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Inventory Management

Gaurav Chhikara[1], Yogesh[2], Sumit Dixit[3]
[1,2,3]Dept of Mechanical Engg., SBMNEC, MDU Rohtak, Haryana

Abstract: Normally, items waiting to be purchased or purchase are considered to be in inventory. One of the most pressing problems in the manufacturing and use of goods is the control of this inventory. Many companies experience financial difficulties each year due to a lack of adequate control in this area. Whether it is raw material used to manufacture a product or products waiting to be purchase, problems arise when too many or too few items are available.

INTRODUCTION

The basic decisions to be made once a source has been determined are how much to order and when to order. Inherent in this analysis is the concept of demand. Demand can be known or unknown, probabilistic or deterministic, constant or lumpy. Each of these characteristics affects the method of approaching the inventory problem. For the unknown demand case a decision must be made as to how much the firm is willing to risk. Normally, the decision would be to produce some k units for use and then determine after some period of time to produce more or to discontinue production due to insufficient demand. This amounts to the reduction of the unknown demand situation to one of a lumpy demand case after the decision has been made to produce the batch of a finite size. Similarly, if a decision is made to begin production at a rate of n per day until further notice, the unknown demand situation has been changed to a constant known demand case. Lumpy demand, or demand that occurs periodically with quantities varying, is frequently encountered in manufacturing and distribution operations. It is distinguished from the known demand case. This second case is that of a product which has historic data from which forecasts of demand can be prepared. A factor of concern in these situations is the lead time and the unit requirement on a periodic basis. The following are the major factors to be considered in the modeling of the inventory situation.

Demand is the primary stimulus on the procurement and inventory system and it is the justification for its existence. Specifically the system may exist to meet the demand of customers, the spare parts demand of an operational weapons system, the demand of the next step in a manufacturing process, etc. The characteristic of demand, although independent of the source chosen to replenish inventories, will depend on the nature of the environment giving rise to the demand. The simplest demand pattern may be classified as deterministic. In this special case, the future demand for an item may be predicted with certainty. Demand considered in this restricted sense is only an approximation of reality. In the general case, demand may be described as a random variable that takes on values in accordance with a specific probability distribution. Procurement quantity is the order quantity, which in effect determines the frequency of ordering and is related directly to the maximum inventory level. Maximum shortage is also related to the inventory level.

TYPES OF INVENTORY MODELS

Deterministic models assume that quantities used in the determination of relationships for the model are all known. These quantities are such things as demand per unit of time, lead time for product arrival, and costs associated with such occurrences as a product shortage, the cost of holding the product in inventory, and that cost associated with placing an order for product. Constant demand is one case that can be analyzed within the category of deterministic models. It represents very effectively the case for some components or parts in an inventory which are used in multiple parents, these multiple parent components having a composite demand which is fairly constant over time.

RESEARCH OBJECTIVE

1. Develop a framework for inventory management
2. Classify the inventory
3. Provide a demand forecasting method

SCOPE OF STUDY

The research is carried out by analyzing one year of data provided by workshop. The model of bus that has been considered in this research is Mod 1, Mod 2, Mod 3, And Mod 4. Fig 1 shows the compiled yearly data for part 01, front glass. The demand data will be modeled and analyzed and the demand for part 01 shall be forecasted for first month of next year.
A quick analysis of the forecasted data shows that the demand trend for part 01 is increasing. This could be due to the buses start running many year ago being returned to workshop for repair. In chapter 3, the research will interpret the demand patterns and chapter 4 will show the inventory policies for such phenomenon.

DATA COLLECTION

Two types of data were collected: primary and secondary to facilitate this study. Primary data refers to direct information from daily operations on inventory handling, while secondary data are administrative records and prior research studies that support this study. Part of the primary data comes from interviews and discussions with staff and management personnel. Interviews were conducted using face-to-face meetings as well as through telephone and email correspondence. Data from physical records such as purchase orders, delivery notes and invoices are also analyzed as part of the primary data. This information has been gathered and processed.

RESULTS AND DISCUSSION

Results for Class AA

The results for the Class AA and the actual practice are shown in Table 9. The results clearly show that the chosen model has marked improvement over the existing method, whereby the inventory level has decreased by 74% and the service level achieved 72%. Additionally, the inventory turnover rate has increased from 1.91 to 3.32 in our model. The manger used these results to support the justifications for system improvement. They did so by comparing predicted benefit to estimate cost for implementing.

	Current	Inventory Model For Class AA
Total Parts	2	2
Inventory cost per year, RM	258,000	55,095
Percentage improvement	"-"	79%
Fill Rate, P_2	"-"	73%
Inventory Turnover Rate	1.26	3.32
Total Replenishment/ year	4	37

Table 9 Comparison of Current Practice against Inventory model for Class AA

Results for Class BB

The results for the control system chosen for items classified under BB are relatively better by giving a higher service level at a lower inventory investment. Table 10 shows the results before and after the implementation of the (Q, r) model. The service level is now 89%. As the average inventory cost decreases, the inventory turnover rate is increased to 3.7. Based upon our selected model, the improvement has achieved the desired service level and total investment has been lowered bringing great financial and operational benefit to the workshop.

	Current	Inventory Model For Class BB
Total Parts	8	8
Inventory cost per year, RM	1.2 mil	144,000
Percentage improvement	"-"	88%
Fill Rate, P_2	"-"	88%
Inventory Turnover Rate	3.74	6.78
Total Replenishment/ year	6	18

Table 10 Comparison of Current Practice against Inventory model for Class BB

Results for Class CC

The Table 11 shows the results for the CC items. Although the results of the control system are not as high as Class AA and Class BB, some cost savings and improvement in service level have been improved. The service level increased to 91% as a result of the systematic way in controlling and managing the numerous items by improving the manual processes and time savings. Moreover, by using the joint order replenishment policy for those part after grouping still demonstrates effective in term of cost saving and number of replenishment per year. This is because after grouping by the same supplier, multiple items in the same group are ordered at the same time.

	Before	Before grouping	After grouping
Total Parts	34	34	34
total cost per year, RM	478,258	682,579	66,019
Percentage improvement	"-"	-43%	86%
Fill Rate, P_2	"-"	89%	94%
Total Replenishment/year	9	17	12

Table 11 Comparison of Current Practice against Inventory model for Class CC

Results for Class DD

Table 12 summarizes the results of Class DD. Although the cost saving is not as high as Class AA or BB this inventory method is simple and easy to implement on a product that will be obsolete and will require less attention. It offers a service level of 93% due to the fact that the workshop keeps sufficient stocks to fulfill the forecasted demand.

	Current	Inventory Model For Class DD
Total Parts	9	9
Inventory cost per year, RM	107,051	105,093
Percentage improvement	"-"	2%
Fill Rate, P_2	"-"	94%
Total Replenishment/year	9	2

Table 12 Comparison of Current Practice against Inventory model for Class DD

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CONCLUSION

The relationship between the inventory cost and the service level is very important. Table 13 indicates how a large investment is required in order to achieve high service level. But these investments don't apply to high demand parts such as AA items which are expensive. Hence, based upon our model, we first calculate the planned inventory levels needed to achieve the desired service levels. Our computation showed that the investment made in each class of spare parts was not suitable to meet a satisfactory level of service 100%.

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