

# MATERIALS MANAGEMENT (M.M.)

## 25.1. INTRODUCTION

Materials Management is 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.

Materials Management functions include several important aspects connected with materials, such as purchasing, storage, inventory control, materials handling, standardisation etc. Hence this subject has become very important and gaining more and more importance.

Even two decades ago the term materials management was little known and understood in the sense in which it is used today. Many terms, like purchasing, store-keeping, material handling etc. were used to denote more or less same meaning as that of materials management, but these terms were unable to give complete idea of materials management.

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

Materials management can also be defined as the functions responsible for the coordination of planning, purchasing, transporting, storing and controlling the materials in an optimum manner, so as to provide a pre-decided service to the customer at a minimum cost.

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

## 25.2. EVOLUTION

### 25.2.1. Supply Management

The term "purchasing" or "procurement" were originally used, later on this term was replaced by "supply management". While purchasing dealt only purchasing functions, supply management dealt starting from participating in deciding materials specification, value analysis, supplier selection etc. including purchasing activities. Supply managers participate in new product

development and are responsible for selecting sources, managing costs, developing and nurturing supplier partnerships and strategic alliances and issuing long-term agreements with carefully selected suppliers.

Supply management has major focus on :

1. To deal with activities that have great potential for impacting the success of the firm, and
2. To be inter-disciplinary in nature and integrate supply actions with those of other important sections of the firm.

Till 1950s, purchase department used to be clerically oriented order-placing unit. Later on, progressive firms started giving managerial emphasis, specialisation and professionalism on purchasing operations. The purchasing function comprises the activities associated with the acquisition of the materials, services and equipment used in operations. In 1970s, it was augmented by an emphasis on longer-range strategic planning for materials.

Since early 1990s, the strategic emphasis has been enhanced by purchasing participation in various cross-functional terms for various activities such as product design, supplier qualification and selection, quality, commodity management. By further accelerating the strategic emphasis, more progressive firms have led to the development of the **Supply management** concept. The supply management is a process responsible for the development and management of a firm's total supply system—both the internal and external.

### **25.2.2. Materials Management**

Now-a-days, "materials management" concept which is different from purchasing/procurement/supply management concepts has emerged and has become popular. This materials management concept is designed to enhance coordination and control of various materials activities.

Materials management provides an integrated systems approach to the coordination of materials activities and the control of total materials cost. All those major activities which contribute to the cost of materials are assigned to the materials management department. The objective of this is to optimise performance of the materials system. Here the materials means raw materials, spare parts, components, factory suppliers, packing materials etc.

## **25.3. SCOPE (FUNCTIONS) OF MATERIALS MANAGEMENT**

Following functions are included under the direction and control of Materials Manager, incharge of materials management department:

1. Materials planning and programming.
2. Purchasing and supply management.
3. Receiving, storekeeping and warehousing.
4. Inventory control.
5. Simplification, codification and standardisation in stores.
6. Transportation.
7. Inspection and Quality control.
8. Materials handling.
9. Value engineering and absolute materials.
10. Disposal of scrap, surplus and obsolete materials.

Looking to the above functions it is clear that Materials Manager has to work in close co-operation with different heads of departments. For example he must co-operate with:

- (i) *Production Department* for:
  - (a) knowing, in how much quantity and at what times materials are required.
  - (b) inventory control;
- (ii) *Sales Department*, for transportation of outgoing material;
- (iii) *Almost all the Departments*, for material handling operations throughout the undertaking;
- (iv) *Sales and Production Departments*, for the disposal of scrap and surplus;
- (v) *Inspection and Quality Control Department*, for getting the incoming materials inspected.

## 25.4. IMPORTANCE OF MATERIALS MANAGEMENT

A survey conducted by the Directorate of Industrial Statistics during 1954-57 showed that the average materials cost is 64 per cent of the sales value. Thus only 36 per cent costs is for wages and salaries, overhead and profit etc. In some industries it costs upto 70 per cent. These figures themselves show the importance of materials management.

In addition to the cost of material (being 64 per cent), inventory carrying costs, come out to be 20 per cent of the material costs. Inventory carrying cost comprises interest charges on the cost of inventory, storage and material handling costs, costs of insurance, physical deterioration and obsolescence. Thus total material cost will amount to 76.8 or 77 per cent (64 per cent plus 20 per cent of 64 per cent) of the sales revenue.

In countries like Japan, inventory consciousness has proved to reduce materials cost substantially. In the year of application of scientific methods and techniques of materials management, i.e., 1958-a saving of more than 3 per cent could be achieved in a period of merely 18 months. Thus in our country, it is very essential to develop inventory consciousness.

In addition to reduce material costs, efficient materials management is useful for following purposes:

- (a) For reducing foreign exchange, by utilising the imported items to their maximum value and thus helps in reducing the imports.
- (b) By reducing the cost of finished goods and maintaining the quality, it is possible for Indian manufacturers to compete better in foreign market and earn more foreign exchange.

Until now efforts have been made for saving in the wages (wages are about 16 per cent of sales value), which was not liked by the labour class and such steps created the labour problems. But the above facts show that more efforts must be made for the saving in materials cost (about 77 per cent) by utilising the techniques of materials management and that too without creating any labour problem.

Materials management resulted in increased productivity of capital by preventing large amount of capital being locked up for long periods in inventories.

## 25.5. OBJECTIVES OF MATERIALS MANAGEMENT

Materials management aims at reducing the cost of production so as to help the organisation in maximizing its profit. As objectives of materials management are many, they can be classified into two categories, viz., primary objectives and secondary objectives.

### **Primary Objectives include :**

1. Provisioning of materials in specified quality and quantity at economic cost at specified time.
2. Minimizing investments and costs of inventories and assurance of a high inventory turn-over.

### **Secondary Objectives mainly include :**

1. To reduce materials cost by adopting various techniques such as variety reduction, simplification, standardization, value analysis, inventory control etc.
2. Coordination of such functions as planning and scheduling, storage, upkeep and maintenance of materials, materials handling etc.
3. Ensure uniform flow of materials for production.
4. Ensure right quality at right price.
5. Establish and maintain good relations with suppliers.
6. Economy in using the imported items and to find their substitutes.

## **25.6. MATERIALS MANAGEMENT AS A SCIENCE**

Best of materials should always be available in time to avoid idleness of machines and men. Materials management, therefore, form the key to the productivity of machines and other capital assets and labour, and can contribute considerably towards achieving efficiency, effectiveness and cost reduction. Materials management is responsible for coordination of materials requirement planning, sourcing, purchasing, handling, storing and controlling materials in an optimum manner so as to achieve its objectives.

Materials management is a science in the sense that it adopts a systematic and scientific approach integrated for improving the management process, by adopting :

- (i) management Science techniques ; like network, quantitative and simulation approach e.g. linear, and dynamic programming, queuing theory, break-even point theory, Monte Carlo probability theory, equipment replacement theory etc.
- (ii) scientific Management Information System and electronic computers.
- (iii) scientific methods of decision making.
- (iv) Information feed back system for better controlling,
- (v) Human behavioural Science approaches.

Materials Management is an art also, as it is an application of human skills to utilize the talent of the people, and because it manages human beings to achieve the desired results.

Materials management department, if not managed scientifically and systematically e.g. by scientific purchasing, inventory control, entire organisation may lead to losses. Therefore in order to achieve optimum results, this department must adopt scientific, rational and logical approach.

## **25.7. INTEGRATED MATERIALS MANAGEMENT APPROACH**

As explained earlier materials management is a very wide term and covers a wide range of activities. Various functions performed by materials management must be well integrated, otherwise a conflict of interest might arise, in case they function independently. In such a situation :

- (a) Purchase department, in order to avail the discount may buy large quantities without taking into account its impact in inventory carrying costs and warehousing costs.
- (b) Marketing department may be interested to have a high level of finished goods inventory to satisfy his customer needs.
- (c) Production department may be interested to have high raw material inventory to achieve an optimum level of machine utilization.
- (d) Purchase department may be interested to have the materials well in advance to avoid the chance of stockout.

These individual interests on inventory level create a lot of problems in the non-liquidity of money and sometimes lead to bankruptcy of financial resources.

In order to sort out these problems "Integrated Materials Management" concept is adopted to take care of needs of all functions, and a close control of inventory is ensured to make use of resources in an optimum way. Inventory carry costs are as high as 25% which means idle resources without any productive use, and an avoidable burden on finances of the enterprise.

An ideal situation of inventory level is 'Just in Time', which is practised in Japan, where only 6 hours inventories are kept. In integrated approach all the departments make efforts to optimize the inventories.

### Advantages of Integrated Approach

Integrated materials management approach has following advantages :

1. It ensures better support and cooperation in the accomplishment of materials functions.
2. It creates an atmosphere of trust and better relations between different sections/departments.
3. This ensures faster and accurate communication.
4. It establishes clear accountability.
5. This helps in evaluating the performance of materials management in an objective manner.
6. This develops team spirit, resulting in better morale and cooperation.
7. This ensures better opportunities for growth and development of the organisation.

## 25.8. ORGANISATION OF MATERIALS MANAGEMENT

In order to fulfil the objectives laid down for the materials management department by following the organizational principles and the corporate objectives, an appropriate organisation structure is necessary. The organisation aims at better division of work, reasonable authority and responsibility, span of control and favourable working environment.

The position of the materials management department in any organisation depends upon type of industry, variety and volume of materials. Present trend is to have an integrated materials management department, or some times simply known as materials department, headed by General Manager Materials with the purchase manager, stores manager inventory control manager, materials planning manager, cost reduction and value engineering manager etc. Integrated materials management concept helps in coordination of interrelated activities.

**Aims :** Aims of the materials management organisations 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 Organizational Structures

Organizational structure of materials management department may be based on :

- (i) Commodities
- (ii) Functions
- (iii) Locations.

### 1. 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, steel, chemical items, spare parts, consumables, machine tools, fuels. These classes of materials can further be sub classified, e.g., raw materials as ferrous items, non-ferrous items or consumables as greases, lubricants etc.

### 2. 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 (or transport), value engineering and cost reduction etc. These sections are further sub divided into sub-sections based on functions like, purchase section into source development, vendor evaluation, tendering, evaluation and issue of orders, follow-up, importation, procurement of capital equipment, spares procurement etc. whereas stores section can be subdivided into receipts, issues, and custody.

### 3. Organisation Based on Locations

When an enterprise has more than one plant located in different locations, they can have either centralized materials management department at the headquarters or decentralized set-up at each location.

#### (a) Centralized Set-up

By establishing a centralized materials management department the enterprise can have the advantage of specialized expertise, bulk supply order to get quantity discount. This also enables the proper use of resources, standardization of policies, uniformity of procedures. In such a set-up, however materials are stored only at the user plant. This can be done by making the specific plant as consignee in the purchase order itself to avoid rehandling of the materials.

However this system may have following draw backs:

- (i) delay in procurement
- (ii) large efforts required by user unit in follow-up
- (iii) more stock—out chances resulting in emergency procurement.
- (iv) requires lot of efforts by user departments to interact with the purchase department at headquarters.

In this type of set-up more attention should be given on following points :

- (i) complete specifications of materials should be given in the requisition by user department.
- (ii) planned indents should be given well in time to avoid emergency/urgent indents.
- (iii) all instructions related to supply be mentioned at the time of placing the indent, so as to avoid last minute changes, cancellations and postponements.

Generally this type of set-up is preferred in multi-product, multi-unit enterprises, where centralized purchasing is done in respect of key items, referred as 'A' items (refer ABC analysis in the chapter on 'Inventory Management' in the book) and those for capital equipment.

### (b) Decentralized Set-Up

In this set-up each unit is made responsible for purchases for its own use. Some enterprises may even make each department responsible for purchases of their own requirements. The advantages of this system are :

- (i) Materials manager of local unit, being at the local spot shall be more committed and have better knowledge of the needs of his unit.
- (ii) Local materials manager will have better knowledge of local suppliers, transport facilities and warehousing facilities.
- (iii) It reduces time lost in communication.
- (iv) Better liaison, coordination and interrelationship.

Since the advantages of one system are the disadvantages of another and *vice-versa*,

hence a combination of both is adopted in practice. As pointed out earlier, generally 'A' category items and capital equipments are purchased centrally while other items are left to the local units.

## ORGANIZATIONAL CHART

Organizational chart for materials management department is drawn after the organisation set-up for it is designed considering all the relevant factors. It indicates the structural relationship among different functions, and the positions of the personnel. This also indicates the lines of command, i.e., authority and responsibility.

An example of organisation chart of materials management department is shown here, however this can vary depending upon the circumstances.

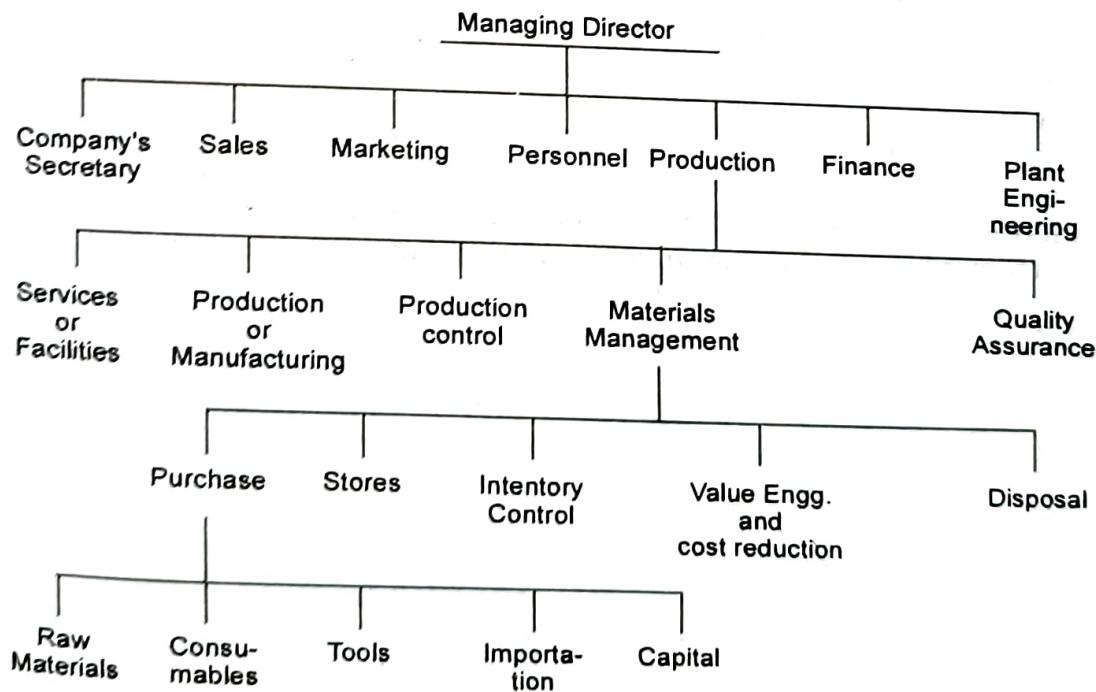


Fig. 25.1.

## Inter-Relationship

In any organizational structure designing inter-relationship or interactions has to be considered, whether it may be (a) amongst the constituents within the department, and (b) with outsiders, may it be within the enterprise or outside the enterprise.

## 25.9. MATERIALS PLANNING

As planning and controlling are the main functions of a manager, materials planning and budgeting is given a prominent place in the integrated materials management set-up. Planning for materials and working out a realistic budget not only help motivate people but also serve as a control device. As we know that in an enterprise planning is done at all levels of the organisation, as illustrated in the following diagram :

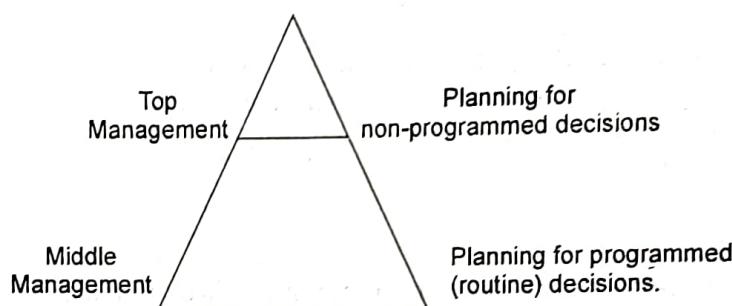


Fig. 25.2.

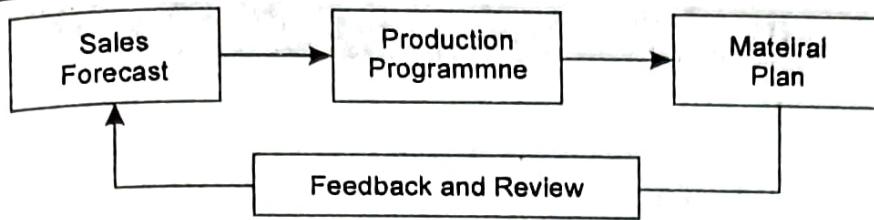
There are large number of non-programmed decisions in materials planning, such as import policy, foreign exchange availability, credit squeeze etc., which are taken by top management. For routine and programmed decisions like working out economic lot, delivery schedule etc., middle level management are involved.

Materials planning is the scientific way of determining the requirements of raw materials, components, spares and other items for meeting the production needs within the economic investment policies.

Planning of materials requirement and its timely provisioning is the essence of the success of materials management. This function involves the setting up of consumption standards of 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 specifications, sources of supply available, availability of stock, import substitution etc. Lead time, manufacturing schedule, economic ordering quantity etc. is considered with programming for material requirement. The department should also follow-up for timely deliveries, and to expedite in case of emergencies.

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

For the purpose of materials 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.



**Fig. 25.3. Materials planning.**

Thus materials planning function is a sub-system in the overall planning activity of the organisation. Purchase section initiates purchase activities only when they are informed by planning cell about the quantity required, procurement programme, and financial provisioning. Materials requirement and its programming is based on lead time so that delivery is ensured at the right time. Materials planning cell prepares its plan based on the production schedules and all of materials received from the production control department. Consumable items are planned considering the consumption pattern, minimum and maximum level of inventories. For project works, network techniques are used to arrive at the latest date by which the materials should be received.

Considering the quantum, period of consumption, lead time etc. the purchase section can decide about the procedure for their purchase, i.e., contract buying, or bulk purchase etc.

#### Factors Governing the Materials Planning

(A) **External Factors :** These cover the factors which are related to the overall business activity affecting the internal policy of the organisation towards the materials management.

1. Price trends of the materials in the market.
2. Import policy of the government, for imported materials
3. Prevailing credit policy of the banks.

(B) **Internal Factors :** These factors are related to the internal business activities of the firm :

1. Objectives of the organisation on which entire planning including materials planning depends.
2. Production programme and scheduling.
3. Lead time decides the inventory level, in turn which help in planning materials requirement and its programming.
4. Working capital requirements and its availability.
5. Purchasing policy of the enterprise.

#### Benefits of Materials Planning

- (i) To ensure that materials and components are available in right quantity at right time.
- (ii) Reduction in inventory.
- (iii) Improved customer service because of the adherence to the production schedules.
- (iv) Quicker response to the change in demand.
- (v) Better machine utilisation, hence greater productivity and economy.

## 25.10. TECHNIQUES OF MATERIALS PLANNING

### 1. Bill of Materials Explosion.

Materials planning is done on the basis of sales forecast. Requirement of various materials are arrived at from sales forecast using bill of materials through explosion charts. Bill of materials indicate materials required for a given component. It also indicates bought out items and shop made items. Explosion chart is then made by combining all the bills of materials, so as to give the exact materials requirement. Thus materials requirement is determined with the help of explosion charts. Delivery schedules of materials are then prepared considering the production, scheduling and inventory level in the stock and organisation policies for maximum and minimum inventory level. For details about 'bill of materials', refer chapter on 'purchasing'.

### 2. Past Consumption Analysis

The materials which are consumed continuously and for which no bill of materials are made, like maintenance items, lubricants, fuel etc., past consumption data is analysed and then future projections are made.

## 25.11. MATERIALS REQUIREMENT PLANNING (M.R.P.)

As we have already discussed, planning of materials requirement and its timely provisioning is the essence of the success of materials management. Before the start of manufacturing process or a service facility, it is necessary to have required materials in hand. If the material is not available in time, entire efforts of starting the manufacturing will go waste. Therefore, materials management department should make prior estimation of materials requirement and proper planning is done, so that right material is available at right time.

M.R.P. can be defined as a computational technique that converts the master schedule for end products into detailed schedule for raw materials and components required for the end product. The detailed schedule identifies the quantities of each raw materials and components. M.R.P. also tells as to when each of these items must be ordered and delivered so as to meet the target of master schedule of the final product.

Materials requirement planning is the scientific way of determining the requirements of raw materials, components, spares and other items required for meeting production needs within the economic investment policies of a productive system.

In manufacturing concerns, the demand for raw materials, components, subassemblies etc. is dependent on the production plan for the final product. Therefore, once we know the production requirements of the final product, it is possible to determine as to how many parts or components will be needed in each future time period. The production requirements for the final product are determined by the sales forecasts.

The materials requirements are derived directly from the production schedules. Requirement plans normally indicate the production lead time, a planned stock record, and the timing of production order releases phased to take account of production lead times.

Several options are available to satisfy net requirements of the material. It can vary from one extreme when we can manufacture the quantity sufficient to satisfy the requirement for entire planning horizon (season, year or manufacturing order) in single batch, to other extreme when we can manufacture the quantity sufficient to meet only a requirement for a week or so. The cost of holding inventory and cost of set-up must be considered in determining a decision policy. Different options available depend upon the policy which we adopt. These may be:

- (i) **Lot-for-lot.** In this policy, lot size for a batch is chosen to satisfy the net requirement for a single period.
- (ii) **Economic Ordering Quantity (EOQ).** In this policy, EOQ is calculated based on expected requirement.
- (iii) **Period Order Quantity.** In this policy, the lot size is equal to the actual requirements for a predetermined fixed period.
- (iv) **Part-period Total Cost Balancing.** In this policy, holding costs and set-up costs are balanced as closely as possible for each lot size decision.

### Objectives

The objectives of materials requirement planning are :

- To avoid inventory stockouts so that production runs smoothly, according to plans,
- To reduce investment in raw materials and work in process inventories,
- Reduction in production and delivery lead times, as it identifies materials and components' quantities, timings, availability and procurement and production actions required to meet delivery deadlines, and by coordinating these actions delay in production can be avoided, and
- Realistic delivery promises which can enhance customer satisfaction.

### Reactive System of Inventory

Reactive or traditional systems of inventory control is simple to manage, but have serious drawbacks, in particular, high inventory costs and unreliable delivery performance. This planning system is a newer way and is more complex to manage, but it offers several advantages, like reduction in inventory and their associated cost, items are available when needed, carries only those items and components that are needed, reduces order processing delays, setting up realistic job completion dates, completion of jobs on time, order promises are kept and production lead times are shortened.

Therefore M.R.P., being an inventory planning system is more beneficial than reactive systems of inventory control (such as the order quantity, reorder point system). MRP reduces the need for large safety stocks, because we know that how many items will exactly be needed and we do not need to accumulate excessive stocks in advance. Thus MRP is a system of planning and scheduling the time-phased materials requirements for production operations.

### Capacity Requirement Planning

Each time the MRP system is updated, it is necessary to ensure that shop capacity is sufficient to implement the current plan. Capacity requirements planning (also known as detailed capacity planning) is a technique that answers this problem.

Thus capacity requirements planning is a process of modifying the Master Production Schedule or planned resources to make capacity consistent with the production schedule.

Earlier inventory control techniques were used for material control, but recently emphasis has been shifted to Material Requirements Planning (M.R.P.) based systems. Conventional techniques of inventory control were not very effective to produce the desired reduction in inventory investments while maintaining high service levels including better capacity utilisation and higher productivity.

Because of not following proper M.R.P., following symptoms are indicated :

- High incidence of shortages.
- Insufficient lead time for procurement.

- (iii) Receipts have no relationship with actual requirements.
- (iv) Extremely large inventory investments.
- (v) Poor inventory turnover.
- (vi) Last minute adhoc decisions and too much follow-ups at nick of time.
- (vii) Buck passing and finger pointing.

In these circumstances only solution is to follow proper M.R.P. and develop systems based on more realistic assumption of the prevailing conditions. Some preparations are necessary before starting M.R.P., and good manufacturing support systems should be developed first, for which proper documentation is the first requirement. Based on Master schedule of the manufacturing system, requirement for all the items to be manufactured is determined, and net requirement is calculated considering inventory available, orders in hand for each item and their delivery schedule. Based on these inputs of the master schedule, M.R.P. establishes, maintains and drives priorities for planning, expediting, retarding or cancelling orders.

### **Guidelines (Pre-requisites) for Launching M.R.P.**

For launching M.R.P. in any organisation following pre-requisites are necessary :

- (i) All inventory items are identified.
- (ii) Inventory reports containing data on the inventory status of every item is prepared.
- (iii) A bill of materials, and product manufacturing details are available.
- (iv) Master schedule of the manufacturing of different products indicating number of end products to be manufactured.
- (v) Lead times for all inventory items are known or at least estimated considering market position.

### **Information Sharing**

Effective functioning of the M.R.P. system also demands an effective sharing of the information between related departments. Prompt and correct informations sharing with manufacturing, production control, marketing, inventory control departments are necessary.

Top management should take interest in M.R.P. system, as its efficiency or failure both effects the entire organisation's working, increases the avoidable expenses in idle time for man, machine or purchase of items at higher rates at nick of time for fulfilment of delivery schedules thereby affecting the reputation of the organisation.

#### **25.11.1. SPARE PARTS PLANNING**

Although spare parts management is a part of material management, but since it requires special attention due to its typical problems, this is being discussed separately in these paragraphs.

Machines worth crores of Rupees are generally idle, for want of spares, while crores of rupees are locked in obsolete items. This emphasizes the need of paying more attention on management of spares. Improvement in the capacity utilisation and cost reduction can be achieved by better spare parts management.

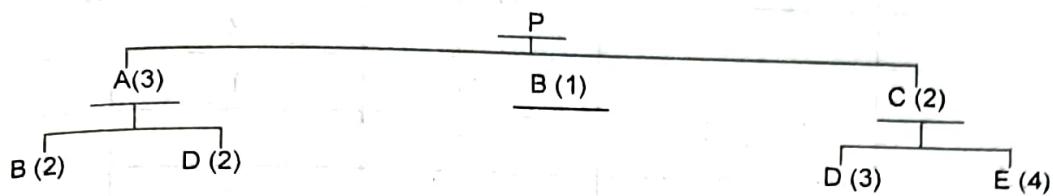
Objective of Spare Parts Management is to provide right parts in right quantity, in right place at the right time and at the right cost.

A spare part can be defined as parts identical to the parts of a machine which needs replacement due to wear and tear during the operating life of equipment.

Spare parts management is discussed separately.

## SOLVED EXAMPLES

**Example 25.1.** Product structure of an end-product  $P$  is shown in following figure. What are the requirements of various lower level items for producing 100 units of  $P$ .



**Solution :**

Above diagram shows that :

- For producing each unit of end product  $P$ , we require 3 numbers of  $A$ , 1 number of  $B$ , and 2 numbers of  $C$ .
- For producing each unit of  $A$ , we require 2 numbers of  $B$  and 2 numbers of  $D$ .
- Each unit of  $C$  requires 3 units of  $D$  and 4 units of  $E$ .

Therefore, for producing one unit of  $P$ , we require

- |                                     |  |
|-------------------------------------|--|
| (a) $A = 3$ numbers.                | (b) $B = 1 + (3 \times 2) = 7$ numbers             |
| (c) $C = 2$ numbers                 | (d) $D = (3 \times 2) + (2 \times 3) = 12$ numbers |
| (e) $E = (2 \times 4) = 8$ numbers. |  |

For producing 100 numbers of  $P$ ; requirements of various lower level items are as under.

$$A = 100 \times 3 = 300$$

$$B = 100 \times 7 = 700,$$

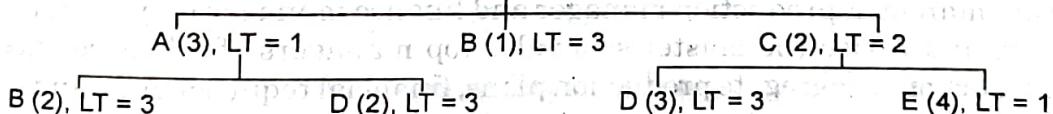
$$C = 100 \times 2 = 200$$

$$D = 100 \times 12 = 1200$$

$$E = 100 \times 8 = 800.$$

**Example 25.2.** If the lead time for various items in previous example are illustrated as shown below, find out the time schedule of the requirement of these items for shipping out the 100 units of product  $P$  on day 8. Specially as to when an item is required and when an order for its production procurement is to be placed and in what quantities.

P. Lead Time (LT) = 2



**Solution.** If 100 units  $P$  are to be shipped out on day 8, considering its lead time of 2 days needed for assembling (or producing) it from  $A$ ,  $B$  and  $C$ , the order for assembling of  $P$  should therefore be placed two days prior to day 8, i.e., on day 6.

Similarly, other calculations are done in the tabular form as shown below :

Item	Requirement		Lead Time	Release of order on day
	Quantity	On day		
P	100	8	2	8 - 2 = 6
A	300	6	1	6 - 1 = 5
B (for P)	100	6	3	6 - 3 = 3
(for A)	600	5	3	5 - 3 = 2
C	200	6	2	6 - 2 = 4
D (for A)	600	5	3	5 - 3 = 2
(for C)	600	4	3	4 - 3 = 1
E	800	4	1	4 - 1 = 3

Above table shows summarised production plans. In this problem it was assumed that the items were produced as and when required. This type of production plan is called lot-for-lot production.

## 25.12. MANUFACTURING RESOURCE PLANNING (MRP II)

Manufacturing resource planning, also known as MRP II or closed loop MRP is an integrated information system that steps beyond first generation MRP to synchronize all aspects of the business. It (MRP II system) coordinates sales, purchasing, manufacturing, finance and engineering by adopting a focal production plan and by using one unified data base to plan and update the activities in all the systems of business.

This means, the MRP II involves developing a production plan from the business to specify monthly production levels. Since the production is then expected to produce this committed level, sales department to sell at these levels, and the finance department to ensure adequate financial resources for these levels, all these functional departments develop these production levels by consensus.

Marketing manager, production manager and finance manager may meet monthly to update sales forecasts and revise the master schedule. Top managers of all these three departments decide the product mix, aggregate production plans, financial requirements, and pricing strategies.

Therefore, MRP II provides help for coordinating the efforts of manufacturing, finance, marketing, engineering and personal departments towards the common business plan. Managers of these departments also analyse the problems, determine the alternative solutions, and take a final decision, they also evaluate the implications of their decisions.

## 25.13. JUST-IN-TIME (JIT) PHILOSOPHY

**JIT** means a structural approach in a manufacturing organisation focussed on improving timeliness, quality, productivity and flexibility utilising various methods of work simplification and waste elimination. The company following the JIT philosophy want to do work systematically,

remove excess work, eliminate waste, unevenness and unreasonableness and thereby raise their productivity.

JIT concept when applied results in smaller set-up costs which justifies smaller lot sizes and provide greater flexibility for changeovers from one product to another. Companies adopting JIT concept found improvement in productivity, reducing set-up-time, reducing inventory, improving quality, saving space and reducing lead times. Reduction in economical batch sizes lead to reduction in-process inventory.

### Importance of JIT

Just-in-time is not just an inventory reduction programme or kanban, or material requirement planning, or a production control technique. It is a corporate strategic philosophy and aims at elimination of waste.

**NOTE :** Kanban is a Japanese word meaning signal. A kanban is a card or a tag usually attached to work-in-process parts, and it is used to facilitate the proper movement of these parts. This movement may be within the same manufacturing plant or between plants.

It is based on following factors :

1. Unnecessary complexity in the design of products should be removed for producing it at least cost.
2. Plant layout should be changed to eliminate or shorten material movement and reduce time loss.
3. Provide incentives to workers to tap their knowledge to develop methods of eliminating waste of all forms.
4. People should be accountable for accuracy and institute programmes to measure it.
5. Reduce paper work. Use of on-line, real-time data update and retrieval and interaction decision making is important.
6. Scrap should be completely avoided, as scrap is more costly than mere material.
7. Reduce inventories by eliminating large queues and many kinds of safety stocks. When ordering purchase of parts from vendors, negotiate prices based on long term commitments and then schedule frequent releases to support the flow of production with minimal inventory.
8. In order to strive for continuous improvement, set goals and when they are achieved, set them higher.

### Benefits

JIT leads to productivity improvement in the following ways :

- Smaller lot size inventories.
- Smaller buffer inventories.
- Less indirect cost in inventories.
- Less space for inventories.
- Less equipment to handle inventories.
- Less inventory accounting
- Less physical inventory control effort
- Less scrap
- Less direct labour wasted on rework.
- Reduction in delays and scrap also improve market response.

- Because of speedy changeover, reduces production lead times, better delivery dates can be promised, as the product mix and quantities can be changed quickly as demand and forecasts of demand change.

For reduction in in-process inventories use of *Kanban* is very helpful.

## Applications

**JIT Purchasing.** : JIT purchasing emphasises on supplying materials just in time for use on factory floor, equally important are the close relationships with suppliers on long-term basis who are geographically close for frequent deliveries of small and exact quantities. For the success of JIT, cooperation from the company's vendors is essential. In this concept vendors are virtually an extension of the company. JIT vendors have to deliver goods to production line at the required time ; which may be quite frequent — say every 3 or 4 hours. In view of this JIT purchase agreements need be simple, specifying price, specifications, and an overall quantity to be delivered in accordance with long-term production schedules. The specifications are focused on product performance rather than being highly detailed.

The objective of this system alongwith *Kanban* is to have right number of parts or components at the right place at the right time.

**JIT Production System.** In this concept, factory produces the required goods only at the times when they are needed in the quantity that is needed, and in this situation the inventory of the finished goods and work in progress would be almost zero. If we make raw material suppliers also agree to deliver their goods only at a time in quantities we need them, then we are almost eliminating raw materials as well. In such a situation we shall have near zero inventories.

In this system, workers go to the preceding process to withdraw the required parts or components for their operations using the *Kanban* system. If there are fluctuations in the rates of which these materials are withdrawn, then the preceding process must hold buffer in-process inventories to give off the shelf service. This require minimising production fluctuations on the final assembly line by scheduling small lots of individual models.

In JIT production processes are so designed that it need less specialisation of workers, and the physical layout is so arranged that a worker can operate two or three different machines for providing flexibility in processes. The organisation of multi functional workers have following benefits :

- (i) A decrease in the number of workers required, resulting in increase in productivity.
- (ii) Increased worker satisfaction because of more broadly defined jobs.

## JIT Implementation Methods

1. **Autonomation.** This means "autonomous defects control" or worker controlled quality control. Although JIT systems control production quantities, the production flow would be interrupted if the items delivered were defective. The **autonomation** system is designed to ensure that, theoretically 100 percent good units flow to subsequent operations.
2. **Self Discipline.** For the success of JIT systems, positive human relations is most essential. Here each worker is his own boss, as he produces and checks his own work and ensures zero defectives in his output that is sent to the next process in line.
3. **Waste and its Elimination.** Anything other than the minimum amount of plant, material, parts, energy, space, and people's time which are absolutely essential to add value to the product or service, is *waste*. Cost reduction can be achieved through elimination of wasteful operations. There are many types of wastes which need elimination are : storage, material handling, set-up time, inspection, expediting, machine

breakdowns, paper work, over-production, queuing (or waiting), unnecessary stock, idle time, idle cash, motion without work, talent misuse etc. All these add cost, without adding value.

4. **Good Housekeeping.** Workplace should be organised with a purpose and to attain unidirectional flow of process. "5-S" principles as discussed earlier should be followed.
5. **Poka-Yoke (Fool proofing):** As discussed earlier Poka-Yoke is designing the work process to eliminate human mistakes.

## 25.14. SUPPLY CHAIN

We have discussed in the beginning of this chapter about "supply management". The main task of supply management is to develop and manage the "supply chain". Supply chain is responsible for ensuring that the right materials, services and technology are purchased from the right source, at the right time, in the right quality.

This supply chain is the upstream portion of the organisation's **value chain**. The value chain is a series of organizations extending to the firms which extract materials from mother earth performing a series of value-adding activities and fabricate the finished good or service purchased by the ultimate consumer.

Once a service or commodity is identified as critical for the organisation's operations, a strategic supply plan must be developed.

A cross-functional team, under the leadership of a supply professional is involved in the selection of the desired supplier, negotiation of applicable terms and conditions. This supply professional must be both technically and commercially competent.

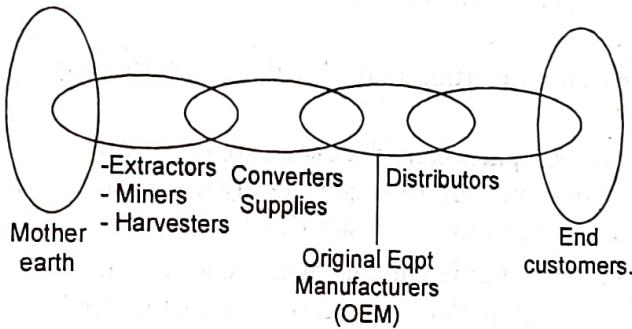


Fig. 25.4. Supply chain.

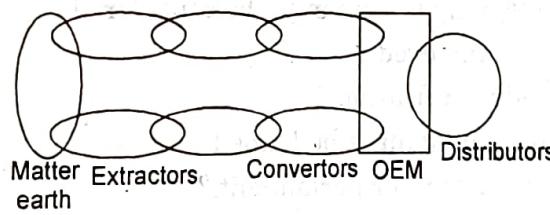


Fig. 25.5. Supply chain network (with value chain).

Vendors	Traditional Suppliers	Certified Suppliers	Partnership type suppliers	Strategic alliance with suppliers

Fig. 25.6. Stages in supply relationship

## 25.15. MAKE OR BUY DECISIONS

Make or buy is a valid consideration in any cost reduction or product improvement programme. Advantages and disadvantages of possible alternatives should be evaluated and the choice that identifies the minimum cost makes for the final decision.

**Make.** It requires appropriate production equipment, suitable personnel, material, adequate space, supervisions, design standards and overheads, maintenance, taxes, insurances, management attention and other indirect and hidden costs.

It also provides work for idle equipment and personnel, utilises scrap material specification and experimentation. It ensures continuity of supply, may cost less than purchase and keep design and research information secret.

**Buy.** Permits lower investment in facilities, smaller labour force, less handling, lower plant cost for building and upkeep, less overhead or taxes, insurance and supervision and less problems of man-management relations.

Buy permits specialisation, allows manufacture by most efficient equipment, lowers inventories, change of design without loss of investment in equipment or inventory, obtaining best price and product by supplies more varied experience and encourages growth of ancillaries.

Whether to make or buy is sometimes referred as a purchasing function. Though the decision whether to make components in one's own factory or to buy them from market is a top management policy matter.

Theoretically, a company has a choice of three alternatives before starting for a new product.

1. Purchase the product complete from a contracted manufacturer.
2. Purchase some components and materials, and manufacture and assemble the balance in its own plant.
3. Manufacture the product completely, starting with the extraction of basic raw-materials.

In practice, almost no company considers the third alternative. Some companies choose the first alternative and obtain a new product completely from another company. These companies usually have no manufacturing units, but sell the product under their trade marks.

But generally, most of companies make certain components of its product and buy others. The companies may buy a component complete or semifinished from outside or buy the raw material.

Before taking a decision to purchase from outside, in case, the product was being manufactured at the company's works, following factors must be considered :

1. What quantities are involved ?
2. Will drawings need modification ?
3. Whether jigs, tools, and gauges be loaned ?
4. Will demand be temporary or permanent ?
5. Will demand fluctuate ?
6. Are special manufacturing techniques involved ?
7. Is there any question of secrecy ?
8. Is there a likely market elsewhere ?
9. Are frequent design changes likely ?
10. Arrangement for inspection, sampling etc.
11. Retention of own production personnel.

## 12. Whether notice of termination is required ?

If it is decided that the part must be manufactured in company's own plant, in case the part is previously purchased from outside, following factors must be considered :

1. Are patents or copy rights involved ?
2. If so, what are the royalties ?
3. Have the best prices been obtained ?
4. Are the quantities optimized ?
5. Is the previously contracted firm already making something similar which could be added to the new item, thus reducing production costs ?
6. Techniques of production may be special.
7. Is raw material readily available ?
8. Is free issue material to be provided ?
9. Will any tax be involved ?

### Criteria For Make or Buy Decision

As already discussed that companies prefer own manufacturing, and buying only raw material or semifinished parts in case of new product. Such decision is made in the following cases :

1. Finished product can be made cheaper by the firm than by outside suppliers.
2. Finished product is manufactured by limited number of outside firms, which are unable to meet the demand.
3. The part has an importance for the firm, and requires extremely close quality control.
4. The part can readily be manufactured with the existing facilities and the company have manufacturing experience.
5. Requires high investment on facilities, which are not already available at supplier's plant.
6. Has a demand that is both stable and relatively large.

Companies will usually buy a finished part from an outside supplier when :

1. They do not have facilities to make it and there are other profitable opportunities for investing company's capital.
2. Existing facilities can be used more economically to make other parts.
3. The skill of personnel employed by the company is not readily adopted to make the part.
4. Patent or other legal barriers prevent the company for making the part.
5. Demand for the part is either temporary or seasonal.

### Analysis For Make-Buy Decisions

There are three types of analysis :

1. Simple cost analysis
2. Economic analysis
3. Break-even-point analysis.

#### 1. Simple Cost Analysis

A make or buy cost analysis involves a determination and comparison of the cost to make the part and the cost to buy it. The final make or buy decision must be based on a careful weighing of the cost considerations and various qualitative considerations. The most difficult make-buy factors to assess are those that will significantly be affected

by changes in economic conditions, technological advancement, growth of the firm, or changes in the labour-management in the near future. Studies show that more mistakes are made in making what could be more profitable to buy than in buying what could be more profitable to be made.

The other two methods of analysis are being discussed in the chapter on "Inventory Management".

## QUESTIONS

1. Explain the importance of Material Management.
2. Explain the different functions of Material Management department.
3. What is material handling? Suggest some steps to reduce the material handling cost.
4. To make or Buy decision, what factors are involved? Explain.
5. Explain the criteria for Make or Buy decision.
6. Explain two analysis for making a decision regarding Make or Buy.
7. Describe in detail the procedure and personnel involved in Make or Buy decision.
8. What is materials management? Write an essay on "evolution of materials management".
9. What are the objectives of materials management? Explain.
10. Write short notes on
  - (a) Integrated materials management approach.
  - (b) Characteristics of good materials management.
  - (c) Materials management as a science.
11. Compare and contrast "supply management" and "materials management".
12. Write short notes on
  - (a) Scope of materials management.
  - (b) Advantages of integrated materials management approach.
13. What is materials planning? Explain the different techniques of materials planning.
14. Explain the factors governing materials planning.
15. What is MRP? Explain. What are the pre-requisites for launching MRP?
16. Explain the term.
  - (a) Manufacturing resource planning (MRP II).
  - (b) Capacity requirement planning.
17. What is 'Just-in-time philosophy'? Explain JIT production planning.
18. What is 'supply chain'? Explain in detail.