

## Improved Inventory Management Performance in Indonesia Spare-Parts Company Using ABC Classification and Min-Max Method

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### Article History

Received: 12.02.2018

Accepted: 23.02.2018

Published: 14.03.2018

### DOI:

10.21276/sjbms.2018.3.3.6



**Abstract:** Inventory management requires high investment in the company, including spare parts companies. Currently, inventory problems at spare-parts Company that is too many types of components (spare parts), some components (spare parts) there are overstock, some others stock-out, and planning the purchasing of components (spare parts) still quite often using intuition. The purpose of this study is to improve inventory management performance solve the inventory problems at Indonesia spare-part company, so the company can establish an economical supply budget by setting safety stock, minimum stock, maximum stock, and order quantities of each components (spare parts) required to Obtain the inventory cost saving. This study was initiated through the stages of ABC analysis to determine the grade of material on each item, and then continued with inventory count minimum, maximum, safety stock, the value of the average inventory, total inventory cost, turnover ratio and inventory turnover, followed by comparing results of a calculation method of the min-max with existing method, The results of applied research with min-max method was found to increased turnover ratio (TOR), inventory turnover (ITO), lower average inventory values and total inventory cost (TIC) to obtain reduce inventory cost.

**Keywords:** ABC classifications, inventory management performance, min-max method, spare-part company.

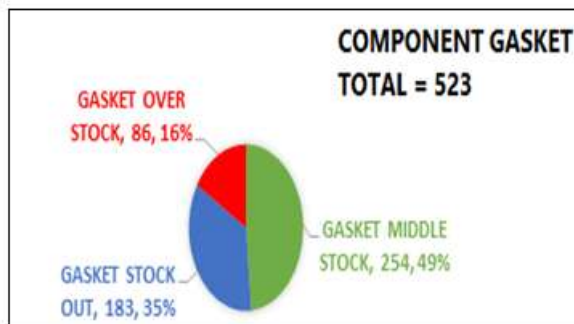
## INTRODUCTION

Every the service or the manufacturing companies always require the good performance of inventory management [1, 2]. The absence of inventory management will be faced with the risk that the company at the time unable to meet the desires of its customers (lost sales) because the goods and services is not always available at any time [3, 4]. According to Chen *et al.*, [5] and Bandaru *et al.*, [6], inventory is very important for every company, both of which resulted in a goods and services. Inventory held if the expected benefits of such inventory assured smoothness or should be endeavored inventory profits greater than the costs incurred. The purpose of inventory management is to minimize costs; therefore the company needs to conduct an analysis to determine the level of inventory to minimize the cost or the most economical [7-10].

Analysis inventory management in a company can be well implemented when supported by

warehousing facilities. The goal is that the inventory is always available so, it can quickly respond to customer needs. By analyzing and filling of the case in the company's inventory and used inventory model approach, then the inventory problem can be solved in order to obtain the optimal inventory procurement policy with a minimum cost. Type of inventory required in the company is not only one type of product, it can lead to a reservation becomes irregular schedule that will ultimately lead to increased costs of inventory [11-15].

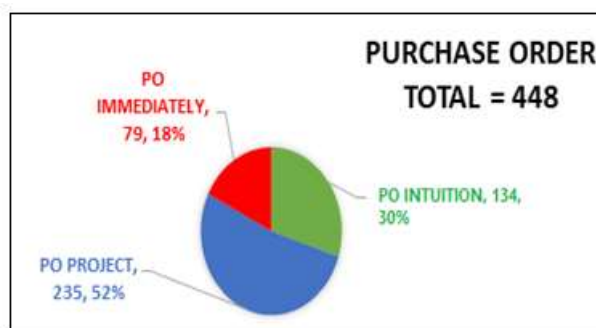
As one of the spare part companies in Indonesia, PT Indo needs to manage its inventory efficiently so as to fulfill the inventory management objectives. Currently, the performance of inventory management in PT Tesco Indomaritim is still not efficient indicated from the occurrence of stockout on some components and overstock on other components. In 2016, stockout occurs in 49% component and over stock at 16% component (Figure-1).



**Fig-1: The component stock data gasket PT.**  
Tesco Indomaritim, 2016

From Figure-1 it looks for component spare parts to the stock ultimately greater than the average usage and there is indication the stock too much (overstock), while for the components to the stock less

than average usage there is indication the stock too few (stock-out), planning the purchase of spare parts is also still a lot by intuition that resulted in the stock of less precise as shown in Figure-2.



**Fig-2: Data Purchase Order**  
PT Tesco Indomaritim, 2016

Due to the low level of inventory management performance in the spare part company, the company needs to evaluate the minimum and maximum levels of spare parts inventory so that it can be determined when the order should be made and how much should be ordered.

The concept of minimum-maximum inventory developed based on a simple idea as follows. To maintain the continuity of the operation of a company or other facilities, some certain type in a minimum amount should be available in the inventory, so that at any time there are damaged can be replaced, but the goods stored in inventory don't too much as well, there is the maximum so that the cost of inventory don't become too expensive. Hasian [16] argue that the minimum inventory is zero and maximum inventory is as much as economically achieve optimum, according to the EOQ calculation. So it is conceivable that exactly at the time of consumable goods, goods ordering the most economical number had come. But this theory calculations, which means that in reality cannot be guaranteed that the planning can be completely fulfilled. There is the possibility of change and increased consumption of goods suddenly, there is the possibility of the goods ordered arrive late, and so on.

According to Mohammed [17] in determining the minimum and maximum of this, we should not take an extreme number, but there is a safety factor that can be calculated based on experience. In the min-max system is used a number of conditions, namely a) the amount of the booking is not fixed or fluctuating, b) the existence of a safety inventory is inventory number prepared to deal with any changes in demand, and c) having the reordering or reorder point, which is when they are at minimum stock inventory. In the minimum-maximum inventory, the time when the reserve always reaches the minimum point. The point where the booking is done also called reorder point (reorder point), while the maximum limit is the limit of the availability of the company to invest the money in the form of material inventory [18].

Having the unit's model and component inventory at PT. Tesco Indomaritim is so much, which is for spare parts the total type reaches 9251 types, therefore the respective types of products/components are divided into several groups, namely by using ABC analysis. ABC analysis is also known as the Pareto analysis or Pareto Law 80/20 is one of the methods used in logistics management for goods group split into three classes: A, B, and C [19-21]. Group A is the number of types of

goods by about 20% but has value investing approximately 80% of the total investment. Group B is the number of types of goods by about 30% but has an investment value of approximately 15% of the total investment. While group C is an item with a number of types of goods by about approximately 50% but has an investment value of approximately 5% of the total investment.

The use of ABC analysis on inventory planning at PT. Tesco Indomaritim intended to prioritize the inventory planning are often used and are few in number, but have a great investment value. So when PT. Tesco Indomaritim can control the inventory of class A and B means it controls 80-95% of the value of the inventory. The purpose of this research is to improve the performance of spare-part component inventory management in PT. Tesco Indomaritim using min max and ABC method.

**METHODS**

The type of research design used in this research method is descriptive method. Researchers used the inventory maximum, minimum, quantities to be ordered, safety stock, the value of inventory on average, turnover ratio (TOR), inventory turnover (ITO), total inventory cost (TIC), and the cost of inventory as a variable used in the method of minimum -maximum. To sharpen the variable research results will be compared with results of other studies using min-max method.

In this research, data processing and analysis focused on the components (spare parts) Gasket many as 523 types of items, which have been divided into three groups based on the methods of ABC analysis, namely, group A = 53 types of items, group B = 163 types of items, and group C = 307 kinds of items. Sample research conducted with probability sampling techniques or random sampling so that each item in group A, B, and C have the opportunity to become the sample group.

To collect the data used methods: a) method of interview or interviews, namely: a way to get the data by conducting interviews with company employees who are competent, so we get an idea of the problems existing inventory system at PT. Tesco Indomaritim, which in this research is conducted interviews with warehouse manager, and b) documentation of the method of collecting data through existing documentation, is expected to obtain data on the use of components (spare parts), the waiting time (lead time), number of bookings.

Problem-solving approach needs to be done in a way that gradually and sequentially. The initial step is qualitative and general, and then the next step is quantitative and specific.

The stages of the ABC analysis is as follows create a list of all the items and put the list price, put the

sheer number of needs in a given period, multiply the price and number of needs, calculate the percentage of the price of each item, organize your list in descending order, the highest price is above, calculate the cumulative percentage of each item to the total price, and determine the classification A, B, and C. After analyzing the ABC, then take a small sample of 10 items of each group to do the calculation.

The calculations step of the min-max method are described below:

Safety stock is the minimum of the chemical inventory that must be held by the company to maintain the possibility of delays in the arrival of raw materials, so there is no stagnation. To estimate the amount of safety stock, can be used relatively more thorough way is by the method as follows:

- Method usage difference maximum and average. This method is done by calculating the difference between the maximum usage to those on an average in a given time period (e.g. monthly), then the difference is multiplied by the lead time.
- Statistical methods for determining the amount of safety stock with this method, it can be used in this calculation is the maximum difference method and the average, namely:

$$SS = (\text{Max. usage} - A) \times L \tag{1}$$

Where,  
SS = safety stock, A = average demand, L = lead time.

Inventory minimum is the amount of usage during the time of booking or purchase, which is calculated by multiplying the time of booking (in units of time) and average usage (in units of time) plus inventory safety (safety stock).

$$\text{Min} = (A \times L) + SS \tag{2}$$

Inventory maximum that is the maximum number allowed is stored in inventory, which is calculated from the amount of usage for 2 x time of booking (in units of time) that is obtained by multiplying 2 x time of booking (in units of time) and average usage during a certain time unit.

$$\text{Max} = 2 \times (A \times L) + SS \tag{3}$$

Order quantity which is the amount that needs to be booked for inventory replenishment back. The formula:

$$Q = \text{Max} - \text{Min} \tag{4}$$

Request Frequency (M) is how many times the ordered components to meet demand. The formula:

$$M = D/Q \tag{5}$$

The average value of inventory (N) can be calculated as follows:

$$N = ((\text{Inventory Inventory Max} + \text{Min})/2) \times \text{Price Component} \tag{6}$$

Turn Over Ratio (TOR) is the ratio between expenditure/use/sales and inventory. The higher the TOR means faster inventory turnover, which also means higher investment utilization or in other words more efficiently. The lower the mean acceleration of capital turnover TOR or investing the slower and more inefficient [1]. TOR formula is as follows:

$$\text{TOR} = (\text{consumption value})/(\text{Value of Inventory}) \tag{7}$$

Inventory Turn Over (ITO) is used to measure how fast the material flows relative to the amount of inventory stored in warehouse for each period. The greater the value of the ITO it will get better control of inventory a company. ITO formula is as follows:

$$\text{ITO} = H/N \tag{8}$$

Where,

H = the usage of the year and N = average value of inventory

Total Inventory Cost (TIC) can be calculated with the following formula:

$$\text{TIC} = \text{Cost} + \text{Request fee} \tag{9}$$

$$\text{Costs requests} = D/Q \times \text{Co} \tag{10}$$

$$\text{Cost Save} = P \times \text{Ch} \tag{11}$$

Where,

D = number of usage, Q = number of orders, P = number inventory, and Co = cost order.

## RESULTS AND DISCUSSION

Implementation of existing company policy with no safety stock while the min-max method is no safety stock. The purpose of this safety stock is to anticipate the surge in demand so there is no shortage of supplies (stock-out). From the summary of the min-max method of calculation and methods of the company in 2016 obtained the following results:

- Total inventories minimum (min) and maximum inventory (max) min-max method is smaller than the methods of the company. As Governor Gasket, minimum inventory (min) 4 pcs and maximum (max) 5.9 pcs by min-max method while based method minimum stock company (min) 15 pcs and maximum (max) 30 pcs. Total inventories

minimum and maximum inventory affects the average inventory value, the smaller the minimum and maximum amount of inventory the average inventory value will also be smaller. This causes the average inventory value min-max method is lower than the methods of the company.

- The stock of the min-max method is smaller than the methods of the company. As Gasket Exhaust, stock ended by the min-max method whereas 8.7 pcs, based method companies 25 pcs. The stock affect the value of the TOR, the lower end of the value of the stock of TOR will be higher. This causes the value of the min-max method TOR higher than the methods of the company.
- Average inventory value method min-max lower than the method of the company. As Head Gasket, average inventory value based on the min-max method of USD \$ 8,324.55, while based on the method of Companies of USD \$ 21,345.00. Average inventory value affects the value of ITO, the lower the average inventory value then the value of the ITO will be even greater. This causes the value of the min-max method ITO is greater than the methods of the company.
- TIC value or number of requests fee plus the cost savings and the min-max method is lower than the methods of the company. As Gasket Oil, TIC value based method of min-max of USD \$ 396.50, while based on the method of Companies of USD \$ 658.54. This led to the min-max method generates TIC value is lower than the company or their savings method inventory cost using min-max method.

## CONCLUSION

The implementation of the min-max method combined with the ABC classification approach to the control of spare-parts inventory at PT Indo has proven to improve the performance of inventory management as indicated by the increase in turnover ratio (TOR), inventory turnover (ITO) and declining average inventory value. The calculation of total inventory cost (TIC) shows that the proposed inventory management is more efficient than the existing management. Using the min-max method PT Tesco Indomaritim can save inventory cost of USD \$ 1,709.56 using actual data in 2016.

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