

# Inventory Control Models In Inventory Management

Vineet Parate

M.Tech. Final Year in Industrial Engineering &  
Management, SAIT, Indore (M.P.)

Sachin Agarwal

Assistant Professor Mechanical Engineering Dept.,  
SAIT, Indore (M.P.)

**Abstract:** *An organization holds the stock in limited quantity for the future purpose to use it properly, when it is required and running all the operations in a continuous flow. To maintain this operation properly an organization has different inventory control models in inventory management. In this paper we have discussed about the inventory models which are beneficial to take decision about the stock for an organization time to time to avoid the problem arises. The deterministic model and the probabilistic model are the two main models in inventory management. In general, demand is not known that model is called probabilistic model and the demand is constant at a fixed interval that model is called as deterministic model.*

**Keywords:** *Inventory, Inventory Management, Economic Order Quantity Model, Economic Production Quantity Model, Deterministic Model, Probabilistic Model.*

## I. INTRODUCTION

Inventory refers to idle goods or materials that are held by an organization for use sometimes in the future. Inventory serves as a buffer against uncertain and fluctuating usage and keeps a supply of items available in case the items are needed by the organization or its customers. Every organization has different type of inventory planning and control system. Production organization, governments and virtually every manufacturing sector are concerned with inventory planning and control. Inventory planning, an organization determines what goods and services are to be produced. Inventory is the common thread that ties all the functions and departments of the organization together. Inventory model, the demand rate is assumed to be constant. Inventory planning, an organization determines what goods and services are to be produced. This happens very rarely in realistic situations when same inventory model have been developed for dealing with time varying demand.

Inventory Model is Mathematical equation or formula that helps a firm in determining the economic order quantity, and the frequency of ordering, to keep goods or services flowing to the customer without interruption or delay. The inventory model is generally used to forecast optimum inventory and to evaluate two or more inventory systems.

Two fundamental techniques are generally employed by industries to develop inventory reserve estimates and they are the deterministic and probabilistic methods. The deterministic model concedes a single best estimation of inventory reserves grounded on economic information. Whereas the probabilistic model employs the known economic and engineering data to produce a collection of approximate stock reserve quantities and their related probability. Deterministic model is the state of affairs to be deterministic and consequently render the numerical model to optimize on system arguments. Since it conceives the system to be deterministic, it automatically means that one has full information about the system. Probabilistic situation is also known as a situation of uncertainty. Although this is present everywhere, the vagueness always makes us comfortless. So people keep attempting to lesser uncertainty. Probabilistic inventory prototypes consisting of probabilistic demand and supply are more suitable in many real circumstances. But, such models also create larger trouble in analysis and often become uncontrollable.

## II. LITERATURE REVIEW

First inventory model was proposed by Hill [1], and then further investigated by Mandal and Pal [2], and Deng et al. [3], to provide a more complete solution procedure. Wou [4], provided an explanation, from managerial point of view, of deriving the optimal solution without constructing the objective function, which dramatically simplifies the solution structure. The classical inventory models usually assume that the available warehouse has unlimited capacity. In many practical situations, there exist many factors like temporary price discounts making retailers buy a capacity of goods exceeding their own warehouse. In this case, retailers will either rent other warehouses or rebuild a new warehouse. This system was first proposed by Hartely [5], Which shows that the holding cost in rented warehouse is greater than that in own warehouse.

In August 2012, Sachin Kumar, 2Pawan Kumar, 3Manju Saini [6], proposed An order level inventory model for deteriorating items with quadratic demand rate and variable holding cost, A deterministic inventory model has been developed for deteriorating items. Demand is taken as quadratic functions of time. Shortages are not allowed and the effect of inflation rate in this model for deteriorating items under inflation. An inventory model is developed for deteriorating items with quadratic demand rate and traditional parameter of holding cost is linearly increasing functions of time and shortages are not allowed. We have discussed the effect of variation in various parameters of the system. Hung [7], published a paper to compare the interior local minimum and the boundary local minimum.

In 2015, Serhii ZIUKOV [8], proposed literature review on models of inventory management under uncertainty. Inventories are raw materials, work-in-process goods and completely finished goods that are considered to be the portion of business's assets that are ready for sale. Formulating a suitable inventory model is one of the major concerns for an industry. Some literature analyzes possible parameters of existing models of inventory control. An attempt is made to provide an up-to-date review of existing literature, concentrating on descriptions of the characteristics and types of inventory control models that have been developed.

## III. CLASSIFICATION OF INVENTORY MODELS

Inventory models are broadly classified in to two categories shows in figure

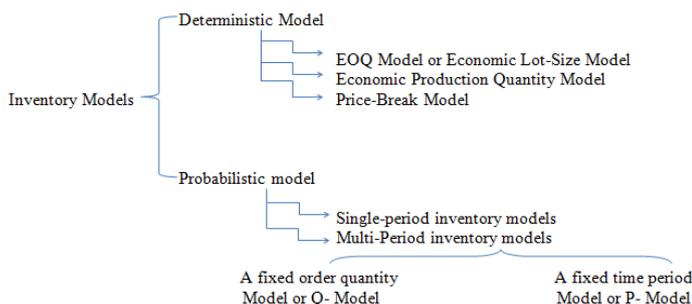


Figure 1: Classification of inventory models

Here we explain the above models in below.

### A. DETERMINISTIC MODEL

Deterministic inventory models in which demand rate of an item is assumed to be constant. EOQ model is another deterministic model as showing in figure.

✓ **ECONOMIC ORDER QUANTITY MODEL:** The order size of an inventory that minimizes the total cost of inventor management is known Economic Order Quantity. It expressed by this Mathematical formula.

$$E.O.Q. = \sqrt{\frac{2O_c D}{H_c}}$$

Where,  $O_c$  = Cost Of Order,  $D$  = Annual Demand,  $H_c$  = Holding Cost/Carrying Cost [in Rs. or Unit]

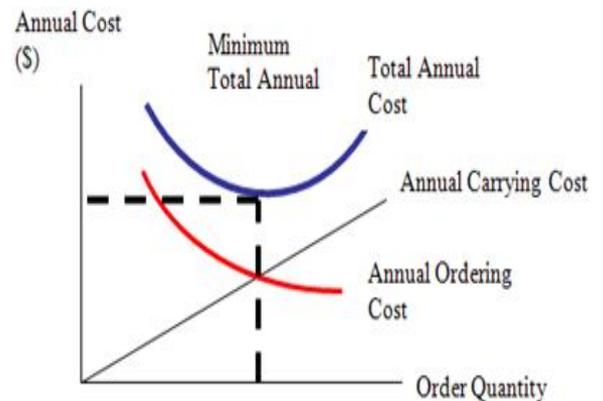


Figure 2: EOQ Model Cost Curves

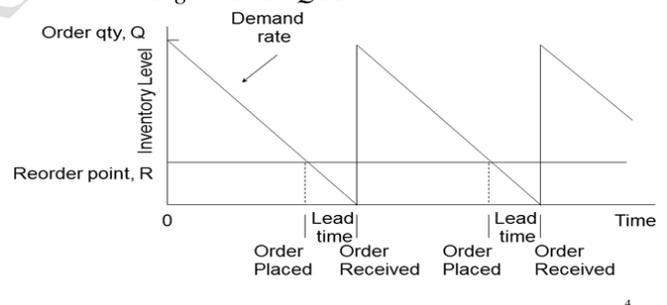


Figure 3: EOQ Model

✓ **ECONOMIC PRODUCTION QUANTITY MODEL:** Economic production quantity (EPQ) is the quantity of a product that should be manufactured in a single batch so as to minimize the total cost that includes setup costs of machines and inventory holding costs.

OR

The *economic production quantity* model (also known as the EPQ model) determines the quantity a company or retailer should order to minimize the total inventory costs by balancing the inventory holding cost and average fixed ordering cost.

$$EPQ = Q^* = \sqrt{\frac{2D C_s}{(1-\frac{d}{p}) C_H}}$$

Production Quantity =  $Q$ ,  $EPQ = Q^*$ , Annual Demand =  $D$ , Setup Cost =  $C_s$ ,

Holding or carrying cost per unit / year =  $C_H$ , Daily production rate =  $p$ , Daily demand rate =  $d$

In this model, we have setup cost,  $C_s$  i.e. setting cost that production facility to manufactured for desired product. The holding cost per unit per year, remains unchanged. However the annual holding cost changes due to the change in average inventory level.

INVENTORY LEVEL

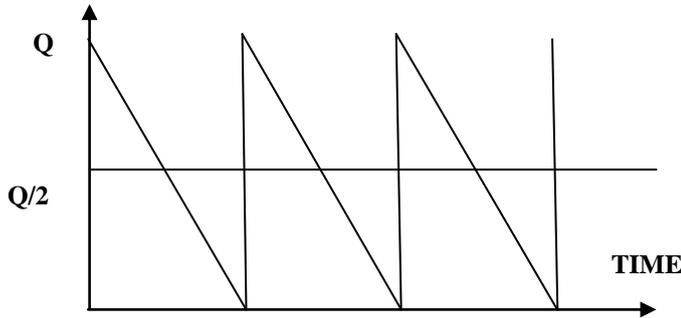


Figure 4: Economic Production Quantity Model

✓ **PRICE- BREAK MODEL:** This model based on EOQ model and adopt the same assumptions

$$Q_{\text{price break}} = \sqrt{\frac{2DS}{ic}} \text{ Where,}$$

$D$  = Annual Demand,  $S$  = Order or Setup Cost,  $ic$  = Annual Holding Cost, in which  $i$  = Percentage of unit cost to carrying inventory,  $c$  = Cost per Unit. Since “C” will change for each price break.

B. PROBABILISTIC MODEL

Probabilistic inventory models where the demand for an item fluctuates or we can say the demand is not known properly.

✓ **SINGLE-PERIOD INVENTORY MODELS:** The single-period inventory model refers to inventory situations in which one order is placed for the product; at the end of the period, the product has either sold out, or there is a surplus of unsold items that will be sold for a salvage value.

OR

Typically orders are made only once. They are also known as the Dollar Limit System and are used for one time ordering for seasonal products or spare parts purchases. This model mathematical expression is:

$$P \leq \frac{C_u}{C_o + C_u}$$

Where,  $C_o$  = Cost /Unit Demand,  $C_u$  = Cost/ Demand,  $P$  = Probability that unit will be sold.

✓ **MULTI PERIOD INVENTORY MODEL:** Orders are placed multiple times over the entire production cycle. This model further classified under two categories. There are two general types of multi period inventory systems: fixed- order quantity models (also called the economic order quantity, EOQ, and Q-Model) and fixed-time period models (also referred to periodic system, periodic review system, fixed-order interval system, and P-Model).

- A **FIXED ORDER QUANTITY MODEL (Q-MODEL):** Purchase-order is placed at any time, On-hand inventory count is known always.

OR

This is used when we want to maintain an item “in-stock,” and when we resupply the item, in a certain number of units must be ordered each time.

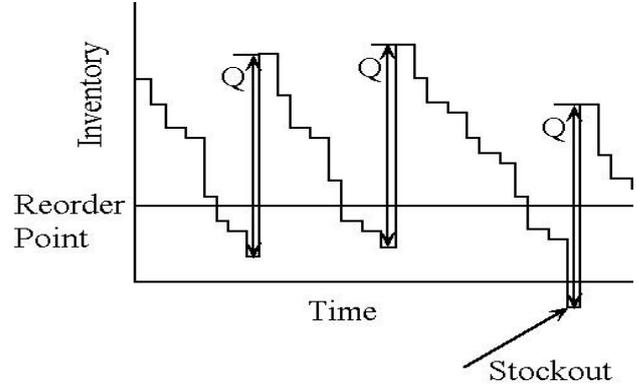


Figure 5: Fixed Order Quantity Model

- A **FIXED-TIME PERIOD MODEL (P-MODEL):** Purchase-order is issued at a fixed interval of time. An inventory control model that specifies inventory is ordered at the end of a predetermined time period. The interval of time between orders is fixed and the order quantity varies.

OR

This is similar to the fixed-order quantity model; it is used when the item should be in-stock and ready to use. In this case, rather than monitoring the inventory level and ordering when the level gets down to a critical quantity, the item is ordered at certain intervals of time.

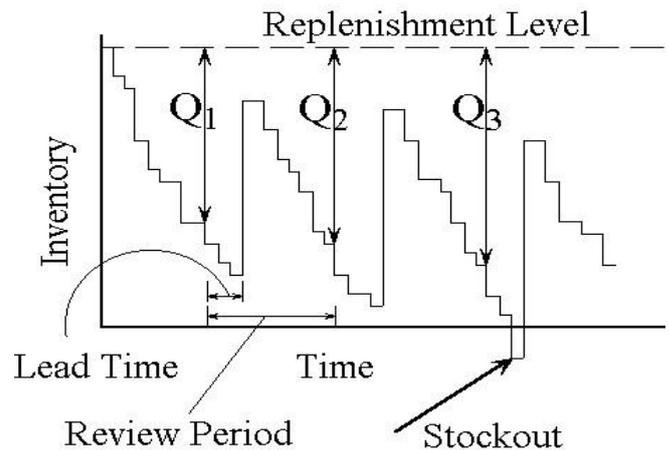


Figure 6: Fixed-Time Period Model

IV. CONCLUSION

This paper concludes that the best inventory plan, in most cases, will be to maintain the cost of holding stock of raw-materials or finished products. Whether to choose between these two models that is deterministic model or probabilistic model of inventory control will depends on the type of the industry. In practice, it is very difficult to decide which model should be used in an organization. In general, when nothing to know about the nature of order like, when to order? How

much to order? How much to store in safety stock? Then probabilistic inventory model is used. And after a time of interval definite order is placed then deterministic inventory model is used.

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