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INVENTORY MANAGEMENT AND ITS TOOLS–A REVIEW

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Abstract
The inventories are total present raw material, finished products and work in progress material in an industry which is meant to be delivered at demanded places. Management of inventory is a challenging task for an organization, so to run the organization eminently inventory model must be followed. The overall function of inventory management is to supply the material at required place within time limits which is very hard in complex systems. The complex system can enhance the overall cost of stockings or may empty the stock very soon, both conditions are not economical. So to run the stock management perfectly some tools or models of management can help well. The inventory management is stepped up from several decades but the scope in this field is still looking further improvements. As the inventory management needs the proper information about any process which is not possible therefore the different inventory models can be applied and the most reliable can be taken under certain parameters. These parameters or factors can affect the overall inventory directly or indirectly. This paper will review some literature based upon inventory methods which helps the industries in several ways to manage the entire inventory present in form of raw, work in progress and finished products.
Keywords: - JIT, VMI. EOQ, Inventory management, cost

I. INTRODUCTION

The inventory management is very important key factor in an industry which helps the management in proper management of stock. It is used to match the demand required by internally and externally. The inventory control and management is a challenging task which is dependent upon several factors such as nature of demand, cost, lead time etc [1]. Inventory management is a linking bridge between demand and supply. It ensures the existing stock is enough to fulfill the demand. It also reduces the extra costs related to over stockings and less stockings. In inventory control some factor are inversely and some are directly related to each other so the proper balance is necessary to run the entire system smoothly [2]. The different models of inventory are developed over decades like just in time (JIT), vendor managed inventory (VMI) and economy order quantity (EOQ) etc and the software are also developed to display the level of inventory [3][4]. The models of inventory are key tools which help in complex conditions. Every model of inventory management has its own characteristics which are applicable in different complex situations.

II. TYPES OF INVENTORY MANAGEMENT

a) Raw Material Inventory: It is inevitable factor which is required in manufacturing the final product. When the item is used in production process but not produced initially by the organization is termed as raw material, but the material which is not used in finishing the manufacturing of product but still required in production is also counted in the same category e.g. nuts and bolts etc Raw material inventories are called primary inventories

b) Work In Process: It is nothing but materials of components which has been released for production process but has not reached at the last stage of finished, these are the semi finished undergoing production process. The goods which are waiting for final acceptance test after manufacturing in the category of work in process.

c) Finished Goods: It is a stock which is ready to ship to customer against an order .These items are the final output of the company which has also passed the screening and acceptance test.

Inventories are also classified as under by a leading author [24] on Materials Management
and Purchasing.

a) Production Inventories:These areraw materials, parts and components which can be count in the firm'sproduct in the production process. These may consist of two general types:

- Special Items manufactured to company specificions.
- Standard industrial items purchased off-the-shelf.

b) MRO Inventories: Maintenance Repair and Operating supplies, which areused in the production process but do not become or even count as part of the product (e.g.lubricating oil, soap, machine repair-parts etc.).

c) In Process Inventories:Semi-finished products found at various stages in theproduction operation.

d) Finished Goods Inventories:These are completed products ready for shipment.

Another author divides Inventory into different groups as under :

- Raw materials
- Packing materials
- Loose tools

- Fuel stock
- Finished stock

e) Partly finished stock:Parts manufactured but not to be sold as completed or finishedproduct of the concern.
f) Work in progress:Materials processed to a stage in production shop that they
cannot be separated exactly in accordance with their respective specifications and
manufactured items issued from stores department
g) Unused stock:These include wastage unused, scrap or defectives which may be sold
or destroyed.

III. FACTORS OF INVENTORYMANAGEMENT

The inventory management and its models are totally dependent upon these factors:-

A. Nature Of Demand

The nature of demand is whether it is deterministic or not. Means the demand is expressed whether it is in a continuous flow or not. Some of the deterministic demand is related to "Chaos Theory" which is almost constant at its initial stages but may change after some time period [5].Levin et al. (1972) and Silver and Peterson (1985) made useful observations in this content. They stated: the display of greater quantity of the same item tends to attract more customers. It is because of a typical psychology of the customers. The customers may have the feeling of getting a wide range for their selection when a large amount is displayed or stored. Datta and Paul (1990) focused on the analysis of the inventory system which describes the demand rate as a power function dependent on the level of on hand inventory and constant holding cost. Deterministic model of perishable inventory with stock dependent demand and non- linear holding cost was developed by Giri and Chaudhury (1998).

B. Cost

The costs are those which are related to store, purchase and to deliver the material. Some of them are fixed and others are variable.Deterministic model of perishable inventory with stock dependent demand and non-linear holding cost was developed by Giri and Chaudhury (1998). They were of the opinion that increase in the holding cost increases total inventory cost. Roy (2008) developed an economic order quantity model for deteriorating items in which deterioration rate and holding cost are considered as linearly increasing function of time, selling price is dependent on demand rate and shortages are completely backlogged.
Shortage cost is the penalty cost per unit due to divergence of sale in stock out situation. Bose, Goswami and Chaudhuri (1995) proposed an EOQ model for deteriorating items with linear time dependent demand rate, shortages under inflation and time discounting.

C. Products

The organizations which handle or produce different products need complex inventory models or combined inventory models.

D. Production Rate

The production rate also plays a vital role in inventory management. It has also a huge impact on cost management [7].Khouja and Meraj (1995) extended the EPLS model with variable production rate and imperfect production. Mandal and Maiti (1999) worked on the inventory of damageable items with variable replenishment rate and stock dependent demand

E. Holding or Stocking Cost

It is the cost which displays the cost of keeping the products in stock. It is related to demand and production directly.

IV. IMPORTANCE OF INVENTORY MANAGEMENT IN INDIAN CONTEXT

Inventory Management has gained importance in India due to following reasons

- Late industrialization
- To conserve valuable foreign exchange
- To Release surplus capital for productive purpose
- To increase competitiveness in foreign markets by reducing costs
- Seller's market
- Inflationary hoarding of stocks
- Strict import procedure
- Excessive dependence on foreign collaboration
- Inadequate storage facilities and higher cost of storage
- Use of scientific techniques at low ebb
- Mechanisation

As defined in the concept of Inventory Management, application of different policies,techniques, system and actual practices to different functions of Inventory Managementof CTMI can be explained

V. INVENTORY MODELS

There are different models which can be adopted in different situations; some of the classical models are reviewed below;

A. Economy Order Quantity (EOQ) Model

It is one of oldest and greatest classical models. The EOQ model has huge impact on supply chain manage-

ment [8]. It helps inventory management to minimize the holding and ordering costs. This model can also tell when to start the sale cycle again. This model is applied when the demand is constant and stock is filled annually. The cost is kept fixed for each order and each order contain its holding cost. The parameters of EOQ are total demand per year, purchase cost per item, fixed cost per order and the storage cost annually. Mathematically the EOQ model depends upon these variables which can be expressed as;

Here, Q is order quantity, D is annual demand, K is fixed cost per order and h is holding cost of order annually [9]. In addition the EOQ model is concerned with quantity discounts all units and incremental [10]. The EOQ model is very helpful tool to calculate the total amount of the inventory which has to be in stock. There is another extension of imperfect quality product sales. These are the products which has some compromised quality assurance. These products are sold at huge discounts at the end of the circle [11].

B. Just In Time (JIT)

Just in time manufacturing system also known as just in time production was first developed by an eminent Japanese automobile manufacturer Toyota in 1960 [12] therefore it is also named as Toyota production system (TPS). The major role of just in time is reduce the time consumed in manufacturing and time taken for response from the vendors and customers. There are two main objectives of just in time manufacturing, first is to make the process smooth and second is to satisfy the customer by reducing the overall cost of product by reduction in various steps. It also reduces the waiting time by adopting the pull system, in which every next stage is in waiting [13]. It is very well growing tool for an industry because studies has shown it can save 97% of cycle time, setup times 50% and lead times by 60% with the help of Kanban system, visual management, employee empowering etc. techniques of JIT [14]. There are some potential risks which should be carefully taken under consideration before applying this technique, some of which are minimum order policies, non standard work [15]. The Toyota production system also reduces wastages and help in well maintained MRP [16]. The JIT system makes the system simpler and reduces part movement, defected parts, time wastage, transportation wastage, inventory waste, overproduction waste and processing waste. If the JIT runs efficiently then it can reach zero inventories easily.

C. Vendor Managed Inventory(VMI)

For streamline flow of inventory vendor managed inventory model is taken under action. It is a smooth delivery agreement between suppliers and their customers. It is the most reliable model of inventory for small scale industries or businesses. In VMI the demand is asked from lower level supply chain member to higher supply chain members [17]. This technique also reduced the total inventory cost because the inventory is only get recycled full after it reaches zero. The VMI model can change the inventory management of both supplier and buyer. This is temporary effect because at the early stages the sale and purchase quantities remains stable but these may alter as the market interests. Therefore it has huge impact on supply chain management [18]. The contraction of supply chain can also be seen in vendor managed inventory because of changing scenario of the market. The five coordinates of supply chain contraction between VMI and retailer managed inventory (VMI) are buyback, quantity flexibility, quantity discount, sales rebate and revenue sharing [19]. The exchange of information also reduces the "bullwhip effect" on supplier [20]. This effect also known as forester effect in which the accuracy of supply chain decreases along its length from origin because it becomes more chaotic and unpredictable at far distances [21].

D. Economic Production Quantity(EPQ) Model

The Economic Production Quantity Model (EPQ) was developed by E.W. Taft (1918). EPQ model, in fact, is an extension of EOQ model. There is, of course, difference between these two models. Whereas EPQ model assumes that the company will produce its own products or the products are going to be supplied to the company while they are being produced by other company.On the other hand, EOQ model says that the order quantity is received immediately and completely after being ordered. This means that the products are produced by another company, and as and when the orders are placed these are shipped to the ordering company immediately.An Economic Production Quantity Model was developed for deteriorating items with constant production and stock dependent consumption rate by Mandal and Phaujdar (1989). Production policy for ameliorating/deteriorating items with ramp type demand was derived by Goyal, Singh and Dem (2013). Sarkar and Moon (2011) developed an EPQ Model with inflation in an imperfect production system.Giri and Bardhan (2015) established a vendor buyer JELS model with stock dependent demand and consigned in-

ventory under buyer's space constraint. They derived integrated vendor buyer model to find optimal delivery batch size and number of shipments and suggested coordination mechanism between the vendor and buyer in an arbitrary ratio

E. Volume Flexible Manufacturing System

Market mechanism has been transformed considerably in view of the advancement in the technology and quick communication. As the emerging market trends, the organizations try to attract customers by storing and displaying the items in large quantity as also in influential manner. All of us observe this in big malls and stores. A careful and attractive storage and display of items in large quantity and in different varieties influences and motivates the customers to purchase more. This activity of purchasing more results in more demand. Dem and Singh (2013) developed a production model for ameliorating items with quality consideration.

VI. CONCLUSION

The inventory control management via different models is complex task. To make it simple the extensions can be studied. The EOQ model can be applied where the holding and ordering costs are higher for long time. If the time taken for a cycle is very much then the just in time (JIT) technique is reliable which also concentrates on higher customer satisfaction. The wastage can also be reduced with JIT model. To reduce the variation in supply chain management the vendor managed inventory model can be employed because it reduces the uncertainties in the chain.

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