UNIT-8 Material Management

Learning Outcomes

By the end of this unit the learner will be able to:

- ✓ Describe the scope of material management.
- ✓ Explain the issues relating to purchase and storage of materials.
- ✓ Describe the integrated materials management approach.
- ✓ Identify the role of material management in construction.

Unit 8

Material Management

Introduction

When a business is able to manage materials efficiently, it becomes profitable. Thus, material management is a key ingredient in maintaining a healthy and competitive edge in business endeavours. Many other functions contribute to a good business management concept but one of the key objectives of a business is to adopt a cost reduction strategy when undertaking material management. In order to gain the full benefits of a cost reduction strategy, a company must develop a plan for handling materials efficiently from purchasing to storage and, finally, to the work site where they become part of the product.

Different approaches such as the centralised, decentralised or integrated management of materials may be adopted, but most large organisations have found the integrated approach superior in terms of meeting the low cost objective of the material management function.

In this unit, we will explore all aspects of material management in construction.

Definition and Scope

Material management involves coordinating, planning, sourcing and purchasing, storing, moving, and controlling materials in such a way that the overall cost of undertaking these activities is kept as low as possible.

We can also define material management as “the process of management requiring supervision, coordination, and execution of tasks involving the flow of materials to an organisation, within the organisation or out of the organisation in an integrated manner.”

It is obvious from the definitions given above that material management has a wide scope which has a direct or indirect effect on the activities of several departments within an organisation. Below, we elaborate on some of the various functions of material management.

Material Planning and Control

Material planning and control is usually done on the basis of sales forecasts and production plans. It involves estimating the quantity of materials required, preparing budgets for procuring the materials, determining quantities of inventories, scheduling orders, and monitoring or measuring the performance of expected outputs.

Purchasing

Purchasing is also carried out as part of material management. It involves identifying and selecting sources of supply, agreeing terms of purchase, placing orders, making payments to suppliers, evaluating, and rating the performance of suppliers.

Stores and Inventory Control

This entails physically verifying stocks and reconciling them with book records. A variety of activities usually take place including the physical control of materials, minimising damages and aging, maintaining store records, and the accurate location and stocking of materials. It also involves setting inventory levels, fixing the cost of materials to order, ABC analysis, setting limits for safety stock levels, lead time analysis, and reporting.

Importance of Material Management

According to results of the analyses of financial statements from several public and private sector companies, materials account for almost 60% of their total expenditure.

Table 7.1 provides information on the average materials expenditure for different industry groups.

Percentage of Total Cost	Industry Groups
Above 75	Construction, Fabrication, Electrodes, Tea etc.
65-75	Wool, Sugar, Jute, Cotton, Yarn, Commercial Vehicles, Earth Moving Equipment, Scooters, Furniture etc.
55-65	Cotton Textile, Bread, Ship Building, Cables, Electricity Generator's, Refrigeration, Heavy Machinery etc.
45-55	Chemicals, Cement, Pharmaceuticals, Electronics, Paper, Engineering, Non-ferrous type Machine Tools, Explosives etc.
35-45	Fertiliser, Steel, Cigarettes, Transportation, Asbestos, News Print, News Paper, Ferrow Alloys, Aircraft Manufacturing etc.

Table 7.1: Average material cost as percentage of total cost

Material management becomes a vital function that contributes to the profitability of an organisation provided the materials manager has the ability to reduce the cost of materials. An alternative way to increase profitability, apart from cutting down on the cost of materials, is to increase sales volume but this is much more difficult given the large number of competitors in the market. Material management therefore presents the best opportunity to reduce costs in a competitive market. It has been established that the cost of materials forms a high percentage of companies' overall expenditure; hence, a small reduction in material costs leads to a high percentage increase in profitability.

Issues Confronting Material Management

Certain issues need to be addressed when undertaking material management in any organisation. These include:

a) Material planning
b) Purchasing
c) Storage and material handling issues

We will discuss these issues in more detail below.

Material Planning

This involves a collaboration between the material management division and other relevant departments, such as design, engineering, processing and production, to choose the right materials, sub-assembly, spare parts, and the equipment needed to produce a product. The material management department works continuously with these departments to provide information on alternative materials that might be used to create a product. The alternatives are assessed to determine their suitability for meeting both design and functional objectives under optimal production conditions. The assessment must be continuous, especially with regard to recent changes introduced into the production process. Continuous assessment of the effectiveness of substitute materials, supply conditions or any changes in the method of production or product specification should also be carried out.

Standardisation

The main purpose of standardisation is to make it possible to interchange parts or components in an organisation or across industries. It is also an effective means of reducing the quantities of parts or components used in companies' production processes. For example, when there are 100 different types of parts for a car, it may be possible to reduce this number by half while maintaining the quality and functionally of the parts.

Make or Buy Decision

Many companies are usually incapable of producing all parts or components required to manufacture a product for the following reasons:

- High cost of manufacturing
- Lack of skills or expertise
- Lack of capital to build additional facilities
- Existence of suppliers of high-quality, low-priced components in the market

Whether an item should be sourced externally or produced in-house is a matter for the material management and other relevant departments such as finance, design and engineering. This policy has to be reviewed frequently. The decision to produce components in-house is a major one because it means investing capital in a fixed asset (facility), and the decision cannot be reversed once it has been executed.

Coding and Classification

Provision is made by the material management to design and implement a system of classification and coding. All parts and components are classified and unique codes are assigned to each component for the purposes of easy identification. The type of coding and classification embarked upon should be understood by all relevant personnel in the organisation.

Factors to consider when designing coding and classification systems include the following:

i. There must be a uniform and consistent coding and classification system that applies to all items.

ii. It should also include all items currently in use and should have the ability to take up or accommodate new items in the future.
iii. A unique code should be provided for each item. No two items should share the same code, and there should never be two different codes referring to the same item.
iv. Codes should be self-explanatory and understood by all.

Advantages

i. Long descriptions are avoided since each item is described by its own code.
ii. It is possible to accurately identify each item.
iii. There is no duplication of items.
iv. Uniformity is achieved across all departments.
v. It is useful for planning materials' location.

Quality Specification

The desired quality and the cost of producing a product are determined by the material management and other relevant departments. The quality specification forms part of the item's description and is integrated into the code for the item. The quality specification may be in the form of physical or chemical properties or it may be performance-related. Quality specification can also be integrated into Engineering Drawings or Blueprints that describe the item.
Specification of quality may be done in a single or a combinational manner as follows:

i. Through provision of samples/prototypes
ii. Through provision of manufacturing process specification
iii. Use of brand or trade name
iv. Specification of popular market grades
v. Specification of testing procedures and standards
vi. Provision of engineering drawings or blueprints

High-quality specifications are very important to purchasing departments, suppliers, and inspection and testing agencies.

Issues Relating to Purchasing

Centralised versus Decentralised Purchasing

The choice between centralised and decentralised purchasing is of more concern to larger companies, which run multiple plants from a single - or different - location(s). For a large organisation operating multiple plants from a single location, the decentralised purchasing option may be possible but to a limited extent. Both types have several advantages that can be exploited. However, it is sometimes more convenient to combine the two for maximum benefit. When the two approaches are combined, it is advisable to mark the quantities of items required under each category.

Centralised purchasing involves a centralised purchasing department buying all items and then distributing them to other plants of the company at different locations. Decentralised purchasing means that each plant will have to purchase its own components required to manufacture a product.

Advantages of Centralised Purchasing

i. Easy to negotiate favourable prices and terms due to larger quantities of items to purchase
ii. Promotes the establishment of specialised ancillary manufacturers to supply the right quality of components
iii. Easier to administer and control
iv. Fewer personnel required to deal with purchasing, resulting in lower expenditure
v. Easy to develop uniform procedures and minimise administrative tasks, thereby saving time
vi. Testing and inspection can be centralised. This helps to maintain the quality of purchased components
vii. The vendor (supplier) benefits from large-volume orders

Advantages of Decentralised Purchasing

i. Quicker and simpler coordination between purchase department and user departments of individual plants
ii. Purchasing from local suppliers will reduce transport costs and the levels of inventories to be kept
iii. When local suppliers are available, it becomes quicker to readjust requirements
iv. Local control, rescheduling and coordination is much easier and quicker

Single Source and Multiple Source Purchasing

Organisations may opt for a single source or multiple sources to supply them with parts or components. In either case, there are advantages and disadvantages to consider before deciding.

Advantages of Single Source Purchasing

i. There are lower administrative and overhead costs.
ii. There is a higher chance of obtaining discounts on purchases or on transportation of items purchased.
iii. A long-term relationship motivates the supplier to cooperate and improve his services.
iv. It is possible to arrange for scheduling of deliveries and enter into a long-term contract.
v. A single source is ideal if the supplier is the sole manufacturer or can provide items of a higher quality or offers the most competitive price compared to other suppliers.

Adequate development of a single source in the long term can result in a substantial reduction in material costs; this is desirable, especially for construction firms, as it forms a significant percentage of total expenditure.

Advantages of Multiple Source Purchasing

i. Risks associated with dependence on a single supplier are reduced.
ii. Problems experienced by one supplier may not adversely affect the buyer.
iii. It encourages competition among suppliers.
iv. There is flexibility in placing orders.

Vendor/Ancillary Development

In situations where a large consignment of items is required from the market, a parent company might set up ancillaries to produce and supply them with the items. Any surplus from the ancillaries is shifted to the market. In some cases, more than one ancillary may be developed to produce a particular item if the volume is quite substantial.

How Parent Companies Develop Ancillary Units

i. Through provision
ii. Through provision of design drawings
iii. By financial arrangements
iv. By providing technical expertise
v. Offering credit facilities
vi. Offering testing facilities as well as quality control
vii. Assisting in procuring raw materials

The dynamic nature of the market and products where new suppliers and substitute materials become available, the changing nature of laws and regulations with regard to the acceptability or non-acceptability of some materials, changes in product specifications etc, require that vendor performance be reviewed frequently since performance is not always consistent.

Size and Timing of Purchase Order

It is necessary to determine the quantity of items that need to be ordered and work out the most suitable time to place the order. This requires coordination between several functions across the organisation including stores and inventory keeping, suppliers' readiness and capability, production schedules, reliability issues, and time lags, etc.

Materials and items have different levels of importance to the organisation. Some have critical uses and are regarded as extremely important while others may be less important. Consequently, items purchased are classified and stored based on their relative importance according to the following classification system:

ABC Class Analysis

This is based on the total value of consumption of the item. There are three main categories: Class A, Class B and Class C.

Class A items

These are subject to the highest level of control and management. They consist of 10-15% of the total value of items which make up 60-80% of the total annual consumption value of all items.

Class B items

Class B items have medium-level supervision and management control. They make up 15-20% of total annual items and cost 15-20% of the total annual value of all items purchased.

Class C items

These are normally not subject to tough control management because they are not of a sufficiently high value to warrant significant attention.
Economic Order Quantity (EOQ) mathematical models can be used to determine the quantity, frequency of purchase and safety stock of class A and B items.

HML

HML classification refers to High, Medium and Low classification based on the importance of price per unit for items. Management usually determines the levels of price per unit at which items should be classified as H, M or L. Items classified as 'H' have the highest control supervision followed by 'M' and finally 'L'. Guidelines for dealing with each category of items are provided by management.

VED

Items or parts may also be classified using the VED (Vital, Essential, and Desirable) system during production. The most important items are those without which production would stop and these are classified as 'V'. Categories labelled as 'D' and 'E' include items whose absence would only affect production to a limited extent but not bring it to a standstill. The expertise of personnel working in production is valuable in identifying items and classifying them with the help of a formulation matrix.

FSN

The rate of item movement from the store can also be used for classification purposes. FSN denotes Fast-moving, Slow-moving and Not-moving. Measurements using this system are based on the time elapsed since an item was last retrieved from the store. Fast-moving parts should be reviewed frequently in order that new purchase orders might be dispatched for parts to be replenished. Slow-moving parts, on the other hand, should be reviewed for the purpose of getting rid of some of them.

Vendor Rating

Poor vendor performance may cause uncertainties with regard to scheduled deliveries and the quantity and quality of items to be expected from them. Any interruption to the buyer's production process due to delays or low-quality parts will cause production costs to increase as a result of resorting to emergency supplies from elsewhere.

To avoid disruption to the production process, the purchasing organisation needs to develop a comprehensive vendor performance assessment procedure to serve as a guide to procuring reliable services.

Frequent reviews of vendor performance improve the performance of the material management and production departments. Vendor rating procedures have been developed to assess vendors based on some well-defined factors. The factors chosen depend on the parts, the production schedule, and the production process among others.

Factors may include the following:

i. Ability to follow delivery schedules, quantity schedules and specifications
ii. Flexibility and cooperation
iii. Attitude when providing service
iv. Competitive prices and supplier's future capability
v. Technical ability
vi. Availability of testing facility and reliability of test certificates
vii. Competitive delivery cost and overall efficiency and scope of delivery

Rating Methods

Weighted Point Method

The purchasing organisation assigns weights to factors they consider to be vital to them when purchasing items from vendors. The performances of the vendors are then assessed based on these factors and weights are assigned accordingly. The overall weight after the assessment is compared to the benchmark weight and a rating is given to each vendor. The results for all vendors are compared and the best performer is chosen.

For instance, if the company purchasing the items assigns weights of 40%, 20% and 40% to the price, quality and delivery schedules respectively, the overall rating may be calculated according to the equation:

$$rating = (\ lowest\ market\ price)/(Price\ of\ vendor) \times 0.4 + (no.of\ lots\ accepted\ )/(no.of\ lots\ supplied$$

Checklist Method

This method involves circulating a checklist of questions on specific factors to the relevant departments to provide their assessment. The results are collated to arrive at a final rating for each vendor.

Critical Incident Method

Past significant events experienced when dealing with vendors are recorded. Events may include all incidents that affected production in one way or another. Events such as delays in delivery or defective items are noted against each vendor. Overall assessment is carried out to arrive at ratings for the vendors.

The aim of classification and rating systems is to assist the material management department to provide adequate control, supervision and management only of critical items of high value and importance since companies dealing with thousands of items may not have the means to monitor all of them.

Quality Assurance of Incoming Materials

The purchasing, engineering and production departments work as a team to certify the quality of purchased materials. Therefore, it is important to include exact specifications in purchase orders. The supplier is also expected to understand all technical issues pertaining to the order. Nothing should be left to chance. Procedures for conducting tests and inspections must be clearly laid out.
The purchasing department can achieve the required quality by:

- Providing accurate specifications
- Rating quality capability of vendors(suppliers) before placing orders
- Carrying out regular testing and inspections at suppliers' facilities
- Ensuring that the supplier provides certification for all dispatched items (no excuses should be accepted)
- Ensuring damages are avoided by employing the right system of transportation and secure packaging and providing proper storage when delivery has been received.
- Insisting on approved certificates for the quality and quantity expected at the receiving point to facilitate release of payment
- Reviewing quality specifications regularly and informing relevant parties in advance of any changes

Undertaking the procedures listed above will ensure that parts and the end product are of the desired quality.

Issues Relating to Storage and Material Handling

Optimum level of inventory

The inventory level should be such that the quantity of items kept is neither too high, to avoid incurring extra costs, nor too low, to avoid shortages.

Location and Layout of Store

The location of the store should facilitate easy receipt and easy accessibility by users. The nature of the store also depends on the type of items being stored. Some items require gadgets to move them. Layout of the storage place depends on factors such as:

- Safety from theft
- Damage prevention
- Easy and safe storage
- Minimising unnecessary handling within the stores
- Using space in stores efficiently
- Quick and easy physical verification of items

Storage System

Good storage facilities should make it easy to store and retrieve items. They should be easily accessible to enable counting and verification and be adjustable to accommodate new items with minimal use of additional material-handling equipment.

The three most popular material location systems are as follows:

Fixed location

Reserved space is provided for one particular item in a specific place which cannot be used for any other item. A code may be designed to include specific locations for particular items.

Random location

In this type of system, items may be stored in any vacant location. This makes it difficult to locate certain items. Moreover, one type of item may end up in more than one place, which can create difficulties during stock checking and retrievals.

Zoned Location

Items of a particular category are grouped together and stored in an area reserved for this group of items. The individual parts or items can then be stored using the fixed or random location system. Stacking and shelves are useful in this system.

Receiving Inspection Record Keeping

Materials arriving at the stores should be professionally inspected for quantity and quality according to standard procedures. Visual inspection results should match the data specified by the purchase orders as well as the specifications on the documents that accompanied the delivery. Testing should be carried out according to predefined standards and the good items separated from the bad.

Accurate records of all transactions and related issues should be kept for store accounting, checking stock levels, account reconciliation and cost accounting, and to assist in providing information for planners and decision-makers.

Material Handling and Equipment

The whole production process should be designed in a way that will reduce unnecessary handling of materials or items throughout the production plant as well as within the storage area itself. The aims of material handling and equipment include:

- Minimisation of cost of handling materials
- Maintaining effective flow of materials
- Ensuring safety of materials during movement and reducing damage and accidents
- Minimising the time taken to move items around
- Ensuring compatibility of equipment and materials

Integrated Materials Management Approach

From previous discussions, we understand that material management consists of diverse aspects such as purchasing, planning, receiving, storing, inventory management etc. When some of these functions are operated independently, conflicts of interest occur. For instance, if the purchasing department orders a lot of materials because of the attractive discount rates on offer without considering how effectively these items might be stored, it creates problems for the storage and inventory departments. Therefore, it is important to balance conflicting objectives to achieve the optimum results by considering the needs of the whole organisation rather than each individual unit in isolation.

The integrated approach of material management requires the material manager to be responsible for all interrelated aspects of the organisation by exercising control and coordinating the activities of individual departments. By integrating the various functions under a central materials manager, the integrated approach makes it possible to transmit large chunks of data efficiently and more rapidly while also uniquely identifying activities for each department. Routing all the functions of each individual departmental unit through a common material management hub makes it easier to coordinate and control all functions in an optimal manner using sound principles and applications.

Advantages

I. Better Accountability

Better accountability is achieved by centralising authority and responsibility for every aspect of material management. Problems can be quickly resolved from a central point and performances objectively evaluated.

II. Better Coordination

The integrated approach encourages better relations and trust between the material management and user departments because all problems are dealt with at a central point. There is, therefore, better support and cooperation.

III. Better Performance

Communication is fast between various departments, resulting in speed and accuracy in administrative and production matters. Swift collection, collation and analysis of data is important for making good decisions on time to reduce costs, stocks and lead times and to provide excellent inventory turnover and cut down on paperwork.

IV. Adaptability to EDP (Electronic Data Processing

It is easy to introduce advanced EDP under the integrated approach at an affordable cost due to its centralised characteristics which facilitate collection, collation and analysis of data for timely decision-making.

V. Other Advantages

With the integrated approach, there are more opportunities for human resource growth and development due to individuals being exposed to a wider range of all aspects of material management. Team spirit and cooperation are also nurtured under this scheme.

Material Management in Construction

Construction involves erecting a structure to serve a unique purpose. When constructing simple structures, only simple materials are required. Complex structures, on the other hand, require special materials or components, complex machinery and equipment, and a diverse workforce.
Materials, labour and fuel are the vital components in the erection of structures. It is important to ensure a continuous flow of materials at an optimal rate to prevent the project and labour coming to a halt.
Although it is necessary to have guaranteed levels of these three main resources available, the supply of these resources is managed in phases during the lifespan of the project. Money earmarked for securing materials later on in the course of the project would have to be locked up for a long while before being released. This presents the temptation to use it for other ventures but such temptation must be resisted.
Materials such as bricks, steel items of various sorts, ceramics, paints, plumbing, electrical cables and glass account for a high percentage of costs. It is common to award the construction contract to a contractor who will undertake the material management at the site. But recent trends show a tendency

to entrust material management to large companies engaged in a large number of construction projects to supply each project with necessary materials from centralised stores.
Construction material management is the art and science of arranging the procurement and purchase of construction materials in an organised manner such that the right quality and quantity are obtained and delivered at the right time.
In construction projects, the fundamental requirement for producing a structure is the availability of materials. There should be an adequate supply of materials at the optimum rate throughout all phases of the project. This means that sources of supply must be very reliable to ensure continuous flow and prevent stoppages which tend to delay the project as well as inflate the cost of production due to idle labour and equipment.
Construction material components vary from one piece of work to another. The cost of some vital components can be estimated from experience. In terms of total material costs for ordinary buildings, bricks usually account for 14-16% of the cost, while cement and steel account for about 40-50%.
With roads, aggregate forms 50% of the total cost whereas the construction of a concrete bridge would mean steel and cement accounting for 50-65% of the cost. Steel used for constructing a steel bridge makes up 75% of costs. Pipes and fittings account for 80% of costs when constructing a water supply system. Considering the importance of materials and the costs of acquiring them, it is imperative to ensure proper planning, procurement, purchase and storage to meet the required quality specifications of the end product.
Good planning of the cost component of materials will ensure the availability of the materials during successive phases of the project by making adequate capital available to cover the entire project lifespan. By ensuring a continuous flow of good-quality materials delivered on time, and by having healthy competition among suppliers, material planning becomes an efficient and easy activity to undertake and it may even become redundant when everything is flawlessly synchronised.
We examine each essential component of construction below:

Material Costs

Materials used for modern construction work may come in raw, semi-processed or completely processed forms. Sand and stone come in raw condition, while timber sections and stone slabs are usually semi-processed. Complex factories produce fully processed materials such as bitumen, glass, tiles etc., using energy, and the associated costs depend on the level of sophistication of the process used to create the materials.
Materials that incur higher costs must be handled with care and should be readily available to ensure the desired end product. The material procurement approach to use will differ from one project to another, with varying costs. For instance, during the construction of a road, aggregates account for about 70% of the cost and these are normally supplied along the length of the road. Bitumen requirements for roads may constitute about 65% of the total cost, and this could be supplied by an agency specialising in petroleum materials.
The type of work being undertaken usually determines the principal component and the optimum manner in which this component should be supplied. There are instances when certain materials that do

not form part of the bill of quantities will be required during the course of projects. Examples of such essential components include truck tyres or explosives for steep-gradient road construction.
Carefully planned procurement procedures should be used to obtain materials such as steel, cement and brick, which form about 65% of the overall material costs.

Labour Costs

Labour costs are incurred by the contractor when paying workers from his own financial resources. For a road constructor, the cost of breaking stones at the quarry may not be as important as the cost associated with spreading materials on the road. The extent of mechanisation employed also affects the cost of labour. Mechanisation tends to reduce the cost of labour significantly, and recent trends show that many companies are moving in this direction.
Labour costs tend to be high for finishing work towards the end of the project. Labour costs for standard work can range from 0% to 25%, but may differ significantly, depending on the qualifications of workers and the nature of the work. Careful planning is required for labour, bearing in mind the desired output.

Different Category	Percentage
Skilled labour on building structure	45% of total labour cost
Unskilled labour on building structure	25% of total labour cost
Plumbing labour on building structure	3% of total labour cost
Glazing labour on building structure	1.70% of total labour cost
Electrical engineering labour on building structure	7.80% of total labour cost
Mechanical engineering labour on building structure	10.30% of total labour cost
Steel work labour on building structure	7.20% of total labour cost
TOTAL	100.00%

Table 7.2 Costs components for different categories

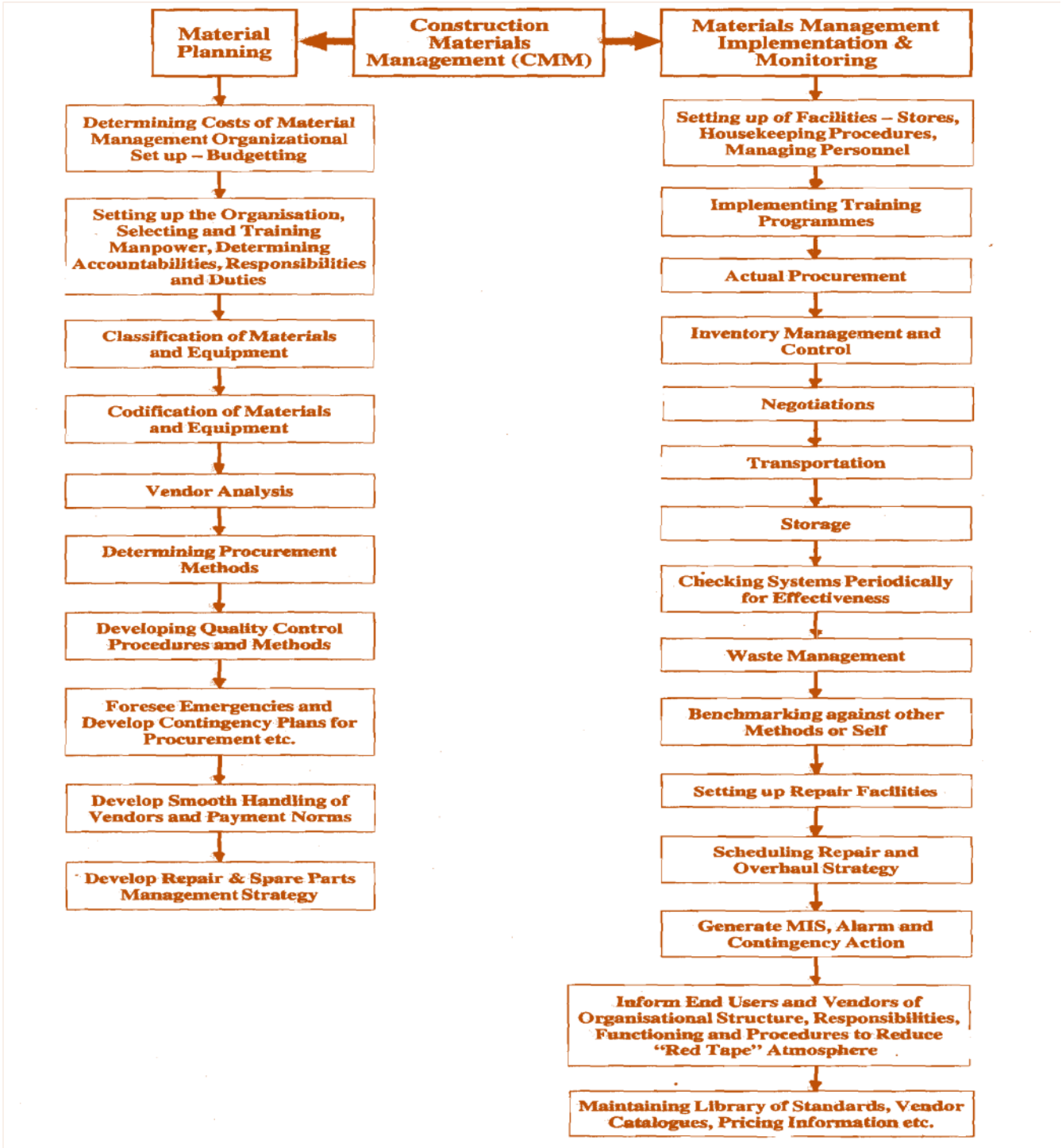
Therefore, it is necessary to plan the category of workers for each piece of work, judging the quality of work needed, importance of the work and the quality of raw materials procured for the work.

Special Material Costs

There are certain materials which do not appear in the bill of quantities but which are nonetheless very important requirements during the course of the project. Items such as spare parts for machines are critical components of the whole process and should be readily available for hire or purchase to ensure that the work flows without interruption.

Summary of Components of Modern Construction Material Management

There is no standard set of activities for all construction projects in terms of project management, procurement etc. However, a general outline for most activities is presented in the following flow chart:


Construction Materials Management (CMM)
Material Planning
Determining Costs of Material Management Organizational Set up – Budgetting
Setting up the Organisation, Selecting and Training Manpower, Determining Accountabilities, Responsibilities and Duties
Classification of Materials and Equipment
Codification of Materials and Equipment
Vendor Analysis
Determining Procurement Methods
Developing Quality Control Procedures and Methods
Foresee Emergencies and Develop Contingency Plans for Procurement etc.
Develop Smooth Handling of Vendors and Payment Norms
Develop Repair & Spare Parts Management Strategy
Materials Management Implementation & Monitoring
Setting up of Facilities – Stores, Housekeeping Procedures, Managing Personnel
Implementing Training Programmes
Actual Procurement
Inventory Management and Control
Negotiations
Transportation
Storage
Checking Systems Periodically for Effectiveness
Waste Management
Benchmarking against other Methods or Self
Setting up Repair Facilities
Scheduling Repair and Overhaul Strategy
Generate MIS, Alarm and Contingency Action
Inform End Users and Vendors of Organisational Structure, Responsibilities, Functioning and Procedures to Reduce "Red Tape" Atmosphere
Maintaining Library of Standards, Vendor Catalogues, Pricing Information etc.

Further Reading:

- ✓ **Peter Fewings (2013),** ***Construction Project Management: An Integrated Approach***
- ✓ **K. Datta (1995),** ***MATERIALS MANAGEMENT: PROCEDURES, TEXT AND CASES***