**Production Management**

**Unit-4**

**Need of Material Management**

The need for materials management was first felt in manufacturing undertakings. The servicing organizations also started feeling the need for this control. And now even non-trading organizations like hospitals, universities etc. have realized the importance of materials management. Every organization uses a number of materials. It is necessary that these materials are properly purchased, stored and used.

Any avoidable amount spent on materials or any loss due to wastage of materials increases the cost of production. The object of materials management is to attack materials cost on all fronts and to optimize the overall end results. Materials management connotes controlling the kind, amount , location and turning of the various commodities used in and produced by the industrial enterprises. It is the control of materials in such a manner that it ensures maximum return on working capital.

De Rose : “Material management is the planning, directing, controlling and co-ordination of all those activities concerned with material and inventory requirements, from the point of their inception to their introduction into manufacturing process.”

As per De Rose all those functions which start with the procurement of materials and end with completion of manufacturing are a part of material management.N.K. Nair: “Material management is the integrated functioning of the various sections of an organization dealing with the supply of materials and allied activities in order to achieve maximum co-ordination.”

N.K. Nair has emphasized the co-ordination of all those activities which are related to the efficient use of materials.

**Importance of Material Management:**

Material management is a service function. It is as important as manufacturing, engineering and finance. The supply of proper quality of materials is essential for manufacturing standard products. The avoidance of material wastage helps in controlling cost of production. Material management is essential for every type of concern.

**The importance of material management may be summarized as follows:**

1. The material cost content of total cost is kept at a reasonable level. Scientific purchasing helps in acquiring materials at reasonable prices. Proper storing of materials also helps in reducing their wastages. These factors help in controlling cost content of products.
2. The cost of indirect materials is kept under check. Sometimes cost of indirect materials also increases total cost of production because there is no proper control over such materials.
3. The equipment is properly utilized because there are no break downs due to late supply of materials.
4. The loss of direct labour is avoided.
5. The wastages of materials at the stage of storage as well as their movement is kept under control.
6. The supply of materials is prompt and late delivery instances are only few.
7. The investments on materials are kept under control as under and over stocking is avoided.
8. Congestion in the stores and at different stages of manufacturing is avoided.

**Functions of Material Management:**

Material management covers all aspects of material costs, supply and utilization. The functional areas involved in material management usually include purchasing, production control, shipping, receiving and stores.

The following functions are assigned for material management:

1. **Production and Material Control**

Production manager prepares schedules of production to be carried in future. The requirements of parts and materials are determined as per production schedules. Production schedules are prepared on the basis of orders received or anticipated demand for goods. It is ensured that every type or part of material is made available so that production is carried on smoothly.

1. **Purchasing**

Purchasing department is authorized to make buying arrangements on the basis of requisitions issued by other departments. This department keeps contracts with suppliers and collects quotations etc. at regular intervals. The effort by this department is to purchase proper quality goods at reasonable prices. Purchasing is a managerial activity that goes beyond the simple act of buying and includes the planning and policy activities covering a wide range of related and complementary activities.

1. **Non-Production Stores**

Non-production materials like office supplies, perishable tools and maintenance, repair and operating supplies are maintained as per the needs of the business. These stores may not be required daily but their availability in stores is essential. The non-availability of such stores may lead to stoppage of work.

1. **Transportation**

The transporting of materials from suppliers is an important function of materials management. The traffic department is responsible for arranging transportation service. The vehicles may be purchased for the business or these may be chartered from outside. It all depends upon the quantity and frequency of buying materials. The purpose is to arrange cheap and quick transport facilities for incoming materials.

1. **Materials Handling**

It is concerned with the movement of materials within a manufacturing establishment and the cost of handling materials is kept under control. It is also seen that there are no wastages or losses of materials during their movement. Special equipment’s may be acquired for material handling.

1. **Receiving**

The receiving department is responsible for the unloading of materials, counting the units, determining their quality and sending them to stores etc. The purchasing department is also informed about the receipt of various materials.

**Meaning of inventory, Types of inventory**

Inventory is the term for the goods available for sale and raw materials used to produce goods available for sale. Inventory represents one of the most important assets of a business because the turnover of inventory represents one of the primary sources of revenue generation and subsequent earnings for the company’s shareholders.

Inventory is the array of finished goods or goods used in production held by a company. Inventory is classified as a current asset on a company’s balance sheet, and it serves as a buffer between manufacturing and order fulfillment. When an inventory item is sold, its carrying cost transfers to the cost of goods sold (COGS) category on the income statement.

Organizations with inventory items of small unit cost generally update their inventory records at the end of an accounting period or when financial statements are prepared (called periodic inventory method). The value of an inventory depends on the valuation method used, such as first-in, first-out (FIFO) method or last-in, first-out (LIFO) method. GAAP require that inventory should be valued on the basis of either its cost price or its current market price whichever is lower of the two to prevent overstating of assets and earning due to sharp increase in the inventory’s value in inflationary periods. The optimum level of inventory for an organization is determined by inventory analysis. Called also stock in trade, or just stock.

**Importance of Inventory Management**

Possessing a high amount of inventory for a long time is usually not advantageous for a business because of storage costs, spoilage costs, and the threat of obsolescence. However, possessing too little inventory also has its disadvantages; for example, the business runs the risk of market share erosion and losing profit from potential sales. Inventory management forecasts and strategies, such as a just-in-time (JIT) inventory system, can help minimize inventory costs because goods are created or received only when needed.

**INVENTORY TYPES**

Generally, inventory types can be grouped into four classifications: raw material, work-in-process, finished goods, and MRO goods.

1. **RAW MATERIALS**

Raw materials are inventory items that are used in the manufacturer’s conversion process to produce components, subassemblies, or finished products. These inventory items may be commodities or extracted materials that the firm or its subsidiary has produced or extracted. They also may be objects or elements that the firm has purchased from outside the organization. Even if the item is partially assembled or is considered a finished good to the supplier, the purchaser may classify it as a raw material if his or her firm had no input into its production. Typically, raw materials are commodities such as ore, grain, minerals, petroleum, chemicals, paper, wood, paint, steel, and food items. However, items such as nuts and bolts, ball bearings, key stock, casters, seats, wheels, and even engines may be regarded as raw materials if they are purchased from outside the firm.

The bill-of-materials file in a material requirements planning system (MRP) or a manufacturing resource planning (MRP II) system utilizes a tool known as a product structure tree to clarify the relationship among its inventory items and provide a basis for filling out, or “exploding,” the master production schedule. Consider an example of a rolling cart. This cart consists of a top that is pressed from a sheet of steel, a frame formed from four steel bars, and a leg assembly consisting of four legs, rolled from sheet steel, each with a caster attached.

Generally, raw materials are used in the manufacture of components. These components are then incorporated into the final product or become part of a subassembly. Subassemblies are then used to manufacture or assemble the final product. A part that goes into making another part is known as a component, while the part it goes into is known as its parent. Any item that does not have a component is regarded as a raw material or purchased item. From the product structure tree it is apparent that the rolling cart’s raw materials are steel, bars, wheels, ball bearings, axles, and caster frames.

1. **WORK-IN-PROCESS**

Work-in-process (WIP) is made up of all the materials, parts (components), assemblies, and subassemblies that are being processed or are waiting to be processed within the system. This generally includes all material—from raw material that has been released for initial processing up to material that has been completely processed and is awaiting final inspection and acceptance before inclusion in finished goods.

Any item that has a parent but is not a raw material is considered to be work-in-process. A glance at the rolling cart product structure tree example reveals that work-in-process in this situation consists of tops, leg assemblies, frames, legs, and casters. Actually, the leg assembly and casters are labeled as subassemblies because the leg assembly consists of legs and casters and the casters are assembled from wheels, ball bearings, axles, and caster frames.

1. **FINISHED GOODS**

A finished good is a completed part that is ready for a customer order. Therefore, finished goods inventory is the stock of completed products. These goods have been inspected and have passed final inspection requirements so that they can be transferred out of work-in-process and into finished goods inventory. From this point, finished goods can be sold directly to their final user, sold to retailers, sold to wholesalers, sent to distribution centers, or held in anticipation of a customer order.

Any item that does not have a parent can be classified as a finished good. By looking at the rolling cart product structure tree example one can determine that the finished good in this case is a cart.

Inventories can be further classified according to the purpose they serve. These types include transit inventory, buffer inventory, anticipation inventory, decoupling inventory, cycle inventory, and MRO goods inventory. Some of these also are know by other names, such as speculative inventory, safety inventory, and seasonal inventory.

1. **MRO GOODS INVENTORY**

Maintenance, repair, and operating supplies, or MRO goods, are items that are used to support and maintain the production process and its infrastructure. These goods are usually consumed as a result of the production process but are not directly a part of the finished product. Examples of MRO goods include oils, lubricants, coolants, janitorial supplies, uniforms, gloves, packing material, tools, nuts, bolts, screws, shim stock, and key stock. Even office supplies such as staples, pens and pencils, copier paper, and toner are considered part of MRO goods inventory.

**Economic Order Quantity (EOQ)**

Economic order quantity (EOQ) is the ideal order quantity a company should purchase for its inventory given a set cost of production, demand rate and other variables. This is done to minimize variable inventory costs, and the equation for EOQ takes into account storage, ordering costs and shortage costs.

The full equation is:

EOQ = √(2SD / H), or the square root of (2 x S x D / H).

S = Setup costs (per order, generally includes shipping and handling)

D = Demand rate (quantity sold per year)

H = Holding costs (per year, per unit)

EOQ applies only when demand for a product is constant over the year and each new order is delivered in full when inventory reaches zero. There is a fixed cost for each order placed, regardless of the number of units ordered. There is also a cost for each unit held in storage, commonly known as holding cost, sometimes expressed as a percentage of the purchase cost of the item.

The economic order quantity is computed by both manufacturing companies and merchandising companies. Manufacturing companies compute it to find the optimal order size of raw materials inventory and

merchandising companies compute it to find the optimal order size of ready to use merchandise inventory.

**The ordering and holding costs:**

The two significant factors that are considered while determining the economic order quantity (EOQ) for any business are the ordering costs and the holding costs.

**Ordering costs**

The ordering costs are the costs that are incurred every time an order for inventory is placed with the supplier. Examples of these costs include telephone charges, delivery charges, invoice verification expenses and payment processing expenses etc. The total ordering cost usually varies according to the frequency of placing orders. Mostly, it is directly proportional to the number of orders placed during the year which means If the number of orders placed during the year increases, the annual ordering cost will also increase and if, on the other hand, the number of orders placed during the year decreases, the annual ordering cost will also decrease.

**Holding costs**

The holding costs (also known as carrying costs) are the costs that are incurred to hold the inventory in a store or warehouse. Examples of costs associated with holding of inventory include occupancy of storage space, rent, shrinkage, deterioration, obsolescence, insurance and property tax etc. The total holding cost usually depends upon the size of the order placed for inventory. Mostly, the larger the order size, the higher the annual holding cost and vice versa. The total holding cost is some time expressed as a percentage of total investment in inventory.

**Models/Methods of inventory Control: EOQ, Re-order Level**

**Economic Order Quantity**

A problem which always remains in that how much material may be ordered at a time. An industry making bolts will definitely would like to know the length of steel bars to be purchased at any one time.

This length is called “economic order quantity” and an economic order quantity is one which permits lowest cost per unit and is most advantages.

**This can be calculated by the following formula:**

**Q = √2AS/I**

Where Q stands for quantity per order

A stands for annual requirements of an item in terms of rupees

S stands for cost of placement of an order in rupees; and

I stand for inventory carrying cost per unit per year in rupees.

**Reorder level of stock** (also known as **reorder point** or **ordering point**) in a business is a preset level of stock or inventory at which the business places a new order with its suppliers to obtain the delivery of raw materials or finished goods inventory.

Every business has to maintain a certain level of raw materials or finished goods in its store. This is done in order to sustain the continuity of production in case of raw materials and the continuity of sales in case of finished goods. For this purpose, the business must set a specific level at which it should place a new order with the suppliers of inventory.

Formula:

The two formulas used to calculate the re-order level are given below:

1. **When the business does not need to maintain safety stock:**

Maximum demand or usage (in days, weeks or months) × Maximum lead time (in days, weeks or months)

1. **When the business needs to maintain a safety stock:**

[Maximum demand or usage (in days, weeks or months) × Maximum lead time (in days, weeks or months)] + Safety stock

**What is lead time?**

The timing difference between placing an order with the supplier and arrival of the goods is known as the lead time.

**What is safety stock /buffer stock?**

In some scenarios, it may be unlikely that the reorder level could be estimated accurately. This is because the demand and the lead time of the goods could differ than the usual trends and in that case the business may run out of stock. So, a level of safety stock is set to avoid such a condition. It is also known as buffer stock.

**ABC Analysis**

ABC method of inventory control involves a system that controls inventory and is used for materials and throughout the distribution management. It is also known as selective inventory control or SIC.

**ABC Method of Inventory Control**

It has become an indispensable part of a business and the ABC analysis is widely used for unfinished good, manufactured products, spare parts, components, finished items and assembly items.

This method of management divides the items into three categories A, B and C; where A is the most important item and C the least valuable.

**Need for prioritizing inventory**

**Item A:**

In the ABC model of inventory control, items categorized under A are goods that register the highest value in terms of annual consumption. It is interesting to note that the top 70 to 80 percent of the yearly consumption value of the company comes from only about 10 to 20 percent of the total inventory items. Hence, it is crucial to prioritize these items.

**Item B:**

These are items that have a medium consumption value. These amount to about 30 percent of the total inventory in a company which accounts for about 15 to 20 percent of annual consumption value.

**Item C:**

The items placed in this category have the lowest consumption value and account for less than 5 percent of the annual consumption value that comes from about 50 percent of the total inventory items.

Note: The annual consumption value is calculated by the formula:

(Annual demand) × (item cost per unit)

**Use of ABC Analysis**

The ABC analysis is widely used in supply chain management and stock checking and inventory system and is implemented as a cycle counting system.  It is most important for companies that seek to bring down their working capital and carrying costs.

This done by analyzing the inventory that is in excess stock and those that are obsolete by making way for items that are readily sold. This helps avoid keeping the working capital available for use rather than keeping it tied up in unhealthy inventory.

When a company is better able to check its stock and maintain control over the high-value goods it helps them to keep track of the value of the assets that are being held at a time. It also brings order to the reordering process and ensures that those items are in stock to meet the demands.

The items that fall under the C category are those that slow-moving and need not be re-ordered with the same frequency as item A or item B. When you put the goods into these three categories, it is helpful for both the wholesalers and the distributors to identify the items that need to be stocked and those that can be replaced.

**Advantages of implementing the ABC method of inventory control**

**(i)** This method helps businesses to maintain control over the costly items which have large amounts of capital invested in them

**(ii)** It provides a method to the madness of keeping track of all the inventory. Not only does it reduce unnecessary staff expenses but more importantly it ensures optimum levels of stock is maintained at all times

**(iii)** The ABC method makes sure that the stock turnover ratio is maintained at a comparatively higher level through a systematic control of inventories

**(iv)** The storage expenses are cut down considerably with this tool

**(v)**There is provision to have enough C category stocks to be maintained without compromising on the more important items.

**Disadvantages of using the ABC analysis**

**(i)** For this method to work and render successful results, there must be proper standardization in place for materials in the store

**(ii)** It requires a good system of coding of materials already in operation for this analysis to work

**(iii)** Since this analysis takes into consideration the monetary value of the items, it ignores other factors that may be more important for your business. Hence, this distinction is vital

# Inventory Control: Objectives, Advantages

The Inventory control system is maintained by every firm to manage its inventories efficiently. Inventory is the stock of products that a company manufactures for sale and the components or raw materials that make up the product. Hence, an inventory comprises of the buffer of raw material, work-in-process inventories and finished goods.

Following are the popular Inventory Control Systems that are being used by big manufacturers and the retail units:

* ABC Inventory Control System
* Three-Bin System
* Just-in-Time (JIT) System
* Outsourcing Inventory System
* Computerized Inventory Control System
* Fixed Order Quantity
* Fixed Period Ordering

There are several inventory control systems that are in practice, and these range from simple system to a complex one depending upon nature and the size of the business operations. Talking about the simple system, several small manufacturing firms operate a Two-Bin System; wherein inventory is stored in two bins. Once the inventory in one bin is used, and the order is placed, meanwhile, the inventory from the other bin is used by the firm.

This system is quite inadequate for the larger firms that deal in several product lines and maintain a heavy sales counter. Thus, self –operating or an automatic computer system is to be employed to keep track on the inventory stock and place the order in case of a shortage.

#### ****Objectives:****

(i) To minimize capital investment in inventory by eliminating excessive stocks;

(ii) To ensure availability of needed inventory for uninterrupted production and for meeting consumer demand

(iii) To provide a scientific basis for planning of inventory needs;

(iv) To tiding over the demand fluctuations by maintaining reasonable safety stock;

(v) To minimize risk of loss due to obsolescence, deterioration, etc.;

(vi) To maintain necessary records for protecting against thefts, wastes leakages of inventories and to decide timely replenishment of stocks.

#### ****Advantages of Inventory Control:****

**Scientific inventory control provides the following benefits:**

1. It improves the liquidity position of the firm by reducing unnecessary tying up of capital in excess inventories.
2. It ensures smooth production operations by maintaining reasonable stocks of materials.
3. It facilitates regular and timely supply to customers through adequate stocks of finished products.
4. It protects the firm against variations in raw materials delivery time.
5. It facilitates production scheduling, avoids shortage of materials and duplicate ordering.
6. It helps to minimise loss by obsolescence, deterioration, damage, etc.
7. It enables the firms to take advantage of price fluctuations through economic lot buying when prices are low.

#### ****Limitations of Inventory Control:****

(i) Efficient inventory control methods can reduce but cannot eliminate business risk.

(ii) The objectives of better sales through improved service to customer; reduction in inventories to reduce size of investment and reducing cost of production by smoother production operations are conflicting with each other.

(iii) The control of inventories is complex because of the many functions it performs. It should be viewed as shared responsibilities.

**Dimensions of Quality**

Important Dimensions of Quality formulated by David A. Garvin

**David A. Garvin**, a specialist in the area of quality control, argues that quality can be used in a strategic way to compete effectively and an appropriate quality strategy would take into consideration various important dimensions of quality

Eight dimensions of product quality management can be used at a strategic level to analyze quality characteristics. The concept was defined by David A. Garvin, formerly C. Roland Christensen Professor of Business Administration at Harvard Business School (died 30 April 2017). Some of the dimensions are mutually reinforcing, whereas others are not—improvement in one may be at the expense of others. Understanding the trade-offs desired by customers among these dimensions can help build a competitive advantage.

Garvin’s eight dimensions can be summarized as follows:

1. **Performance**

It involves the various operating characteristics of the product. For a television set, for example, these characteristics will be the quality of the picture, sound and longevity of the picture tube.

1. **Features**

These are characteristics that are supplemental to the basic operating characteristics. In an automobile, for example, a stereo CD player would be an additional feature.

1. **Reliability**

Reliability of a product is the degree of dependability and trustworthiness of the benefit of the product for a long period of time.

It addresses the probability that the product will work without interruption or breaking down.

1. **Conformance**

It is the degree to which the product conforms to pre- established specifications. All quality products are expected to precisely meet the set standards.

1. **Durability**

It measures the length of time that a product performs before a replacement becomes necessary. The durability of home appliances such as a washing machine can range from 10 to 15 years.

1. **Serviceability**

Serviceability refers to the promptness, courtesy, proficiency and ease in repair when the product breaks down and is sent for repairs.

1. **Aesthetics**

Aesthetic aspect of a product is comparatively subjective in nature and refers to its impact on the human senses such as how it looks, feels, sounds, tastes and so on, depending upon the type of product. Automobile companies make sure that in addition to functional quality, the automobiles are also artistically attractive.

1. **Perceived quality**

An equally important dimension of quality is the perception of the quality of the product in the mind of the consumer. Honda cars, Sony Walkman and Rolex watches are perceived to be high quality items by the consumers.