

***SHRIMATI INDIRA GANDHI COLLEGE***  
*(Nationally Accredited at 'A' Grade(3<sup>rd</sup> cycle) by NAAC)*  
***TIRUCHIRAPPALLI - 02***

**DEPARTMENT OF HOSPITAL ADMINISTRATION**



**LEARNING MATERIAL  
MATERIALS MANAGEMENT**



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## **M.Sc. HOSPITAL ADMINISTRATION – II SEMESTER**

### **MATERIALS MANAGEMENT**

**Objective:** The course is indented to provide an in-depth knowledge about the scientific methods of purchasing, storing and dispensing of materials in hospital.

#### **UNIT I**

Materials Management - concepts - importance in organisation - relation to other administrative functions - organisation of materials management department - role and functions of materials managers.

#### **UNIT II**

Stores - Concepts of stores - importance in hospital settings - types of stores in a hospital - layout - location - store routine - supply and replacement of stock – stores audit- stock verification - control of pilferage.

#### **UNIT III**

Inventory control - definition - scope - advantages- ABC - VED analysis - EOC lead time - safety stock - just in time - inventory models - scientific techniques - deterministic model - probabilistic model.

#### **UNIT IV**

Purchase - right quantity - right price - right time - right source – price ( requirement planning) forecasting methods. Methods of purchasing - ABC - VED - analysis in purchase control – endor selection - purchase of capital equipment.

#### **UNIT V**

Information system development for Materials Management - - standardization on materials - bar codes - trends in material control – role of computers in materials management.

#### **References:**

1. Dutta A.K. Integrated Materials Management., S. Chand & Co. New Delhi, 1989.
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# **MATERIALS MANAGEMENT**

## **UNIT-1**

### **INTRODUCTION TO MATERIAL MANAGEMENT**

Materials management is concerned with planning, directing and controlling the kind, amount, location, movement and timing of the various flows of commodities used in and consumed by a hospital. The term “Materials Management” is of very wide significance, encompassing within its scope all the activities relating to

- i) Purchasing
- ii) Store-keeping, and
- iii) Inventory control

Material management is one of the basic functions of every business. Economic success of any manufacturing company has a direct relationship with the efficiency of the material management. Material management can be defined as a function, which aims for integrated approach towards the management of materials in an industrial undertaking. Its main object is cost reduction and efficient handling of materials at all stages and in all sections of the undertaking.

Material management’s functions include several important aspects connected with material; such as purchasing, storage, inventory control, material handling, standardization etc. Hence this subject has become very important and requires more attention.

Materials management is covers a very wide field and deals with material costs, material supply, utilization and its handling. It is concerned with planning and programming of materials and equipment, market research for purchase, procurement of materials (capital goods, raw materials, components and semi finished items) storage and inventory control, transportation of materials, salvage, material handling, disposal of scrap and surplus etc.

For balanced growth and efficient running of an enterprise it is necessary that materials cost, materials supply and its utilisation is controlled in such a way so as to result in:

- i) Maximization of production
- ii) Reduction of cost of production
- iii) Maximization of profit

This is achieved by reducing materials cost, preventing large amount of capital locked up in inventory for long, and by improving the capital turn-over ratio.

Thus materials management can be defined as the function responsible for the coordination of planning, purchasing, transporting, storing and controlling the materials in an optimum manner, so as to provide a predecided service to the customer at a minimum cost.

### **Definitions of Materials Management**

Materials management has been defined in several ways. Some of the important definitions are given below:

Materials management is the “process by which an organization is supplied with goods and services that it needs when the material is either consumer or incorporated into some product. The executives who engage in materials management are considered with three basic activities viz., buying, storage of materials and movement”.

- Ammer

Materials management is “the function of responsible for the coordination of planning, sourcing, purchasing, moving, storing, preserving and controlling materials in an optimum manner so as to provide a pre-determined service to the customer at a minimum cost”.

- P.Gopalakrishnan and M.Sundaresan.

Materials management is the “management of the flow of materials into an organization to the point, where, those materials are converted into the firm’s end products.

Material management is a concept that integrates all the activities of planning, scheduling and controlling material from design through production and including delivery to the customer. Thus it establishes full responsibility over the material flow system with full accountability for quality, delivery and cost.

Materials Management is the “management of the flow of materials into an organisation to the point, where, those materials are converted into the firms’ end and product(s)”.

- (Bailey and Farmer)

Material management can also be defined an organisational concept in which a single manager has authority and responsibility for all activities principally concerned with the flow of materials into an organisation, which includes purchasing, production, planning and scheduling, incoming traffic, inventory control, receiving and stores.

- (National Association of Purchasing Management, USA)

## **Objectives of the materials management:**

The objectives of the materials management is generally classified in to two categories:

1. **Primary objectives or direct objectives** which contribute to the achievement of some of the firms over all objectives.
2. **Secondary objectives or indirect objectives** which arise due to materials department assisting some other department in the organisation.

### **Primary objectives:**

These are concerned with achieving

#### **i) Low prices:**

Objective of purchasing materials at the least possible price is important because it helps in reducing the production costs and improves profits. This objective applies to all purchases including raw materials, parts, components, assemblies which are bought and services as well as transportation.

#### **ii) Higher inventory turnover:**

The inventory turn over is the ratio of cost of goods sold to cost of average inventory held in the organisation over a period of one year.

$$\text{i.e., Inventory turn over ratio} = \frac{\text{Cost of goods sold}}{\text{Cost of average inventory held}}$$

When average inventory is low, the capital tied up in inventory is low and this will increase the turnover ratio. This in turn increases the efficiency of utilisation of the firms' capital and improves the return on investment (ROI).

#### **iii) Low cost acquisition and possessions:**

Efficient receiving, handling and storing of materials result in low acquisition and possession costs. The cost of ordering and carrying inventory can be reduced to the minimum by optimising the order quantities per order.

#### **iv) Continuity of supply:**

If continuity of supply of materials is not maintained, storage of materials may cause idling of machines and labour and also stoppage of production. This will result in increase in production costs, increase in expediting and transportation costs and so on. In continuous production and mass production systems, continuity of supply is extremely important

because of automation in production processes and lack of flexibility in the production process.

**v) Consistency of quality:**

Quality of raw materials, components, parts, assemblies which make up the product very much determines the quality of the end product. Purchase managers should ensure **quality at the source** i.e., quality should be maintained by the suppliers.

**vi) Low pay roll cost:**

This objectives is concerned with keeping the pay-roll costs low in all activities coming under the purview of materials management (i.e., materials planning, purchasing, storing, materials handling, shipping etc) and also keeping the idle time in the production departments at the minimum level by avoiding shortage of materials. Lowering pay roll costs adds to profitability.

**vii) Cordial relationship with suppliers:**

Maintaining cordial relationship with suppliers will be helpful in getting prompt supplies from suppliers at reasonable prices at the right time and builds mutual trust and confidence between the firm and its suppliers. In such situations the customers are more likely to place orders on the firms having reliable suppliers. Also, the firm can have flexibility and can respond better to its customer's needs of changes in product design, purchase quantity, improvement in quality and changes in delivery schedules, which requires the cooperation of suppliers.

**viii) Development of personnel:**

The materials managers must develop the executives and employees in their departments by training them adequately to acquire the necessary knowledge and skills for efficient functioning in their area of operations. This will create potential leaders among the subordinates and will be helpful in smooth succession without disrupting the efficient functioning of the departments.

**ix) Maintenance of good records:**

Since employees of purchasing department may have the tendency to favour the suppliers and accept grafts for doing favours to them, it is necessary to maintain good records of all transactions such as quotations, tenders, comparative statements, management approvals for placing orders, purchase order copies, invoices, inspection reports, payment of bills etc.

Good record keeping helps to remove the onus of suspicion from honest employees who have to work in an environment which may be associated with corruption, favouritism etc.

### **Secondary objectives**

#### **i) Reciprocity:**

Reciprocity means reciprocal relationships of a firm with its customers. This means a firm buys as much materials as possible from its customers. (i.e., customers become suppliers wherever possible). A firm buying some items (say raw materials) from a supplier firm will try to sell its products to the same supplier for example, a furniture manufacturer may try to sell his products to the supplier firm which supplies raw materials (i.e., steel sheets) to his firm.

#### **ii) New materials and products:**

The purchase department can help the product development and R & D departments by giving them information about latest developments taking place in materials and components being supplied by the suppliers. This will help R & D engineers and product development engineers to adopt latest technology materials and components in their designs.

#### **iii) Economic make or buy:**

The purchase manager can furnish valuable information regarding outside sources of supply to the committee of managers responsible for make or buy decisions.

#### **iv) Standardizations:**

The purchase department can coordinate with the standards department of the firm in the field of standardisation, simplification and variety reduction which will bring substantial cost reduction.

#### **v) Product improvement:**

The purchasing department can assist the engineering or product design department in its primary objective of product improvement. The purchase department can suggest economic sources of supply for raw materials and components which can help design engineers to incorporate changes in product design effecting cost reductions without affecting product quality.

#### **vi) Interdepartmental relationships:**

All other departments in a firm need the help of materials management department to purchase their requirement of materials, machinery, equipments, suppliers, stationary items,



tools, furniture, office equipment's and so on. Hence, mutual cooperation and good interdepartmental relationships between materials management department and other departments is essential for the smooth functioning of any organisation.

**vii) Economic forecasts:**

Materials management department has the responsibility of forecasting the future prices, costs and general business activity (booms and recessions in a business cycle). Purchase managers translate these general economic forecasts into specific forecasts for purchased materials. They are familiar with the market and general business conditions through their day to day contacts with suppliers.

**Scope of Materials Management**

Basically materials management span of activities are:

**i) Planning**

What is needed, how much, where and when, to fulfil the objectives of the organisation. Scheduling of purchase of materials is a detailed time phased plan.

**ii) Procuring**

The raw materials, parts, components or subassemblies to meet the schedules on time from the required sources.

**iii) Controlling:**

The follow up or tracking to ensure that the plans and schedules are adhered to expediting; record keeping, data collection and information feedback all facilitate controlling.

**iv) Storing:**

Receiving, incoming inspection, and storing and issuing of the raw materials, component parts, subassemblies and work –in process required by the manufacturing function. Also, includes storage and handling of the finished goods and office supplies.

**v) Handling:**

Movement, packaging, transfer and delivery of materials involved from incoming receipt to final distribution of finished products.

**vi) Distribution:**

Distribution of the finished goods, warehousing, packing and shipping to customer.

**vii) Transportation and Traffic Control:**

Routing standards, carrier selections, commodity rates, consolidation and dispatching shipments.

### **Importance of Materials Management:**

Management of materials in most organisations is crucial to their success because the cost of purchasing, storing, moving and shipping materials account for over half of the product's cost. Improving productivity is a crucial factoring facing the challenge of competition and this involves driving down the cost of all aspects of business activities. Since there is maximum scope of cost reduction in the area of materials, doing the job of efficient and effective management of materials is seen as the key to higher productivity. Production and operations manager are working hard to develop better way of managing materials that on time deliveries, quality and costs are improved so that firms can survive in an increasingly competitive world. Reasons for significance of managing materials in an organisation are:

- i) The amount of money spent on materials is higher than other inputs put together
- ii) Materials offer considerable scope for reducing cost and improving profits.
- iii) Since materials is treated as a major part of current assets, improving return on investment depends on the effective utilisation of materials and keeping down the capital invested in the form of inventory of materials (which is treated as current assets)
- iv) Materials add value to the product
- v) Quality of finished products depends on the quality of materials used to produce them.
- vi) Materials management encompasses areas such as purchasing, storing, inventory control, materials handling, transportation and shipping etc.
- vii) There is need for procurement and preservation of scares materials for future use.
- viii) There is increasing demand for ensuring safety of environment by using biodegradable and less toxicity materials which do not cause any health hazards.
- ix) The efficiency of a firm depends upon the availability of right materials in right quality, at the right time, at the right price form the right source of supply(vendor)
- x) Materials are lifeblood of development of humanity.

### **Functions of Material Management:**

Functions of Material management department are grouped as follows

- 1) Materials planning and programming
- 2) Purchasing

- 3) Store keeping
- 4) Inventory control
- 5) Materials handling
- 6) Quality control and inspection
- 7) Value engineering.

## **1. Materials planning and programming**

Planning of Materials requirement and its timely provisioning is the essence of the success of materials management. This function involves the settling up of consumption standard or working out the requirements for all materials for any given manufacturing programme, considering all relevant factors, i.e. make or buy, laying down standards and specification, sources of supply available, availability of stock, import substitution etc. Lead time, manufacturing schedule, economic ordering quantity etc. Is considered while programming for materials requirement. The department should also follow up for timely deliveries, and to expedite in case of emergencies.

A material planning also involves maintenance of information system to feed details necessary for its better functioning in future.

For the purpose of material planning two concepts are followed depending upon the category. Direct production materials are planned on 'requirement basis', while the stock items are planned on the basis of 'norms of consumption'.

## **2. Materials Purchasing**

Purchasing function includes locating and development of sources of supply, market research for purchasing, calling for tenders, selection of suppliers, negotiating, entering into rate contract and issue of purchase orders mentioning specifications, delivery schedule and other terms and conditions

Purchasing function also includes supplier's performance evaluation, preparation of materials budget with the help of materials planning and inventory control sections.

Each organisation has its own purchase policy, which indicates its policies about (i) open, limited and single tenders, (ii) rate and running contracts, (iii) purchase through manufactures, distributors or suppliers, (iv) delegation of powers to its various levels of personnel.

Import cell of purchase section deals with the importation of the items as per prevailing government rules.

### **3. Store-keeping**

Storekeeping involves receipt, custody and issue of materials. The materials received against purchase orders placed by purchase section, are kept in stores after they are inspected and checked for quality as per specifications, physical condition and quantity.

The materials are kept in stores in such a way that they require minimum handling and remain well protected against any damage or loss. Materials issued for the stores against the authorised indents of store issue vouchers and proper record is maintained for receipts and issue of materials.

Physical verification, salvage and disposal of surplus materials is another key function of storekeeping.

### **4. Inventory control**

Inventory control is a systematic location, storage and recording of goods in such a way that desired degree of service can be made to the operating shops at minimum ultimate cost.

Inventory control has following functions:

- i) To run the stores effectively
- ii) To ensure timely availability of material and avoid build up of stock.
- iii) Stock control systems be developed and followed.
- iv) To maintain specified raw materials.
- v) To protect the inventories.
- vi) To develop policies, plans and standards essential to achieve inventory control objectives.

### **5. Materials handling**

Various functions related to storekeeping require lot of handling. Starting from receipt of material, inspection, storage and issue items should be handled in such a way that it requires minimum handling. For large stores, suitable materials handling equipment like cranes, hoists, forklifts, conveyors etc. are required.

Scientific materials handling system not only economises handling but also space, provides better working condition, and effective distribution system.

## 6. Quality control and inspection

Quality control in simplest terms is the control of quality during manufacturing. Quality of a product itself comprises several engineering and manufacturing characteristics which go to make the product meet the performance expectations of the designer and the customers. These characteristics are: dimensions, chemical properties, sensory property. In other words quality includes appearance, performance, life, dependability, reliability, durability, maintainability, smell, taste, feel, sound etc.

Inspection is the process of sorting good from bad, and rejects the bad. Inspection is defined as the art of comparing materials, products, or performance with established standards. The objectives of the inspection are: to detect errors in manufacturing system, to protect the customer from receiving a product that is below the quality level, and to complete information's regarding the conformance of the product with specifications for the use of engineering, production, purchasing, quality control and other divisions.

## 7. Value engineering.

Value engineering is a tool of management which approaches the question of saving cost from the point of view of value. In other words value engineering is a study of relationship between the design function and cost of a part, keeping this in view, reduce the cost through change in design, modification is specification of the materials used, changing in the sources of supply etc.

Term value is used in different ways and has different meanings. Generally the value can be categorised as:

- a) **Cost value:** This is the sum of all the elements of costs required to produce an item or provide a service.
- b) **Use value:** Use value is equal to the value of the functions performed.
- c) **Esteem value:** The properties, features or attractiveness which creates a desire to possess an article.
- d) **Exchange value:** the properties or qualities which will remain attractive enough to other people to permit resale in the future.

## 8. (A) Simplification

This is a form of standardisation for the reduction of the number of types of products within a definite range to that number which is adequate to meet the prevailing needs at a given

time. Simplification reduces range of products, their types, and sizes and also reduces their complexity of manufacturing procedure.

**(B) Standardisation:**

Standardisation is the setting up of standards for quality, raw material, sizes, and performance etc. of any product. It is helpful for checking the quality performance and value of product.

**(C) Product development:**

A product is an article obtained by the transformation of raw material. Under modern conditions of competition, and customer's high expectations and changing requirements about product, a continuous process of product development is essential.

Product development is done in following stages:

- (i) Idea generation
- (ii) Screening
- (iii) Market research
- (iv) Design the product
- (v) Develop the product by preparing prototype
- (vi) Test the product
- (vii) Reproduction and test marketing by producing few products and inviting suggestions or observe the performance and reactions.
- (viii) Manufacture from commercial point of view.

**D) Make or Buy Decisions:**

Make or Buy decision is a ticklish as well as vital decision. Both have their own advantages and disadvantages which needs careful evaluation and the choice which is optimum in long run is considered as final decision.

**9) Disposal of surplus, obsolete and scarp items:**

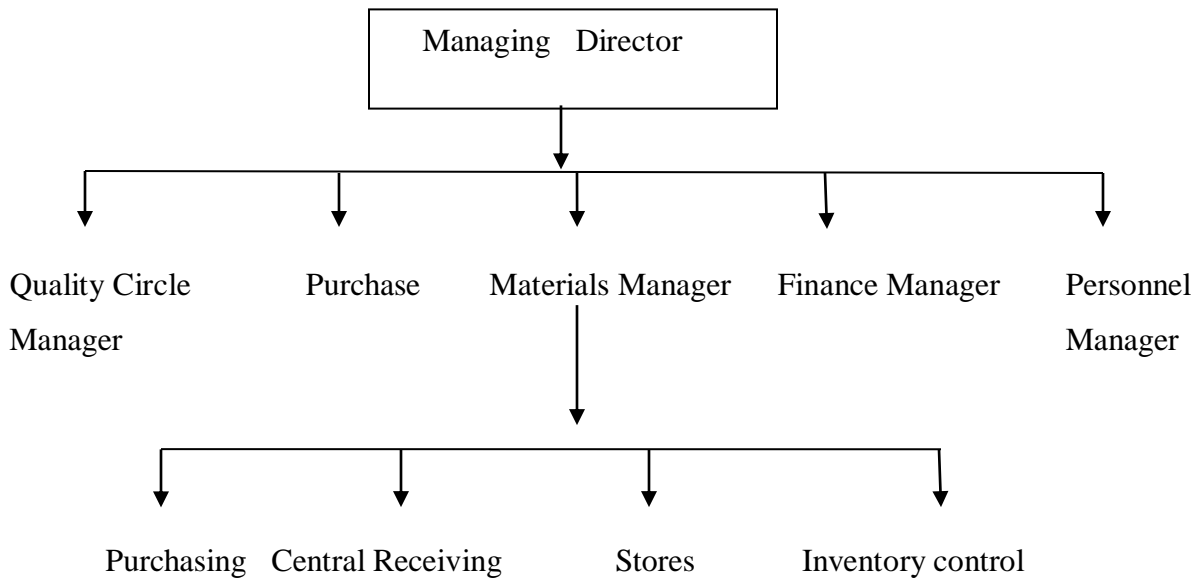
Holding surplus, obsolete and scrap stock affair as it includes inventory carrying costs, cost of periodic stock taking, and cost of maintaining records, cost of security and locked up costs.

**MATERIALS MANAGEMENT ORGANISATION (MMO)**

In order to fulfil the objective laid down for the material management department by following organisational principles and the corporate objectives, an appropriate organisation

structure is necessary. The organisation aims at better division of work, reasonable authority, span of control and favourable working environment.

A separate department for materials management is essential to carry out the functions like purchasing, store-keeping, inventory control etc. to facilitate smooth functioning for the organization. In such a case, the relationship of materials management with other functional areas like finance, marketing, personnel etc. becomes vital.



### **Aims of the materials management organizations**

Aims of the materials management organizations are:

1. To help in effective functioning of the enterprise by providing smooth materials flow.
2. To provide coordination between different functionaries in the department itself as well as with other departments of the enterprise.
3. To avoid all types of delays, wastages and spoilages.
4. Reduction in operational costs.

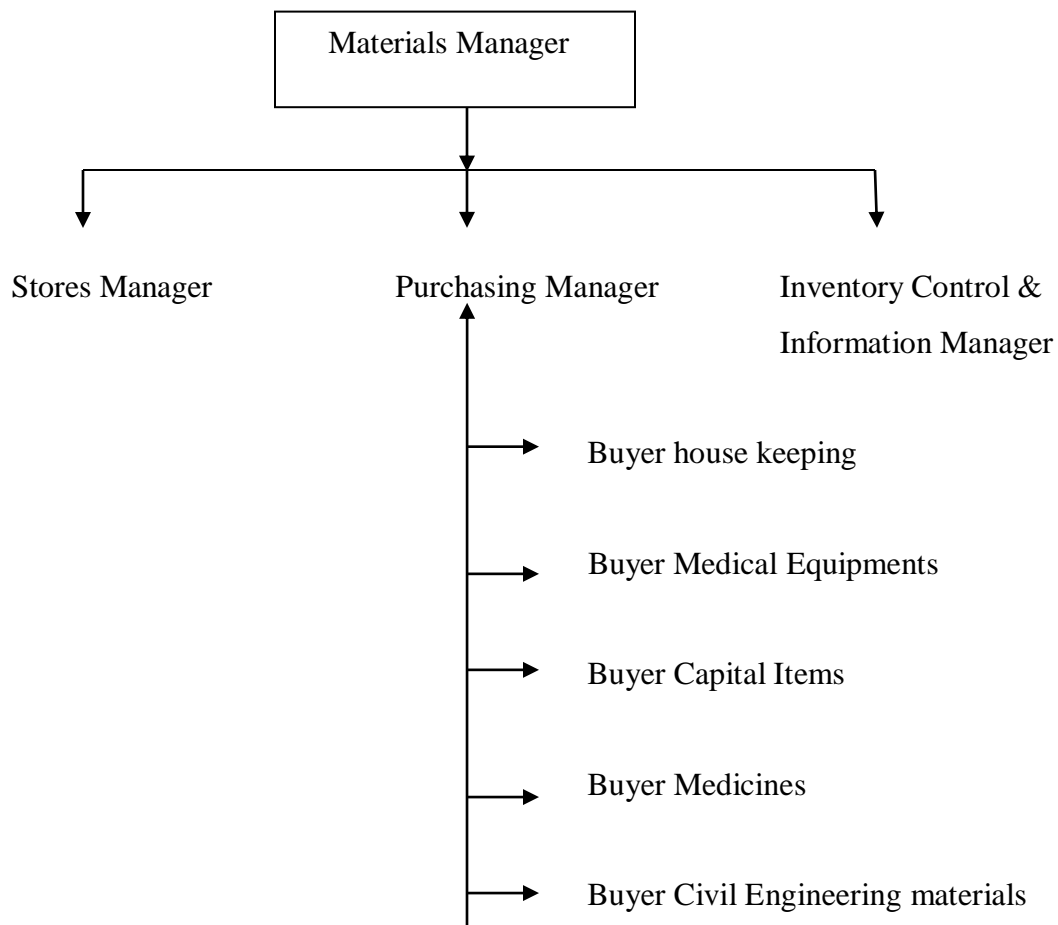
### **Types of Organisational Structure**

Organisational structure of material management department may be based on:

- Commodities
- Functions
- Location

### **Organisation Based On Commodities:**

In this type, materials are generally classified as: raw materials, consumables, fuels, imported items, spare parts, bought-out components etc. Or as electrical items, cement, steels, chemical items, spare parts, consumables, machine tools, fuels. These classes of material can be further be sub classified e.g.: raw materials as ferrous items, non-ferrous or consumables as greases, lubricants etc.



### **Organisation Based On Functions:**

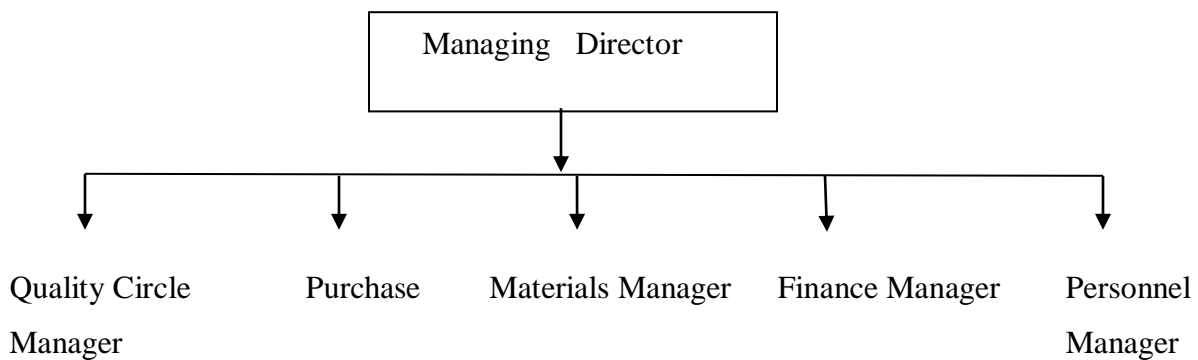
In this type of organisation, materials management department is divided into sections based on functions like purchase, stores , inventory control, materials planning, materials handling, value engineering, cost reduction etc., these sections are further sub divided into sub sections based on functions like purchase department into source development, vendor evaluation, tendering, evaluation and issue of orders , follow-up, importation, procurement of



capital equipment, spares procurement etc., whereas stores can be sub divided into receipts, issues and custody.

### **Organisation based on location:**

When an organisation has several plants located in the different parts of the country, there are two alternatives. One is to have a centralized organisation located at the head quarters. The other is to have a decentralised material management set up in each location. The decentralised system can be followed when distances from the plants are significant and the hospitals have different service lines. Each hospital may require many unique materials and materials management department located at the plant will be in a much better co-ordination with the service, finance and marketing departments.



### **Interdepartmental Relationships**

The relationship of materials management with other functional areas like finance, marketing, personnel etc. becomes vital.

#### **A. Materials Management and finance**

The materials manager has to establish smooth relationship with the finance manager as the latter releases the funds required by the materials manager based on materials planning. When the required materials are likely to be in short supply in the near future the materials manager has to resort to forward buying which requires heavy financial resources. Hence, the requirements of materials management should be made known well in advance to the finance manager to mobilize adequate financial resources.

#### **B. Materials management and service**

Service department supplies vital information about the orders in hand, the delivery date, the requirement of raw materials both in quantity and quality. This helps the materials manager to

make lead time analysis and materials planning, so that the required materials are available for the service units on time.

### **C. Materials management and personnel department**

The personnel recruit and select adequate number of personnel with desired qualifications and experience to be employed in the materials management department. The field of specialisation of each person selected is a very important one, when making an organisation based on commodity group. The training and wage and salary administration by the personnel department largely help the materials manager to have well trained and highly motivated personnel with him to meet the organisational objectives.

### **D. Materials management and marketing**

The marketing personnel are constantly in touch with the consumer and hence they are well aware of the buying motives and buyer behaviour. Further they are well aware of changes in technology and the materials manager can decide about the risk of obsolescence.

To increase the inventory turnover, it is very much essential to keep down the investment locked up in inventories and to ensure this, close co-ordination with marketing department is very much essential.

### **Challenges of materials management**

1. Scarce capital for investing in material inventory.
2. Difficulty in forecasting demand accurately
3. Increasing cost of land and storage space.
4. optimising purchasing quantity of materials
5. diversification of product lines
6. Optimising time and quantity of demand for products.
7. Managing information.

### **Modern trends in materials management**

Studying flow of materials – the acquisition, storage, movement and processing of raw materials, components, assemblies-is a good way to understand manufacturing. Also, services such as retailing, warehousing and transportation companies can be viewed as systems of material flows. In these systems, all organisational functions are greatly affected by the planning and control of the materials system.

### **Supply chain management:**

A supply chain refers to the way materials flow through different organisations starting with basic raw materials and ending with finished products delivered to the ultimate customer. It consists of a sequence of suppliers, warehouses, operations, and retail outlets.

Supply chains from complex networks involving many companies and materials coordination of all companies involved in a supply chain including effective communication) is crucial to providing high quality finished products in a timely manner at the lowest possible cost. The most relevant aspects of supply chain management involve all management functions related to the flow of materials from the company's direct suppliers to its direct customers including purchasing, warehousing, inspection, production, materials handling and shipping and distribution.

Materials management and **logistics management** are two alternative names sometimes used to refer to **supply chain management** *within a single firm*. Some organisations have centralised their diverse materials management functions under one department headed by a **materials manager or director-materials management**.

Four important activities in materials management or supply-chain management, are purchasing, logistics, warehousing and expediting.

**Logistics management** is the management (i.e., planning, execution and control) of all factors that affect the materials flow and the information about it, seen from the perspective of customer requirements for the purpose of achieving high delivery reliability, a high degree of delivery completeness and a short delivery time.

Logistics management function involves short-term materials planning the supply of raw materials and other purchased goods, internal transportation, storage and physical distribution. It is some times also referred to as materials management and /or **integrated business logistics**.

Supply chain management is a systems approach to viewing the supply channel and distribution channel as a whole rather than a set of fragmented parts. It differs from traditional approaches on inventory central and focuses on management relies on forming strategic partnerships with trading partners along the supply chain.

Supply chain management should be considered as logical extension of the logistics concepts. In order to be able to manage cost throughout the supply chain effective and cooperative supplier relationships are required. Hence, purchasing and supply chain management (including supplier management) can be viewed as an integrated part of supply chain management which encompasses both the logistics and the purchasing and supply function.

### **Role of materials manager:**

The organisational approach is known as materials management has gained validity in recent years. Production and operations managers found it necessary to develop an organised body of knowledge related to planning, acquisition and utilisation of materials in the process of production and it has resulted in the discipline known as “**materials management**”. All activities involved in bringing materials into and through the plant are combined under one head known as “**materials manager**”.

By giving the materials manager overall authority, responsibility is centralised to assure that the overall cost of materials is kept at the lowest possible level. The basic rationale for this organisational change is to overcome the problems of conflicting objectives.

For example, purchase departments concern to ensure continuous supply of component materials may conflict with the inventory control departments objective to minimise inventory levels or the objective of shipping in full car load lots.

While the specific functional areas vary depending on the type of production process, the area always included under the materials manager are:

- a) Purchasing
- b) Inventory control
- c) Traffic

The additional functional areas often included are production control and warehousing/stores. As such materials management can be defined as an organisational approach that brings under one organisational component the responsibility for:

- i) Determining the production requirements
- ii) Scheduling the production processes
- iii) Procuring, storing and dispersing of materials at minimum cost.

The essential reason for uniting material departments under a materials manager is to provide improved coordination and control of the following issues involved in making decisions regarding materials:

- i) Applying control tools** such as operations research and profit centres to materials problems cutting across functional lines, which requires the coordination and control under materials management
- ii) Achieving cost reduction** through inventory reduction, transportation, and purchasing as a result of improved coordination of these activities.

**iii) Reconciling conflicting objectives:** For instance the goal of purchasing and traffic is to buy and ship in large quantities in order to cut cost conflicts with the objective of inventory control for high inventory turnover and low obsolescence.

Materials management provides improved coordination and control of the materials sub-functions by centralising materials authority.

**Review Questions:**

1. Explain the objectives of materials management.
2. State the importance of materials management in an organization.
3. Mention some of the key functions of materials management.
4. Discuss the scope of materials management.
5. Explain with an organizational chart, the organizational structure of materials management.
6. What are the challenges of materials management today?
7. Discuss the modern trends in materials management.
8. Explain the Role of materials manager.

## **Unit-II**

### **Stores**

#### **Introduction**

Receiving and storing are important flow control activities in the materials management chain. Materials have to be stocked to meet the consumption requirements during lead time or during extension of lead time due to delays by suppliers or due to unexpected increase in the consumption rate. Warehousing is not the simple act of storing materials, but rather a package of services which enables the smooth flow of materials through the production departments without causing stoppage of production due to shortage of materials.

Storekeeping is primarily a service function in which the storekeeper acts as a custodian of all items carried in the store. Stores management should aim at providing this service as efficiently as possible with minimum possible cost. Storekeeping may be defined as a function of receiving, storing and issue of raw materials, bought-out parts and components, spare parts, tools, consumables, supplies and stationery items etc. to the user departments which have indented for the same. It is the aspect of material control concerned with the physical storage of materials and goods.

#### **Definition of Stores:**

Store keeping involves “to receive materials, to protect item, while is the storage from damage & unauthorized renewal to issue the materials in the right quantities, the right time, to the right place and to provide there services promptly and at least cost.

#### **Meaning of Stores:**

The term store in general manner is a place (opened & closed) where the goods, inventories, stocks, spares, drugs, surgical instruments, dietaries etc are kept for meeting day to day activities periodic works and so on.

#### **Importance of Stores:**

- Receiving materials ordered by purchased department
- Informing indenting department regarding the arrival of the material
- Inspection of materials
- Preparation of goods receipts (GRs) for approved material.
- Entry of materials into stores ledger.
- Storage and preservation of materials
- Issue of materials against authorized indents.

- Bill passing of materials received
- Entry of issued materials into ledger.
- Physical safe custody of materials.
- Raising purchase requisition for inventory items.

**Objectives of stores management:**

- i) To facilitate a balanced and smooth flow of raw materials, components, tools and any other items necessary to meet production requirements.
- ii) To maintain optimum stock of materials to compensate for irregular supplies by suppliers.
- iii) To achieve efficient utilization of storage space.
- iv) To reduce usage of materials handling equipments
- v) To provide codification of stored items for easy recognition
- vi) To enable flexibility in production schedules
- vii) To facilitate quantity purchases at discount prices.
- viii) To keep the account of all goods kept in stores.
- ix) To prevent theft, damage, wastage and deterioration of stored materials.
- x) To maintain record of all incoming materials and issue of materials to user departments.

**Functions of storekeeping**

- i) To receive raw materials, components, tools, equipments and other items and account for them.
- ii) To provide adequate and proper storage and preservation of various kinds of materials
- iii) To meet the demands of the user departments by proper issues and keeping account of items used by user departments.
- iv) To minimize obsolescence, surplus and scrap through proper codification, preservation and handling.
- v) To highlight accumulation of stocks, discrepancies and abnormal consumption and implement proper control measures.
- vi) To ensure good housekeeping to facilitate proper materials handling, material preservation, receipt stocking and issue of materials.
- vii) To assist material accounts department in stock verification and provide supporting information for effective purchasing.

viii) To coordinate storekeeping with related production functions.

**Problems due to inefficient storekeeping:**

- (i) Failure to locate store rooms properly and the inefficient use of available storeroom space can increase the storage costs.
- (ii) Excess handling of materials, need for more persons and equipments for materials handling.
- (iii) Difficulty is locating materials
- (iv) Overstocking and the resulting costs.
- (v) Problems in material control and time involved in supplying materials when needed because of improper store room location and use.
- (vi) Inventory carrying costs due to deterioration, damage and pilferage of materials and related indirect labour costs.

**Types of Stores:**

The hospital stores can be divided into two broad categories.

1. Consumable Stores → These stores are those which can be used only once.
2. Non-consumable Stores → are those which can be used again and again.

**Planning of hospital stores:**

Hospital stores can be planned according to the nature of store.

**Medical and drug stores:**

The medical and drug stores consist of emergency drugs, special drugs, medical gases and chemicals, etc.

**Surgical stores:**

These stores have bandages, gauges, sutures, instruments, equipments, rubber goods, glass items, cotton and general surgical items.

**General stores:**

The items of general stores are cleansing materials like soap and detergents, enamel wares, ward and general furniture, small electric items.

**Linen stores:**

Linen stores include textiles, synthetic fabric, woolen articles and furnishings.

**Stationary Stores:**



All the stationary items, including medical forms and papers for medical documentation, etc., are available in stationary stores.

**Dietary stores:**

Raw materials like vegetables and fruits, tinned items, dry rations like atta and rice, etc., are dealt by dietary stores.

**Engineering and Maintenance stores:**

These consist of spare parts of civil, electrical, mechanical and electronic items, etc.

**Layout of Stores**

Physical arrangement of storage facilities for efficient receiving, storing and issuing materials is referred to as stores layout. A properly laid out store will result in proper and orderly storing of materials and optimum utilization of storage space.

The efficiency of storekeeping depends upon how and in what way the materials management is planned.

**Meaning of stores layout:**

Stores layout is an effort to average materials other parts and other services within a predesigned building ensuring steady, smooth the environmental flow of materials.

**Aims of stores layout:**

The following are the aims of a good layout:

- Maximum utilization of the available space
- Greater efficiency of the stores depot
- Easy accessibility to all materials
- Maximum security of all materials
- Proper maintenance of records
- Greater economy and use of lesser time in receipt
- Minimum of spoilage, damage, and other kinds of losses.

**Factors to be considered while planning the layout of stores are as below:**

i. **Type of materials stored:**

The prior knowledge of the nature of various types of materials to be stored is essential for planning the layout of stores. It helps in determining the nature, size, quantity of equipment and material to be stored and type of storage facility needed.

ii. **Volume of materials stored:**

The volume and weight of the materials to be stored have a major role in layout of stores and in deciding the kind of materials handling equipment needed in stores department. Sufficient passages should be provided for free movement of materials handling equipments inside the stores. Also the storage space depends on the volume of materials to be stored.

iii. **Availability of space:**

Lack of adequate space causes congestion of materials in stores. It also limits the quantity of materials that can be stored. Both too much of space and too little space lead to storing of materials haphazardly and higher handling costs.

iv. **Physical factors:**

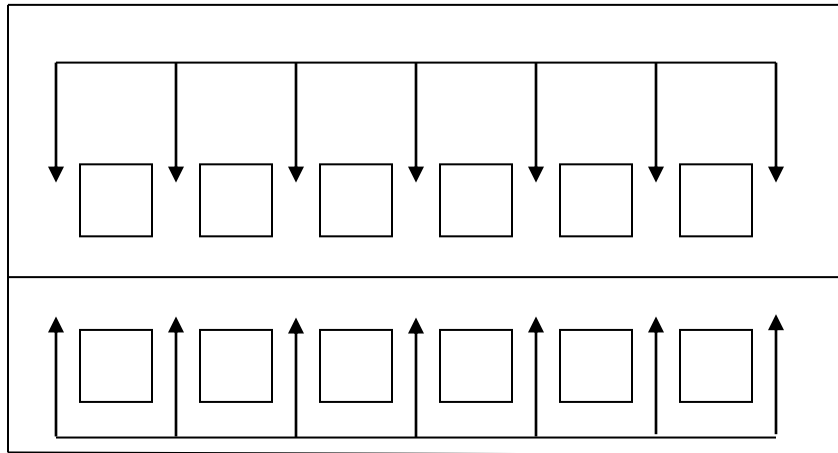
Physical environment factors such as good lighting, ventilation, controlled noise and temperature etc. protects the materials from damage, deterioration and hazard during storage. It also increases efficiency of stores personnel.

**Principles of stores layout:**

- i) Provision for easy receipt, storage and disbursement of materials and nearness to point of use.
- ii) Minimum handling and transportation of materials
- iii) Good accessibility of materials for handling equipment and personnel.
- iv) Optimum utilization of floor space and cubic space.
- v) Clear identification of materials, quick location of items and ease of physical counting.
- vi) Flexibility to suit the changing storage requirements of the future.
- vii) Protection against waste deterioration, damage, pilferage and fire.
- viii) Good lighting to prevent thefts, damage of materials and errors in storing.
- ix) Easy shelf life rotation to permit first in first out issue control.
- x) Periodic housekeeping and rearrangement
- xi) Isolated storage of inflammable materials like oil, wood, paint, cotton waste, kerosene etc.,
- xii) Incorporation of safety in the layout plan.

## **Types of stores layout:**

### **Straight through flow:**



This is the simplest form of layout design. The goods enter through one door and stocked. In straight line, packed line, packed moved in one direction along the length of stores house & move on through the exit. This can be shows the above diagrams.

### **Element basis:**

In this the stores are stored either on their consumability. Fast moving, medium moving and slow moving are other characteristic such as long life, short life or expandable or non-expandable are required in special temperature such as cold room.

### **Stores manual:**

Manual is a written statement of policies and procedures. A manual has several advantages such as spelling out responsibilities and authority of storekeeping, standardizing storekeeping activities and stimulating new ideas and suggestions for improving and streamlining storage operation.

### **Location of Stores**

#### **Meaning of store location:**

Stores location concerned with a store should be located at a place where in habitance are interested in the success a material can be issued receive & purchase & profit & cost its economical menu.

Hospital storerooms have normally been found located in areas which are either unusable by other departments or are not suitable for other functions of the hospitals. Basement is one of

such areas being use as stores. They are poorly designed even for use as storage facilities with low ceilings, exposed pipes, poor access and flow design.

### **Aims of stores location:**

The location of stores should be such that it fulfils the following aims:

- To receive and issue materials within least possible time.
- The cost of transportation is economical
- Materials are saved form unnecessary pilferage, theft and fire
- To have strict control over the movement stock
- Unnecessary fatigue and monotony is avoided
- To be easily accessible to all user areas of hospital.

The store building should be close to the area where the materials are required. While selecting a suitable site for a store, due consideration should be given to temperature, humidity and lighting arrangements and also to scope for future expansion of the store.

### **Factors influencing location of stores:**

The determination of the location of stores area will depend on the needs of the plant and will vary from plant to plant. Certain basic factors to taken into account to determine the best location for stores are:

#### **i) Materials classification:**

Materials of the same classifications may be stored together regardless of differences in size, weight, and destination. For example, separate storage areas may be designated for raw materials, purchased parts, supplies, semiprocessed parts, finished products, packing materials, inflammable materials, spare parts for maintenance department etc.

#### **ii) Similarity of materials:**

Items of similar size, shape, and weight may be stored together even though they may be classified differently of be required at different production locations. According to this approach all small parts may be stored in one place, bar stocks in another, castings, forgings and bulky items in another place, raw materials such as steel, aluminum and brass sheets etc., in yet another place.

#### **iii) Point of use:**

It is sometimes desirable to locate all materials to be used at each production centre as close as possible to that particular centre. This approach may result in decentralization of stores, creating holding stores for each production division or centre.

**iv) Materials handling consideration:**

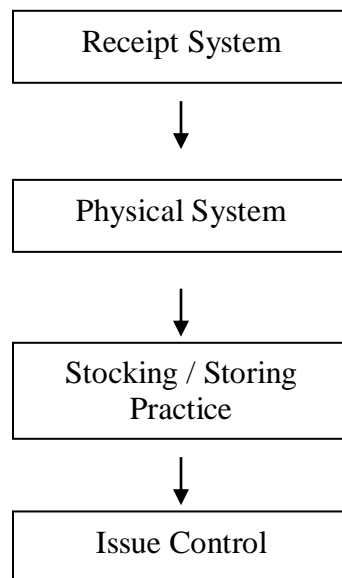
Materials which require similar handling equipment may be grouped together. For example, materials in the form of liquids may be stored together. Also items which are to be frequently handled because of a greater frequency of requisition may be placed at more accessible locations than less frequently handled items

**v) Special requirements:**

Some items may be fragile, explosive, and extremely valuable or may require special atmospheric conditions for storage. Such materials will have to be stored in locations which provide proper facilities.

**Stock Routines:**

Broadly the systems in stores can be studied under three areas, namely receipt, physical, stocking and issue. It will be seen that at every stage a great deal of information is required for checking, controlling and feedback purposes. Well designed stores systems and procedures ensure timely information for decision making, particularly because stores is the starting point of all activities for control. Let us briefly consider the systems and procedures in each area.



### **Receipt System:**

This can be divided into receipts from outside suppliers and receipts from internal divisions. Systems for receipt start even before the time when the material actually reaches the plant. When a purchase order is placed, a copy is sent to the stores, indicating quantity and delivery date. These should arrange in a chronological sequence so that the stores manager can at any time estimate the volume of receipt. This also helps in planning labour contracts when unloading activities exceed a particular limit. This is the first step in the stores system. Secondly suppliers once they dispatch, carrier details, description of the consignment and value. This is sent in advance so that quick and easy clearance may be done. The third stage is the document prepared by the transport carrier. Very often different suppliers employ different transport organizations for transportation of their materials. These three documents, namely, copy of the purchase order, supplier's advice document and the consignment note, enable the stores manager to organize and plan for expeditious clearance of materials and minimize costly demurrages. In some cases, suppliers send a packing slip detailing the contents in the package.

- ❖ Receipt from outside supplementing
- ❖ Planning labour contracts for loading & unloading
- ❖ Reports for stores inspection
- ❖ Materials issued to production
- ❖ Updating stores document
- ❖ Conception controlled
- ❖ Insurance disposable
- ❖ Transport contract

### **Physical System:**

When the anticipated day of delivery comes, the above documents are tallied for identify with respect to quantity and value. When the consignment arrives it is identified with the help of these documents. Then it is physically verified using weighbridges, measuring devices, tapes etc., when the volumes of receipts are high, and this process could be unwieldy and may prove to be a bottleneck.

- ❖ Match with value & quantity
- ❖ Physical verification
- ❖ Rechecking the receipt
- ❖ Find the storage

- ❖ Material department & stores section

### **Stocking / storing practices:**

At the end of the receipt and inspection stage, stocking follows. This is the most under-related function in stores management. Stocking involves routine activities like sorting out materials coming at the end of inspection process and storing them in their locations.

- ❖ Stock near than testing laboratories at inspect outfits
- ❖ Accept the material after inspection in each stage
- ❖ Reject the material if it fails in one stage
- ❖ Return to the supplier.

### **4. Issue control:**

- ❖ Issue
  - Conception department
  - Outside supplier for processing & conversion.
- ❖ Check the content given in bills of materials
- ❖ Equalizing the requirement & conception.

### **Supply & Replacement of stock:**

1. Waste management
2. Salvaging
3. Reclamation
4. Review

#### **1. Waste management:**

All non metabolic scrap is called waste. Paper corrugated containers, oils bags, plastics, rubber wood etc. it can be managed by chemical reaction and other process.

#### **2. Salvaging:**

Recovering or saving, condemned, discarded or abandoned materials, equipment or property in order to obtain useful parts is called salvaging. It can be also mean the saving of material for further utilization. The materials thus saved are called salvaged material.

#### **3. Reclamation:**

This involves the bringing back to their original serviceable condition, equipment, worn out parts etc. A typical example is regrading a type or metalising a worn out spare and bringing it back to its original specification.

#### 4. Review:

In most organization, some degree of obsolescence or surplus is inevitable. It is particularly acute in factories making product where the design changes frequently and also in organization such as transport undertaking or the armed force, where rapid technical development is a frequent phenomenon and large quantities of spares.

### **Stores audit**

#### **Meaning & Definition of Auditing:**

Auditing is concerned with verification of accounting & financial record with a view to determining their accuracy & reliability.

According to Institute of Chattered Accountance of India (ICAI), "Auditing is a systemic & independent examination of data statements, records, operation & performance of an enterprise for its stated purpose in any auditing situation. The auditor preserves & recognizes them proposition before him for examination collects evidence, evaluate same formulation is a judgment which is communicated through his audit report.

#### **Purpose of auditing:**

- To prevent frauds & errors
- To maintain accuracy & clear documents
- To maintain clear record about stores position & status.
- Clear record for issue & purchase
- Requirement of material & purchase department.
- Acting as an evidence for supplied & inspection department.

#### **Stores Auditing:**

Stores auditing is a process of verification, valuation & formulating the stores recorded translation is a systemic manner here the auditor verifies stock returns issued purchase records, bills of materials etc. by finishing this statement the auditor given a report. These are known as stores auditing.

All the newly received stores from the firms, after placement of order, should kept separately till their inspection is carried out. In no circumstances these will be merged with the regular stocks.

A standing committee should be constituted for carrying out the inspection at the hospital level.



On receipt of any store, these would be thoroughly checked and inspected with a view to ascertaining the quantity, quality and correctness of the stores received and also to know the breakages.

In case where supply is in bulk, it may not be feasible to carry out a 100 percent check of the stores. Here checking of stores based on random selection can be carried out. In case of any doubt on the random checking, entire consignment should be subjected to physical verification.

Injectables and life saving drugs at Medical stores depot level should normally be accepted only after testing. At the hospital level where requirements may be urgent, the item may be accepted on the post lab test basis or under a guarantee/warranty certificate.

The following points are to be kept in mind while auditing the drugs:

- The supplies are as per specification quoted in supply order.
- Packing schedules are as specified in supply order and challan
- Shelf life of items should be adequate.
- The supplies have been made within the date of delivery (D.O.D)
- The supplies and containers have been stamped.

In case of non-expendable items, inspection should be carried out with reference to the specification/catalogue/approved samples or sealed samples in stock/sample rooms.

All items found in order should immediately be entered on the inspection note, and adjustment of items should be completed promptly after that.

Items are not approved should be rejected after recording adequate reasons for such rejections. Necessary action for replacement and lifting of the rejected stores by the firm should be taken.

### **Stock Verification**

No matter how diligently a storekeeper performs the custodial job or how carefully a ledger clerk maintains records (computerized or manual) some discrepancy between the actual and book balance of inventory is bound to occur. The system is operated by people, and people do commit mistakes. For this reason, every inventory item should be physically counted and checked against its book balance at least once in a year. The books are subsequently adjusted to match the actual count. The account is eventually closed by transferring the balance to manufacturing overhead account.

Stock verification should be done half-yearly by the Head of the department concerned or once a year by an officer nominated by the Head of the organization. It is advisable to carry out surprises stock verification of the few potentially pilferage items every now and then.

**Definition:**

Stock verification may be defined as the process of physical conditioning, weighting or measuring the stock of material. Ex. Health care service materials.

Stock verification is the process of physically counting, measuring or weighting the entire range of items in then stores and recording the results in a systematic manner. The purposes served by stock verification are as follows:

- ❖ To reconcile the stock records and documents for their accuracy and usefulness.
- ❖ To identify areas which require more disciplined document control.
- ❖ To back up the balance sheet stock figures and
- ❖ To minimize pilferage and fraudulent practices.

**Needs of stock verification:**

- ❖ To verify the stock physically against them quantity shown in the ledges.
- ❖ To identify which repair and control
- ❖ To disclose the possibility of fraud, theft, loss etc.,
- ❖ As a necessary against spoilage, damage, obsolescence & error.

Stock verification is usually carried out by the materials audit department, reporting to either the materials manager or the internal audit. One person is usually given the exclusive responsibility with adequate facilities and authority.

**Methods of Stock Verification:**

The hospitals carry out stock certification by any of the following methods:

1. **Annual Inventory Method / Periodic verification:**

In this method verification is usually done at the close of the financial year. Verification should be completed within two weeks and report submitted to the Head of the institution.

2. **The Continuous Method:**

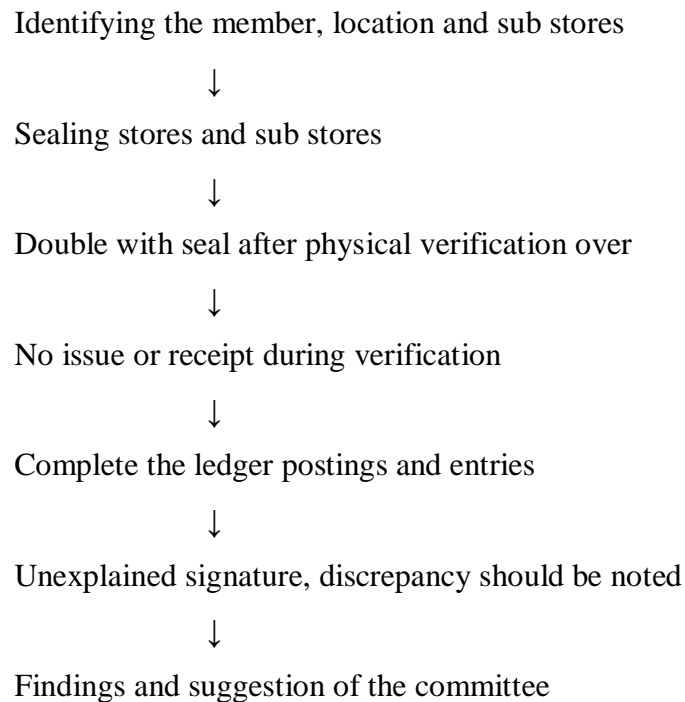
The inventories are divided into twelve equal parts and one part checked every month. This method has the advantage that the store room operations are not required to be shut down during the stock verification. The approach has three advantages. It can be planned and worked into scheduled activities without a shutdown. It can be conducted in an orderly and relaxed manner; these conditions are also conducive to accurate work. Secondly, there is the possibility of

detecting and eliminating causes for discrepancies without allowing them to continue throughout the year. Finally, this approach facilitates efficient utilization of stores personnel. In many storerooms, withdrawals are heavy early in the day and are much lighter later on. Thus, when the issue clerk's busy work slacks off, he will have backlog of inventory also.

**Verification Report:**

Verification report should be examined by the purchase officer and submitted to the Head of the institution/hospital with his remarks and recommendations for his orders.

**Steps / procedure of stock verification:**



**Control of pilferage**

**Pilferage: Meaning**

In general, pilferage refers to theft or misleading of goods & spare by the employees or the person related or unrelated to the organization engaged in taking away the goods without permission or knowledge of officials who are responsible for the organization or department.

**Control of pilferage:**

**1. Proper Record keeping:**

This is the method by which the store keeper maintenance records for each and every transaction. Through this he will be able understand the correct inflow & out flow goods & control pilferage to large extent.

**2. On the spot inspection:**

In this way store manager make surprise inspection to the store to make sure that all items are the right place if he finds any in adequately the level of stocks be can enquire it right than.

**3. Adoption of latest technology:**

Here the organization adopts latest technology in order to defect the pilferage, frauds. For example, it closed circuit camera will capture all the activities happening with in the stores. They are other high hand sophisticated methods to detect all fraudulent activities control

**4. Control of errors:**

Here the management should have make all efforts should to minimize the level of errors with respective input & output of stock storage, preservation etc.

**5. Proper storage:**

Storage of all items should be in a transparent manner so that incase of loss the goods lost should come under the notice of the store manager immediately.

**6. Close assessment of personnel's:**

Here the personnel working in the organization should be asset and cross checked at the end of the day to ensure the particular person is not involved in any pilferage activity.

**7. Proper security:**

It is a most essential requirement of store keeping. If the security arrangement are made without any loopholes. The chances of any misappropriation will remain impossible.

**8. Systemic layout & location:**

This means that the building and the location in which the items are stored should be in a secured environment.

**Review questions**

1. What is storekeeping?
2. List the various types of hospital stores.
3. State the importance of storekeeping.
4. List the functions of storekeeping.
5. Mention the problems that arise due to inefficient storekeeping.
6. What is meant by location of stores? Discuss the basic factors that must be taken into account to determine the best location of stores.
7. What is meant by layout of stores? Discuss the factors to be considered while planning layout of stores.
8. Discuss the various types of stores layout.

9. How is stock verification conducted?
10. Explain about the control of pilferage.

### **Unit-III**

#### **Inventory Control**

Inventory control is a tool of management which is used to maintain an economic minimum investment in materials and products for the purpose of obtaining a maximum financial return.

In the Inventory control system, control is exercised by fixing a minimum and maximum stock level for each item. An item is reordered in such a way that the stock level, at any time, never goes beyond the minimum level fixed for it. Similarly, the quantity to be reordered is so adjusted that the stock does not exceed its maximum level. Thus, the system answers the two fundamental questions-when to reorder and how much to reorder.

#### **Objectives of Inventory Control:**

- ✚ To reduce the financial investments in inventories.
- ✚ To minimize idle time by avoiding stockouts and shortages of essential medical and surgical items.
- ✚ To avoid losses from inventory obsolescence.
- ✚ To improve quantity of care in hospitals.

#### **What is Inventory?**

Inventory is the sum total and costs of all supplies, official and non-official, wherever they may be stored, that have not yet been used.

#### **Types of inventories;**

Inventories can be classified as official and unofficial.

#### **Official inventories:**

Official inventory is one that is brought into a storage space or unit, counted and controlled until it is dispensed to a using department, for example,

##### **a. Central stores**

- Medical and surgical items
- Dressings
- Linens
- X-ray supplies

- Laboratory supplies
- Housekeeping items
- All processes of sterile supplies.

**b. Pharmaceuticals**

- All drugs, fluids

**c. Dietary**

- Cereals, pulses etc.

**Unofficial inventories:**

Unofficial inventories are those supplies that have been expended and dispensed to the various departments and units where they are stored until used. Most hospitals never count or rarely control this stock. Unofficial inventory exists in all supply consumer departments, such as:

- Nursing units
- Laboratories
- Casts rooms
- Anaesthesia
- Surgery
- Emergency rooms
- Radiology
- Disaster storage
- Maintenance
- Administrative offices
- Physician offices
- Recovery rooms
- Special care unit.

**Functions of inventory:**

One reason organization maintains inventory is that it is rarely possible to predict sales levels, production levels, and demand and usage patterns exactly. In such situations, inventory serves as a buffer against uncertain and fluctuating demand and keeps a supply of items available in case items are needed by the organization or its customers.

The many functions that inventories perform can be summarized as follows:

**a) Smoothing out irregularities in supply:**

Inventories provide a buffer to overcome the problems of uncertainties in supplies such as delayed deliveries and supply of short quantities by vendors as against the promised delivery schedules and quantities. Also, the customer demand for the goods may increase suddenly which affects the ability of the manufacturer to meet the customer demand. In such cases also, an inventory of finished goods held in the warehouses will act as a buffer against the uncertainties in demand. Thus, inventories fill the gap between supply and demand.

**b) Buying or producing in lots or batches:**

When the demand for an item does not justify its continues production throughout the year, it is produced in batches or lots on an intermittent basis. During the time when the item is not being produced, demands are met from the inventory which is accumulated by batch production.

**c) To meet seasonal or cyclical demand:**

Companies will produce items at a constant production rate more than the demand rate in order to meet the seasonal demand occurring at a later period for which the production capacity is insufficient.

**d) To take advantage of price discounts while buying items:**

A company will often purchase large amounts of inventory to take advantage of price discounts, as a hedge against anticipated price increases in the future. In some cases large quantities are ordered because the cost of an order may be very high and it is more cost-effective to have higher inventories than to order small quantities several numbers of times in an year.

**e) To maintain continuity to operations in production processes:**

Many companies find it necessary to maintain in-process inventories at different stages in a manufacturing process to provide independence between operations and to avoid work stoppages ore delays and to continue production smoothly if there are temporary machine breakdowns or other work stoppages.

**Scope of inventory control:**

The following points in regard to the scope of inventory control or inventory management can be particularly noted:

- i) Defining policies to guide the inventory control programmes.
- ii) Determining the most appropriate organization structure.
- iii) Determination of stock out.
- iv) Determining lead time

- v) Determining safety stock.
- vi) Determination of inventory status.
- vii) Minimizing handling and storing cost.
- viii) Effective running of stores which may include effective layout, effective utilization of storage space and equipment and simplified but efficient receiving and issuing procedure.

Inventories are maintained basically for the operational smoothness which they can affect by uncoupling successive stages of production. The materials management department is expected to provide this operational convenience with a minimum possible investment in inventories. The objectives of inventory, operational and financial are conflicting. The materials department is accused of both stock outs as well as large investment in inventories. The solution lies in exercising a selective inventory control and application of inventory control techniques.

#### **Principles of inventory control:**

The main principle of inventory control is that items for which annual consumption is high, orders are placed frequently so that the inventory level is as low as possible. For items whose annual consumption is not high, sufficient stocks are maintained and orders placed less frequently.

For proper control of inventories, the following terms should be understood properly:

- + Lead time
- + Buffer stock (Safety stock or reserve stock)
- + Optimum safety stock
- + Economic Ordering Quantity (EOQ) System
- + ABC analysis
- + VED analysis

#### **Lead time:**

Lead time is the average duration of time in days between the placing of order and the receipt of materials. When determining the quantity of any item to be ordered we have to take into consideration this 'Lead Time' so that orders could be placed at a time when the existing stocks are sufficient for the needs of the hospital during the lead time.

From the time the requisition for an item is raised, it may take several weeks or months before the supplies are received, inspected and taken into stock. This time is called 'Lead time'



or 'Procurement Time' and involves the time for the completion of all or some of the following activities:

- i) Raising of a purchase requisition
- ii) Receiving quotations, tenders their scrutiny and approval
- iii) Placing of an order on suppliers
- iv) Time needed by the suppliers to make the goods ready (may have to be manufactured or supplied ex-stock)
- v) Transportation and clearing
- vi) Receipt of materials at the company
- vii) Time for unpacking goods
- viii) Inspection and verification of the materials
- ix) Time for movement of goods to store
- x) Time for entering the goods in stocks
- xi) Issuing the materials
- xii) Carrying them to the place of work

The lead time required to procure any item can be divided into two parts, namely;

1. Internal lead time (also known as administrative lead time)
2. External lead time (also known as delivery lead time)

**1. Internal lead time:**

Internal lead time is the time required for the organizational formalities to be completed.

**2. External lead time:**

External lead time is the time taken in placement of order and receipt of goods.

**Total lead time:**

The total lead time can be computed by working out the time taken in internal and external procurement processes.

<b>Internal lead time (ILT)</b>	<b>External lead time (ELT)</b>	<b>Internal lead time (ILT)</b>
+	+	
<b>Requisition order</b>	<b>Placement of order and Receipt of goods</b>	<b>Taking unit in stock</b>

It is a common belief that external lead time should be controlled and reduced, but in actual practice the internal lead time constitutes a considerable part of total lead time and offers ample scope for reduction. The internal lead time is within the purview of the administration.

The external lead time cannot be avoided but it can be prevented for exceeding the stipulated time by:

- + Timely reminders and follow up;
- + Judicious expending and maintaining good relations with the suppliers;
- + Penalty for delayed supplies.

**Buffer stock (Safety stock or Reserve stock):**

Buffer stock is the quantity of stock set apart as a safeguard against the variations in demand and procurement period. This quantity of item can be used only at the time of emergency for unforeseen demands. It is calculated by multiplying the difference between maximum and average consumption rate per day by the lead time for the item.

**Reorder level:**

This term is used to denote the stock level at which fresh order has to be placed. This is equal to the average consumption per day multiplied by the lead time plus the buffer stock. At the time of ordering when the stock reaches the reorder level we will assure that the chances of 'Stockout' are practically nil.

**Optimum Safety stock:**

If the safety stock maintained is inadequately low, the inventory carrying charges on the safety stock would be low but stockouts will be frequently experienced and stockout costs would be very high. Hence it calls for inventory costs to arrive at an optimum safety stock. Stockouts may affect the functioning of the hospital in the following ways:

- + Quality of patient care is affected adversely
- + Patient satisfaction
- + Emergency purchase of stores at high cost
- + Extra transportation charges
- + Overloading of machines or men.

**Economic Ordering Quantity (EOQ) System**

This is the fixed quantity of material for which order is to be placed each item. In the cyclic system, it is the requirement of review period and lead time plus buffer stock minus stock in hand. In the Two-bin system, it is calculated by using a formula which takes into consideration the annual demand (A) for the item, the ordering cost per order (S), unit cost of item required (C) and carrying cost per rupees of inventory per year (I). The formula is:

$$Q = \frac{2AS}{IC}$$

Once the order quantity is known, the frequency for placing the order can be calculated by dividing the annual consumption with the order quantity.

### **Advantages:**

In this system of ordering the following are the major advantages:

- ✚ Each item of the store can be procured in the most economical quantity, hence called economic ordering quantity system.
- ✚ The item is purchased only when it is required to be purchased.
- ✚ Positive control can easily be exercised to maintain inventory investment at the desired level.

### **Disadvantages:**

This system functions correctly only if each of the items exhibits reasonably stable usage and lead time. When these factors change significantly, new order quantity and new order point is required to be determined and in such cases, the system becomes extremely cumbersome to operate.

### **ABC Analysis**

ABC stands for 'Always Better Control'. The intention is to control the best, then better and, lastly the good. ABC analysis is the analysis of stores on cost criteria. By analysis of the total cost of various inventories it has been found that inventories can be divided into three groups as A, B, and C. the analysis has revealed that 10 percent of items of inventory attribute to nearly 70 percent of the value of the inventory, 20 percent of the items attribute to 20 percent of the value of the inventory, and 70 percent of item of inventory will be of low value and attribute only 10 percent of the value of the inventory.

Based on ABC analysis, an average pattern of percentage of item and percentage of their respective rupee values can be worked out as follows:

Item	Percentage of items	Percentage of rupee value
'A' items	10	70
'B' items	20	20
'C' items	70	10

It has been seen that a large number of items consume only a small percentage of resources and vice versa. 'A' items represent high cost centre, 'B' items represent intermediate cost centre, and 'C' items are low cost centres. So far as inventory control is concerned, the following guidelines help in keeping the system optimum:

**'A' items:**

- ✚ Tight control should be exercised.
- ✚ Rigid estimates of requirements should be maintained.
- ✚ Strict and close watch should be kept.
- ✚ Safety stocks should be low.
- ✚ Management of items should be done at top management.
- ✚ Exact cost of individual items should be counted.

**'B' items:**

- ✚ Moderate control should be exercised.
- ✚ Purchase should be based on exact requirement
- ✚ Reasonably strict watch and control should be kept.
- ✚ Safety stocks should be moderate.

- + Management should be done at middle level.

**‘C’ items:**

- + Ordinary control measure should be exercised
- + Purchase should be based on usage estimates.
- + Controls exercises may be done by storekeeper
- + Safety stocks should be high
- + Management should be done at lower levels.

From the above, it is observed that ‘A’ class items receive strict control and ‘B’ class items receive moderate control from overstock and stockout points of view, and ‘C’ class items are not subjected too much control or attention.

**Advantages of ABC analysis:**

By concentrating on ‘A’ class items the materials manger is able to control inventories and show ‘visible’ results in a short span of time. By controlling the ‘A’ class items and doing a proper inventory analysis, obsolete stocks are automatically pinpointed. Many organizations have claimed that the ABC analysis has helped in reducing their clerical costs and resulted in better planning and improved inventory turnover. ABC analysis has to be resorted to because equal attention to ‘A’, ‘B’, and ‘C’ items is likely to have a diffused effect on all the items irrespective of their priorities.

**Limitations of ABC Analysis:**

- To be fully effective, it should be carried out with standardization and codification.
- Importance is given to an item based only on its annual consumption value and not on its critically for the production.
- It should be reviewed periodically so that changes in prices and consumption are taken into account.
- It does not apply to dependent demand inventory which is controlled by material requirement planning system.

**VED Analysis**

This analysis is based on the critically of the items in relation to the functioning of the hospital. The items can be classified into Vital (V), Essential (E), and Desirable (D) items.

**‘V’ items:**

These are vital items without which the hospital cannot perform its functions, that is, patient care. These items should have more safety stocks to ensure a higher degree of safety.

These items should be available at all times, and they should be controlled by the top management.

**‘E’ items:**

These are essential items without which the hospital can function for a short period but which may affect the quality of patient care to a limited extent. These items can be controlled by middle-level managers.

**‘D’ items:**

These are desirable items, the non-availability of which for a considerable period may not affect the functioning of the hospital. Such items can be controlled at the lower management level.

An example of the coupling matrix model-1 for equipment between criticality and cost is shown in figure.

	V	E	D
H	Defibrillator 1	X-Ray machine 2	Air-contains 3
M	Ventilator 4	Electric cutlery 5	Ultrasonic wash machine 6
L	Oxygen Regulator 7	Patient Trolley 8	Electric BP Apparatus 9

Cell 1 contains Vital and high cost items like defibrillator. It must be noted that a material manager has to comprehensively supervise category 1 items since an item may be a low cost one but critical for patient care e.g. oxygen regulator.

## **Just in Time**

A concept developed by the Japanese in which required materials are delivered by the original supplier to the location where they are utilized and at the time they are needed.

### **Definition:**

Just in time as “a philosophy of manufacturing based on planned elimination of all wastes and continuous improvement of productivity”.

JIT is an approach that seeks to eliminate all sources of waste in production activities by providing the **right part** at the **right place** at the **right time**.

The long term result of eliminating waste is a cost efficient, quality-oriented, fast response to customer needs such as organization has a huge competitive advantage in the marketplace.

JIT encompasses the successful execution of all manufacturing activities required to produce a final product, from design to delivery and including all stages of conversion from raw materials onward. The primary elements of JIT are to have only the required inventory when needed to improve quality to zero defects, to reduce lead times by reducing set-up times, queue-lengths and lot sizes, to incrementally revise the operations themselves and to accomplish these things at minimum cost.

### **Just in time environment**

Many elements are characteristic of a JIT environment. They may not all exist in a particular manufacturing situation but in general they provide some principles to help in the development of a JIT system. These can be grouped under the following headings:

1. Flow manufacturing
2. Process flexibility
3. Total quality management
4. Total productive maintenance
5. Uninterrupted flow
6. Continuous process improvement
7. Supplier partnership
8. Total employee involvement

### **Characteristics of JIT system:**

The salient characteristics are:

- (i) Pull method of material flow

- (ii) Constantly high quality
- (iii) Small lot sizes
- (iv) Uniform workstation loads
- (v) Standardized components and work methods
- (vi) Close supplier ties
- (vii) Flexible workforce
- (viii) Line flow strategy
- (ix) Automated production
- (x) Total preventive maintenance

**Benefits of JIT system:**

- (i) Inventory levels are drastically reduced and high inventory turnovers have been achieved.
- (ii) Reduced production cycle time or product throughput time
- (iii) Improved product quality and minimum scrap
- (iv) Root-cause elimination approach to solve production problems.
- (v) Multiskilled and flexible work-force reduces worker idle time, overheads, fewer lay-offs etc.
- (vi) Elimination of unpleasant suppliers
- (vii) Reduced customer related problems
- (viii) Lesser work in process and finished goods inventory
- (ix) Shorter procurement lead times
- (x) Improved employee morale due to high employee involvement and employee empowerment
- (xi) Reduced amount of inspection

**Techniques of JIT:**

The philosophy and techniques of JIT manufacturing discussed in this chapter are related to how process and methods lies with manufacturing and industrial engineering. Manufacturing planning and control is responsible for managing the flow of material and work through the manufacturing process, not designing the process. However, manufacturing planning and control is governed by and must work with the manufacturing environment.

**1. Manufacturing planning and control**

- ❖ Forecasting



- ❖ Master planning
- ❖ Material requirements planning
- ❖ Capacity management
- ❖ Production activity control
- ❖ Purchasing

## **2. Process design**

- ❖ Flow manufacturing
- ❖ Process flexibility
- ❖ Total quality management
- ❖ Uninterrupted flow
- ❖ Total employee involvement
- ❖ Supplier partnership

## **Scientific Techniques**

1. Feedback loop
2. Time series analysis
3. Value analysis
4. Queuing theory
5. PERT and CPM
6. Statistical quality control
7. Work study
8. Cost analysis
9. MBO
10. Quality circles
11. MAPs.

### **1. Feedback loop:**

The hospital, in one way can be desired as a collection of functional service units. Each of the units performs some specialized function. The departmental organizational structure of units, such as nursing, dietetics, radiology, laundries etc. are in fact built in this manner. In a typical acute hospital there may be more than thirty such functional units. The functions of the units vary widely and these may range from removal of waste and garbage to very specialized clinical functions. Never the less from the point of view of the hospital manager each of these

units can represent a basic feedback loop or can provide result expected information or goal achievement results. Each unit has a manager or a group of supervisors.

## 2. **Time Series Analysis:**

In the context of economic and business researchers, we may obtain quite often data relating to some time period concerning a given phenomenon. Such data is labeled as 'Time Series'. More clearly it can be stated that series of successive observations of the given phenomenon over a period of time are referred to as time series.

## 3. **Value Analysis:**

According to Miles, 'the pioneer in value analysis is implemented by the use of a specific set of techniques, a body of knowledge and a group of learned skills'.

Value is one of the most used words and has several meanings. From materials view point value of an item may be thought of as composed of: (i) the functions required of the item (ii) features which the user usually the patient wants and is willing to pay for it.

## 4. **Queuing Theory:**

A queuing system can be described as composed of patient arriving for service, waiting for service if it is not immediate and if having waited for service learning the system after being served

The study of a problem would take into account:

- a. The arrival pattern : regularly or randomly varying
- b. The no of queues: single or multiple
- c. The queue discipline: FCFS or any other
- d. The no of service points: single or multiple.

## 5. **PERT and CPM:**

A time-event network analysis system in which the various events in a program of projects are identified with the planned time established for each is called programme evaluation review technique (PERT) or Critical Path Method (CPM). Its application is sequential scheduling of problems, where certain activities cannot be started until others have been completed. Building contracted and massive developmental projects for hospital are the most common example.

## 6. **Statistical Quality Control:**

It is the application of statistical techniques to which determine how far the product conforms to the standards of quality and precision and to what extent its quality deviates

from the standard quality. The purpose of statistical quality control is to discover and correct only those forces which are responsible for variations outside the stable pattern.

**7. Work Study:**

Work study is a management tool to achieve higher productive efficiency of an organization. It is concerned primarily with human manual work, more efficiency with the efficient design of such work and with the establishments of standards of performance.

International labour organization, 'work study' as the technique of method study and work measurement employed to ensure the best possible use of human and material resources in carrying out a specified activity.

**8. Cost analysis:**

A large part of management decision deals with alternatives differing in both the amounts of capital and operating expenses. To assess the value impact calculation of expenses and cost are essential. Cost analysis is a systematic pattern of analysis, which will aid in reducing cost in the selection of alternatives and to gain the maximum benefit from a given level of expenditures.

**9. MBO (Management By Objectives):**

MBO is process where by the superior and the subordinate managers of an organization. Jointly identify its common goals, define each individual major areas of responsibility in terms of the results expected of him/her, and use these measures & guides fir operating the unit and assessing the contributions of each of its members.

**10. Quality Circles:**

Quality circle is a people-building philosophy capable of providing astonishing results. Quality circles is a small group of people doing similar or related work who meet regularly to identify, analyze and solve quality, production, cost reduction, safety and other problems in their work area leading to improvement in their performance and enrichment of their work life.

**11. MAPs:**

The organization ability can be improved by the use of management problem solving methods (MAPs). The problem solving case study approach involving actual or contingency situations is suitable for all management levels.

**Inventory Model**

One of the basic problems or inventory management is to find out the order quantity so that it is most economical from over all operational points of view. Here the problem lies in minimizing the two conflicting cost, i.e, ordering cost and inventory carries cost. Inventory

model help to find out the order quantity which minimized the total costs (sum of ordering costs and inventory carrying costs). Inventory model are classified in to two categories;

- a. Deterministic Model
- b. Probabilistic Model

Both of them are just an elements or parts of inventory model. First deterministic model assumes certainty i.e, by analyzing and referring the main dates, events, past records, situation, sales and demand, consumption etc. by analyzing above factors it predicts the future. But incase probabilistic model all are assumed by probability and chances, but for this analysis no need of keeping long or more information details to analyze. Just an experience personnel and a person from statistics and maths can able to tell the future requirement. Any way both of the model follows the same period and quantity system. The details of there are as follows:

- (i) Fixed order quantity System
- (ii) The working of the system
- (iii) Fixed periodic review system

**i) Fixed Order quantity system:**

This is also called Q-system. In this system, the order quantity is fixed and ordering time varies according to the fluctuations in demand.

**Characteristics of this system:**

- (xi) Re-order quantity is fixed and normally it equals economic order quantity (EOQ)
- (xii) Depending upon the demand, the time interval of ordering varies.
- (xiii) Replenishment action is initiated when stock level falls to Re-order Level (ROL)
- (xiv) Safety stock is maintained to account for increase in demand during lead time.

**(i) Working of the system:**

To begin with the stock from the first bin is consumed first. The emptying of first bin indicated that the stock has reached ROL and the replenishment action is initiated. The quantity in then second bin is thus consumed during the replenishment period. This system reduces the work involved record keeping.

**(ii) Fixed periodic review system:**

It is also called fixed ordering system or P system. This system has a fixed ordering interval but the size of the order quantity may vary with changes in demand. In this system, the inventory position is verified at a prefixed interval

(weekly/monthly/quarterly) then depending upon the situation, replenishment action is taken.

**Characteristics of this System:**

- (i) Order interval is fixed for individual item or group of items.
- (ii) Stock is received at periodic intervals and quantity which will bring the inventory to maximum level is ordered.
- (iii)

**Review questions:**

1. Define the term inventory.
2. How are inventories classified?
3. Briefly explain the various functions of inventory.
4. State the objectives and scope of inventory control.
5. Write note on JIT system.
6. Explain briefly about the principles of inventory control.
7. List out the advantages and limitations of ABC and VED analysis.
8. Explain about the inventory model.
9. Discuss the scientific techniques.
10. Write note on EOQ analysis.

## **Unit-IV**

### **Purchasing**

Purchasing is a managerial activity, that goes beyond a routine act of buying and includes the planning and policy activities, covering a wide range of related activities, like proper selection of materials, selection of the appropriate supplier, inspection of incoming materials and development of proper procedure and policies to enable the purchase department to carryout its functions effectively.

“Purchasing” refers to the function of procuring of materials, supplies, machines, equipments, tools, spare parts and services required for meeting the needs of production department and maintenance department.

Purchasing implies the act of exchange of goods and services for money whereas procurement is a genuine term with a wider connotation for the responsibility of acquiring goods and services. In its narrow sense, purchasing refers to merely to the act of buying an item at a price. In a broader sense purchasing is a managerial activity involving planning and policy formulation, research and development strategies required for the proper selection of materials and sources of supply, negotiating with supplies for best price terms, placing purchase orders, follow up to ensure timely delivery, coordinating with other departments viz., receiving, inwards inspection, stores and accounting (bills payable section).

#### **Objectives of purchasing**

**i. To avail the materials, medicines and equipments at the minimum possible costs:**

The saving in purchasing the items at low cost largely help in increasing the productivity and profitability of the organization.

**ii. To ensure the continuous flow of service:**

All the items required for service like medicines components and consumable stores and supplies and the items required for maintenance (spares, tools etc) must be made available at the right time to achieve uninterrupted flow of service. This minimizes stock out situations and will stride to earn reputation in the minds of customer.

**iii. To increase the asset turnover**

The investments in fixed assets in inventories must be kept minimum in order to increase the turnover of the assets and achieve greater profitability.

**iv. To develop alternate sources of supply:**

The purchase department is constantly in touch with the market and thereby updating the list of suppliers. This will largely help in evaluating a large number of suppliers based on their finance strength, reliability in supply, consistency in quality etc. so that ultimately the cost of purchases is largely reduced.

**v. To establish and maintain good relations with the suppliers:**

Maintenance of good relations with the supplier helps in evolving a favorable image in business circles. Further the buyer can get the benefits of better credit facilities, discount, and reliability in super uniformity in quality etc.

**vi. To achieve maximum integration with the other departments of the hospital:**

The purchase department has to co-ordinate with the service departments in order to get the information regarding the material specifications, quantity, the time at which the materials are required etc.

**vii. To train and develop the personnel:**

The purchase section must have to build, an imaginative work force through training and development and the employees must be provided with the opportunity to fulfill their aspirations for promotions in the organization.

**viii. Efficient record-keeping and management reporting:**

Paper processing in purchase department has to standardize to facilitate efficient record keeping. The purchase department has to report to the top management about the purchase activities periodically so that the volume and the value of the purchases, analysis of work performed in the purchase department, information about the cash discount and quantity discount, the trend about the price changes in the near future, new sources of supply etc. can be made aware of which help the management to frame policies.

**Functions of purchasing department:**

It is entrusted basically with the procurement duty. The functions of the purchasing department is to procure the needed materials, supplies, machines, tools and services at an ultimate cost consistent with economic conditions surrounding the item being purchased, while safeguarding the standards of quality, continuity of service, competitive position and the company's reputation for fairness and integrity. The purchasing department must also ensure that it does not violate the laws governing commercial transactions. The major functions of purchasing management are listed as follows:

- i) Materials requirements review
- ii) Specifications development for materials
- iii) Make or buy analysis
- iv) Materials standardization
- v) Determination of inventory levels
- vi) Determination of quality requirements
- vii) Negotiation of price and terms of supply
- viii) Supplier selection
- ix) Joint problem solving with supplies
- x) Supplier monitoring and analysis
- xi) Communication of specification changes
- xii) Productivity /cost improvements
- xiii) Development of sourcing strategy
- xiv) Vendor analysis and vendor rating
- xv) Vendor development
- xvi) Market analysis
- xvii) Price forecasting
- xviii) Long-range purchasing planning
- xix) Determination of purchasing policy
- xx) Value analysis.

### **Importance of purchasing department**

- i) It is a primary function, directly influencing the major cost of operating a business
- ii) Efficient operation of any industry depends upon proper turnover of investment.  
The purchasing department must ensure receipt of proper materials when needed, in sufficient quantities to maintain production, at the same time it must not increase investment beyond that required to meet current needs and maintain a reasonable factor of safety against stock out conditions.
- iii) Discovering new materials which may be used to advantage as substitutes for materials in use.
- iv) Building up goodwill in the business world with which it deals.
- v) Identifying possible new line of products to be added.



- vi) See changes in trends, either in price or other factors that will affect the sales of the company.
- vii) Its knowledge of vendors and manufacturing and marketing policies of other industries make it possible for the purchasing department to contribute invaluable help in framing plans for initiation of new products, scheduling of production and determination of marketing policies.

### **Principles of Purchasing**

Purchasing is one of the basic functions in any industrial, commercial or public utility concern. It involves decisions on what to buy, when to buy, where to buy, how much to buy, how much to pay, and how much to stock. All these require considerable expertise and study of economic trends and market performance of the purchasing department.

For effective performance, it is necessary to follow five essentials of right purchasing:

- Right quantity
- Right Quality
- Right Price
- Right Delivery (time)
- Right source of supply.

### **Right Quantity**

Maintenance of a regular flow of materials for the operation of the hospital is the main aim of the purchasing organization. For this, the right quantities of materials have to be purchased. Excess purchases are to be avoided as they result in overstocking of materials, resulting in unnecessary blocking of capital and high inventory carrying cost. At the same time, it is also essential to ensure uninterrupted flow of materials for the smooth functioning of the organization. Buying the right quantity can result from a good inventory control system. The inventory control is basically a scientific system which indicates as to what to order, how much to order, and how much to stock so that purchasing costs and storing costs are kept as low as possible.

Buying the right quantity is often determined by the economic order quantity. To determine this quantity, it is necessary to analyze all the cost factors in the practice:

1. The cost of material itself
2. The cost associated with keeping the materials in stock, that is, the inventory carrying cost.

3. The cost associated with the placement of purchase order-ordering cost.

The economic order quantity of items can be worked out by using formula ( the most popular mathematical model )

$$Q = \frac{2 AS}{IC}$$

A = annual consumption of an item in rupees

S = the ordering cost per order

I = The inventory carrying cost for a rupee worth of material stored per year

C = unit cost of item

Q = the minimum quantity to be ordered at a time expressed in rupees (minimum cost of inventory)

If Q rupees is divided by the unit cost of the item the quantity of units to be ordered is obtained.

The inventories must not to be unnecessarily increased. However, the continuity of supply of materials should be maintained .The quantity purchased from time to time should ensure a smooth and even flow of materials.

### **RIGHT QUALITY**

Right quality means that the quality should be just right, neither too high nor too low. Quality is related to the suitability and cost rather than the intrinsic excellence. It is the duty of the materials manager to bring to the notice of the user departments materials of different qualities so that they can select the right quality materials for purchasing. Deterioration of the right quality involves a number of factors namely the price installation costs, maintenance costs, life expectancy, market availability, operational workability, and attitudes of users. The right quality is determined from a balance of two major considerations, the technical consideration with regard to suitability and the economic considerations with regard to the lowest over all costs. The user department is responsible for the suitability determination and the purchasing department is responsible for the economic consideration of quality. The ultimate responsibility to determine quality, including the right to change, rests with the department responsible for the use of the materials.

The quality of materials should be described correctly so that the supplier can understand exactly what is wanted. The most common methods of describing quality are market grades, brand or trade names, commercial standards, blue prints, chemical or physical specification, performance specification, material and method of manufacture specification and sample. Each

type of description has advantages and disadvantages. Often a combination of two or more method is used.

Standardization of various products required for the hospital has to be carried out in order to evaluate the voluminous and continuous flow of new and improves products. It also helps to minimize varieties of products, identical products and of genuinely different products. By adopting a policy of standardization and simplification one can substantially improve the procurement in hospitals by eliminating wasteful and excessive variety among products.

### **RIGHT PRICE**

Right price is the value of goods and services asked for and paid in monetary terms. It is difficult to assess the correct value of goods and services since it is the utility and satisfaction which helps in assessing the value. It is the purchaser's skill in negotiating, using the existing competition in the market and his relations with the suppliers, which determine the actual purchasing price.

Some basic methods by which a buyer can seek to arrive at the right price are discussed here.

- Public price lists in the form of daily quotations exist for standard commodities traded on the various commodity exchanges throughout the world. Usually the price list shows different prices for varying quantities. Quite often a vendor who has a particular commodity in the inventory will set at a price lower than the price quoted for the commodity on the exchange. The prices shown on the price list are the prices the vendor would like to get. They can best be called his asking prices. They may or may not be his actual selling prices.
- Competitive bidding is the best method of obtaining fair purchase price. When competition is not adequate cost analysis is the only basis on which a buyer can determine prices that are fair and reasonable.
- Negotiation involves both the hospitals and the supplier to bring about a mutual agreement. The rules of negotiation to be followed are as follows:
  - Never purchase at list price.
  - Ask for the quantity price and then try to get that price for any amount purchased.
  - Always ask for a discount regardless of how little you buy.

- Always ask for price protection on negotiated prices. Begin with 2 years and work downwards. Remember, price protection for even 30 days is better than no price protection at all.
- Assume you will get at least d2 per cent if you pay the total invoice by the tenth of the next month.
- Never feel sorry for the supplier or the sales representative.
- Try quoting prices at which the supplier will sell, rather than having the supplier quote a price at which hospital must buy.
- Always keep in mind that regardless of how good a proce you are getting most likely somebody is getting a better one.

### **Value analysis**

Value analysis is one of the most important techniques of materials management for reducing cost. It is an organized approach for getting the same performance at a lower cost without affecting quality. Value analysis is a philosophy implemented by the use of a specific set of techniques, a body of knowledge, and a group of learned skills. It is an organized creative approach, its purpose being the efficient identification of unnecessary cost, the cost which provides neither quality nor use, life appearance or customer satisfaction.

Value analysis is not a substitute for conventional cost reduction. It improves the effectiveness of work and if properly applied it can achieve 10-25 per cent savings in manufacturing costs.

Value may be defined as the relationship between function and cost. Value is always greatest when the cost of obtaining a required function or service is at its minimum.

### **Types of value**

- Use value
- Cost value
- Esteem value
- Exchange value

### **Benefits of value analysis**

- A reduction in cost of existing products or systems.
- The prevention of unnecessary costs in new products and system.

## **Methods of value analysis**

- **Brainstorming sessions:** This refers to a group activity which produces an abundance of ideas.
- Formation of value analysis committee which should include representatives from sales, buying, design and production.
- Formation of a value analysis team by combination of brainstorming session and value analysis committee.

A value analysis committee should be established in hospitals to study the relationship of design function and cost of any product material or service with the object of reducing its cost through modification of design of material specifications, change in source of supply or possible elimination or incorporation into a related item.

## **Right Time (Delivery)**

This implies purchase according to the current requirement, market condition, follow-up, and expediting.

The right time for the procurement of an item is the point of minimum stock, the point at which the materials are expected to arrive in the store. The responsibility for the procurement of materials lies with the materials control and purchase departments. The materials control department sends requisition to the purchase department as soon as the materials touch the reorder level, and the purchase department takes steps to replenish stock by calling quotations, approving one of them, choosing the supplier and placing the orders. After the purchase orders are placed, the right type of follow-up is essential so that the materials arrive at the right time to avoid stock outs.

## **Right Sources**

According to Lamar Lee (1974) a good supplier is one who is fair and honest in his dealings at all times and who has the required facilities to meet the buyer's specifications within the limits available.

The right source for the procurement of materials is a supplier who can supply the right quantity material as ordered, in the right quantity as ordered, and at the right time at which the purchase department has asked for the supply at a right agreed price; who is in a position to honour the commitment without much follow-up; who has necessary financial resources and adequate manpower to handle orders and is well-established with proven business integrity.

There are many factors which must be properly evaluated before the right vendor can be selected. By a process of elimination, the buyer can develop a list of selected vendors with whom he desires to negotiate or from whom he can solicit bids. The vendors list should be broad enough to ensure the existence of every type of competition, including price competition, technology competition and service competition.

It is always better to have two suppliers for each important item so as to reduce the risk of interruption of supply due to problems of quality, labour status, fires, etc. there can also be a healthy competitive spirit among the suppliers to improve methods and reduce costs to get a greater share of business. One of the basic objectives of materials management is the correct and cordial relations with the supplier so as to maintain strict business-like relations and ensure that suppliers perform outstandingly as far as quality and delivery is concerned. Good buyer-seller relationship must be properly understood and appreciated and fostered so as to be mutually beneficial to buyers' as well as sellers' interest.

#### **Forms of purchasing organization:**

There are three ways in which responsibility for purchasing is organized:

- a) Centralized Purchasing
- b) Decentralized purchasing
- c) Centralized-decentralized purchasing.

#### **(a) Centralized purchasing:**

Responsibility for purchasing function should be centralized whenever it can be done without sacrificing the efficiency due to restriction of local initiative. The advantages of centralization are:

- i) Undivided responsibility
- ii) Consistent purchasing policies and
- iii) High degree of purchasing power.

When centralized purchasing, all purchase records are kept in one place and under one supervision and control, which facilitates easier compiling and consulting the record.

Centralized purchasing is thus more effective for taking action to meet changing market conditions.

Centralization aids in the standardization of specifications and tends toward lower inventory investments. The order quantities on vendors will be high resulting in lower purchase

prices. Usually any organization having a single location must adopt centralizing purchasing as a rule.

In case of organization's having multiple plants, centralization must consider factors such as geographical location of plants, similarity of products produced, type of materials forming the bulk of purchases, special market situations relating to large volume materials, location of suppliers etc.

**(b) Decentralized purchasing:**

When manufacturing plants are widely dispersed geographically and manufacture different products having different materials requirements, decentralized purchasing is better than centralized purchasing. In such cases each manufacturing plant will have its own purchasing department. The purchasing manager directly reports to the chief executive of the plant or to the general manager (material management). But the individual purchase departments of various plants will have functional relationship with director at the corporate management level. The corporate director for materials management will establish and enforce general purchasing policies and procedures for all the purchasing departments of different plants of the organization.

**(c) Centralized and decentralized purchasing:**

Many firms operated several plants whose geographical locations may not be too widely scattered and whose product and materials requirements may cover a large number of similar parts and materials used in common and in large quantities may adopt centralized – decentralized purchasing approach.

A general purchasing department may be setup to establish general purchasing and to do actual buying of common parts and materials and also to supervise and direct the work of local purchasing departments which are set up at each plant.

**Responsibilities of purchasing manager:**

The major responsibilities of the purchasing manager, some of which assigned to their assistants are:

- i) Keeping up the company's standard of quality production by proper choice of materials used.
- ii) Organizing and directing the purchasing department
- iii) Spending wisely as large amount of company's finance.
- iv) Supporting the operations of the company production schedules without interruption.

- v) Maintaining the company's integrity and fair dealing by his/her method of negotiating with suppliers.
- vi) Participating in the preparation of purchase budget.
- vii) Facilitating the progress and competitiveness of the company by conducting purchase research, vendor development and having open mind on new materials, tools, machinery and equipments available in the market.
- viii) Acting as final check, in the interest of economy, on all goods requisitioned, questioning need, and quantity and quality specifications.

**Personal duties of purchasing manager:**

- (i) Interviewing sales representatives of supplier firms to obtain up-to-date information, securing and comparing quotations and placing orders for such main commodities as he or she shall receive to himself or herself to purchase.
- (ii) Establishing purchasing policies for the purchase department to execute.
- (iii) Overseeing the preparation of all general reports on purchasing to be presented to top management.
- (iv) Conducting all major adjustment negotiations which are vital to the company's goodwill.
- (v) Taking part in interdepartmental meetings representing purchasing department.
- (vi) Approving material specifications on major commodities.
- (vii) Supervising the functions of purchase officer, in change of buying, follow up, purchase research, vendor development, sub-contracting, bills payment etc.,

**ABC Analysis**

ABC stands for 'Always Better Control'. The intention is to control the best, then better and, lastly the good. ABC analysis is the analysis of stores on cost criteria. By analysis of the total cost of various inventories it has been found that inventories can be divided into three groups as A, B, and C. the analysis has revealed that 10 percent of items of inventory attribute to nearly 70 percent of the value of the inventory, 20 percent of the items attribute to 20 percent of the value of the inventory, and 70 percent of item of inventory will be of low value and attribute only 10 percent of the value of the inventory.

Based on ABC analysis, an average pattern of percentage of item and percentage of their respective rupee values can be worked out as follows:



<b>Item</b>	<b>Percentage of items</b>	<b>Percentage of rupee value</b>
'A' items	10	70
'B' items	20	20
'C' items	70	10

It has been seen that a large number of items consume only a small percentage of resources and vice versa. 'A' items represent high cost centre, 'B' items represent intermediate cost centre, and 'C' items are low cost centres. So far as inventory control is concerned, the following guidelines help in keeping the system optimum:

**'A' items:**

- + Tight control should be exercised.
- + Rigid estimates of requirements should be maintained.
- + Strict and close watch should be kept.
- + Safety stocks should be low.
- + Management of items should be done at top management.
- + Exact cost of individual items should be counted.

**'B' items:**

- + Moderate control should be exercised.
- + Purchase should be based on exact requirement
- + Reasonably strict watch and control should be kept.
- + Safety stocks should be moderate.
- + Management should be done at middle level.

### **‘C’ items:**

- + Ordinary control measure should be exercised
- + Purchase should be based on usage estimates.
- + Controls exercises may be done by storekeeper
- + Safety stocks should be high
- + Management should be done at lower levels.

From the above, it is observed that ‘A’ class items receive strict control and ‘B’ class items receive moderate control from overstock and stockout points of view, and ‘C’ class items are not subjected too much control or attention.

### **Advantages of ABC analysis:**

By concentrating on ‘A’ class items the materials manger is able to control inventories and show ‘visible’ results in a short span of time. By controlling the ‘A’ class items and doing a proper inventory analysis, obsolete stocks are automatically pinpointed. Many organizations have claimed that the ABC analysis has helped in reducing their clerical costs and resulted in better planning and improved inventory turnover. ABC analysis has to be resorted to because equal attention to ‘A’,’B’, and ‘C’ items is likely to have a diffused effect on all the items irrespective of their priorities.

### **Limitations of ABC Analysis:**

- i. To be fully effective, it should be carried out with standardization and codification.
- ii. Importance is given to an item based only on its annual consumption value and not on its critically for the production.
- iii. It should be reviewed periodically so that changes in prices and consumption are taken into account.
- iv. It does not apply to dependent demand inventory which is controlled by material requirement planning system.

### **VED Analysis**

This analysis is based on the critically of the items in relation to the functioning of the hospital. The items can be classified into Vital (V), Essential (E), and Desirable (D) items.

### **‘V’ items:**

These are vital items without which the hospital cannot perform its functions, that is, patient care. These items should have more safety stocks to ensure a higher degree of safety.

These items should be available at all times, and they should be controlled by the top management.

**‘E’ items:**

These are essential items without which the hospital can function for a short period but which may affect the quality of patient care to a limited extent. These items can be controlled by middle-level managers.

**‘D’ items:**

These are desirable items, the non-availability of which for a considerable period may not affect the functioning of the hospital. Such items can be controlled at the lower management level.

An example of the coupling matrix model-1 for equipment between criticality and cost is shown in figure.

	V	E	D
H	Defibrillator 1	X-Ray machine 2	Air-contains 3
M	Ventilator 4	Electric cutlery 5	Ultrasonic wash machine 6
L	Oxygen Regulator 7	Patient Trolley 8	Electric BP Apparatus 9

Cell 1 contains Vital and high cost items like defibrillator. It must be noted that a material manager has to comprehensively supervise category 1 items since an item may be a low cost one but critical for patient care e.g. oxygen regulator.

## **VENDOR SELECTION**

As selection is the essence of the purchasing process, it is imperative that final authority rest with the purchasing department. In some hospitals improper selection causing inferior goods and services has resulted in authority being shared with the user department.

### **PROCEDURE**

The procedure of source selection involves the preparation of an extensive test of prospective suppliers and the successive elimination from the list on various grounds until the number has been reduced to one or few to be favoured with the business. The procedure is therefore one of searching for all likely suppliers and then sorting for one or ones with whom to do business. Some of the important factors responsible for selection of the prospective suppliers are: Experience; Catalogs; Trade directories; Trade Journals; Associates; Trade shows and convention;

### **REQUESTS FOR QUOTATIONS:**

When a new item is under consideration, a buyer should therefore, first of all inquire whether any of this present or past suppliers are likely prospect. Most purchasing department maintain vendor files which contain the names and addresses of vendors with whom the company has dealt throughout its history as well as notation of classes of goods that have been purchased from each vendor . Frequently the files are set up to include additional data on such things as the reliability of the supplier in meeting commitment dates, willingness to handle emergency and rush orders, and defect or reject ration on shipment received in the past.

### **CATALOGS:**

For standard service such catalogs frequently are one of the most effective and efficient sources of potential suppliers. All buyers make some use of their catalogs and a substantial percentage of buyers use them extensively.

### **TRADE DIRECTORIES:**

A trade directory is a publication that list and classifies suppliers according to the services they provided. Frequently it also gives a minimum amount of information on such matters as the financial status of the companies ,their method or distribution and location of their offices.

## **TRADE JOURNALS:**

Trade Journals or business magazines are other very fruitful sources of supplier names. There are thousands of such publication, and no purchasing department can subscribe to more than a small fraction of total number.

## **TRADE SHOWS AND CONVENTION:**

Another source of information about suppliers that is available to all buyers is the trade show or convention. At the trade show the members of an industry display their wares in an attempt to attract buyers, build up their wares in an attempt to attract buyers, build up their interest, and, if possible, make sales.

## **REQUESTS FOR QUOTATIONS:**

Finally information on prospective suppliers can be secured through a request for quotation form. Such requests contain a blue print or written specifications including quality requirements and estimate usage. The procedures are usually used annually on all significant parts and services that are being purchased. Bids are solicited from three potential suppliers, thereby providing an opportunity for equitable comparisons amount competitors.

## **VENDOR RATING:**

The objective assessment of vendors demands a systematic analysis of their past performance. But reassessment at regular intervals is a time consuming process and thus did not receive adequate attention. The systematic assessment of suppliers ability to meet the quality, delivery schedules, product price and service giving an appropriate weightage to each factor can help us in designing vendor Rating system. The overall vendor rating could be prepared to evaluate the vendors. Following are the three methods normally used for rating vendors.

1. The Categorical method
2. The Weighted method
3. The cost-ratio method

### **1. The Categorical Method**

This is a functional method giving emphasis on the cost of value analysis. In this method the functional utility is given more importance in vendors' selection. We can device a system with three level bases on the value viz High value Middle value; Low value. In each of

these value system a list of factors is made for the purpose of evaluation, for example delivery; price and quality are given high value.

## 2. The Weighted Point Method

In this method the number of factor such as the objective of the organization, its products and economic conditions of the organization are included. The relative worth of these factor as compared to each other will give a composite performance index. The relative worth's of these factors vary from products to product, organization .The following are the maximum but average points for the best performance.

## 3. Cost Ratio Method

The object of this method is to evaluate the suppliers on the basis of proceeding considerations which may not be practical considerations. The small difference in the point score among various suppliers may not be of a great significance to justify their reactive merits.

FACTOR	AVERAGE POINT
1. Quality	35
2. Price	30
3. Delivery	20
4. Service	15

### Lowest Price Bid

$$\text{Percentage of Price Performance} = \frac{\text{Lowest Price Bid}}{\text{Actual Price}}$$

Shortest lead time (any vendor on comparable item)

$$\text{Percentage of lead-time performance} = \frac{\text{Shortest lead time (any vendor on comparable item)}}{\text{Actual Time}}$$

### Purchasing of capital equipment

#### Capital equipment:

Capital equipment refers to those items of machinery and equipments whose long life and high value require that they be carried in balance sheet and depreciated over a period of time.

## **Procedure for purchasing capital equipment:**

### **Evaluation of need:**

The recognition of the need originates with the using department and the evaluation of this need requires the study of alternative methods, a cost analysis of alternative methods, a search for equipment that will do the job, and a second cost study to determine the savings made possible by the use of the proposed equipment.

### **Specification:**

Once the need has been established and the type of equipment determined the next step is to draw up specifications. The manufacturer's representatives are also consulted in designing the specifications.

### **Negotiations:**

The materials management department which has so far arranged the contacts with vendors determine which vendors to solicit for quotations. The specifications are provided to selected vendors and they are invited either to quote or to send a representative to survey the job before quoting.

### **Ordering:**

After deciding the supplier, it is necessary for the purchasing department to work out with that vendor all details of the purchase order. An experienced buyer knows that, although he may be reimbursed for any damages incurred he can save himself much trouble, cost and work by taking precautions before placing the order.

### **Follow-up:**

Because the purchase of capital equipment usually covers an extended period of time, follow up of the order is an important responsibility of the purchasing department. The follow-up of an order should be performed by the executive who placed the order.

### **Economic Analysis:**

#### **Approaches to capital equipment:**

The hospital considering the purchase of new equipments makes a careful cost analysis to compare the operation of the proposed equipment with its present equipment. Because of the large size of capital equipment expenditures, most hospitals use detailed economic analysis procedures to calculate the expected return for the purchase against the expected cost

### **Payback Period:**

Payback period is calculated by relating the cost of the equipment to the profit it earns and then estimating the number of years it takes for the equipment to pay for itself. The basic objective is to purchase the equipment with the fastest payback period. Payback period is simply the time it takes to cover the cost of the equipment and is expressed in the formula  $P=C/R$  where  $P$ = The payback period;  $C$ =Cost and  $R$ = The cash return from the investment, or the present value of the further return. This simple approach assumes the return each year to be constant, does not allow for depreciation or taxes, and ignores returns after the original investment is recovered.

### **Discount cash Flow:**

According to this approach the management assumes that a minimum return must be made on their capital, and an investment is not made if this standard is not met. For example, a lot of companies assume that they must earn a 20 percent return after tax on new investment in hospital and equipment. They then discount the value of future cash flows until their sum equals the supply price of the assets. It is given in the formula

$$C = \frac{R_s}{1+r} = \frac{R_1}{1+r} + \frac{R_2}{(1+r)^2} + \dots + \frac{R_n}{(1+r)^n} + \frac{S}{(1+r)^n}$$

Where  $r$  = discounted rate of return

$R_1 R_2$  = Cash flow after taxes in years 1, 2...4.

$N$  = Life of association

$S$  = Salvage value

After the discount rate of return on the investment has been calculated it is compared with the cost of the capital to be invested. If the return is greater than the cost, the purchase is economically sound, because the discounted return is greater than the return that could be obtained from the invested capital in alternative use.

### **Present Value:**

Any investment calculation involves two things; the expected pay off; or savings, which extends over many years, and the cost of the capital invested. Because capital equipment will usually produce savings over a long period of time, it is necessary to determine the worth of the



future savings today. The present value of anticipated savings can be obtained by several means, the simplest of which is;

$$V = \frac{R_1}{1+i} + \frac{R_2}{(1+i)^2} + \dots + \frac{R_n}{(1+i)^n} + \frac{S}{(1+i)^n}$$

Where V = Present value

i = The interest rate on capital

R1; R2...Rn = Cash flow after taxes in years 1, 2, 3...n

N = Life of asset

S = Salvage value in year n,

If the present value of the investment exceeds the cost of the equipment, the purchase is economically sound. The determination of the present value of estimated future savings is an integral part of any capital equipment economic analysis.

#### **Return on Assets:**

The approach relates the cash savings anticipated to result from the purchase to the amount of money invested.

$$\text{Return on Assets} = \frac{\text{Present Value of Savings}}{\text{Ruppee investment}} \times 100$$

This approach is subject to all conceptual difficulties already mentioned viz estimated if of equipment; estimated future return, etc.

Therefore variety of economic analysis techniques is great, and they often involve quite detailed and complicated procedures. It a new machine has a greatest output or a faster of operation; one might assume this to be a greater value. But this is not necessarily true if there is no need for the faster or greater output.

#### **Forecasting Techniques:**

Forecasting is the first step in planning. It is defined as estimating the future demand for products and services and the resources necessary to produce these outputs. Estimates of the future demand for products or services are commonly referred to as sales forecasts. The sales forecasts or demand forecasts are the starting point for the entire planning in production and operations management. For example, material planning, financial planning and production scheduling, all depend on sales forecasting.

Forecasting is the art and science of predicting future events. It is not a mere guess or prediction about the future without any rational basis. It may involve taking historical data and projecting them into the future. It may include a manager's good judgement or a subjective or intuitive prediction in the absence of historical data.

A large number of forecasting techniques with various degrees of complexity are available to the forecaster these days. The availability of computer programmes has facilitated the task of the forecaster. The methods of forecasting can be classified as subjective method, depending upon the individual judgement and objective method, after analyzing the quantitative information. In general forecasting methods are classified as:

- 1) Judgemental techniques
- 2) Time series methods
- 3) Casual (Economic forecasting) methods.

**The judgement technique** is a method which relies on the art of human judgement. This has been in practice since a long time. The other two techniques are relatively new and are heavily used in statistics for analyzing the past data.

In economic forecasting, the analyst tries to establish cause and affect relationship between sales and some other parameters that are related to sales, i.e., for example, the demand for cement depends upon the projected growth of construction industry. The objective in this method is to establish a cause and effect relationship between changes in the sales level of the product and set of relevant explanatory variable. It utilizes regression and correlation analysis.

The important method of making an inference about future on the basis of what has happened in the past is called time series analysis. Time series analysis identifies the historical pattern of demand for the product and project or extrapolates this demand into the future.

### **Judgemental Techniques**

This technique is commonly used techniques in business and industry. This is subjective method wherein there is a heavy reliance on the past experience of the person and skill. The various judgemental techniques are:

#### **1. Opinion survey method:**

Opinion survey method is relatively a simple and practicable method for forecasting demand for the new products. In this regard, opinions are collected from the prospective buyers as to why they buy a particular product and what they expect out of it, etc. The sampling

technique is used to survey the customers. From the representative sample, it is possible to forecast how the target population will respond to the product.

## **2. Experts Opinion Method:**

In this method, the opinion of experts is sought on the future demand for the product. It is biased and subjective as it is not backed by any scientific method or statistical data. The accuracy of the predicted demand depends upon the skill, expertise and experience of the person making the forecast. This method is used for forecasting the demand of established product.

## **3. Customer and Distributor Surveys:**

The individuals who have bought a product can be asked the reason for making the purchase. A questionnaire can be given along with the guarantee cards. Estimates of expected sales (distributor surveys) can be requested from retail outlets and company's sales force. Many companies heavily rely on judgement made by their sales personnel.

## **4. Marketing Trials:**

This method is specially applicable to new products. If the product is entirely new to the customer or market, then it is very difficult to know the acceptability of the product to a limited market area. Such a trial is like a controlled experiment in which the market area and the method of presentation are carefully selected and controlled. Its cost aspect is very high. This method is normally recommended for consumables like cosmetics, toothpastes, etc.

## **5. Market Research:**

This method can be used for new products or existing ones. Usually, the work is assigned to external, marketing agencies. This method is recommended if executive data are needed. The purpose of this research is to gather information regarding the nature of consumption. The details about various factors which influence the demand like location, buyer occupation, price, quantity, quality, consumer's income etc., are collected and factors are related to get the forecast.

## **6. Delphi Method:**

To make the judgemental forecasts more realistic by minimizing bias, this method, a panel of experts (either within or outside the organization) is asked sequential questions in which the response to one questionnaire is used to produce next questionnaire. The information available to some experts is made available to the other experts.

## **Time series Methods**

There are various methods of demand forecasting under time series methods, four of which are as follows:

1. Simple Average Method
2. Moving Average Method
3. Weighted Average Method
4. Trend Correction Method.

Whatever may be the basis and method of demand forecasting, it is necessary that the data used for forecasting should be i) Accurate ii) Reliable. Unless the accuracy and reliability of data are ensured, accurate forecasting will not be possible.

**Simple average method** of demand forecasting is the simplest. The arithmetic mean of a given data for a specified period is calculated and on the basis of the figure so available, demand forecasting is made. But when there is a great variation in the data available for a given period, the simple average method fails to forecast correctly. The rising or declining trend in the data is not correctly accounted for by the simple arithmetic mean. The rising trend in the past will give a mean which will be much in excess of the actual demand. Similarly the declining trend in the past will give a mean figure which again will not be a representative one but which in fact will fall short of actual demand. Both the situations will be dangerous. Here the **moving average method** comes to help of the demand forecaster. The moving averages record the trend-both rising and declining and eliminate the possibility of wrong predictions. Thus, they reduce the uncertainty to a certain extent. However, a certain amount of uncertainty will still be present there and the degree of accuracy in forecasting will still be elusive.

For accurate demand forecasting, the **weighted moving average method**, developed by R.G. Brown of U.S.A. can conveniently be used. In the weighted moving average method, more emphasis is laid on the recent figure than that of the distant past. Thus, the weighted moving average determines the relative weights on the more recent data, controlled by *smoothing factor-the alpha*, that is,  $\alpha$  Brown called this method *Single Exponential smoothing or First Order Exponential smoothing*. According to this method, moving averages are given weight by determining the value of  $\alpha$  which varies from 0 to 1, depending upon the weight desired. A higher value will give a heavier weight on comparatively recent data and a lower value will give a lower weight, that is, it will spread the weight over a long period.

**Trend correction method** has been described by Brown as *Double Exponential smoothing or second order exponential smoothing*. According to him, this method should come into use when there is a variation between the forecast made and actual observation.

## **Causal Forecasting Method**

Casual forecasting method tries to identify the factors which cause the variation of demand and try to establish a relationship between the demand and these factors. In this method, the analyst tries to identify those factors that best explain the level of sales of the product. This process is called *econometric forecasting*. The objective of this method is to establish a cause and effect relationship between the changes in the sales level of the product and set of relevant explanatory variable. Some of the casual methods are (a) Regression and correlation analysis (b) input-output analysis and (c) End use analysis.

### **Review questions:**

1. Enumerate the major functions of purchasing department.
2. Discuss the importance of purchasing.
3. State the objectives of purchasing.
4. Explain the principles of purchasing.
5. Briefly discuss the various methods of purchasing practiced by various types of organization.
6. Discuss the forms of purchasing organization.
7. List the duties and responsibilities of purchasing manager.
8. State the forecasting techniques.
9. Explain the procedure for purchasing of capital equipments.
10. Briefly discuss about the vendor selection.

## **Unit-V**

### **Information system development for materials management**

Since the advent of computers in India, there have been tremendous advancements in the field of computer technology, information processing and database management. Nowadays, there is hardly any area in production and materials management field where computers are not used. Even though earlier of computers were in payrolls and financial accounting, materials management is also an area which has a wide scope for the application of computers.

### **Integrated management information system for materials management**

The efficient functioning of an organization largely depends upon a continuous process of information flow in which information is received, stored, processed and exchanged. An information system for materials planning, purchasing, warehousing and inventory management. Such an information system requires the combined effort of people, equipment (computer hardware), processing facilities (computer software) and the operating procedures which are aimed at meeting the information requirements of the materials management system. The computer applications in materials management are discussed in the following section.

#### **1. Forecasting Requirements:**

Sales forecasting is an estimate of future customer needs. For the very survival of a company, it must be able to forecast its customers' needs fairly accurately and meet the customer needs as quickly as its competitors. These sales forecasts form the basis for production plans and production budgets which in turn form the basis for materials plans and materials budgets. Since forecasting techniques need vast amounts of past sales data and also data regarding economic indicators, population, market characteristics data etc. storage and analysis of these data is facilitated by computer hardware and software.

#### **2. Materials planning:**

Sales forecast is the major input to materials planning. The sales forecast is converted into forecast for finished goods. The bill of materials is used to estimate the requirement of materials for producing the finished goods as per the sales forecast. The bill of materials data (product explosion based on product design documents such as product structure tree, part lies etc.,) and the master production schedule (estimate of finished products to be produced for time period such as quarter or month or week) are stored in the computer and based on these data, the materials requirements for the production program are arrived at.

### 3. Purchasing:

The various aspects of computer application in purchasing are:

- a) **Creation of supplier data base:** information about suppliers such as company name and address, name of contact person and his/her designation, telephone numbers, fax numbers, e-mail address, website details, quality systems used, payment terms etc.,
- b) **Sourcing evaluation-** supplier ratings such as financial data, quality system, capabilities, track record, strength and weaknesses etc.,
- c) **Supplier performance evaluation** – consistency in quality of suppliers, price stability, response to inquiries, delivery performance, after sale service/product support rendered, lead time performance etc.,
- d) **Supplier performance history** – quality supplied, quantity accepted, delivery as per promise or delivery delayed etc.,
- e) **Maintenance of product specification** – company standards, national and international standards.
- f) **Purchase order release** – filling the purchase order format through computer and printing of purchase orders or sending the purchase order to the supplier through internet, by e-mail or by fax using fax modem of the computer. Electronic data interchange (EDI) can be used if the company's computer system is linked with the suppliers computer system. EDI provides faster information transfer between the buyer and the seller.
- g) **Order status** - up to date order release status is maintained using computers and information such as supplier wise overdue supplies, partial supplies made, pending supplies rejected items not replaced, anticipated supplies, shipping documents status etc., can be obtained.
- h) **Purchase order follow-up**-based on the purchase order status data, the purchasing personnel can expedite supply of critical items by contracting the suppliers by telephone, fax, e-mail etc.,
- i) **Analyzing price cost data** – the price and the purchase history record is useful for preparation of purchase orders, for providing information for developing price trends and for estimating standard materials costs.

- j) **Payment to supplier** - the computerized database can be used to check the payment status to suppliers and payment due to them and to take action for payment either electronically (electronic money transfers) or through cheque.
- k) **Invoices** - details of invoices sent by suppliers along with supply of materials. The invoices can be consolidated supplier wise –periodically and payment can be effected accordingly.
- l) **Order acknowledgement** – when purchase orders are related in the computerized system, the order acknowledgement by the supplier in turn can be obtained through e-mail quickly.

#### **4. Warehousing:**

The incoming materials, after inspection are moved to holding stores/warehouses for storage and issue to user departments as and when needed by them. With proper linking and integrating the stores database with materials receiving notes (MRN) database, the stores records for receipts can be maintained accurately. Also stores database should be integrated with job order /work order requirements.

#### **5. Inventory control:**

This is the major area where the company can reduce costs by controlling inventory using computer systems. Computer application involve;

- d) periodic valuation of inventory
- e) Inventory status and stores ledger,
- f) Exception reports of high/low stocks and reorder level,
- g) ABC analysis or classification,
- h) FSN analysis,
- i) X-Y-Z analysis,
- j) consumption analysis,
- k) Reports on inventory turn over,
- l) spare parts inventory status,
- m) materials requirements planning (MRP) outputs reports (using bill of materials file, master production schedule file, lead time file, inventory status file),
- n) manufacturing resource planning (MRP II),
- o) work-in process inventory status,



p) Finished goods inventory status etc.,

### **Integrated management information system**

Computers facilitate storage of vast amount of data and faster analysis of data and computations required to make several decisions in the materials management field. The integrated computer system functions as an integrated information system which would result in the smooth operation of materials functions. The major objectives of such a system are:

- i) Accuracy in reporting demand and inventory
- ii) Ensuring fast response to changes in environment such as changes either in supply or price of materials, changes in customer taste and so on.
- iii) Measuring performance of functions such as purchasing, sourcing, vendor rating and inventory control.

The normal flow of information regarding Materials in an organization is discussed below with detailed explanation of activities:

A computer system obtains input data/information from production planning, product design maintenance department, sales and purchase departments. It can provide output data/information regarding inventory records to production planning department, remind purchase department about supply status and for follow up and send purchase orders directly to suppliers for standard repeat purchase items.

Integrated management information system using computer encompass the following areas:

- i) Long term and short term sales forecasting and production schedules.
- ii) Materials control.
- iii) Information regarding lead time, supply status priced trends, anticipated price changes etc.,
- iv) Materials requisition from production planning to stores.
- v) Materials issued from production department.
- vi) Information regarding incoming materials and inwards inspection.
- vii) Due dates of supply from purchase department.
- viii) Information to purchase department for follow up of suppliers.
- ix) Purchase requisitions to purchase department.
- x) Materials supplied by suppliers to receiving stores.

xi) Previous year's consumption data.

Operational and exception reports generated by computerized integrated materials management system are:

- (i) Bills of materials
- (ii) Price forecasts
- (iii) Items below safety stock levels
- (iv) Purchase budgets
- (v) ABC analysis
- (vi) XYZ analysis
- (vii) FSN analysis
- (viii) Stock verification
- (ix) Inventory levels
- (x) Vendor rating
- (xi) Stores accounting
- (xii) Outstanding payments.

**Limitations of computer applications in materials management:**

- i) Need for a disciplined database for successful operations of the computer system. Otherwise phrase –“garbage in, garbage out (GIGO) or “trash in, trash out (TITO)”, may prove to be correct.
- ii) Lack of appropriate computer software tailor made for specific applications.
- iii) Need for expensive infrastructural facilities such as air conditioning, dust free atmosphere, storage space, fire protection, reliable power supply (with UPS back-up) etc., may increase the expenses involved.
- iv) Computers cannot be treated as a panacea for all the problems of an organization and cannot replace experienced purchase staff.
- v) Complexity involved in the design of a successful integrated computer information system to link all details of different functions involved in materials management.

## **STANDARDIZATION**

According to the international standard organisation, standardisation is defined as “ the process of formulating and applying an rules for an orderly approach to a specific activity, for the benefit and with cooperation of all concern and in particular for the promotion of the overall economy, taking due account of functional performance conditions and safety requirements.

Standardization is helpful not only for ensuring procurement of right quality of material but also for cost reduction. Standardization is the setting of standards for quantity, quality, raw materials, sizes and performance etc, of any product. Standard of products can only be achieved by Standardizing tools, equipment, materials, components; method of production etc., A machine should be in good condition to keep the quality of product uniform. Therefore it is necessary for maintaining the machines and tools in good working condition. Since Standardization ensures a particular standard of quality and reduction of cost, it gives satisfaction to the customer.

The concept of Standardization is applied in two different areas:

### **1) Industrial Standardization:**

It is concerned with the Standardization of things – their size, shape, colour, physical properties, performance characteristic etc. This can be defined as “The process of establishing agreement on uniform identifications for definite characteristics of quality, design, performance, quantity, service and so on”. A uniform identification that is agreed on is called a standard.

### **2) Managerial Standardization:**

This type of Standardization deals with the managerial aspects of business activity such as operating practices, procedures and system.

All the tools, equipment, working conditions, materials, quantity etc should be standardised. Standard of product can only be achieved by standardising tools, equipment, materials etc. A machine in good condition to keep the quality of the product to be same as was in the beginning. Therefore, it is most essential to keep the tools and machines both in good condition.

### **Aim of Standardization:**

The aim of Standardization is to have uniform standards for similar items and the standards evolved should take cognizance of the indigenous materials to the maximum extent possible. The process of Standardization logically leads to simplification or variety reduction, as this tends to

reduce unnecessary variety of standardising the most economical sizes, grades, shapes, type etc. These items can analysed by their sale and the margin of profit.

### **Advantages of Standardization:**

- (1) Better quality of product, more customers' satisfaction
- (2) Use of automatic machines is easy and economically possible
- (3) It saves production time and labour, resulting in less production cost.
- (4) It reduces inventory which saves investment on stock and spares for storage.
- (5) It reduces maintenance of spares and their by reduces maintenance cost.
- (6) It provides better managerial control and better manufacturing efficiency.
- (7) Since only standardised items are used, purchasing efficiency is increased.
- (8) Standardisation leads to reduction in number of items which results in easy identification and codification items.

### **Limitations:**

Since standards are developed with the consensious approach of the committee consisting of persons from different fields. Because of the varying interest of the committee members, and their knowledge and competence, it becomes difficult and time consuming to reach consensious.

### **Barcode**

A barcode is an optical machine readable representation of data. Originally, barcodes represented data in the widths (lines) and the spacing of parallel lines and may be referred to as linear or 1D (1 dimensional) barcodes or symbologies. But they also come in patterns of squares, dots, hexagons and other geometric patterns within images termed 2D (2 dimensional) matrix codes or symbologies. In spite of there being no bars, 2D systems are generally referred to as barcodes as well.

The first use of barcode was to automate grocery checkout systems, a task where they have become almost universal today. Their use has spread to many other roles as well tasks that are generically referred to as Auto IDC Data Capture (AIDC). Newer systems, like RFID, are attempting to make inroads in the AIDC market, but the simplicity, universality and low-cost of barcodes has limited the role of these newer systems.

Barcodes can be read by optical scanners called barcode readers or scanned form an image by special software.

### **Use:**

Since their invention in the 20<sup>th</sup> century, barcodes-especially the UPC-have slowly become an essential part of modern civilization. Their use is widespread and the technology behind barcodes is constantly improving. Some modern applications of barcodes include:

- Practically every item purchased from a grocery store, department store, and mass merchandiser has a UPC barcode on it. This greatly helps in keeping track of the large number of items in a store and also reduces instances of shoplifting. Since the adoption of barcodes, both consumers and retailers have benefited from the savings generated.
- Document management tools often allow for bar-coded sheets to facilitate the separation and indexing of documents that have been imaged in batch scanning applications.
- The tracking of item movement, including rental cars, airline luggage, nuclear waste, mail and parcels.
- Recently researchers have placed tiny barcodes on individual bees to track the insects mating habits.
- Used on automobiles, can be located on front or back.
- Joined with in-motion checkweighers to identify the item being weighed in a conveyor line for data collection.

**Benefits:**

In point of sale management, the use of barcodes can provide very detailed up-to-date information on key aspects of the business, enabling decisions to be made much more quickly and with more confidence.

- Fast selling items can be identified quickly and automatically reordered to meet consumer demand
- Slow-selling items can be identified, preventing a build-up of unwanted stock.
- The effects of repositioning a given product within a store can be monitored, allowing fast-moving more profitable items to occupy the best space.
- Historical data can be used to predict seasonal fluctuations very accurately.
- Items may be repriced on the shelf to reflect both sale prices and price increases.

Barcodes sales and inventory tracking, barcodes are very useful in shipping/receiving/tracking.

- When a manufacturer packs a box with any given item, a Unique Identifying Number (UID) can be assigned to the box.
- A relational database can be treated to relate the UID to relevant information about the box; such as order number, items packed, qty packed, final destination etc.,

- The information can be transmitted through a communication system such as Electronic Data Interchange (EDI) so the retailer has the information about a shipment before it.
- Tracking results when shipments are sent to a Distribution Center (DC) before being forwarded to the final destination.
- When the shipment gets to the final destination, the UID gets scanned, and the store knows where the order came from, what's inside the box and how much to pay the manufacturer.

The reason for barcodes are business friendly is that barcode scanners are relatively low cost and extremely accurate compared to key-entry-only about 1 substitution error in 15,000 to 36 trillion characters entered. The error rate depends on the type of barcode.

### **Role of computers in materials management**

The broad goals of automation in hospital stores are outlined as under:

- Reducing clerical work
- Prevention of stock out situation
- Better control and supervision of inventory and continuous assessment of performance
- Trend analysis and planning of hospital stores
- Quick and accurate accounts keeping
- Quality control
- Prevention of pilferage, bureaucracy and corruption
- Reduction of administrative expenses of stores management
- Curb space and other wastage on the storage of record.

### **Materials planning**

- Annual forecasting of hospital/other departments
- Drug formulary
- Vocabulary of stores
- Standards reference system

### **Procurement**

- Vendor details-items by vendor, vendor by item, vendor performance and evaluation and items under DGS &D rate contract.
- Generation of tender/rate enquiry
- Tender analysis and source selection

- Service contracts
- Determination of economic order quantities
- Automatic generation of purchase order
- Materials history file: pending supply order, inquiry by due data and open order report.

### **Receiving**

- Invoice matching
- Voucher generation
- Daily or periodically receipts reports

### **Inventory Control**

- Inventory analysis on usage and utility analysis
- Determination of reorder points
- Determination of safety stocks
- Stock ledger, ledgers for narcotics, perpetual inventory
- Item usages report-item wise/ward wise
- Exception reporting
  - Overstocking
  - Under stocking
  - Slow moving/non-moving items
  - Deteriorate items list
  - Expired drug list/items nearing expiry list
  - Non-availability /critical item support
- Analysis of returned /defective items
- Multiple asset management: stock status of different items at different locations in the hospital, asset transfer from one location to another.
- Physical inventory count: inventory count sheet, inventory discrepancy list, an inventory adjustment report.

### **Product Distribution**

- Equivalent brand availability list
- Preprinted departments indenting
- Par stock recommendation

- Label generation for use in drug distribution area.

### **Equipment Maintenance and Repair**

- Equipment utilization report
- Equipment status reporting
- Equipment out of order report
- Equipment maintenance report
- Maintenance scheduling and monitoring
- Demand listing and repair review.

### **Expense and Revenue Control**

- Revenue forecasting and departmental budgeting
- Stock valuation-current and average
- Issue valuation-current and average
- Department/ward expense detail/summary
- Tracking of bills

### **Charge Generation For Paying Ward Patient**

- Patient material billing report.

### **Other Management Reports**

- Cost per patient day analysis
- Average cost per purchase order
- Processing cost per purchase order
- Volume of services provided over a period. Periodical information on workload data like number of indents complied, number of items issued/handled, number of items received/purchased, etc.
- Inventory turnover report
- Any other management report required for annual review.



**Review Questions:**

1. Explain the application of computers in various functions of materials management.
2. Explain briefly about the barcode.
3. Discuss the role of computers in materials manager.
4. What is meant by standardization? And its advantages and limitations?
5. Discuss the limitations of computer applications in materials management.