising from the activity of the starter pack made reservations to hold inventory starter pack in PT XYZ, Jabotabek region. Order costs are influenced by the cost of all orders based on the facility being used at the time of order and the number of times orders are being made to hold a inventory of stater pack.

Below is a table comparing the total order cost for inventory starter pack:

Table IV.3 Comparison of Order Cost between Proposed and Existing Condition

Comparison of Order Cost between proposed and existing condition			
Condition	Total Order Cost	The Percentage of Savings	Retrenchment
Existing State	Rp 204.189	Rp (122.515)	-
The proposed Condition	Rp 326,705		

The total order cost on the existing conditions at PT XYZ Jabotabek region for Rp. 204.189 while the total order cost on the conditions proposed is Rp. 326.705. In the proposed conditions by using a model of P (periodic review) does not make a savings when compared to the order cost in the actual condition. That is happened because of on the proposed condition, they only order a few quantity. If the quantity order when the ordering only a few can causing the high cost of the order.

Comparison of order cost (Oc) in the graph can be seen in the picture below :

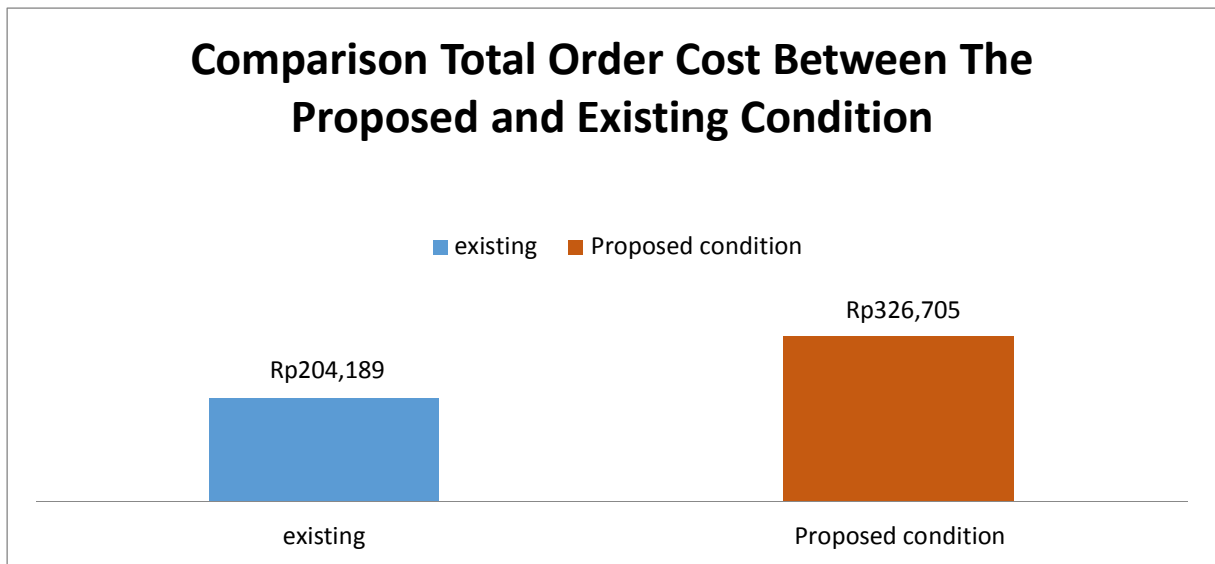


Figure IV.3 Comparison Total Order Cost between Proposed and Existing Condition

In the proposed conditions using P model (periodic review) with variant demand did not occurred savings when compared to the cost of the actual condition. That is happened because of on the proposed condition, they only order a few quantity. If the quantity order when the ordering starter pack only a few starter pack can causing the high cost of the order.

4. Comparison of Total Shortage cost

Cost shortage would arise if the unavailability of stater pack when there is demand from customers. Shortage cost measured by lost profits because it can not meet customer demand.

The total cost of a shortage on the actual condition compared to the total cost of the flaws in the proposed conditions:

Table IV.4 Comparison Total Shortage Cost between Proposed and Existing Condition

The comparison of shortage cost the proposed condition and existing existing			
Condition	Total Shortage Cost	The percentage of savings	Retrenchment
Existing	Rp -	0%	Rp
The proposed	Rp -		-

In the proposed condition and existing condition PT XYZ Jabotabek region, did not experience a shortages inventory. So there is no cost to be incurred as a result of the shortage.

In the existing condition PT XYZ Jabotabek region did not experience a shortages in the inventory starter pack but too much inventory should be stored in the warehouse. While on the proposed condition, PT XYZ, not deficient, but also did not experience the shortage of inventory.

5. Conclusion

Based on the research objectives that have been set and the result from the data processing, the conclusions of this study are:

1. On October 2014, stater pack A207 have safety stock as 44.293. Stater pack A207 will be order if amount of inventory approaching the safety stock. The order will be do twice in October 2014, on 20 October 2014 with 15,463 as optimum order quantity and on 27 october 2014 with 92,667 with as optimum order quantity. The maximum inventory on first week is 412.738, second week is 320.071, third week is 227.403, fourth and fifth week is 150.199. During October 2014 until September 2015, there are 49 times orders.

2. Safety stock, optimum order quantity, reorder point and maximum inventory make some cost such as carrying cost, order cost, shortage cost which variable from total inventory cost. Total carrying cost in proposed condition

with P model (periodic review) with variant demand method is Rp.488.721.544, while the carrying cost resulting from the existing condition in PT XYZ Jabotabek region regional is Rp. 647.219.313. In the propose condition with use P model method in PT XYZ Jabotabek region occurs savings 24% when compared with the carrying cost on the existing condition.

In the proposed conditions by using a model of P (periodic review) did not occurred savings when compared to the cost of the actual condition. Because of on the proposed conditions, ordered quantities only a few quantity causing the high cost of the orders. The order cost in existing condition is Rp.204.189 while in proposed condition is Rp 326.705.

In the proposed condition and existing condition PT XYZ Jabotabek region, did not experience a shortages inventory. So there is no cost to be incurred as a result of shortage. In the existing condition PT XYZ Jabotabek region did not experience a shortages in the inventory starter pack but too much inventory should be stored in the warehouse. While on the proposed condition, PT XYZ, not deficient, but also did not experience the shortage of inventory.

The total cost of inventory on the actual condition of PT XYZ Jabotabek region is Rp.647.423.502. While the total cost of inventory in proposed condition using the P model (periodic review) is Rp. 489.048.273. Comparison of the total inventory cost between the proposed condition with the existing condition have savings of Rp. 158.375.229 or savings of 32% from the existing condition. Carrying cost,order cost,shortage cost and total inventory for each stater pack can be find in attachment sheet.

Reference

- [1]Russel, Roberta S. (2011). Operation Management. United States: John Willey&Sons Inc..
- [2]Rangkuti, F. (2002). Manajemen Persediaan: Aplikasi di Bidang Bisnis. Jakarta: PT RajaGrafindo Persada.
- [3] Ristono, A. (2009). Manajemen Persediaan. Yogyakarta: Graha Ilmu.
- [4]Tersine, R. J. (1994). Principles of Inventory and Materials Management. New Jersey: PTR Prentice-Hall,Inc.