

DIRECTORATE OF DISTANCE & CONTINUING EDUCATION

MANONMANIAM SUNDARANAR UNIVERSITY

TIRUNELVELI- 627 012



BBA Course material

PRODUCTION AND MATERIAL MANAGEMENT

Prepared by

Dr. MARIMUTHU, KN

Assistant Professor

Department of Management Studies

Manonmaniam Sundaranar University

Abishekapatti, Tirunelveli - 627012.

Production and Material Management

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UNIT - I

1.0 Introduction

Production and Material Management are two interrelated and essential functions of any manufacturing or service organization. Together, they ensure that the organization's resources are efficiently utilized to produce goods and services that meet customer needs in terms of quality, quantity, cost, and time. In today's competitive business environment, organizations must produce high-quality products at the lowest possible cost while maintaining flexibility to meet changing market demands. This requires proper planning, coordination, and control of all production activities and material movements - which is precisely the role of Production and Material Management. It focuses on the process of converting raw materials and inputs into finished products using men, machines and methods. It is concerned with designing, planning, scheduling, and controlling production operations to achieve efficiency and effectiveness. Material Management, on the other hand, deals with the systematic control of materials - from their initial purchase to their final use in production. It ensures that the right materials are available at the right time and place, in the right quantity and quality, to facilitate uninterrupted production. Both functions are closely linked: efficient production cannot take place without a proper material supply, and material management is meaningless without a well-planned production system. Thus, Production and Material Management together contribute significantly to cost reduction, productivity improvement, quality assurance and customer satisfaction.

1.1 Meaning

Production Management refers to the process of planning, organizing, directing, and controlling all the activities related to the production of goods and services. It involves transforming raw materials and other inputs into finished products in the most efficient, economical, and timely manner.

In simple terms, Production Management means managing the production process so that the desired output (product or service) is produced at the right time, in the right quantity, with the right quality, and at minimum cost.

1.1.0 Definitions of Production Management

E. F. L. Brech

Production Management is the process of effective planning and regulating the operations of that section of an enterprise which is responsible for the actual transformation of materials into finished products

Joseph G. Monks

“Production Management is the process of effectively planning and regulating the operations of that part of an enterprise which is responsible for the actual transformation of materials into finished products.”

William J. Stevenson

“Production Management is primarily concerned with the effective utilization of resources materials, machines, and labour -to produce goods and services of the desired quality at the right time and cost.”

1.2 Scope of Production Management

1. Product Design and Development

It involves designing a product that meets customer needs, is cost-effective, and can be easily manufactured. Activities include research, product specifications and prototype development.

2. Process Design

Selection of the best production process, technology, tools and equipment for manufacturing the product. It ensures efficiency and consistency in production operations.

3. Plant Location and Layout

Choosing the most suitable location for setting up the plant based on availability of resources, market, transportation, etc. Designing the layout of machinery, equipment and departments to achieve smooth workflow and minimal material handling.

4. Production Planning and Control (PPC)

It includes planning production schedules, determining production capacity, and ensuring that production takes place according to plan. Planning, Routing, Scheduling, Dispatching, and Follow-up are key elements of PPC.

5. Maintenance Management

Ensuring that all machines and equipment are properly maintained to prevent breakdowns and production delays. It includes preventive, predictive, and corrective maintenance.

6. Quality Control and Assurance

Maintaining and improving product quality according to set standards. It involves inspection, testing and quality improvement programs like TQM (Total Quality Management).

7. Inventory Control

Managing raw materials, work-in-progress, and finished goods to ensure that there is neither shortage nor excess. It helps in reducing holding costs and ensuring smooth production.

8. Cost Control

Monitoring and reducing production costs through better resource utilization, waste reduction, and improved productivity.

9. Research and Development (R&D)

Continuous innovation in products and processes to improve performance and stay competitive in the market.

1.3 Function of Production Management:

The functions of production management are essential for coordinating various production activities efficiently. These functions ensure that manufacturing processes run smoothly, products meet quality standards, and resources are used effectively. Here are the key functions of production management:

1. Planning

This includes choosing the objectives of the production, the strategies to reach these objectives, the necessary resources and the production schedule. Demand forecasting, estimating production capacity, and schedule-setting are other aspects of planning.

2. Organising

Creating the organizational and physical framework required for production. This includes how physical facilities including machinery and equipment are arranged as well as the organizational structure that controls the authority and information flow.

3. Staffing

It includes recruiting and educating the labor force required for manufacturing tasks. It guarantees that the manufacturing division is staffed with qualified workers to manage a variety of duties from quality control to machine operation.

4. Directing

Leading the workers and assisting them in performing effectively through communication and encouragement are part of this role. By providing direction, managers may make sure that staff members understand their roles and duties and are productively achieving their goals.

5. Controlling

Make sure that the manufacturing process is meeting performance goals and standards by keeping an eye on it. This involves managing inventory levels, controlling costs and ensuring quality. Adjustments are done when actual results differ from projected results.

6. Coordinating

Ensuring that many sectors and departments collaborate to achieve the shared production objectives. To keep things running smoothly this involves coordinating the efforts of other departments including sales, production, and procurement.

7. Decision Making

Making decisions to increase production efficiency based on analytics and data. This includes strategic decisions for which product lines to provide, using new technologies, and simplifying procedures.

8. Budgeting

Allocating funds to different production tasks while making sure that expenses stay under budget and that the manufacturing process is cost efficient.

1.4 Objectives of Production Management:

The main objectives of production management are to produce goods and services of the right quality and quantity, at the right time, and at the right cost. This is achieved by ensuring the efficient utilization of resources like labor, materials, and machinery, which ultimately aims to increase overall productivity and profitability.

Right Quality:

Producing goods that meet customer needs and specifications, without necessarily being the "best" quality possible, which could lead to excess costs.

Right Quantity:

Producing the exact amount of a product needed to meet demand. Producing too much can tie up capital in inventory, while too little can lead to lost sales.

Right Time:

Delivering products to customers promptly and meeting deadlines, which is crucial for customer satisfaction and trust.

Right Cost:

Manufacturing products at or below the pre-established cost to minimize waste and maximize profit.

Efficient Resource Utilization:

Optimizing the use of all available resources, including labor, machinery, and materials, to minimize waste and maximize output.

Productivity and Capacity Optimization:

Maximizing the amount of output from a given set of resources while minimizing consumption.

Continuous Process Improvement:

Encouraging a culture where employees are always looking for ways to identify and eliminate inefficiencies.

Cost Reduction:

It continuously working to lower production a cost, which in turn increases profitability.

1.5 Production System:

The production system of an organization is that part, which produces products of an organization. It is that activity whereby resources, flowing within a defined system, are combined and transformed in a controlled manner to add value in accordance with the policies communicated by management. A simplified production system is shown below.

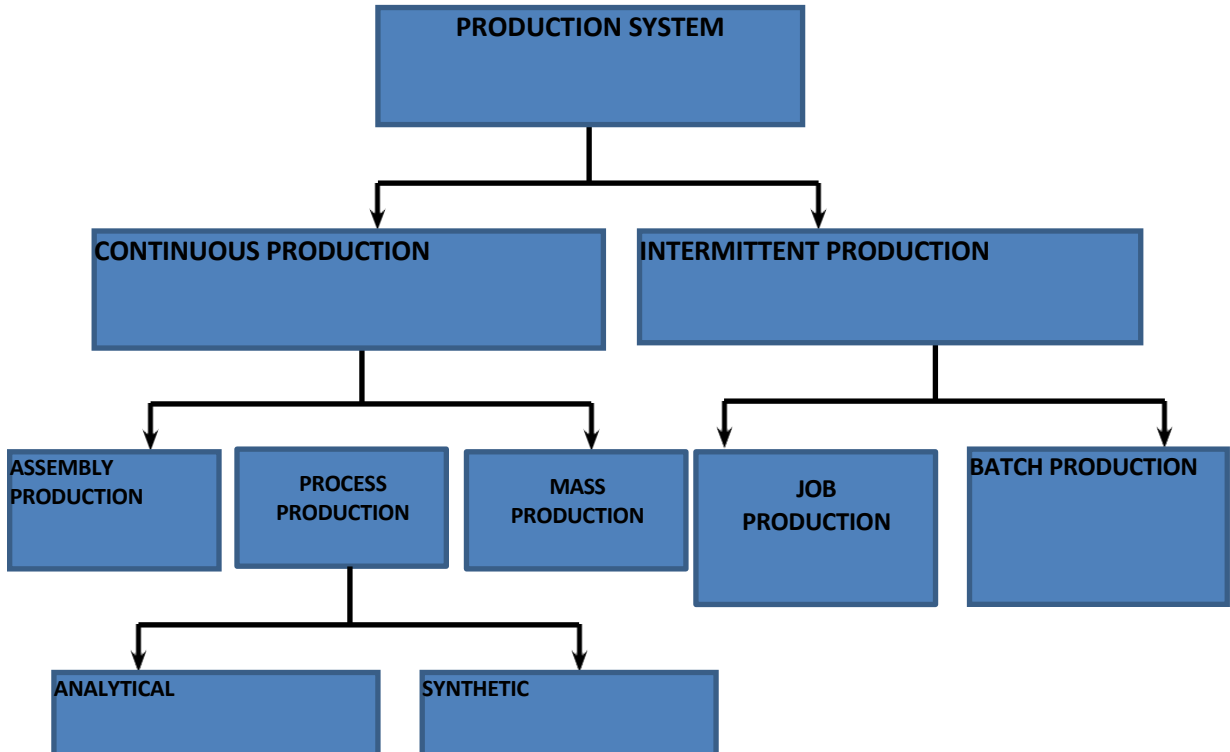


Fig 1.1: Types of Production System

The production system has the following characteristics:

1. Production is an organized activity, so every production system has an objective.
2. The system transforms the various inputs to useful outputs.
3. It does not operate in isolation from the other organization system.

4. There exists feedback about the activities, which is essential to control and improve system performance.

A. Continuous Production

Production facilities are arranged as per the sequence of production operations from the first operations to the finished product. The items are made to flow through the sequence of operations through material handling devices such as conveyors, transfer devices, etc.

- Dedicated plant and equipment with zero flexibility.
- Material handling is fully automated.
- Process follows a predetermined sequence of operations.
- Component materials cannot be readily identified with final product. e.
- Planning and scheduling is a routine action.

Advantages of Continuous Production:

The advantages of continuous production include high efficiency and productivity, consistent product quality, and lower costs due to economies of scale. This system minimizes downtime, reduces waste, and allows for better resource and energy utilization. It also leads to a higher output rate, reduced labor costs per unit, and a more predictable supply chain.

Efficiency and Productivity

Higher output: Continuous production runs 24/7, eliminating the start-up and shutdown time associated with batch production and leading to higher volumes in a shorter time.

Reduced downtime: Eliminating pauses between processes means machines and operators have less idle time, creating a smoother and more uninterrupted workflow.

Improved resource utilization: Automated systems precisely control the flow of materials, which minimizes waste, scrap, and energy consumption.

Cost Savings

Lower unit cost: Spreading fixed costs over a higher production volume decreases the cost per item.

Reduced labor costs: Automation often reduces the number of workers needed per shift.

Lower carrying costs: Materials move directly into production, and finished products are shipped quickly, which reduces the need for large inventories and storage space.

Product Quality

Consistency: The highly automated and consistent process minimizes the risk of human error and ensures the final product is uniform in quality.

Better process control: Continuous monitoring allows manufacturers to identify and address issues quickly, ensuring the product meets quality standards.

Other Benefits

Increased worker safety: Automating material handling can reduce strenuous or dangerous tasks for employees.

Simplified supply chain: Reduced dependency on bulk storage can lead to a more agile and resilient supply chain

1. Mass Production

Manufacture of discrete parts or assemblies using a continuous process are called mass production. This production system is justified by very large volume of production. The machines are arranged in a line or product layout. Product and process standardization exists and all outputs follow the same path.

Characteristics of Mass Production

1. Standardization of product and process sequence.
2. Dedicated special purpose machines having higher production capacities and output rates

3. Large volume of products.
4. Shorter cycle time of production.
5. Lower in process inventory.
6. Perfectly balanced production lines.
7. Flow of materials, components and parts is continuous and without any back tracking.
8. Production planning and control is easy.
9. Material handling can be completely automatic.

Advantages of Mass Production

1. Higher rate of production with reduced cycle time.
2. Higher capacity utilization due to line balancing.
3. Less skilled operators are required.
4. Low process inventory. e. Manufacturing cost per unit is low.

Limitations of mass production

- 1 Breakdown of one machine will stop an entire production line. .
- 2 Line layout needs major change with the change

2. Process Productions

Process manufacturing is the production of goods that are typically produced in bulk quantities, as opposed to discrete and countable units. Process manufacturing industries include chemicals, food and beverage, gasoline, paint and pharmaceutical.

What is Process Manufacturing?

Process production offers advantages such as cost savings through bulk production and efficiency, increased output via continuous or automated processes, and consistent quality due to standardized recipes and reduced human error. This method also allows for better scalability, improved inventory management and reduced waste and emissions.

Efficiency and cost savings

Economies of scale: Producing large quantities of a product lowers per-unit costs, as demonstrated by bulk purchasing of raw materials and streamlined production lines.

Lower labor costs: Automation and standardized processes can reduce the need for extensive manual labor, leading to lower labor costs and higher profit margins.

Reduced waste: Efficient processes and optimized inventory management minimize waste and the cost associated with storing excess materials.

Quality and consistency

Standardized products: By using formulas or "recipes," process manufacturing creates standardized products, which minimizes human error and ensures consistency in quality.

Improved quality control: The standardized nature of the process allows for easier monitoring and control over quality at each stage.

Scalability and flexibility

Increased scalability: Continuous processes allow for high-volume production, making it easier to scale up or down based on demand.

Improved lead times: Streamlined and optimized processes reduce production lead times, allowing for faster delivery to customers.

Other benefits

Reduced environmental impact: Efficient production processes can lead to reduced waste and lower emissions.

Enhanced employee morale: Clear and standardized processes can reduce confusion and frustration among employees, leading to improved morale and efficiency.

Better resource management: Process-based systems make it easier to track and allocate resources precisely where and when they are needed.

1.6 Types of Process Production:

It has two types.

a) Analytical and

b) Synthetic.

Analytical Process

In Analytical Process of production, a raw material is broken into different products e.g. crude oil is analysed into gas, naphtha, petrol etc. Similarly, coal is processed to obtain coal gas, coal tar etc.

Synthetic Process

Synthetic Process of production involves the mixing of two or more materials to manufacture a product for instance, lauric acid, myristic acid, stearic acid are synthesised to manufacture soap.

3. Assembly Production

Assembly line a type of flow production which is developed in the automobile industry in USA. A manufacturing unit prefers to develop and employ assembly line because it helps to improve the efficiency of production. In an assembly line, each machine must directly receive material from the previous machine and pass it directly to the next machine. Machine and equipment should be arranged in such a manner that every operator has a free and safe access to each machine. Space should be provided for free movement of forklifts trucks etc. which deliver materials and collect finished products.

B. Intermittent Production System

Intermittent Production System According to Buffa, Intermittent productions are those where the facilities must be flexible enough to handle a variety of products and sizes or where the basic nature of the activity imposes change of important characteristics of the input (e.g. change. in the product design). In instances such as these, no single sequence pattern of operations is appropriate, so the relative location of the operation must be a compromise that is best for all inputs considered together. In the industries following the intermittent production system, some components may be made for inventory but they are combined differently for different customers. The finished product is heterogeneous but within a range of standardized options assembled by the producers. Since production is

partly for stock and partly for consumer demand, there are problems to be met in scheduling, forecasting, control and coordination.

1 Batch Production

Batch production is defined by American Production and Inventory Control Society (APICS) as a form of manufacturing in which the job passes through the functional departments in lots or batches and each lot may have a different routing. It is characterized by the manufacture of limited number of products produced at regular intervals and stocked awaiting sales.

Characteristics of Batch Production:

1. When there is shorter production runs.
2. When plant and machinery are flexible.
3. When plant and machinery set up is used for the production of item in a batch and change of set up is required for processing the next batch.
4. When manufacturing lead time and cost are lower as compared to job order production

Advantages of Batch Production:

1. Better utilization of plant and machinery.
2. Promotes functional specialization.
3. Cost per unit is lower as compared to job order production.
4. Lower investment in plant and machinery.
5. Flexibility to accommodate and process number of products.
6. Job satisfaction exists for operators.

Limitations of Batch Production:

1. Material handling is complex because of irregular and longer flows.

2. Production planning and control is complex.
3. Work in process inventory is higher compared to continuous production. d. Higher set up costs due to frequent changes in set up.

2. Job Shop Production

Job shop production are characterized by manufacturing of one or few quantity of products designed and produced as per the specification of customers within prefixed time and cost. The distinguishing feature of this is low volume and high variety of products. A job shop comprises of general purpose machines arranged into different departments. Each job demands unique technological requirements; demands processing on machines in ascertain sequence.

Characteristics of Job Production

1. High variety of products and low volume.
2. Use of general purpose machines and facilities.
3. Highly skilled operators who can take up each job as a challenge because of uniqueness.
4. Large inventory of materials, tools, parts.
5. Detailed planning is essential for sequencing the requirements of each product, capacities for each work centre and order priorities.

Advantages of Job Production

1. Because of general purpose machines and facilities variety of products can be produced.
2. Operators will become more skilled and competent, as each job gives them learning opportunities.
3. Full potential of operators can be utilized.
4. Opportunity exists for creative methods and innovative ideas.

Limitations of Job Shop Production

1. Higher cost due to frequent set up changes.
2. Higher level of inventory at all levels and hence higher inventory cost.
3. Production planning is complicated.
4. Larger space requirements.

1.7 Product Design

Design of a product means determining the shape, standard, and pattern of the product. It includes specification, experimental, development work, calculation of estimates etc.,

1.7.1 Stages of Product Design:

1. Conception
2. Acceptance
3. Execution
4. Evaluation and Review of Design
5. Translation
6. Production

1. Conception

It is the first stage and the most importance stage in any product design. A draft specification is prepared at this stage by the marketing department consultation with the design department

2. Acceptance

Draft specification prepared earlier is scrutinized for its viability by subjecting it to all possible calculations model making, preliminary drawing, laboratory scale processes,

etc, if it is not accepted, it may have to be modified or rejected and such decisions are taken jointly by design and marketing department.

3. Execution

In this stage involves the conversion of design specifications into drawings to build the prototype model should be a true replica of the proposed new product satisfying all the requirements of the customer.

4. Evaluation

The design is evaluated by a cross functional team having representatives from finance, marketing manufacturing and service department to achieve optimal design (the overall best combination of product qualities at the lowest per unit production cost)

The design is reviewed to ensure that all requirements of the product such as function, aesthetics (appearance), materials and process alternatives, and their cost, economic assembly, repair and maintenance, lead time required for installing the new process and training the labour etc, are met by the product design.

5. Translation

In this stage based on the experiences in the previous stages, the detailed engineering drawings for parts, subassemblies, final assemblies, parts lists etc., are prepared. These documents are known as provisional design documents which take into account the productivity aspects of the design. Also detailed estimates of costs are prepared at this stage

6. Preproduction

A pilot production run is carried out using the provisional design documents and the producibility aspect in this stage. Based on the experience gained in pre-production, the provisional design is modified in to final design approved for bulk production later

1.7.2 Characteristics of a Good Product Design:

1. Function

A product can be sold if it meets the needs of the consumer and as such the product must be designed to meet such needs

2. Reliability

It is the probability that there will not be any major failure of the product during its use.

3. Maintainability

The lubrication points and other areas for servicing of the product to be designed ought to be easily accessible even though the physical form may have to be altered a bit.

4. Producibility

A product should be designed in such a manner that it can be produced easily at a reasonable cost. Least number of operations are required to produce a product quickly and cheaply. This may be possible with change in technology.

5. Simplification

Simplification and producibility go hand in hand the simpler the design of the product, the simpler the design of the product, the easier it is to produce, the lesser it costs and more reliable it is.

6. Product standardization and variety reduction

It refers to the design activity that reduces variety among a group of products or parts.

7. Specification

A detailed description of a material part or product, including physical measures such as dimensions, volume, weight, surface finish etc.

8. Safety

The product must be safe to the user and should not cause any accident while using or should not cause any health hazard to the user. Safety in storage, handling and usage must be ensured by the designer and a proper package has to be provided to avoid damage during transportation and storage of the product.

9. Appearance

This includes the style, colour, look, feel etc., which appeals to the human sense and adds value to the product.

10. Availability

This refers to the continuity of service to the customer. A product is available for use when it is in an operational state. Availability is a combination of reliability and maintainability.

1.8 Types of Product Design:

1. Functional design

Functional design involves developing an idea into a rough model of the proposed products

2. Aesthetic design

Before production on a commercial scale is undertaken another type of design must be integrated with the functional design and its aesthetic design for market acceptability.

3. Production design or product design

The functional design is translated into production design to make it easy for manufacturing.

4. Packing design

Packing design should also be appealing to the consumers depending upon the size and nature of the product. Different packing materials can be used to suit the consumer's taste and to maintain the chemical properties of the product.

1.9 Process planning

Process planning is concerned with planning the conversion processes needed to convert the raw material into finished products. Process planning is also known as process designing.

1.9.1 Procedure for Process Planning

1. Product Design

Designing a process begins with the consideration or a careful review of the product design and specifications to ensure that economical manufacturing is feasible.

2. Material List

All the materials and parts that will be used are listed. The standard quantity of each item that will be required for manufacturing one unit of final product should be determined.

3. Sequence of Operations

The labour operations to be performed on each component and their sequences are decided. The sequence should be such that it will permit the desired rate and quality of output at the optimum manufacturing cost.

5. Tool Design

The machines, equipment's and tools most appropriate for the product and volume of output are the 4 designed. Machine setting e.g.: speed, temperature, pressure are also decided at this stage.

6. Layout

The layout of production, installation of manufacturing facilities and auxiliary services is decided.

7. Control System

Necessary control of materials, machines and manpower is established to ensure effective utilization of the manufacturing facilities and most economical production of the product.

1.10 Plant Location

Plant location is the process of determining a geographical site for a firm's operations achieving maximum operating economy and effectiveness. The degree of significance for the selection of location for any enterprise mainly depends on its size and nature.

Importance of Plant Location

1. Location of the plant partially determines the operating and capacity costs. It determines the nature of investment cost to be incurred and also the level of many operating costs
2. Each prospective location implies a new allocation of capacity to respective market area
3. Location fixes some of the physical factors of the overall plant design etc., heating and ventilation requirements, storage capacity for raw materials taking into consideration their local availability, transportation needs for raw materials and finished goods, power needs, cost of labour, taxes, land construction etc.,
4. Location helps to deliver the product at a cheaper price and thus helps a combat competition.

Objectives of Plant Location

1. Reduced capital investment and operating cost
2. Ensuring effective plant layout

3. Coordination with government policies
4. Employee welfare and public needs
5. Security

Factors influencing Plant location

A. Factors related to buying

1. Nearness to raw materials

The cost obtaining raw materials is an influencing factor on location. The importance of nearness to raw materials varies greatly with the nature of the business.

2. Accessibility to raw materials

The presence in abundance of any material is not sufficient in itself finalizing the location. The location must also be easily available

B. Factors related to manufacturing

1. Availability of Labour

Labour supply refers to the number of skilled and unskilled persons who are available for the kind of work to be done.

2. Nearness to Source of Power

The sources of energy for running the wheels of industry have a decisive influence in a plant location and the development of industrial centres.

3. Availability of services

Services include gas, electricity, water, drainage, disposal of wastes, communication etc. These services should be available with considerable quantity.

4. Readily accessibility to repair shop

The factor is important mainly in case of small scale industries with plenty of orders on hand and a breakdown of its machinery will incur loss in business and being down its image.

5. Availability of amenities

A location which provided good external amenities housing, shops, community services, communication systems – is often more attractive than one which is more remote. One important amenity in connection to the transport such as buses, trains etc.

6. Transport and communication

The next important factor is transport cost. It is possible to obtain raw materials and market finished goods only with the help of an effective transport network.

7. Safety Requirements

Some production units may present, or may be believed to present potential dangers to the surrounding neighbourhood for example nuclear power stations, chemical and explosives factories are often considered dangerous.

8. Adequate fire fighting facilities

Fire may originate from within or outside the plant. Internal fire can be controlled with fire fighting appliances but it's difficult to control agencies causing fire from outside.

9. Availability of Educated Personnel and Research facilities

New industries as well as the development and expansion of those already established hinge on research and investigation to develop products and improve methods.

10. Ability to build and expand plant capacity

A plant has to be built in such a way that the manufacturing processes are carried on with minimum expenditure of time and material.

11. Political stability

A government influences the development of industry by providing political stability and also subsidies.

12. Suitable soil, climate and topography

Soil and climate have direct bearing upon the type of activity that can be undertaken in any area in its early development

13. Association with other industries

Some manufacturers select locations which are near complementary or subsidiary industries.

14. The momentum of an early start

As a rule, people are likely to have faith in an industry that is being started in a locality where similar ventures have been successful already.

15 Regional regulations

It is important to check at an early stage that the proposed location does not infringe any local regulations

C. Factors related to selling

1. Characteristics of people

All manufacturers exist to supply markets with goods which people buy.

2. Special grants, regional taxes and import / export barriers

Certain government and local authorities often offer special grants, low interest loans for setting up industries in particular locations.

3. Nearness and accessibility to market

The advantages of being near to a market are numerous. A manufacturer can ensure quick and uninterrupted supply of his products at all the times.

Check Your Progress

Choose the Correct Answer:

1. Production Management mainly deals with

- a) Marketing activities
- b) Planning and controlling production processes
- c) Financial activities
- d) Sales promotion

Answer: b

2. Production means

- a) Buying goods
- b) Creating goods and services
- c) Selling goods
- d) Advertising goods

Answer: b

3. The scope of production management includes

- a) Production planning and control
- b) Sales promotion
- c) Advertising
- d) Banking

Answer: a

4. One important function of production management is

- a) Recruitment
- b) Production planning

- c) Pricing
- d) Promotion

Answer: b

5. Job production system refers to

- a) Mass production of identical goods
- b) Production based on specific customer order
- c) Continuous production
- d) Automated production

Answer: b

6. Mass production is suitable for

- a) Custom-made goods
- b) Large scale standardized products
- c) Small batch production
- d) Experimental production

Answer: b

7. Plant location refers to

- a) Size of factory
- b) Place where production facilities are located
- c) Number of workers
- d) Production cost

Answer: b

8. One important factor affecting plant location is

- a) Availability of raw materials

- b) Advertising
- c) Packaging
- d) Branding

Answer: a

9. Process planning mainly involves

- a) Designing production processes
- b) Selling products
- c) Advertising products
- d) Market research

Answer: a

10. Transportation facility is considered while deciding

- a) Plant location
- b) Recruitment
- c) Advertising
- d) Pricing

Answer: a

Small Questions – LOCF Mapping Table

S.No	Small Question	CO	Bloom's Level	PO
1	What is Production Management?	CO1	Remember	PO1
2	What are the functions of production management?	CO2	Understand	PO2
3	What are the different types of production systems?	CO3	Understand	PO3
4	What is meant by plant location?	CO4	Remember	PO4
5	What are the factors influencing plant location?	CO5	Understand	PO5

Big Questions – LOCF Mapping Table

S.No	Big Question	CO	Bloom's Level	PO
1	Explain the meaning, scope and functions of production management.	CO1	Understand	PO1
2	Discuss the different types of production systems.	CO2	Analyze	PO2
3	Explain the concept of production design and process planning.	CO3	Understand	PO3
4	Discuss the concept and importance of plant location.	CO4	Analyze	PO4
5	Explain the factors to be considered while selecting plant location.	CO5	Evaluate	PO5

UNIT - II

LAYOUT

2.1 Introduction:

Layout is the arrangement and organization of elements within a space, whether physical or digital. It can refer to a plan or design for something, like the layout of a building or a website, or the final arrangement of items, such as the placement of text and images on a page. The term also means the process of planning or arranging these things.

A manufacturing facility, also known as a factory or plant, is a location with buildings, machinery, and equipment where tangible goods are produced or assembled from raw materials. These facilities handle various stages of production, such as processing, assembly, quality control and packaging, to create products for sale.

Examples include automobile manufacturing plants where individual car parts are brought together to create a finished vehicle. Continuous production plants: Found in industries such as oil refining and chemicals, these facilities operate 24/7, producing goods in a non-stop process to meet high demand.

Most modern factories have large warehouses or warehouse-like facilities that contain heavy equipment used for assembly line production. Large factories tend to be located with access to multiple modes of transportation, some having rail, highway and water loading and unloading facilities.

2.1.1 Key Components and Functions:

Buildings and space:

Typically consists of one or more buildings with large, open spaces and high ceilings to accommodate production lines and machinery.

Machinery and equipment:

Houses the machinery and equipment necessary for the physical or chemical transformation of materials into new products.

Production process:

Carries out the entire manufacturing process, which can include:

- Processing raw materials
- Assembling parts into finished products
- Quality checks
- Packaging products for shipment

Labour and administration:

Employs skilled labor and has administrative areas to manage operations.

Examples:

Industries that use manufacturing facilities include automotive, food processing, textiles and chemical production.

A manufacturing facility's layout is the strategic arrangement of equipment, machinery, workers, and workspaces to ensure the most efficient production flow. The four main types are product layout (sequential, assembly-line), process layout (function-based, flexible), fixed-position layout (product stays stationary), and cellular layout (hybrid, team-based), with a combination layout integrating elements of different types. Effective layout planning minimizes costs, maximizes productivity, and ensures a safe and efficient work environment.

2.2 Layout of Manufacturing Facility

The layout of a manufacturing facility refers to the arrangement of machines, equipment, departments, work centers, and service areas within a plant. A well-designed layout ensures smooth workflow, optimal use of resources, efficient material handling, and safe working conditions.

Meaning

Plant layout means the physical arrangement of all facilities that are required for manufacturing such as machinery, materials, manpower, tools, and supporting services within the factory premises.

Definitions

James Lundy

“Plant layout is the arrangement of machines, work areas, and service areas within a factory so that production is carried out in the most efficient manner.”

Moore

“Plant layout is a plan of an optimum arrangement of facilities including personnel, operating equipment, storage space, material handling equipment, and all other supporting services along with the design of the best structure to contain these facilities.”

Mundel

“Plant layout involves the physical arrangement of industrial facilities. It is the configuration of departments, work centers and equipment in the conversion process.”

Objectives of Layout:

The basic objective of the plant layout is to arrange production facilities economically. The objectives of plant layout are given below:

1. Streamline the flow of materials through the plant.
2. Facilitate the manufacturing process.
3. Minimize materials handling cost.
4. Effective utilization of men, equipment and space.
5. Flexibility of manufacturing operations and arrangements.

6. Provide for employee convenience, safety and comfort.
7. Minimize investment in equipment

2.3 PRINCIPLES OF A GOOD LAYOUT:

Good layout design is built on principles like alignment, which organizes elements on the page; balance, which creates a sense of stability; proximity, which groups related items together; repetition, which creates consistency; and contrast, which makes important elements, stand out. Other key principles include establishing a clear visual hierarchy to guide the viewer, utilizing white space to avoid clutter, and using a grid system for a professional, organized structure.

Core principles of Good Layout:

Alignment:

Arranges elements in relation to each other to create a visually appealing and easy-to-navigate structure. Text and images should be aligned to grid lines or other elements for a clean look.

Balance:

The distribution of visual weight in a design. Balance can be symmetrical (centered, mirrored) for harmony or asymmetrical (elements of different weights) for a more dynamic feel.

Proximity:

Placing related items close together to create a sense of connection, while separating unrelated items to prevent confusion.

Repetition:

Reusing the same or similar elements, such as fonts, colors, or shapes, throughout a design to create a cohesive and consistent look and feel.

Contrast:

Using differences in color, size, and font to make certain elements stand out and create a clear focal point. This can be used with alignment and balance to make a design unique.

Visual Hierarchy:

Organizing information based on its importance, ensuring the most crucial elements are the most prominent to the viewer.

White Space:

The empty space around and between design elements. Sufficient white space prevents a design from looking cluttered, helps guide the eye, and makes the content easier to read and focus on.

Grid:

A system of intersecting lines used to organize text, images, and other elements in a structured and balanced way. Breaking away from the grid can be used to emphasize specific details.

2.4 FACTORS TO BE CONSIDERED IN PLANT LAYOUT:

The following are the important factors to be considered at the time of plant lay out. They are given below

1. Need for plant expansion

The future requirements of the organization should be considered at the time of planning for plant location.

2. Protection of operation equipment

Every care should be taken to ensure the safety machinery and equipment. Shelter is required whenever there is need to protect equipment from adverse climatic conditions.

3. Maintenance requirements

Some equipment's require continuous maintenance. There should be adequate facilities in maintain the equipment's and machinery. This requirement has to be considered at the time of planning plant layout.

4. Location

The site selected for the plant also determines the plant lay out. The structure, geology, climatic conditions of the location influence the decision on plant layout.

2.5 TYPES OF LAYOUTS:

The main types of layouts are process layout (grouping similar machines or functions), product layout (arranging machines in a line for a specific product), fixed-position layout (keeping the product stationary and moving resources to it), and combination layout (integrating elements of both process and product layouts). Other specific layouts include cellular, hybrid, and grid layouts. Layouts can be classified into the following five categories.

1. Process Layout
2. Product Layout
3. Combination Layout
4. Fixed position Layout
5. Group Layout

2.5.1 PROCESS LAYOUT

In the case of process lay out all the machines performing similar type of operations are grouped at one location. In process layout the arrangement of facilities is grouped together according to their functions and operations. The flow of material through the facilities from one functional area to another functional area varies from product to product. Process layout is suggested for batch production. Usually the paths are long and

there will be possibility of backtracking. Process layout is normally used when the production volume is not sufficient to justify a product layout.

2.5.1.1 Advantages of Process Layout:

The main advantages of a process layout include flexibility for a wide variety of products, lower initial investment due to the use of general-purpose machines and increased equipment utilization as machines can perform multiple jobs. It also offers greater flexibility in work distribution and specialization, allowing for better supervision and making maintenance and expansion efforts simpler.

Flexibility:

It is ideal for industries producing a high mix of products or custom orders because the layout can be easily reconfigured for different production needs.

Changes in operations or the addition of new ones can be made without disrupting the entire process.

Lower investment:

It typically uses low-cost, general-purpose machines instead of expensive, specialized ones, which can significantly lower the initial investment.

Duplication of machinery is avoided, and general-purpose machines are less likely to become obsolete.

Higher equipment and personnel utilization:

General-purpose machines are used for a variety of jobs, which increases their overall utilization.

Flexibility in work distribution allows for better load balancing between machines and workers.

No stoppage of production:

If one machine breaks down, the entire process doesn't come to a standstill. Work can be transferred to other similar machines in the department.

Scope for expansion:

New machines and labor can be added to different capacity lines without disrupting the existing layout or order of arrangement.

Better supervision:

Grouping similar operations together allows for specialization, which can lead to more efficient and effective supervision

2.5.1.2 Limitations of Process Layout:

The main disadvantages of a process layout are complex material handling, high work-in-process inventory, and long production cycle times due to the back-and-forth movement of materials between specialized departments. Other drawbacks include higher costs for supervision and space, the need for skilled labor for general-purpose machines, and difficulties with production planning and control because processes are not standardized.

Material handling and costs**Complex and costly material handling:**

Materials often have to be transported long distances between different departments, increasing handling costs and lead times.

Higher space requirement:

This layout typically requires more floor space to accommodate waiting materials between workstations.

High inventory:

The lack of a continuous flow leads to high levels of work-in-process inventory, which increases capital investment.

Production and planning**Longer production times:**

The non-sequential movement of products results in a longer overall production cycle time.

Complex planning and control:

Scheduling and coordinating work across multiple, an independent department is more difficult and time-consuming.

High supervision costs:

A larger number of employees per supervisor and the need for frequent inspection at each stage increase supervision costs.

Labor and flexibility**Skilled labor required:**

The use of general-purpose machines means more skilled labor is needed to perform a variety of tasks.

Lack of flexibility:

Specialized skills can make it difficult to reassign workers to different tasks or areas, and the layout is less adaptable to changes in product design or volume.

Monotony and specialization:

Performing specialized tasks can lead to worker monotony.

2.5.2 PRODUCT LAYOUT

In product layout, machines and other supporting services are located according to the processing sequence of the product. It implies that various operations on a product are performed in a sequence and the machines are placed along the product flow line. In product layout machines are arranged in the sequence in which a given product will be operated upon. This type of layout is preferred for continuous production of goods.

2.5.2.1 Advantages of Product Layout:

The advantages of a product layout include high production rates, reduced material handling costs, and lower unit costs due to efficiency and standardization. It also leads to less work-in-progress inventory, a smoother production flow, and easier supervision because tasks are repetitive.

Operational efficiency

High production rate:

The linear flow allows for continuous, high-volume production, making it ideal for mass-producing standardized items.

Reduced production time:

The streamlined process and arrangement of machines in the sequence of operations shorten the total production time per unit.

Smooth flow of materials:

The layout ensures a continuous and uninterrupted flow, which minimizes delays and keeps production moving steadily.

Cost and space savings

Low material handling costs:

Machines are arranged sequentially, which minimizes the backward and forward movement of materials between workstations.

Optimum space utilization:

The arrangement of machines based on the operation sequence leads to better use of available space.

Reduced work-in-progress:

With a continuous flow, there is less inventory waiting between production stages, which reduce storage needs and associated costs.

Lower unit costs:

The combination of high volume, efficiency, and specialization can lead to lower costs per unit, especially when the fixed costs are spread over a large production run.

Labor and quality**Specialization:**

Workers can become highly skilled at specific tasks, which improve both quality and productivity.

Less skill required:

Due to the repetitive nature of the work, less-skilled labor can be trained to perform the tasks, which reduces training costs.

Easier supervision:

Supervision is simplified because the repetitive tasks are easy to monitor and control.

Reduced errors:

Automation and standardization reduce the scope for human error on the production line

2.5.2.2 Limitations:

The main disadvantages of a product layout are its lack of flexibility, high initial investment, and vulnerability to production stoppages from machine breakdowns. It is also

less flexible to product changes and requires a high level of skill and specific training for workers.

High initial investment:

Specialized machinery and equipment for a single product are expensive to purchase and install.

Lack of flexibility:

The system is inflexible and difficult to adapt to changes in product design or production volume without significant and costly reconfiguration.

Production stoppages:

A breakdown in one part of the assembly line can halt the entire production process, leading to lost time and output.

Vulnerability to machine breakdowns:

Power fluctuations or breakdowns can stop the entire assembly line, unlike a process layout where other machines can continue to operate.

Employee inflexibility:

Workers become highly specialized and skilled in a single task, making them less adaptable if a different product is introduced.

High inspection cost:

The need for a high level of inspection throughout the process adds to the cost.

Large space requirement:

Requires a significant amount of space to accommodate the specialized machinery and equipment.

2.5.3 COMBINATION LAYOUT:

A combination layout combines the advantages of both types of product and process layouts. A combination layout is possible where an item is being made in different types and sizes. Here machinery is arranged in a process layout but the process grouping is then arranged in a sequence to produce various types and sizes of products. It is to be noted that the sequence of operations remains same with the variety of products and sizes

2.5.3.1 Advantages

A combination layout offers the advantages of both product and process layouts by blending the benefits of efficiency and continuous flow with flexibility and machine utilization. This hybrid approach allows for the production of various product types and sizes, enables better supervision, minimizes material handling time for the product and provides flexibility to accommodate different services within a single facility.

Efficiency:

It allows for a more efficient workflow by creating product-like sequences for families of components, resulting in lower material handling costs and less work-in-progress.

Flexibility:

It provides the flexibility to handle a variety of products and processes, accommodating medium-quantity, medium-variety production runs. This makes it suitable for companies producing similar parts in small batches, allowing them to take advantage of flow line economics.

Machine and personnel utilization:

It ensures that equipment is utilized efficiently, as the layout combines the advantages of a process layout for machine grouping and a product layout for the product sequence. It also allows for greater flexibility in equipment and manpower allocation.

Skill enhancement:

It can lead to job enlargement and upgraded skills for operators, as they become more invested in and take pride in the products they are working on.

Lower investment:

It can have a lower capital investment compared to a pure product layout, as it may require less specialized equipment.

Production control:

It simplifies production planning and control systems compared to a pure process layout.

Handling of different product sizes:

It is ideal for products that are made in different types and sizes, but follow the same general sequence of operations.

2.5.3.2 Disadvantages of Combination Layout:

The main disadvantages of a combination layout include increased complexity, higher material handling costs, and potential bottlenecks due to combining both process and product layouts. Other drawbacks are the need for more space and skilled personnel, a more difficult scheduling and production control process, and the potential for higher investment in duplicated equipment.

Increased complexity:

Combining different layout types makes production planning, control, and scheduling more complicated.

High material handling costs:

Because parts of the layout may require movement between different machine groups and back again, this can lead to long and inefficient material flow paths.

Potential for bottlenecks:

Work in progress can accumulate at various points, creating bottlenecks where too much work is waiting for the next operation.

Higher equipment investment:

To maintain flexibility and avoid backtracking, it may be necessary to duplicate equipment in certain areas, which increases initial investment.

Requires more space:

The mixed nature of the layout often requires a larger facility to accommodate both the process and product sections.

Higher labour costs:

A combination layout may require a more skilled workforce to manage the variety of tasks and equipment, increasing labor costs.

2.5.4 GROUP LAYOUT:

This type of layout brings an element of flexibility into manufacturing system as regards to variation in batch sizes and sequence of operations. Group Technology (GT) is the analysis and comparisons of items to group them into families with similar features. GT can be used to develop a hybrid between pure process layout and pure product layout. This technique is very useful for companies that produce variety of parts in small batches to enable them to take advantage and economics of flow line layout.

The application of group technology involves two basic steps; first step is to determine component families or groups. The second step in applying group technology is to arrange the plants equipment used to process a particular family of components. This represents small plants within the plants. The group technology reduces production planning time for jobs. It reduces the set-up time. Thus group layout is a combination of the product layout and process layout. It combines the advantages of both layout systems

2.5.4.1 Advantages of Group Technology Layout:

Group layout, or cellular manufacturing, offers advantages like reduced material handling costs, shorter production times and decreased work-in-progress inventory. It achieves this by grouping similar parts into families and creating dedicated "cells" of machines to produce those families, which also leads to higher machine utilization and easier production flow balancing.

Operational Advantages:

Reduced material handling:

Material movement is minimized because machines are grouped together to serve a specific product family, reducing travel distance.

Shorter production and lead times:

By having all necessary machines in one cell, the time it takes to complete a product is reduced.

Lower work-in-progress (WIP) inventory:

Fewer inventories are needed because parts can move directly from one machine to the next within the cell without having to be stored and moved to a different department.

Higher machine and equipment utilization:

Equipment within a cell is used more efficiently for a specific family of parts.

Easier flow balancing:

It is simpler to balance the workflow within a dedicated cell compared to a more general process layout.

Strategic and Financial Advantages:

Increased flexibility:

Group layout allows for flexibility in handling different types of products and batch sizes.

Reduced overall cost:

Many costs, such as paperwork, machine setup, and material handling, are reduced.

Improved customer service:

Increased efficiency and reliability lead to better customer service.

Standardization:

It promotes standardization of tooling, fixtures, and setups across the similar parts families.

Advantages for Workers**Specialization:**

Supervision and worker specialization become possible within each cell.

Greater incentives:

Workers may feel a greater sense of pride and incentive when their cell is successful in meeting production goals.

2.5.4.2 Disadvantages of Group Layout:

Disadvantages of a group layout include potential conflicts, unequal participation, and reduced individual privacy and focus due to increased noise and distraction. In a classroom, it can limit student-to-student interaction and promote a teacher-centric environment, while in manufacturing; it can lead to less shop flexibility and potential for unbalanced workloads.

For teamwork or classroom environments**Conflict:**

Different opinions can clash, leading to disagreements and negative impacts on group morale.

Unequal participation:

Some members may do more work, while others may do very little.

Lost privacy and focus:

Increased noise and proximity in communal areas can make it difficult to concentrate and lead to distractions.

Time-consuming:

Reaching a group consensus or coordinating schedules can take more time than working individually.

Difficulty with individual support:

Teachers may find it challenging to provide one-on-one help in a crowded group setting.

For manufacturing or workplace layouts

Reduced shop flexibility:

It may be harder to change the layout and a specific part may need to be moved between different machines or cells.

Potential for unbalanced workload:

A manufacturing cell's workload can become unbalanced, leading to bottlenecks.

Complex supervision:

Supervisors may need to be experts in multiple fields represented in the cell.

Increased job flow times and tardiness:

Parts may be delayed in the production process, leading to longer completion times.

2.5.5 FIXED POSITION LAYOUT:

This is also called the project type of layout. In this type of layout, the material, or major components remain in a fixed location and tools, machinery, men and other materials are brought to this location. This type of layout is suitable when one or a few

pieces of identical heavy products are to be manufactured and when the assembly consists of large number of heavy parts, the cost of transportation of these parts is very high.

2.5.5.1 Advantages of Fixed Position Layout:

The advantages of a fixed-position layout include reduced material handling costs and movement, increased flexibility for customizing large products, and higher worker morale due to a sense of ownership and continuity. This layout is ideal for bulky, heavy products like ships or aircraft, as it avoids the high cost and difficulty of moving them, while also allowing skilled workers to be assigned to a single project from start to finish.

Reduced material movement:

The product stays stationary, and all resources (workers, tools, equipment) are brought to it. This is crucial for large, heavy items where the cost and complexity of moving the product are prohibitive.

Lower material handling costs:

By minimizing the movement of large materials, this layout significantly cuts down on handling costs and effort.

Increased flexibility and customization:

The layout can easily accommodate product design changes and variations because the product is not on a fixed production line. It's ideal for one-off or customized products.

Improved worker morale and continuity:

Workers can see a project through from start to finish, fostering a sense of pride and ownership. This continuity can also lead to higher morale and job satisfaction.

Efficient use of space:

While a large space is needed, the layout itself can be very efficient as it focuses all activities in one place.

Lower capital investment:

The cost of setting up the layout is often lower compared to other types of facility layouts.

Effective use of labor:

Allows for the use of skilled labor on a single project, which can improve quality and efficiency.

Simplified scheduling and planning:

Work can often be scheduled and performed concurrently on different parts of the same product, simplifying overall scheduling.

2.5.5.2 Disadvantages of Fixed Position Layout:

The main disadvantages of a fixed-position layout are high labor costs due to the need for skilled workers, increased costs from moving equipment and materials, and potential for longer production times and less efficiency. This layout also requires a large amount of space and can lead to coordination challenges and confusion among multiple work teams working in close proximity.

Cost and efficiency

High variable costs:

Moving equipment, materials, and workers to the product can be expensive and time-consuming.

Increased capital investment:

The production process is often long, which can lead to a very high capital investment.

Inefficient use of resources:

There can be idle time for equipment and labor between tasks, leading to lower productivity.

Space and coordination

Large space requirement:

The layout demands a significant amount of space to accommodate the product and all the surrounding work areas.

Coordination challenges:

Multiple teams working simultaneously can lead to confusion and conflicts.

Labour and time

Highly skilled labor:

The process requires a high level of skill, which can be difficult and expensive to find.

Time-consuming production:

Moving equipment and managing resources can significantly extend production times

2.6 SERVICE FACILITY LAYOUT:

A service facility layout refers to the physical arrangement of resources, equipment, and service areas in an organization that provides services rather than tangible products. The goal is to design the layout in such a way that it enhances customer satisfaction, ensures smooth service delivery, and improves employee efficiency.

Meaning:

Facility layout is about how physical spaces are set up in a building, including where equipment, workstations, and storage areas go. This setup is key to make work flow better, boost output, and keep things safe and easy to access.

Definition:

Heizer and Render

Service facility layout is the arrangement of service areas and facilities to achieve the best customer experience and efficient service delivery.”

James Fitzsimmons

The layout of a service facility is designed to facilitate the interaction between the service provider and the customer while ensuring operational effectiveness.

2.6.1 Objectives of Service Facility Layout:

Service facility layout is the physical arrangement of workers, equipment, and space within a service organization to improve the flow of customers and staff, boost efficiency and enhance the customer experience. Effective layouts focus on strategic placement of resources to minimize delays, improve safety and facilitate customer satisfaction, while bad layouts can lead to higher costs and decreased efficiency.

2.6.2 Key objectives of a service facility layout

Minimize customer and employee movement:

Reduce the distance customers and staffs have to travel to decrease frustration and save time.

Maximize efficiency:

Optimize the use of space, labor, and equipment to improve workflow and productivity.

Enhance customer satisfaction:

Design the layout to be welcoming, easy to navigate, and to balance waiting and service areas effectively.

Provide flexibility:

Ensure the layout can adapt to changing demands or future changes in services.

Improve safety:

Create a safe environment by ensuring clear pathways and reducing clutter.

Promote clear communication:

Make it easy for customers and staff to communicate with each other.

2.6.3 Common types of service facility layouts**Process layout:**

Groups similar equipment or activities together, creating a flexible layout suitable for handling a wide variety of services or products. This is common in environments like hospitals or banks.

Product layout:

Arranges resources in a fixed sequence of operations to efficiently provide a high-volume service. A self-service cafeteria is a good example.

Fixed-position layout:

The service or project remains in one location, and all necessary resources are brought to it. This is typical for on-site services like landscaping or pest control.

Cellular layout:

Creates self-contained "cells" or work areas, each designed to handle a specific set of products or services. This can be found in some hybrid environments.

Hybrid layout:

Combines two or more layout types to leverage the benefits of different approaches. Restaurants and hospitals often use a hybrid layout.

Check Your Progress

Choose the Correct Answer:

1. Plant layout refers to

- a) Location of factory
- b) Arrangement of machines and equipment in a factory
- c) Marketing plan
- d) Sales strategy

Answer: b

2. A good plant layout helps in

- a) Increasing production cost
- b) Efficient use of space and resources
- c) Reducing productivity
- d) Increasing wastage

Answer: b

3. One principle of good layout is

- a) Maximum movement of materials
- b) Minimum movement of materials
- c) Complex workflow
- d) Unplanned arrangement

Answer: b

4. Product layout is suitable for

- a) Mass production
- b) Job production

- c) Small batch production
- d) Service industry only

Answer: a

5. Process layout is mainly used for

- a) Continuous production
- b) Customized production
- c) Mass production
- d) Automated production

Answer: b

6. Layout factors include

- a) Machines, materials and manpower
- b) Advertising
- c) Promotion
- d) Pricing

Answer: a

7. Service facilities refer to

- a) Production machines
- b) Support services like maintenance and storage
- c) Raw materials
- d) Marketing departments

Answer: b

8. Fixed position layout is mainly used in

- a) Ship building

- b) Mass production
- c) Textile industry
- d) Food industry

Answer: a

9. The main aim of plant layout is

- a) Efficient production flow
- b) Increasing labor cost
- c) Increasing material handling
- d) Reducing space utilization

Answer: a

10. Material handling is an important factor in

- a) Plant layout design
- b) Advertising
- c) Sales promotion
- d) Pricing

Answer: a

Small Questions – LOCF Mapping Table

S.No	Small Question	CO	Bloom's Level	PO
1	What is plant layout?	CO1	Remember	PO1
2	What are the principles of a good layout?	CO2	Understand	PO2
3	What are the factors affecting plant layout?	CO3	Understand	PO3
4	What are the basic types of plant layout?	CO4	Remember	PO4
5	What are service facilities in plant layout?	CO5	Understand	PO5

Big Questions – LOCF Mapping Table

S.No	Big Question	CO	Bloom's Level	PO
1	Explain the concept and importance of plant layout in production management.	CO1	Understand	PO1
2	Discuss the principles of a good plant layout.	CO2	Analyze	PO2
3	Explain the factors affecting plant layout.	CO3	Understand	PO3
4	Discuss the basic types of plant layouts with examples.	CO4	Analyze	PO4
5	Explain the importance of service facilities in manufacturing layout.	CO5	Evaluate	PO5

UNIT-III

3.0 Introduction to Method Analysis:

Method analysis and work measurement are two complementary techniques within work study that aim to improve efficiency by analyzing and standardizing work processes. Method analysis (or method study) focuses on improving how a job is done by eliminating waste, while work measurement (or time study) focuses on determining the standard time it should take to complete a standardized method. Together, they help set performance standards, control costs and increase productivity.

Method analysis and work measurement are integral components of industrial engineering focused on optimizing work processes and improving productivity. Method analysis involves systematically studying tasks and workflows to identify inefficiencies and develop better methods for performing work. Work measurement, on the other hand, quantifies the time required for tasks, establishing standards and benchmarks for performance. Together, these techniques help in streamlining operations, reducing costs, and enhancing overall efficiency in various industries.

3.1 Method Analysis (Method Study)

Focus:

Improving the method of performing a job to eliminate unnecessary operations and motions.

Goal:

Find the most efficient way to do a task, considering factors like time, cost and human factors.

Process:

Record: the current process.

Examine: the steps critically to identify waste.

Develop:

An improved method by eliminating unnecessary steps, changing the sequence, or changing the whole process.

Install: the new, improved method.

3.2 Work measurement (Time Study)

Focus:

Determining the standard time required to complete a job at a defined level of performance.

Goal:

Establish a basis for performance standards, which is essential after the method, has been improved and standardized.

Process:

Divide the job into elements.

Record:

The time taken for each element using techniques like time study.

Define:

A standard time for each element by accounting for the worker's performance rating.

Add:

Allowances for relaxation, personal needs and fatigue.

Calculate:

The total standard time for the job.

3.2.1 How they work together

Method analysis is performed first to improve the method, as it is difficult to measure a standardized time for a poor or inefficient process.

Once the best method is established, work measurement is used to set the standard time for that improved method.

The combined process of work study leads to increased productivity, reduced costs and improved working conditions by ensuring the most effective method is performed in the most efficient timeframe.

Meaning

Method study is a structured and scientific evaluation of work systems, aiming to improve efficiency and productivity. It involves a critical analysis of existing methods and processes, seeking enhancements through an objective and imaginative approach.

Definitions

H. B. Maynard

"Method study is the systematic recording and critical examination of ways of doing things in order to make improvements."

K. B. Zandin

Method study is the technique of subjecting each operation to a systematic, critical scrutiny to develop and improve its productivity."

3.2.2 OBJECTIVES OF METHOD STUDY

The main objective of method study is to find the "one best way" to perform a job by systematically recording and critically examining existing and proposed methods to develop simpler and more effective procedures. This process aims to improve efficiency, reduce costs, enhance quality, and improve the working environment by optimizing the use of materials, plant, equipment, and manpower.

1. Better design of plant equipment and buildings

Enhances operational efficiency by ensuring that machinery and buildings are designed to meet the specific needs of production. This results in a more productive and safer working environment.

2. Improved layout of factory and offices

Optimizes space utilization and reduces unnecessary movement of materials and personnel. This leads to smoother workflows and increased productivity.

3. Better working conditions and environment

Creates a comfortable and healthy workplace, which boosts employee morale and reduces absenteeism. This contributes to higher overall efficiency and job satisfaction.

4. High standards of safety and health

Ensures that safety protocols are integrated into the workflow, reducing the risk of accidents. This protects workers and complies with health regulations.

5. Improved flow of work

Streamlines processes to minimize bottlenecks and delays. This ensures that production is continuous and efficient.

6. Better quality

Implements procedures to maintain high standards of production quality. This reduces defects and increases customer satisfaction.

7. Greater job satisfaction

Enhances the work experience by making tasks less strenuous and more rewarding. This leads to higher motivation and lower turnover rates. High earnings: Increases productivity and efficiency, which can result in higher wages for employees. This also improves the financial performance of the company.

8. Improved utilization of resources

Maximizes the use of available resources, including materials, labor, and machinery. This reduces waste and lowers production costs.

9. Effective material handling

Develops efficient systems for moving materials within the factory. This reduces handling time and minimizes the risk of damage.

10. Efficient processes and procedures

Standardizes operations to ensure consistency and reliability. This improves overall operational efficiency and reduces errors.

11. Optimum inventory

Maintains the right level of inventory to meet production needs without overstocking. This reduces storage costs and minimizes waste.

12. Optimum output

Achieves the highest possible level of production with the resources available. This enhances the company's ability to meet market demand.

13. Improved administration

Streamlines administrative processes to support production more effectively. This improves coordination and decision-making within the organization.

14. Waste reduction

Identifies and eliminates sources of waste in the production process. This reduces costs and minimizes the environmental impact.

15. Standardization and rationalization

Implements standard procedures to simplify and unify operations. This improves efficiency and ensures consistent quality.

3.2.3 SCOPE OF THE STUDY

Method study can be applied to various areas including layout, working conditions, movement, quality standards, design, tools and equipment and material handling. Potential improvements from method study can be categorized as follows:

1. Short-term Improvement

These are enhancements that can be quickly and economically implemented using existing resources. They are feasible and readily acceptable to both management and workers.

2. Long-term Improvements:

These are enhancements that require careful planning and investment. They may

not be immediately acceptable but are aimed at achieving significant improvements over time.

3.2.4 METHODS STUDY PROCEDURE:

1. Breakdown of Job Operations

Create a detailed list of all operations involved in the current manufacturing method. Include material handling, machine work, and manual tasks.

2. Questioning Every Detail of the Job

The method study expert critically examines the operations by asking several key questions

I Purpose

What is the purpose of this operation? Does it fulfill the requirements, and can it be eliminated?

II Place

Where is the best place to perform this operation?

III Sequence

When is the best time to perform this operation? Can it be done simultaneously with other tasks, or is there a more suitable time?

IV Person

Who is best suited to perform this operation?

V Means

How can this operation be performed? What machines and tools should be used?
Can the work be made easier and safer for the worker and equipment?

3. Develop a New Method

After addressing the above questions, a new and improved method is developed.
Consider the following aspects before finalizing the new method:

I Elimination

- Determine if any operation can be removed without causing harm.
- Combination
- Check if two or more operations can be combined to save time without negative effects.

II Rearrangement

Assess if rearranging the sequence of operations improves efficiency. For example, in a factory, the initial sequence might be assembling, storage, inspection and dispatching. If inspection is done before storage, it reduces unnecessary handling of defective components. The revised sequence would be assembling, inspection, storage and dispatching.

III Simplicity

Simplify operations to make them easier, more efficient and economical.

This can involve

- Placing materials, tools and equipment in proper working areas.
- Using gravity feed hoppers and other material handling equipment.
- Utilizing both hands for productive work.
- Using special jigs and fixtures.

4. Installing the New Method

Once the new method is developed, it must be approved by management, supervisors and workers. Workers should be trained to follow the new method, with continuous monitoring to ensure the method runs smoothly.

5. Maintaining the New Method

The new method should be maintained in its specified form without unauthorized changes. The following steps are recommended for proper maintenance

- Distribute copies of job instruction sheets to all concerned parties. These sheets should provide details for setting up the job correctly.
- Conduct routine checks to ensure the actual work aligns with the job instruction sheets.
- Select and train personnel according to the job specifications for the new method.

3.3 WORK MEASUREMENT

Work measurement is the systematic application of techniques to determine the appropriate amount of time a qualified worker needs to complete a specific task, performed at a defined level of efficiency and using a specified method.

Definitions

Ralph M. Barnes

"Work measurement is the application of techniques designed to establish the time for a qualified worker to carry out a specified job at a defined level of performance."

Benjamin W. Niebel

Work measurement is the systematic determination, through the use of various techniques, of the amount of effective physical and mental work in terms of work units or time units in a specified task.

3.3.1 Objectives of Work Measurement:

1. Comparison of Alternative Methods

When two methods seem equally advantageous, the one that requires less time for completion is considered more efficient. Work measurement helps identify the most time-effective method.

2. Manning

Accurate work measurement data helps determine the number of workers needed for a job. It ensures efficient allocation by analyzing effective and idle times inherent in the job.

3. Planning

Work measurement data provides a reliable basis for planning the use of men and machines. This allows management to utilize resources to their best advantage.

4. Control

Accurate figures on resource usage help management make sound decisions to increase productivity and efficiency. It provides valuable insights for resource management.

5. Incentives:

Work measurement offers a fair basis for creating incentive schemes. It ensures that employees are rewarded appropriately for their efforts.

6. Budgeting

It provides essential information for labor budgeting systems. Accurate work measurement data aids in the preparation of realistic budgets.

7. Costing

It work measurement data forms the foundation for standard costing systems. It helps in determining the cost of labor for various tasks.

8. Team Work

It ensures that work is evenly distributed among team members. Each member has an equal amount of work, promoting balanced teamwork.

9. Delivery:

It provides accurate information for estimating and meeting delivery times to customers. It helps in aligning estimated and actual delivery schedules.

3.3.2 Procedure for Work Measurement:

The general procedure for work measurement involves several steps to determine the standard time required for a job.

1. Break the Job into Elements

Divide the entire job into smaller, manageable elements.

2. Record Observed Tim

Measure and record the time taken to complete each element.

3. Convert Observed Time to Normal Time

Apply a rating factor to the observed time to adjust it to a standard performance level, thereby obtaining the normal time for each element.

4. Assess Relaxation Allowance

Determine the necessary relaxation allowance for personal needs and physical and mental fatigue for each element.

5. Calculate Work Content

Add the relaxation allowance to the normal time for each element to determine the work content.

6. Determine Frequency of Elements

Assess how often each element occurs in the job. Multiply the work content of each element by its frequency and sum the times to obtain the total work content for the job.

7. Add Contingency Allowance

If applicable, add a blanket allowance (typically not exceeding 5%) to account for contingency delays that are uneconomical to measure separately. When this allowance is added to the work content, it yields the standard time for the job. If no contingency delays are involved, the work content itself becomes the standard time for the job.

8. Include Other Allowances if Required

Add any other necessary allowances to finalize the standard time.

3.3.3 Classification of Work in Work Measurement:

For work measurement purposes, work can be classified into two categories: repetitive work and non-repetitive work.

1. Repetitive Work

This type of work involves the continuous repetition of the main operation or group of operations throughout the time spent on the job. It applies to work cycles of very short duration.

2. Non-repetitive Work

This includes tasks such as maintenance and construction work, where the work cycle is rarely repeated immediately.

3.3.4 Techniques of Work Measurement:

The main techniques for measuring work include

1. Pre-determined Motion Time Systems (PMTS)

- Motion Time Analysis (MTA)
- Basic Motion Time (BMT)
- Work Factor (WF)
- Methods Time Measurement (MTM)
- Motion Time Data (MTD)

2. Time Study

3. Synthetic Data

4. Analytical Estimating

5. Activity or Work Sampling

1. Pre-determined Motion Time Systems (PMTS)

This technique establishes time standards for basic human motions to build up the time for a job at a defined performance level. It analyses basic motions, known as

Therbligs, by carefully studying filmed operations. Filming allows for multiple observations of each element

2. Time Study

This method records the time and rate of working for specific job elements under defined conditions. The data is then analyzed to determine the necessary time for completing the job at a set performance level

3. Synthetic Data

This approach builds job times by totaling element times from previous time studies or existing synthetic data. It's useful for jobs or parts of jobs with elements similar to previously studied tasks.

4. Analytical Estimating

In this technique, experienced estimators use their knowledge and practical experience to estimate time required for job elements at a defined performance level. It's commonly used in engineering maintenance and construction work. While less accurate than time study, it can provide satisfactory results when performed by trained estimators who break tasks into longer elements.

5. Activity or Work Sampling

Also known as random observation work sampling, this method involves making numerous instantaneous observations of machines, processes, or workers over a period. It provides a snapshot of what's happening at each observation point. The accuracy of results depends on the number of observations made.

3.4 TIME STUDY

A time study is a work measurement technique used to determine the standard time required to complete a specific task. It involves breaking down a job into smaller elements,

observing and timing each element with a device like a stopwatch, and using the data to establish an efficient, standard time for a qualified worker. Time studies help improve production efficiency, set performance goals, optimize workflows, and reduce inefficiencies.

Key aspects of a time study

Objective:

To establish a standard time for a job, which accounts for the time a qualified worker needs to complete the task at a set performance level.

Method:

The task is broken down into smaller, measurable elements or steps.

The time taken for each element is recorded using a timing device, such as a stopwatch or specialized software.

The operator's performance is rated to account for variations in skill and efficiency.

Allowances for necessary delays, such as personal time or machine downtime, are added to the observed time.

Applications:

Improving efficiency:

Identifying bottlenecks and inefficiencies in processes to optimize workflows.

Setting standards:

Establishing realistic performance goals and benchmarks.

Labour management:

Helping to determine staffing needs and creating incentive schemes.

Process improvement:

Providing the data needed to make informed decisions about how to improve a process.

Best for:

Repetitive tasks with a predictable and defined set of actions, making it ideal for factory settings or operations like a coffee shop barista making a latte

Time study is conducted to determine the standard time required for a job. This involves selecting average workers and machines. The time study expert, who must be well-versed in all aspects of the job and its conditions, should observe operations and movements from a distance that does not disturb the workers. The time study is conducted in several stages:

3.4.1 Methods for Time Study Procedure:

1. Analysis of Work

The entire job and its operations are divided into various elements, as identified in motion study. These elements are finalized after conducting the motion study. Time for job preparation, machine cleaning, and oiling is also included, ensuring the study covers all tasks performed by the workers, not just the effective work.

2. Standardization of Method

Before starting the time study, all job components, including materials, equipment, tools, working conditions, and methods, are standardized. The chosen method should be the easiest, safest, and quickest under the given conditions to ensure worker acceptance.

3. Conducting Time Study

Time study is recorded on a printed time study record sheet attached to a Time Study Board, with a stopwatch placed in the top right corner. The stopwatch should have a decimal scale dial for precise readings up to 0.001 minutes. Time readings for each element are recorded in the corresponding column of the sheet. Multiple sets of readings are taken to ensure accuracy. The average time, or observed time, is calculated after discarding any abnormal values. Observed time represents the time taken to perform an element or combination of elements through direct measurement.

This average time is adjusted by a rating factor, typically ranging from 90% to 120%, to determine the time required by a normal worker. The product of average time and rating factor is called Normal Time. Additional allowances for personal needs (20%), fatigue (5%), and preparation (5%) are added to the normal time to calculate the standard time. The standard time is used as the basis for determining wages and incentives.

3.4.2 The Purpose of Time Study:

1. Determine Standard Times

The objective of establishing standard times is to define the time required for each task, ensuring efficient and fair work measurement. This provides a benchmark for performance, essential for planning and controlling production activities, setting clear expectations, and evaluating worker performance against defined criteria.

2. Improve Productivity

By identifying areas for process improvements and optimizing work methods, time study helps uncover inefficiencies, bottlenecks, and redundant activities. Analyzing each step of a process allows managers to streamline operations, eliminate waste, and enhance overall productivity, leading to faster production times, reduced costs, and improved output quality.

3. Set Wage and Incentive Standards

Standard times are used to develop fair and motivating wage and incentive systems. Accurate time measurements provide a basis for setting wages and creating incentive programs, which can motivate workers, increase job satisfaction, and improve overall morale. Incentives linked to performance encourage employees to meet or exceed standards, boosting productivity.

4. Balance Workloads

Time study data helps in distributing tasks evenly among workers, preventing overburdening some while underutilizing others. Balanced workloads lead to a more harmonious work environment, reduce fatigue and stress, and enhance overall efficiency and productivity.

5. Enhance Scheduling and Planning:

Accurate time measurements provide precise data for scheduling, planning, and resource allocation. This helps in forecasting production timelines, managing inventory levels, and allocating resources effectively. Enhanced planning reduces downtime, improves workflow, and ensures timely delivery of products.

6. Support Training and Development

Time study data serves as a valuable tool for training new employees and developing existing ones. By understanding the standard time required for tasks, trainers can provide clear instructions and set realistic performance goals. Continuous development based on time study insights helps in maintaining consistency and efficiency in performance across the workforce.

3.5 STOPWATCH TIME STUDY:

Stopwatch time study is a method used to measure the time taken to complete a task or a set of tasks. It is a fundamental tool in industrial engineering and production management for establishing standard times and improving work efficiency.

3.5.1 Procedural Steps:

1. Preparation

Select Task:

Identify the task or operation to be studied.

Select Worker:

Choose an average worker who performs the task regularly.

Prepare Equipment:

Ensure the stopwatch, time study forms, and other necessary tools are ready.

2. Break Down the Task

Element Identification:

Divide the task into smaller, manageable elements. Each element should have a clear start and end point.

Record Details:

Note down the details of each element, such as the name and a brief description

3. Conduct the Study

Observe and Record: Use the stopwatch to measure the time taken for each element. Record the time readings on the time study form.

Multiple Observations: Perform multiple observations for each element to ensure accuracy. This helps in identifying any variations and establishing a reliable average time.

4. Analyze Data

Calculate Average Time: Compute the average time for each element after discarding any abnormal values. This is known as the observed time.

Adjust for Performance Rating: Apply a performance rating factor (usually between 90% to 120%) to the observed time to account for the worker's performance. The product of the observed time and the rating factor gives the normal time

5. Determine Standard Time

Add Allowances: Add allowances for personal needs, fatigue, and delays. Common allowances include 20% for personal needs, 5% for fatigue and 5% for preparation.

Calculate Standard Time: The standard time is obtained by adding these allowances to the normal time. This is the time required by a normal worker to complete the task under standard working conditions. Formula: Standard time = Normal time + Allowances

3.5.2 Importance of Stopwatch Time Study:

1. Establishing Standard Times

It provides a benchmark for performance and productivity, essential for planning and control.

2. Improving Productivity

It identifies inefficiencies and areas for improvement, leading to optimized work methods and increased productivity.

3. Setting Wage and Incentive Standards

It helps develop fair and motivating compensation systems based on accurate time measurements.

4. Balancing Workloads

It ensures even distribution of tasks, preventing overburdening and underutilization of workers.

5. Enhancing Scheduling and Planning

It provides precise data for scheduling and resource allocation, improving overall production planning.

6. Supporting Training and Development

It serves as a basis for training programs, helping workers understand performance expectations and achieve consistency in task execution.

3.6 Performance Rating:

Performance rating is the process of adjusting the actual pace of an operator's work by comparing it to a mental picture of the pace of an operator working at normal speed. It can be expressed mathematically as:

$$\text{Performance Rating} = (\text{Observed Pace}/\text{Normal Pace}) * 100$$

In other words, rating is a leveling factor used to convert observed times into normal times. The normal time of an element is the time an average worker would take to complete the task at a defined level of performance.

A performance rating is a structured evaluation of an employee's work against predefined criteria, often using a numerical or textual scale. These ratings are used to measure contributions, identify areas for improvement, and inform decisions about compensation, promotions, and training. Performance ratings provide a standardized framework for appraisals, ensuring consistency and fairness in how an employee's effectiveness, productivity, and behaviors are assessed.

3.6.1 Key aspects of Performance Ratings:

Standardized criteria:

Ratings are based on a set of criteria related to job goals, competencies, and expected behaviors.

Quantifiable data:

Scales allow for the quantitative measurement of performance, which can be used to track progress and make data-driven decisions.

Areas of assessment:

Common factors assessed include work quality, productivity, communication, teamwork, and adaptability.

Purpose:

Performance ratings support talent management by providing a basis for fair and consistent evaluations that inform compensation, promotions, and development plans.

Rating scales:

Scales can be numerical (e.g., 1-5) or textual (e.g., "Exceeds expectations") and are a central component of a performance review.

Feedback mechanism:

Performance ratings provide employees with feedback on their job performance, which is crucial for effective work and development

3.6.2 Factors Affecting Performance Rating:

The variation in actual times for a particular element can be due to both internal and external factors.

I External Factors (not controlled by the work study expert)

- Variation in the quality or other characteristics of the material used, even if within prescribed tolerance limits.
- Changes in the operating efficiency of tools and equipment within their useful life.
- Unavoidable changes in methods or conditions of operations.
- Changes in working conditions such as heat, light, dust, and vibration.

II Internal Factors (controlled by the work study expert)

- Acceptable variation in the quality of the product.
- Variation due to the operator's ability.
- Variation due to the operator's attitude.

3.6.3 Need for Performance Rating

Observed time can vary from element to element and within the same operation due to inconsistencies in the worker's pace and the basic motions employed. Variations in the operator's speed are simple to understand; different workers have different temperaments and attitudes towards work. Some workers are naturally quick, while others are slow. If the time taken by both types of workers is measured for the same element, the time taken by the slow worker could be almost twice that taken by the fast worker.

Setting standard time based on the time taken by a fast worker would make the standard unattainable for most, while setting it based on a slow worker's time would result in a loose standard that even the most inefficient worker could easily meet. This would undermine the purpose of time setting.

The work study expert does not try to find workers who can perform at a normal pace nor ask them to adjust their speed to perform at a normal pace. Instead, the expert records the time for whatever speed the worker operates and uses a performance rating as a

leveling factor to specify the standard time as if the worker were working at the normal pace

3.6.4 Methods of Rating:

There are five different methods of performance rating: Speed Rating, Westinghouse System of Rating, Synthetic Rating, Objective Rating, and Systems Based Physiological Evaluation.

1. Speed Rating

- In this method, the observer compares the operator's movements with their own concept of a normal pace to fix the performance rating.
- An average worker is rated at 100. A worker better than average is rated higher than 100, while a below-average worker is rated lower than 100.
- For example, if a worker is rated at 110, it means an average worker would require 10% more time to perform the job. Conversely, if rated at 85, the average worker would need 15% less time.
- The observed time of the element is multiplied by the speed rating divided by 100 to obtain the normal time of the element.

2. Westinghouse System of Rating

This system uses four criteria to measure an operator's proficiency: skill, effort, consistency and conditions.

Skill:

Measures the operator's proficiency, coordination, and adherence to the method, classified into six degrees: poor, fair, average, good, excellent and super skilled.

Effort:

Measures the speed with which skill is applied, also divided into six degrees: poor, fair, average, good, excellent, superb.

Consistency:

Measures the operator's ability to perform the work cycle repeatedly within the same time, considering variations in materials, tool wear, etc. and classified into six degrees: poor, fair, average, good, excellent, perfect.

Conditions:

Measures the impact of environmental factors like temperature, vibration, light and sound on the operator's performance, also classified into six degrees: poor, fair, average, good, excellent, perfect.

The analyst assigns ratings for each criterion, obtains numerical values from respective tables, sums the four values and adds a levelling factor to normalize the observed time of the job. This system is applied to the cycle time in manual work rather than individual elemental times.

3. Synthetic Rating

Performance rating is established by comparing observed times of manual elements with known time values from pre-determined motion and time studies.

Steps:

- Conduct a time study to record time values of the work cycle elements.
- Pick pre-determined standard times of some manual elements from PMTS tables.
- Divide motion time values by observed time values for each element to get rating factors.
- Aggregate individual rating factors into an average performance rating factor.
- Apply the performance rating factor to all manual elements to normalize their times.
- Beginners may use this method until proficient. Actual times of as many manual
- Elements as possible should be taken to compile synthetic rating effectively.

4. Objective of Rating

- Rates the operator's speed against a standard pace independent of job difficulty. The observer rates the speed of movement without considering the job itself.
- An allowance or secondary adjustment is added to the pace rating for job difficulty.
- Job difficulties are divided into six classes: amount of body used, foot pedals, bi-manualness, eye-hand coordination, handling equipment and weight.

5. Physiological Evaluation of Performance Rating

- Studies have shown a relationship between physical work and the amount of oxygen consumed by the operator, and more recently, the change in heartbeat rate is found to be a reliable measure of muscular activity.
- Although not widely used now, many researchers worldwide are working on this method.

3.7 Standard Time and Allowance Factors:

Standard time is the duration taken by a typical worker to complete a specific task under moderate conditions, including various allowances for factors such as fatigue, tool setup, and repairs. These allowances are added to the normal time to derive the standard time. The key allowances and their purposes are as follows

1. Process Allowance (Unoccupied Allowance)

This compensates workers for enforced idleness due to the nature of a process or operation. This idleness is unavoidable, for example, when a worker handles an automatic machine or when a production line cannot be completely balanced. Without this allowance, workers might feel discouraged if idle time constitutes a significant portion of the cycle, as it limits their earning potential despite working at a faster pace during active periods

2. Relaxation Allowance

Workers cannot maintain continuous operation like machines and require breaks for personal needs (e.g., drinking water, having tea) and to recover from the physical and mental strain of their work. Excessive fatigue negatively impacts performance and this allowance help mitigate that. Relaxation allowance can range from 12% to 20% of normal time, depending on the nature of the work (light to heavy).

Personal Needs Allowance:

Compensates for time spent attending to personal needs, such as getting a drink or washing hands. Typically, men receive an allowance of 5% and women 7%, corresponding to 24 minutes and 34 minutes in an eight-hour workday, respectively.

Fatigue Allowance: Provides time for workers to recover from fatigue due to their tasks. It includes:

Basic Fatigue Allowance: For light work in good conditions, a 4% allowance is typical.

Variable Fatigue Allowance:

For medium to heavy work or work under less favorable conditions, the allowance varies based on factors like posture, restricted movements, lifting weights, thermal conditions, atmospheric conditions, light conditions, visual strain, noise, physical monotony, and mental monotony. Tea breaks are included in the relaxation allowance.

3. Special Allowance

These allowances, which can be temporary or permanent, are for activities not typically part of the work cycle but essential for job performance. They include:

Periodic Activity Allowance: For periodic tasks within the work cycle, such as setting up equipment or regrinding tools.

Interference Allowance:

For workers managing multiple machines, compensating for production losses due to machine stoppages. These can be cyclic (e.g., different automatic cycle times) or random (e.g., yarn breaks in winding)

3.7.1 Factors Influencing Interference Allowance:

Number of Machines per Operator:

The more machines an operator is assigned, the greater the interference allowances.

Machine Running Time:

The longer the machine running time, the lesser the interference allowances.

Ratio of Machine Time to Outside Work:

A higher ratio of machine time to outside work results in a lower interference allowance.

Inside Work:

More inside work leads to greater loss due to interference.

Methods of Measuring Interference Allowance:

These include work sampling, production study, queuing theory and interference theory.

4. Contingency Allowance:

This is a small time allowance included in the work content to compensate for legitimate interruptions and delays that are infrequent and irregular. These occurrences can include:

- Total breakage and tool replacement
- Obtaining necessary gauges
- Filing coolant reservoirs
- Removal of turnings, borings, and drillings by helpers
- Daily oiling and cleaning by maintenance
- Machine stoppages due to delays in part movement

- Operator waiting for helpers or mechanical handling
- Consultation with supervisors and others
- Short power failures

5. Policy Allowance

This is an additional time added to the standard time to allow workers to achieve a specified level of earnings at a specified level of performance. Key considerations include:

- It is a management decision and cannot be demanded by workers.
- Once awarded, it cannot be withdrawn.
- It is typically the same for all operations and is allowed as a percentage of standard time, creating allowance time or specified time, distinct from standard time.
- The time study expert advises management on the policy allowance but is not the decision-maker.

Types of Policy Allowance:

1. Introductory Allowance

Temporary allowance given when an incentive scheme is introduced gradually decreased over 4 to 5 weeks.

2. Learner Allowance

It given to accommodate the slower pace when a new worker is integrated into the team.

3. Unusual Conditions Allowance

Covers additional time required for handling specific types of raw materials or equipment. Comparison of Alternative Methods

4. Manning

Determines the number of workers needed for a plant by analyzing effective and idle time, enabling efficient work allocation.

5. Planning

Fixes production norms for each operation, allowing for the planning and scheduling of production and maintenance jobs to maximize resource utilization.

6. Control by Management

Establishes a plan that can be reviewed and controlled closely using accurate records of waiting times and actual performance against expected rates.

7. Rational Basis for Incentives

Provides a fair basis for financial incentive schemes by setting clear expectations for normal performance.

8. Standard Data

Builds a repository of standard data for job constituents that can be reused for similar jobs, eliminating the need for repeated studies.

3.8 STANDARD TIME:

Standard time is the time it should take a qualified worker to complete a task at a normal pace, under specific conditions, including allowances for personal needs, fatigue and unavoidable delays. It is calculated in work measurement by first determining the normal time (NT) by adjusting the observed time (OT) with a performance rating factor (PR) and then adding allowances to the normal time to find the standard time (ST)

Calculation steps Determine Observed Time (OT):

Record the time taken to perform the task, often by observing and timing a qualified worker.

Calculate Normal Time (NT):

Adjust the observed time based on the worker's performance rating.

Normal Time (NT) = Observed Time (OT) × Performance Rating Factor.

The performance rating factor is a value (e.g., 110% or 1.1) that accounts for whether the worker is faster or slower than a normal pace.

Add Allowances:

Include allowances for personal needs, fatigue, and other delays.

Calculate Standard Time (ST):

Add the allowances to the normal time to get the final standard time.

Standard Time (ST) = Normal Time (NT) + Allowances.

A common formula is: $ST = NT / (1 - \text{Allowances})$

3.9 WORK SAMPLING TECHNIQUE:

Work sampling is a statistical method used to estimate the proportion of time workers or machines spend on different activities by making a large number of random, instantaneous observations over a set period.

The percentage of observations for a specific activity is used as a measure of the percentage of time that activity occurs, helping to analyze efficiency, productivity, and identify areas for improvement without constant observation.

How it works

Random observation:

Observers record what an individual, group, or machine is doing at random, pre-determined times.

Categorization:

At each observation, the activity is recorded into a pre-defined category, such as "working," "idle," "under maintenance," or a more specific task.

Statistical Analysis:

The percentage of observations for each category is calculated. For example, if a worker is observed 100 times and 20 of those observations show them "idle," the analysis indicates they spent 20% of their time idle.

- Work sampling is a method used for various purposes in work measurement, including
- Measuring the working and non-working time of personnel and machines to determine delay allowances or machine utilization.
- Estimating the percentage of time spent on different tasks by individuals such as maintenance staff, office workers, managers, and more.
- Establishing time standards.

How Work Sampling Works

The technique involves taking numerous random observations of an activity to determine the percentage of time dedicated to each aspect of operations. For example, consider a forklift truck operator. Through 50 random observations, it was noted that the operator was working 80% of the time (40 out of 50 observations) and idle 20% of the time (10 out of 50 observations). The simplicity of this procedure belies the importance of the number of observations, as more observations yield higher accuracy. The required number

of observations for a desired accuracy level can be calculated using standard formulae based on the binomial distribution.

3.9.1 Applications and Benefits:

Work measurement:

It can be used to determine the ratio of working to idle time for a job or process.

Performance analysis:

It helps in preparing a performance index by measuring working and idleness on working times.

Efficiency analysis:

It can reveal how much time is spent on specific tasks or delays, helping to identify bottlenecks and inefficiencies.

Cost-effective:

It is often faster and less costly than continuous time studies.

Data-driven insights:

By providing data on how time is actually spent, it allows for informed decisions to streamline processes and improve productivity.

Employee selection:

In a different application, work sampling can involve having applicants perform a sample of a job's tasks and observing their performance on those tasks.

3.9.2 Advantages of Work Sampling:

Work sampling is advantageous because it is a cost-effective and less tedious method for analyzing work activities, requiring less training than time studies. It is particularly useful for non-repetitive or long operations where continuous observation is impractical, and a large number of random observations over a longer period reduce the impact of daily fluctuations and minimize observer bias. This method is flexible, doesn't require specialized timing devices and helps in identifying sources of delay to improve efficiency.

Cost and effort

Economical:

It is cheaper to perform than a time study.

Less training:

Observers require less training.

No specialized equipment:

No specialized timing devices like stopwatches are needed.

Work and data

Versatile:

It is suitable for both direct and indirect jobs, as well as group activities, which are hard to measure with other methods.

Reduces bias:

Random, non-continuous observations over a long period lead to a more accurate and less biased representation of actual work routines.

Minimizes disruption:

It is less tedious and fatiguing for the worker and the observer, as the observer doesn't have to watch continuously.

Flexible:

Data collection can be done over an extended period, reducing the chance of day-to-day variations affecting the results.

Reliable:

Interruptions during the observation period have a minimal impact on the overall results.

Operational benefits

Identifies delays:

It helps uncover and quantify idle time, leading to efficiency improvements.

Establishes time standards:

It can be used to establish time standards for various jobs, including repair and maintenance work.

Improves planning:

Data from work sampling can assist in production planning.

Evaluates efficiency:

It can be used to evaluate the efficiency of different departments or machines

3.9.3 Disadvantage Work Sampling:

Disadvantages of work sampling include its lower accuracy for short tasks, the potential for employees to alter their behavior if they know they are being observed, the

method's ineffectiveness for studying a single operator or a single machine, and the lack of detailed elemental time data. It may also be more expensive than time-study methods for some applications due to the initial setup and clerical work involved, and can lead to biased results if the sampling isn't done correctly.

Inaccuracy and limited data

Less accurate for short tasks:

The method tends to be less accurate when trying to measure very short tasks.

Lacks elemental time data:

It does not provide detailed elemental time data, which is useful for setting performance standards or analyzing individual steps in a process.

Misses short-term fluctuations:

Work sampling provides a snapshot and may not capture important short-term fluctuations in activity or bottlenecks.

Doesn't record working speed:

It does not record the speed at which a worker is operating.

Employee and observer-related issues

Changes in behavior:

Workers may alter their work patterns when they are aware of the observation, leading to inaccurate results.

Requires trained observers:

Consistent and reliable data collection requires trained observers.

Can cause complaints:

The method can be perceived as more intrusive than time studies and may generate complaints.

Difficulty with individual differences:

It provides average results for a group, and does not show the individual differences between workers.

Cost and feasibility

Uneconomical for single operators:

It is not economical for studying a single operator, machine, or short-duration jobs.

Costly for widely dispersed locations:

It can be expensive and impractical for studying workers or machines spread over a large area.

Requires significant groundwork:

There is a substantial amount of initial work required, including planning the sample size and observation schedule, which can involve significant clerical effort.

Check Your Progress

Choose the Correct Answer:

1. Method study is mainly concerned with

- a) Marketing activities
- b) Improving work methods and efficiency
- c) Financial planning
- d) Sales promotion

Answer: b

2. The main objective of work measurement is to

- a) Increase production cost
- b) Determine the time required to complete a task
- c) Reduce worker efficiency
- d) Increase machine breakdown

Answer: b

3. Time study is used to

- a) Determine standard time for a job
- b) Recruit employees
- c) Conduct marketing research
- d) Improve advertising

Answer: a

4. Stopwatch time study is a technique used to

- a) Measure worker productivity
- b) Measure time taken for a task

- c) Measure machine cost
- d) Measure product quality

Answer: b

5. Performance rating refers to

- a) Evaluation of worker speed and efficiency
- b) Worker salary
- c) Machine maintenance
- d) Product design

Answer: a

6. Allowance factors include

- a) Personal needs and fatigue
- b) Advertising cost
- c) Production cost
- d) Raw materials

Answer: a

7. Standard time means

- a) Maximum time taken by a worker
- b) Time required by an average worker under normal conditions
- c) Minimum production time
- d) Machine idle time

Answer: b

8. Work sampling technique is used to

- a) Measure machine cost

- b) Estimate proportion of time spent on different activities
- c) Calculate profit
- d) Design products

Answer: b

9. Work measurement helps in

- a) Increasing labor cost
- b) Improving productivity
- c) Reducing efficiency
- d) Increasing waste

Answer: b

10. Method study procedures mainly aim at

- a) Finding the best method to perform a job
- b) Increasing complexity of work
- c) Reducing worker performance
- d) Increasing time taken

Answer: a

Small Questions – LOCF Mapping Table

S.No	Small Question	CO	Bloom's Level	PO
1	What is method study?	CO1	Remember	PO1
2	What is the purpose of time study?	CO2	Understand	PO2
3	What is performance rating?	CO3	Remember	PO3
4	What are allowance factors in work measurement?	CO4	Understand	PO4
5	What is work sampling technique?	CO5	Remember	PO5

Big Questions – LOCF Mapping Table

S.No	Big Question	CO	Bloom's Level	PO
1	Explain the concept of methods analysis and work measurement.	CO1	Understand	PO1
2	Discuss the procedures involved in method study.	CO2	Analyze	PO2
3	Explain the purpose and steps involved in time study.	CO3	Understand	PO3
4	Discuss stopwatch time study and performance rating.	CO4	Analyze	PO4
5	Explain allowance factors, standard time and work sampling technique.	CO5	Evaluate	PO5

Unit - IV

4.0 Introduction of Material Management

Materials management is a crucial business function that encompasses the planning, procurement, storage, and distribution of materials essential for production or operations. Its primary goal is to ensure the availability of the right materials at the right time, in the right quantity, at the right place, and at the right cost. This comprehensive approach includes various aspects such as purchasing, inventory control, warehousing, transportation, and quality control of materials. By effectively managing these elements, businesses can optimize their production processes, reduce costs and enhance overall operational efficiency.

The scope of materials management extends to forecasting material requirements, sourcing reliable suppliers, negotiating favorable prices and maintaining strong supplier relationships. A key component of this discipline is inventory management, which involves striking a delicate balance between maintaining sufficient stock levels and avoiding excess capital tied up in inventory. To achieve these objectives, many organizations utilize advanced technologies like Enterprise Resource Planning (ERP) systems and specialized inventory management software. Materials management plays a vital role in the broader context of supply chain management, ensuring a smooth flow of materials from suppliers through production and ultimately to customers. In recent years, there has been a growing emphasis on sustainable materials management, which focuses on minimizing environmental impact and conserving resources. Successful implementation of materials management strategies requires close coordination across various departments, including procurement, production, finance, and logistics, making it an integral part of an organization's overall success.

Meaning

Materials management can be consolidated as the systematic planning coordination, and control of all activities related to the sourcing, procurement, handling, storage,

distribution, and utilization of materials to ensure they are available when needed, in the right quantity and quality, and at the lowest possible cost. It involves managing the entire lifecycle of materials from acquisition to disposal, while optimizing processes to meet goals of efficiency, cost-effectiveness, and customer satisfaction.

Definition:

Materials management is the planning, directing, and controlling of activities concerned storage, distribution, and utilization of materials to ensure they are available when needed, in the right quantity and quality, and at the lowest possible cost. It involves managing the entire lifecycle of materials from acquisition to disposal, while optimizing processes to meet goals of efficiency, cost-effectiveness, and customer satisfaction with materials and inventory requirements, from the point of their inception to their introduction into the manufacturing process. It is the function responsible for the coordination of planning, sourcing, purchasing, moving, storing and controlling materials in an optimum manner so as to provide a pre-determined service to the customer at a minimum cost.

-Philip M. Rosenblatt

“Materials management encompasses all aspects of planning, purchasing, expediting, transport, inspection, handling, storage, distribution, inventory control, and salvage of materials. It also includes the essential components of supplier management, quality control, and forecasting”.

-Gower and Davies

4.1 Concept of Integrated Materials Management

Integrated Materials Management is a strategic approach aimed at effectively managing expenses on materials while maximizing returns on investment without compromising organizational efficiency. This approach involves designing and operating a system where all functions that impact the flow, conservation, utilization, quality and cost of materials work together seamlessly.

To achieve optimal materials management, it's essential to integrate functions such as materials planning, purchasing, inventory control, receiving, warehousing, material handling and disposal of scrap and surplus. When these functions operate independently, they may achieve efficiency in their own areas but fail to meet the broader goal of maximizing returns on material investments.

For instance, a purchasing manager might be inclined to buy a large quantity of a specific item to secure a 10% discount. However, an integrated materials manager would consider factors like storage space limitations and the costs associated with carrying excess inventory before making such decisions.

By integrating these functions into a cohesive system, organizations can highlight the interconnectedness of various operations and focus on achieving overall cost efficiency and effectiveness, rather than just operational efficiencies within individual sectors. This holistic approach ensures that every rupee spent on materials contributes to achieving the organization's strategic objectives.

Integrated Materials Management (IMM) is a comprehensive and holistic business strategy that coordinates and manages all material-related activities from initial planning and procurement to disposal as interconnected components of a single system. The primary objective is to ensure a smooth, uninterrupted flow of materials to support production and meet customer demand at the lowest possible cost.

4.2 Core Components:

IMM integrates several key functions to ensure efficiency across the entire supply chain:

Materials Planning & Control

Estimating material requirements based on sales and production forecasts, preparing material budgets, and scheduling orders to ensure timely availability.

Purchasing/Strategic Sourcing

Locating and evaluating suppliers, negotiating prices and terms, and procuring materials of the right quantity and quality from the right source at the right time.

Receiving & Inspection

Assuring that incoming materials meet quality standards and specifications, proper documentation, and preparation for storage or use.

Stores Management & Warehousing

Providing adequate and proper storage and preservation of materials, managing inventory, and issuing items to consuming departments.

Inventory Control

Implementing systems like ABC analysis or Just-in-Time (JIT) to maintain optimal stock levels, prevent stockouts or overstocking, and minimize carrying costs.

Material Handling & Logistics

Managing the efficient movement and transportation of materials within and outside the facility to reduce damage, time, and costs.

Disposal of Scrap and Surplus

Managing the timely identification and disposal of obsolete or surplus materials to recover value and free up space.

Key Benefits:

Implementing an integrated approach to materials management offers significant advantages over fragmented departmental approaches:

Cost Efficiency

Reduces overall costs by optimizing procurement, minimizing inventory carrying costs, eliminating waste, and avoiding emergency "rush" purchases.

Improved Coordination and Communication

Breaks down departmental silos, leading to faster data transfer, better teamwork, and more coherent decision-making across departments like production, finance, and marketing.

Enhanced Productivity

Ensures a smooth and uninterrupted flow of materials to the production line, preventing downtime and maximizing the utilization of machines and labor.

Better Inventory Management

Leads to improved inventory planning, faster inventory turnover, and a reduction in stockouts and dead stock.

Stronger Supplier Relationships

Fosters better, long-term relationships with suppliers through improved communication and consistent dealings.

Increased Adaptability and Resilience

Allows the organization to respond quickly to changes in demand, supply chain disruptions, or market conditions.

Improved Accountability

Centralizes responsibility and authority under a single function, allowing for objective evaluation of performance and clear accountability

4.3 Functions of Integrated Materials Management:

Integrated Materials Management involves several key functions essential for effective operations within an organization. Here's a simplified explanation of each function

1. Procurement of Materials

The procurement function is responsible for acquiring materials needed by various departments within the organisation. This includes sourcing suppliers, negotiating prices, issuing purchase orders and evaluating supplier performance. Effective procurement ensures timely availability of materials while adhering to budgetary constraints and regulatory requirements.

2. Storage Management

Logistics and transportation management plays a crucial role in the movement of materials efficiently. It involves coordinating transportation methods (such as air, sea, or rail) to ensure timely delivery of materials to and from the organization. Efficient transportation systems contribute to cost savings and support the overall economic growth of the organization by facilitating smooth operations and meeting customer demand.

Inventory Control

Inventory control is the process of managing the organization's stock of materials. This includes raw materials, finished goods, and other supplies necessary for production or distribution. Effective inventory control aims to strike a balance between having enough inventories to meet demand and minimizing excess stock that ties up capital. It involves forecasting demand, setting reorder points, and implementing inventory tracking systems to optimise stock levels and reduce costs.

4.4 Need of Integrated Materials Management

The need for an integrated approach in materials management is crucial due to its significant impact on reducing costs. Materials management involves overseeing the entire lifecycle of materials within an organization, from identifying the need for specific materials through to their delivery as finished goods to customers. This integrated concept ensures a unified approach across departments, optimizing the flow and control of materials.

Materials costs are distributed across various functions within a company, including sales, production, design, accounts, legal, quality control, maintenance, transportation, storekeeping, and purchasing. If these functions operate separately, conflicts of interest can arise, hindering efficient materials management. Therefore, materials management cannot be solely the responsibility of one department; it requires collaboration from all departments. Each department plays a role in controlling costs effectively, and an integrated approach ensures that they work together towards this common goal.

Integration facilitates a proper balance among the conflicting objectives of individual functions. It enables swift data transfer through efficient communication channels, enhancing overall operational efficiency. Only through integration can departments align themselves with a central materials management department focused on reducing material costs and minimizing waste across all processes.

In essence, an integrated approach in materials management maximizes efficiency by leveraging modern methods and systems throughout the organization. It fosters coordination among departments, enhances cost control efforts, and promotes a unified strategy towards achieving optimal materials management outcomes.

4.5 Objectives of Integrated Materials Management:

The objective of integrated materials management approach is to achieve streamlined operations, efficiency, and cost-effectiveness through centralized coordination and effective communication. Here are the key objectives

1. Speedy Implementation

By centralizing materials management, decisions such as purchase orders and inventory control can be implemented swiftly. This ensures that materials are procured and managed efficiently to support uninterrupted operations.

2. Greater Accuracy

Integrated management ensures accurate forecasting of material requirements and timely scheduling. This minimizes errors in procurement and inventory management, leading to smoother functioning of the organization.

3. Improved Communication

An integrated approach facilitates better communication across departments regarding material needs, supply schedules and inventory levels. This enhances coordination and responsiveness to changes in demand or supply.

4. Efficient Functioning

The approach aims to achieve efficient operations by ensuring that materials are available as needed without excessive stockpiling or shortages. This contributes to achieving production targets and minimizing costs associated with idle inventory.

5. Achieving Targets

Integrated materials management focuses on achieving organizational targets by:

- Proper materials planning based on accurate forecasts and demand patterns.
- Systematic handling of materials to minimize damage and maximize efficiency.
- Better inventory turnover to optimize working capital and reduce carrying costs.
- Reduced stock-outs by maintaining optimal inventory levels.
- Shortened lead times in procurement and delivery processes.
- Minimizing storage and preservation costs through effective management practices.

- Providing prompt solutions to materials-related challenges to maintain operational continuity.

6. Result-Oriented Communication

The approach emphasizes clear and effective communication channels to promptly address materials management issues and ensure that objectives are met.

An integrated setup allows for the effective introduction of advanced electronic data processing (EDP) systems, which are crucial for managing material functions efficiently and economically. Centralizing all material-related information under this approach facilitates data collection and analysis, leading to informed decision-making. Reliable data and relevant information are essential for making necessary decisions, and modern organisations are progressively adopting sophisticated EDP systems within integrated setups. This integration significantly benefits the materials department by:

- Ensuring proper, efficient and effective management of materials.
- Enhancing coordination efforts across various functions.
- Improving materials planning processes effectively.

Moreover, an integrated approach fosters a spirit of teamwork among all involved in materials management, considering them valuable assets to the organization. This cooperative environment emphasizes teamwork, boosts morale, and enhances overall performance.

In India, organizations increasingly recognize the importance of integrated approaches in achieving dual objectives of minimizing costs and maximizing profits. This trend underscores the growing adoption and utility of integrated systems across industries.

4.6 Advantages of Integrated Materials Management:

1. Better Accountability

Centralizing materials management establishes clear accountability and responsibility. It ensures that all material functions are clearly defined and distributed among departments, facilitating quick identification and resolution of issues.

2. Improved Coordination

With centralized authority and responsibility, there is improved coordination among departments. This alignment fosters better support and cooperation, leading to smoother operations and enhanced relationships between user departments and the materials management team.

3. Enhanced Performance

Integration enables better performance across various aspects of materials management:

- Accurate estimation of material requirements.
- Optimal inventory levels and management.
- Effective production planning and scheduling.
- Timely procurement and delivery of materials.
- Improved control over inventory to reduce costs.
- Efficient utilization of storage space.
- Proper handling and care of materials to prevent damage.
- Rigorous analysis and evaluation of performance metrics

4.7 Service Function Advantages:

In integrated materials management, the service function plays a crucial role in ensuring smooth operations and customer satisfaction. Here are the key advantages of the service function in this context

1. Enhanced Customer Satisfaction

The service function focuses on meeting customer needs and expectations, which leads to improved customer satisfaction and loyalty. By addressing customer queries and resolving issues promptly, the service function ensures that customers have a positive experience, fostering long-term relationships and repeat business.

2. Improved Coordination

The service function facilitates better coordination between different departments involved in materials management, such as procurement, inventory and distribution. This coordination helps in synchronizing activities, reducing delays, and ensuring that materials are available when needed, which in turn supports seamless operations.

3. Efficient Problem-Solving

Serving as a liaison between various stakeholders, the service function improves information flow and reduces miscommunications. Clear and consistent communication helps in aligning goals, sharing updates, and ensuring that everyone is on the same page, which is crucial for the success of materials management processes.

5. Cost Reduction

By optimizing processes and addressing inefficiencies, the service function can help reduce overall operational costs. It identifies areas where costs can be cut without compromising quality, such as reducing waste, improving process efficiency, and negotiating better terms with suppliers.

6. Increased Responsiveness

The service function allows for quicker adaptation to changing customer demands and market conditions. It ensures that the materials management process is flexible and agile, capable of responding to new challenges and opportunities as they arise.

7. Better Resource Allocation

By identifying areas that need more attention or resources, the service function leads to more efficient resource allocation. It helps in prioritizing tasks and distributing resources where they are most needed, ensuring that the organization operates effectively and efficiently.

8. Quality Improvement

Through constant feedback and monitoring, the service function contributes to continuous improvement in product and service quality. It ensures that any quality issues are promptly addressed and that there is a continuous effort to enhance the overall quality of materials and processes. Enhanced

9. Decision-Making

Providing valuable insights and data, the service function supports more informed decision-making across the materials management process. It helps in analyzing trends, forecasting demand, and making strategic decisions that enhance operational efficiency and effectiveness.

10. Improved Supplier Relationships

The service function can help in managing and improving relationships with suppliers, leading to better terms and more reliable supply. Strong supplier relationships are crucial for ensuring timely deliveries, high-quality materials, and favorable pricing, all of which contribute to the success of the materials management process.

11. Increased Operational Efficiency

By streamlining processes and eliminating bottlenecks, the service function contributes to overall operational efficiency. It ensures that all aspects of materials management are working smoothly, reducing delays and enhancing productivity.

12. Better Inventory Management

The service function helps in maintaining optimal inventory levels by providing accurate information on demand and usage patterns. It ensures that inventory is managed effectively, reducing excess stock and minimizing stock outs, which in turn helps in maintaining a smooth supply chain.

13. Compliance Assurance

Ensuring that all materials management activities comply with relevant regulations and standards is another key role of the service function. It helps in maintaining compliance with legal and regulatory requirements, reducing the risk of penalties and ensuring that the organization operates within the established guidelines.

4.8 Inventory Control

Inventory control is the process of managing and regulating the investment in materials and parts held in stock within predefined limits, as per the inventory policy established by Gordon B. Carson

4.8.1 Functions of Inventory:

Inventory serves several critical functions in an organization, ensuring that the flow of goods and materials supports efficient and effective operations. Here are the primary functions of inventory

1. Buffer Stock

Inventory acts as a buffer to protect against uncertainties in demand and supply. It ensures that there is enough stock to meet customer needs even when demand fluctuates or supply chain disruptions occur.

2. Decoupling Function

Inventories help in decoupling different stages of production and supply processes. By holding stock, companies can continue operations even if there are delays or interruptions at any point in the supply chain.

3. Economies of Scale in Production

Maintaining inventory allows for bulk production and purchasing, which can reduce unit costs through economies of scale. This helps in achieving cost efficiency and maximizing profitability.

4. Speculation

Inventory can be held in anticipation of price increases or shortages. By purchasing and storing materials in advance, organizations can avoid higher costs or potential supply issues in the future.

5. Seasonal Demand Management

Inventories allow companies to manage seasonal variations in demand. By producing or purchasing goods in advance of peak seasons, businesses can ensure they have adequate stock to meet increased customer demand.

6. Continuous Production

Maintaining appropriate inventory levels ensures a steady supply of raw materials and components, supporting continuous production processes and avoiding downtime due to stock outs.

7. Lead Time Reduction

Inventories help to bridge the gap between the time a purchase order is placed and when the goods are received. This reduces lead time and ensures that production and sales processes are not interrupted.

8. Customer Service Improvement

By having sufficient inventory on hand, organizations can meet customer orders promptly. This improves customer satisfaction and loyalties by ensuring products are available when needed.

9. Protection against Supply Chain Disruptions

Inventory provides a buffer against disruptions in the supply chain, such as delays from suppliers, transportation issues, or other unforeseen events. This helps maintain stable operations and consistent product availability.

10. Production Smoothing

Inventory allows for smoothing production schedules by absorbing fluctuations in production levels. This helps in maintaining consistent output and avoiding the inefficiencies of fluctuating production rates.

11. Flexibility in Operations

Inventories provide the flexibility to respond quickly to changes in market demand or production requirements. This agility is crucial in dynamic markets where customer preferences and demand can change rapidly.

12. Risk Management

Holding inventory can mitigate risks associated with supply shortages, demand spikes, and other uncertainties. It acts as a form of insurance against various operational risks.

4.8.2 Importance of Inventory Control:

4.8.2.1 The Importance of Inventory Control in Organizations

Prevent Delays Due to Inventory Shortages: Ensuring that there is enough inventories to meet customer demand is critical for maintaining smooth operations and customer satisfaction. Shortages can lead to production halts, delayed deliveries, and lost sales opportunities, which can harm an organization's reputation and profitability. Effective inventory control involves accurate demand forecasting, timely reordering, and maintaining safety stock levels to prevent such delays.

Minimize Costs Related to Holding Inventory: Holding inventory incurs costs such as storage, insurance, and taxes. Additionally, over time, items in inventory can become obsolete, leading to losses if they cannot be sold or used. Efficient inventory management seeks to balance the cost of holding inventory against the need to meet demand promptly. This involves techniques like Just-in-Time (JIT) inventory and economic order quantity (EOQ) to minimize holding costs while ensuring availability.

Return on Investment (ROI)

One of the key financial metrics that organizations use to gauge the effectiveness of their operations is Return on Investment (ROI). ROI is calculated using the following formula:

Return on Capital = Profit/Capital Investment

Profit: The financial gain obtained after subtracting all costs from revenue.

Capital Investment: The total amount of money invested in the business, including inventory, equipment, facilities, and other assets.

ROI measures how effectively an organization is using its capital to generate profit. A higher ROI indicates better utilization of capital and more efficient operations.

4.8.2.2 Factors Influencing Profit Margins:

1. Market Competition

Profit margins in business can be influenced by a variety of external factors, such as the presence of competitors, which can affect pricing strategies and market share. Competitive pressures may force businesses to lower prices or increase spending on marketing and innovation to maintain their market position.

2. Economic Conditions

Inflation, interest rates, and overall economic health can impact consumer spending and business costs. During economic downturns, reduced consumer spending can lead to lower sales, while rising costs of raw materials and labor can squeeze profit margins.

3. Regulatory Environment

Changes in regulations can introduce new costs or opportunities for businesses. Compliance with new laws may require additional investments in technology, training, or processes, impacting profitability. Conversely, deregulation can open up new markets or reduce compliance costs, enhancing profit margins.

4.8.2.3 The Role of Efficient Inventory Management:

1. Optimising Inventory Levels

By carefully managing inventory levels, organizations can ensure that they have just enough stock to meet demand without holding excess inventory. This helps reduce the capital tied up in inventory, freeing up resources for other investments or operational needs. Techniques like demand forecasting, inventory turnover analysis, and automated inventory management systems are crucial in achieving optimal inventory levels.

2. Reducing Holding Costs

Minimizing the amount of inventory held reduces storage costs, insurance, and taxes. It also reduces the risk of inventory obsolescence, which can lead to significant financial losses. Adopting strategies such as drop shipping, vendor- managed inventory (VMI) and consignment stock can help in reducing holding costs.

3. Ensuring Smooth Operations

Proper inventory management ensures that goods are available when needed, preventing production delays and lost sales. It supports customer satisfaction by ensuring timely delivery of products and services. This involves maintaining accurate inventory records, timely reordering, and effective supply chain coordination.

4. Enhancing Financial Planning

Efficient inventory management provides better visibility into inventory levels and turnover rates. This helps in budgeting and financial planning; allowing organizations to forecast needs more accurately and allocate resources more effectively. Advanced inventory management software can provide real-time data and analytics to support financial planning and decision-making.

5. Maximizing Profitability

Efficient inventory management reduces unnecessary costs, freeing up resources that can contribute to profit. By minimizing waste and optimizing resource use, organizations can enhance their overall profitability.

6. Managing Operational Risks

Proper inventory levels prevent disruptions in production and supply chain operations, ensuring business continuity. Effective risk management involves identifying potential supply chain vulnerabilities and implementing strategies to mitigate these risks.

7. Improving ROI

By minimizing capital tied up in inventory and reducing related costs, organizations can improve their return on investment, indicating better use of their financial resources. Improved ROI reflects the organization's ability to generate more profit from its investments, demonstrating financial efficiency and effectiveness.

Replenishment Stock

Replenishing stock is crucial for any organization, as it directly impacts its financial health and operational efficiency. There are two main types of capital in any organization: fixed capital, which includes buildings and machinery, and working capital, which includes inventory. Unlike fixed capital, working capital tied up in inventory can be adjusted and optimized.

Efficient inventory management plays a significant role in enhancing profit margins by reducing operational costs associated with inventory, lowering production costs, increasing competitiveness, and improving turnover rates. Surpluses tie up capital, while shortages lead to operational difficulties. Scientific inventory control methods help eliminate these issues and prove their importance in organizational success.

In today's complex and competitive industrial environment, the materials manager plays a critical role in restocking the organization's stores efficiently. The manager cannot afford to rely on trial-and-error methods, as this could result in costly outcomes. Instead, they must carefully balance different stock levels to ensure materials are available when needed while minimizing holding costs

Materials are received, stored, preserved, and issued on demand by the storekeeper. When stock levels reach a critical point, the storekeeper alerts the materials and purchase departments to replenish supplies to fulfill future requisitions. Failing to replenish stock promptly can bring operations to a standstill, leading to wasteful expenditures and disrupting economic activities within the organization.

Therefore, effective replenishment of materials involves proactive steps to purchase fresh stocks either when supplies are exhausted or when they reach a predefined reorder level. This ensures continuous availability of materials and supports the organization in achieving its operational goals efficiently.

4.9 Material Demand Forecasting:

Forecasting involves estimating future sales or demand for products based on historical data and assumptions about external economic factors. It's a critical part of both strategic and operational planning, bridging the gap between planning and control in an organization.

There are two main types of forecasting: short-term and long-term. Short-term forecasts cover periods less than a year and are used for materials control, scheduling and budgeting. Long-term forecasts extend beyond a year and are essential for product diversification, sales planning, advertising budgets, capacity planning, and investment decisions.

In the context of inventory control, accurate demand forecasting is crucial. It helps determine how much inventory should be kept on hand to meet future demand without excessive stocking or stockouts. Forecasts also assist in predicting material requirements, procurement lead times, scrap rates, and other factors essential for effective production and operations management.

The marketing department plays a pivotal role by providing forecasts based on customer demand and market conditions. This input is vital for production planning and ensures that the organization can meet customer needs efficiently. Similarly, in materials management, forecasting not only predicts material needs but also estimates the time required to acquire or process these material.

4.9.1 Objectives of Material Demand Forecasting:

I Short-term Objectives:

1. Production Policy Formulation

Forecasting helps in planning production volumes to align with anticipated sales. This ensures continuous material supply and optimal inventory levels.

2. Machine Utilization

By predicting demand, production schedules can maximize machine capacity utilization, enhancing operational efficiency. Labor

3. Management

Anticipated production needs based on forecasts enable effective scheduling and deployment of skilled and unskilled labor.

4. Price Policy

Forecasting aids in setting stable pricing strategies that mitigate price fluctuations during economic shifts, ensuring market stability.

5. Sales Control

Regional demand forecasts guide setting sales targets for different territories, facilitating performance evaluation.

6. Financial Planning

Sales forecasts help estimate financial requirements, optimizing financial planning and minimizing costs associated with obtaining finance.

II Long Term Objectives:

Production Capacity Planning

Long-term forecasts assist in determining optimal plant size and production capacity alignment with future sales projections.

Labour Management

Accurate forecasts enable better planning for labor needs, optimizing labor costs as a significant component of production expenses.

4.10 Capital Structure

Long-term production plans based on forecasts assist in arranging adequate and cost-effective long-term financing from various sources. Long-term sales forecasts are critical for strategic decision-making and policy formulation, ensuring the firm's alignment with market demands and achieving long-term success. The reliability and quality of forecasting mechanisms significantly influence organizational strategies and outcomes.

Long-term sales forecasts are critical for strategic decision-making and policy formulation, ensuring the firm's alignment with market demands and achieving long-term success. The reliability and quality of forecasting mechanisms significantly influence organizational strategies and outcomes.

4.10.1 Steps in Forecasting of Demand:

1. Determining Objectives

Begin by clearly defining the goals and objectives of the sales forecasting process.

2. Forecasting Period

Decide whether the forecast will cover the short-term or long-term period.

3. Scope of Forecast

Specify the scope of the forecast, whether it pertains to specific products, geographic areas, industry sectors, or global markets.

4. Subdividing the Task

Divide the forecasting task into manageable groups based on product types, geographic regions, market segments, or customer demographics.

5. Identifying Variables

Identify and prioritize the variables that influence sales, ensuring all relevant factors are considered.

6. Selecting Forecasting Methods

Choose an appropriate forecasting method based on the nature of data available, the purpose of the forecast, and the desired level of accuracy.

7. Data Collection and Analysis

Gather relevant data; analyze it using statistical or graphical techniques, and cross-check for consistency and reliability.

8. Correlation with Sales Promotion

Assess how sales forecasts align with planned sales promotion strategies such as advertising and personal selling.

9. Competitor Analysis

Study competitors' activities, strategies, and market positioning as they impact the company's sales volume.

10. Preparing Final Forecasts

Review initial forecasts, make necessary adjustments based on analysis, and finalize the sales forecast figures.

11. Evaluation and Adjustment

Continuously monitor actual sales performance against forecasts at regular intervals (monthly, quarterly, etc.), make adjustments as needed and incorporate lessons learned into future forecasts.

A. Judgemental Techniques:

1. Opinion Survey Method

This method involves collecting feedback from potential buyers through structured questionnaires or interviews. It helps in understanding consumer preferences, buying behaviours, and expectations related to a product or service.

2. Experts Opinion Method

Relies on insights and predictions from industry experts or experienced individuals. This approach is particularly useful for forecasting demand of established products where historical data may be limited or less relevant.

3. Customer and Distributor Surveys

Surveys gather data directly from customers and distribution channels. Feedback from retail outlets, distributors and sales teams provides valuable insights into current market demand trends and customer preferences.

4. Marketing Trials

Conducted for new products, marketing trials involve introducing the product to a limited market segment to gauge initial consumer acceptance, preferences, and potential demand patterns.

5. Market Research

Utilizes external agencies to conduct comprehensive studies on consumer behaviour, market trends, competitive landscape and economic factors influencing demand. It provides detailed insights into market dynamics essential for accurate forecasting.

6. Delphi Method

Involves iterative rounds of structured questionnaires with a panel of experts to achieve consensus on future demand scenarios. It minimizes bias by synthesizing diverse expert opinions and adjusting forecasts based on collective insights.

B. Time Series Methods:

Simple Average Method

Calculates the average of historical data points over a specified period to forecast future demand. It's straightforward but may not capture trends or seasonal variations adequately.

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Moving Average Method

Smooth out variations by averaging a subset of sequential data points, giving more weight to recent observations. It helps in reducing short-term fluctuations for a more stable forecast.

Weighted Average Method

Assigns different weights to historical data points based on their relevance, with higher weights given to recent data. This method enhances accuracy by reflecting changes in demand patterns over time effectively.

Trend Correction Method (Double Exponential Smoothing)

Adjusts forecasts by considering both level and trend components observed in historical data. It incorporates smoothing factors to minimize errors and improve the accuracy of long-term forecasts.

C. Causal (Econometric) Forecasting Methods:

Regression and Correlation Analysis

Establishes statistical relationships between sales and variables like consumer income, pricing and promotional activities. It quantifies the impact of these factors on demand to predict future sales accurately.

Input-Output Analysis

Examines how changes in one sector of the economy affect demand for products in another sector. It identifies interdependencies and economic flows to forecast demand based on broader economic trends.

End-Use Analysis

Analyses how different sectors or industries utilize a product to anticipate future demand. It provides insights into specific consumption patterns and preferences that influence overall market demand dynamics.

The limitations of Demand Forecasting:

1. Changing Consumer Preferences

Fluctuations in consumer needs, tastes, and fashion trends can significantly impact sales forecasts. Products that align well with consumer preferences thrive, while others may fail to meet sales targets unless forecasts are regularly updated to reflect evolving consumer preferences.

2. Lack of Historical Data

Forecasting accuracy suffers when historical sales data is sparse or unavailable for certain products. In such cases, managers must rely on less reliable guesswork to estimate future demand.

3. Anticipating Growth

Forecasting consumer psychological factors, such as sudden shifts in confidence or apprehension about the future, is complex. External events like rumors or economic uncertainties can quickly influence consumer behavior, impacting demand unpredictably

4.10 Materials Requirement Planning

Materials Requirement Planning (MRP) is essential for production planning and inventory control. It categorizes techniques into direct and indirect material planning, further classified by value. MRP uses a structured approach to convert production plans into material requirements, ensuring availability without excess inventory costs.

MRP is both a scheduling and inventory management technique. It starts from the master production schedule for finished goods, breaks down to sub-assemblies and raw materials, considers lead times, and evaluates current inventory levels. This systematic process determines when and how much of each material is needed to fulfill production requirements.

Conditions for MRP:

MRP is beneficial when

- Products are complex with multiple assembly levels.
- Long procurement lead times are involved.
- Specific manufacturing plans are needed.
- Inventory reduction is a priority.

4.10.1 Objectives of MRP:

1. Inventory Reduction

Minimize excess inventory by ordering components as needed.

2. Lead Time Reduction

Coordinate procurement and production to meet delivery deadlines.

3. Realistic Commitments

Provide accurate delivery schedules to enhance customer satisfaction.

4. Increased Efficiency

Improve production efficiency by synchronizing operations and minimizing interruptions.

4.10.2 Functions Served by Materials Requirement Planning:

Order Planning and Control

MRP assists in determining the timing and quantity of purchase orders for materials and components needed in production.

It ensures that orders are placed in such a way that materials arrive just in time for use in manufacturing, minimizing inventory holding costs and ensuring production continuity.

Priority Planning and Control:

MRP helps prioritize production activities by comparing the expected availability date of materials/components with the actual date they are needed.

This prioritization ensures that critical components are available when required— for production, thereby preventing delays and disruptions.

Basis for Capacity Planning and Business Plan Development

MRP provides the foundational data for capacity planning, helping businesses determine their production capacity requirements based on the scheduled production of finished goods.

It supports the development of broader business plans by aligning production schedules with overall strategic goals and market demands.

4.10.3 Procedural Steps in Materials Requirement Planning:

1. Determine Gross Requirements of Finished Products

Aggregate the quantity needed from three sources: pending sales orders, sales forecasts, and management adjustments to smooth production.

2. Determine Net Requirements of Finished Products:

Adjust gross requirements by subtracting available inventory to find net requirements.

3. Develop Master Production Schedule (MPS):

Create a detailed plan specifying what products to manufacture over a defined period based on net requirements.

4. Explode the Bill of Materials (BOM) and Determine Gross Requirements:

Break down the BOM for each assembly to identify parts and quantities needed. Compute gross requirements by multiplying net requirements of assemblies by BOM quantities.

5. Screen 'B' and 'C' Category Items

Identify and manage items categorized as 'B' (low value) and 'C' (very low value) based on their importance and usage.

6. Determine Net Requirements of Items

Adjust gross requirements of each item by considering current stock on hand and stock on order. Decide whether to replenish based on actual need.

7. Adjust Requirements for Scrap Allowance:

Account for expected scrap and waste during manufacturing by estimating losses and adjusting net requirements accordingly.

8. Schedule Planned Order

Determine when and how much of each item to order, considering manufacturing cycle times and delivery schedules.

9. Explode the Next Level of Assemblies

Repeat steps 5 to 7 for each subsequent level of the BOM, ensuring all parts and quantities are determined and time-phased.

10. Aggregate Requirements and Determine Order Quantities:

Consolidate demands for common items across different assemblies before placing orders to optimize purchasing and production efficiency.

11. Write and Place Planned Orders

Generate purchase orders or work orders based on the MRP calculations and requirements, ensuring clarity and accuracy.

12. Maintain Schedules:

Regularly monitor and follow up on orders to ensure timely delivery. Expedite as needed to resolve any delays or issues

4.10.4 Assumptions of a Successful MRP Program:

A successful Materials Requirement Planning (MRP) program relies on several key assumptions

1. Availability of Suitable Computer

Requires a computer with adequate capacity to handle MRP calculations and data storage

2. Use of Assembly Line Principle

Manufacturing operations are structured based on assembly line principles to facilitate efficient production flow.

3. Accurate Bill of Materials (BOM)

Up-to-date and precise BOMs for all assemblies are essential to accurately determine material requirements.

4. Existence of Updated Master Schedule

A master schedule that is regularly updated and accurate, providing the foundation for MRP calculations.

4.11 MRP System Overview

An MRP system utilizes inputs such as Master Production Schedule (MPS), Inventory Status File, and Bill of Materials (BOM) to generate outputs like planned order releases, order rescheduling, and planned orders. It operates on the principle of perpetual inventory; calculating net requirements based on current inventory levels and scheduled receipts.

4.11.1 Pre-requisite Information for Installing MRP System

Before installing an MRP system, essential pre-requisite information includes

- Existing customer orders and open orders for production planning.
- Forecast of demand for products over the planning horizon.
- Rough-cut capacity plan to anticipate resource shortages.
- Product structure detailing how components assemble into finished products.
- Information on product design changes and current inventory levels.
- Planned inventory receipts expected during the planning horizon.

4.11.2 Advantages and Disadvantages of MRP System

- Detailed inventory control in real-time or near real-time.
- Improved production scheduling by setting material arrival deadlines.
- Reduction in inventory levels by optimizing timing of material orders.

- Capacity planning support.
 - o Ability to simulate different inventory ordering policies.
- Long planning and implementation time.
- High data entry and maintenance requirements.
- Dependency on forecasts and lead time estimates can sometimes lead to inaccurate outputs.
- High initial investment in computer infrastructure for larger scale operations.

4.12 Manufacturing Resource Planning - II

Manufacturing Resource Planning (MRP-II) is an integrated system that harmonizes all facets of a business operation. It coordinates sales, purchasing, manufacturing, finance, and engineering through a unified database and centralized production plan. This system is structured into three main components

Product Planning Functions

Managed at the executive level, this involves strategic decisions regarding product lines and long-term production goals.

Operations Planning

Production departments are tasked with meeting these commitments, sales departments align sales efforts accordingly, and finance ensures adequate financial resources are available. Handled by staff units, operations planning translate strategic decisions into detailed production schedules and resource allocations.

Operations Control Functions

Managed by manufacturing supervisors, operations control oversees the day-to-day execution of production plans, ensuring adherence to schedules and resource availability.

4.13 Manufacturing Resource Planning - III

MRP-III represents an advanced iteration of MRP-II, integrating concepts from MRP-I, JIT (Just-In-Time), expert systems, increased operator involvement and Simultaneous Engineering. Unlike MRP and MRP-II, which were standardized solutions, MRP-III emerged from the British computer manufacturer, ICL, in April 1990 as a synthesis of existing methodologies rather than a pre-packaged solution to manufacturing management challenges.

4.14 ABC

ABC Analysis is a method of inventory control that classifies items based on their importance, aiming to allocate resources efficiently. Originating at General Electric in the USA, it categorizes inventory items into classes A, B and C according to their value and usage.

An effective inventory control system prioritizes high-value items for closer monitoring and management, ensuring they receive adequate attention and protection compared to lower-value items. This principle, known as Control by Importance and Exception (CIE), is operationalised through ABC analysis, also referred to as Always Better Control or Proportional Value Analysis

The Pareto Principle, or the 80/20 rule, underpins ABC analysis by suggesting that roughly 20% of items (A class) often account for 80% of the inventory value or usage impact. This principle guides the classification process, helping organizations focus efforts where they will have the most significant impact.

4.14.1 Implementation of ABC Techniques:

1. Classification

Inventory items are classified into A, B, or C categories based on their total cost, with A items being the highest and C items the lowest.

2. Evaluation Criteria

A Class Items:

These items require stringent control due to their high value and potential impact on operations if stock-outs occur. Close monitoring, frequent reviews, and possibly vendor contracts ensure continuous supply.

B Class Items:

Moderately valued items that require regular attention and control, managed using computer-based systems with periodic reviews.

C Class Items:

Items of lower value and usage, which can be managed with routine controls like, reorder point systems without extensive monitoring.

4.14.2 Advantages of ABC Analysis

- Enables focused inventory management, reducing costs associated with excess inventory.
- Improves efficiency by directing attention to critical items, enhancing overall inventory turnover.
- Helps in identifying obsolete items and optimizing inventory levels based on usage and value.

4.14.3 Limitation

- Requires standardization and periodic review to remain effective, as item priorities and values may change.
- Some critical items may be undervalued in monetary terms but crucial for operations, necessitating careful consideration beyond monetary value.

4.15 VED

VED classification, which stands for Vital, Essential, and Desirable, is commonly used for categorizing spare parts, particularly in situations where demand patterns are unpredictable compared to raw materials. Spare parts, especially for aging machinery, may see sudden increases in demand for maintenance purposes. Traditional methods of inventory management may not account for these fluctuations effectively.

In VED classification, parts are categorized based on their importance and criticality to plant operations. Items deemed vital to operations are classified as 'V'. Essential items receive an 'E' classification, indicating significant importance but not as critical as vital items. 'D' classification is given to items considered desirable but not essential for immediate operations.

The classification process considers factors such as criticality for machine functioning, availability, price, and one's own experience. For instance, readily available items may not receive a 'V' classification, whereas imported or critical components automatically qualify as 'V' items due to their importance.

4.15.1 Implementation Guidelines:

V (Vital) Items

Require substantial stock levels due to their critical role in operations. Close monitoring and stringent control are necessary, especially if they fall into the 'A' category.

E (Essential) Items

Important for operations but may not require as rigorous control as 'V' items. Managed with moderate stock levels and periodic reviews.

D (Desirable) Items

Items of lower importance that may not necessitate stocking if they are also classified as 'C'. Minimal attention is required for these items.

4.16 FSN Analysis:

FSN classification is a method used to categorize inventory items based on their issue patterns from stores. The acronym FSN stands for Fast-moving, Slow-moving and Non-moving. This classification is particularly useful for managing obsolescence within inventory.

4.16.1 Key Points:

Fast-moving (F) Items:

These are inventory items that have a high rate of issues or consumption from stores. They are in constant demand and require regular monitoring to ensure adequate stock levels.

Slow-moving (S) Items:

These items have a lower rate of consumption compared to fast-moving items. They may have occasional demand or a fluctuating usage pattern. Monitoring of these items is necessary to avoid overstocking and obsolescence.

Non-moving (N) Items:

Non-moving items are those that have not been issued from stores over a long period. They are at risk of obsolescence and require careful management. Reasons for items becoming non-moving could include changes in technology, specifications, or reduced demand.

Purpose of FSN Classification

FSN classification helps highlight inventory items that need specific attention based on their usage patterns. It provides managers with clear insights into which items are critical (F), which need careful monitoring (S), and which require immediate action to prevent obsolescence (N).

Check Your Progress

Choose the Correct Answer:

1. Integrated Materials Management (IMM) refers to

- a) Managing only production
- b) Coordinating purchasing, storage and inventory activities
- c) Managing marketing activities
- d) Managing finance only

Answer: b

2. One important service function of materials management is

- a) Supplying materials to production department
- b) Selling products
- c) Advertising
- d) Recruitment

Answer: a

3. Inventory means

- a) Finished goods only
- b) Stock of raw materials, work-in-progress and finished goods
- c) Machinery
- d) Workers

Answer: b

4. One function of inventory is

- a) Maintaining adequate stock of materials
- b) Advertising

- c) Sales promotion
- d) Recruitment

Answer: a

5. Replenishment stock refers to

- a) Excess stock
- b) Stock kept to replace used materials
- c) Damaged stock
- d) Dead stock

Answer: b

6. Material demand forecasting helps in

- a) Predicting future material requirements
- b) Increasing wastage
- c) Reducing production
- d) Advertising

Answer: a

7. MRP stands for

- a) Material Resource Planning
- b) Marketing Resource Planning
- c) Material Requirements Planning
- d) Management Resource Planning

Answer: c

8. ABC analysis classifies inventory based on

- a) Quantity

- b) Value of materials
- c) Size of materials
- d) Weight of materials

Answer: b

9. VED analysis classifies materials based on

- a) Cost
- b) Criticality or importance
- c) Weight
- d) Size

Answer: b

10. FSN analysis classifies materials based on

- a) Price
- b) Usage rate (Fast, Slow, Non-moving)
- c) Weight
- d) Size

Answer: b

Small Questions – LOCF Mapping Table

S.No	Small Question	CO	Bloom's Level	PO
1	What is Integrated Materials Management?	CO1	Remember	PO1
2	What are the service functions of materials management?	CO2	Understand	PO2
3	What is inventory control?	CO3	Remember	PO3
4	What is MRP (Material Requirements Planning)?	CO4	Understand	PO4
5	What are ABC, VED and FSN analysis?	CO5	Understand	PO5

Big Questions – LOCF Mapping Table

S.No	Big Question	CO	Bloom's Level	PO
1	Explain the concept and advantages of integrated materials management.	CO1	Understand	PO1
2	Discuss the functions and importance of inventory control.	CO2	Analyze	PO2
3	Explain the concept of replenishment stock and material demand forecasting.	CO3	Understand	PO3
4	Discuss the concept and importance of Material Requirements Planning (MRP).	CO4	Analyze	PO4
5	Explain the basis and tools of inventory control such as ABC, VED and FSN analysis.	CO5	Evaluate	PO5

Unit- V

5.1 Introduction of Purchase Management

Purchase management is the strategic process of acquiring goods and services from suppliers to meet an organization's needs efficiently and cost-effectively. It includes everything from identifying what is needed, selecting and negotiating with the right suppliers, to the final payment and receiving of goods. Effective purchase management aims to get the right quality and quantity, at the right price and delivered at the right time, ultimately helping to improve a company's profitability and competitiveness.

The primary goal of purchase management is to ensure that the right materials are procured at the right time, in the right quantity, from the right source, at the right price and with the right quality. This function encompasses various activities including supplier selection, negotiation, order placement, expediting and vendor relationship management. Effective purchase management contributes significantly to cost reduction, quality improvement and operational efficiency, thereby playing a crucial role in maintaining a company's competitive edge in the market

Meaning:

Purchase management is about carefully planning and organizing how a company buys goods and services. The goal is to get the best value for money while making sure everything meets high standards. This includes choosing suppliers wisely, making sure purchases are cost-effective, ensuring the quality of what's bought and managing the whole process to help the company achieve its goals and create more value.

"Purchasing, as defined by Alford and Beary, is the essential function of acquiring materials, supplies, machinery and services vital for the smooth operation of a manufacturing plant. It encompasses the procurement of goods and services from external sources to ensure uninterrupted production, maintenance and ultimately, the successful marketing of the company's products.

Traditionally seen as a subset of production management, modern perspectives acknowledge its strategic importance amidst evolving business landscapes, heightened

competition and rising input costs. Led by a Purchase Manager or Officer, the purchasing department, also known as Commercial Management or Purchase Chief in some organizations, plays a pivotal role in securing the right quality, quantity, timing, source and pricing of goods.

Definitions:

Purchase management is the strategic orchestration of procurement activities aimed at optimizing the acquisition of goods and services to meet organizational needs while maximizing cost efficiency and competitive advantage.

-Peter Kraljic

"Purchase management involves the comprehensive management of the entire procurement process, from identifying requirements and selecting suppliers to negotiating contracts, monitoring supplier performance and ensuring timely delivery of goods and services, all aimed at supporting organizational objectives and enhancing value creation".

-Jonathan Chapman and Ann Wyatt

Key Components and Activities:

Identifying needs:

Determining what goods or services are required for the business to operate.

Supplier selection:

Finding and vetting suppliers to ensure they are reliable and can provide quality products at competitive prices.

Negotiation:

Reaching agreements with suppliers on terms, including price, delivery dates and other conditions.

Order placement:

Creating and issuing purchase orders to suppliers for the approved goods and services.

Receiving and inspection:

Verifying that the items received match the purchase order in terms of quantity and quality.

Payment processing:

Approving and processing invoices for payment, which is a critical part of the financial cycle.

Inventory management:

Balancing inventory levels to avoid shortages or excessive holding costs.

Risk management:

Developing strategies to mitigate potential supply chain disruptions.

5.2 The Importance of Purchasing:

Purchasing is important for both individuals and businesses as it provides the goods and services necessary for daily life and operations. For businesses, it's a strategic function that impacts profitability by controlling costs, ensuring quality and maintaining efficiency. Effective purchasing also mitigates risks, builds strong supplier relationships and can provide a competitive edge.

1. Supplying Materials for Production

Purchasing ensures the timely procurement of materials necessary for production. Without these materials, machinery in factories would come to a halt, disrupting operations and potentially leading to significant losses in productivity and revenue.

2. Cost Savings and Increased Turnover

Even minor savings in material costs can have a substantial impact on overall turnover. Efficient purchasing practices that secure materials at lower costs can lead to significant savings, potentially equivalent to a substantial increase in turnover. Custodian of Company's Finances: The purchasing manager plays a crucial role as the custodian of the company's finances. With over 50% of the company's earnings allocated to purchases,

3. Custodian of Company's Finances

The purchasing manager plays a crucial role as the custodian of the company's finances. With over 50% of the company's earnings allocated to purchases, effective management of procurement expenditures is essential for maintaining financial health and sustainability.

4. Shift towards Buying Over Making

There has been a notable shift towards purchasing materials rather than manufacturing them in-house. This change in practice highlights the growing significance of purchasing in modern business operations.

5. Contribution to Import Substitution and Foreign Exchange Savings

Strategic purchasing decisions can contribute to import substitution by sourcing materials domestically or from alternative suppliers. This not only supports local industries but also helps in saving foreign exchange by reducing reliance on imported goods.

6. Timely Execution of Industrial Projects

Purchasing plays a pivotal role in ensuring the timely execution of industrial projects by securing the necessary materials and resources according to project timelines. Delays in procurement can lead to project setbacks and increased costs.

7. Evolution of Materials Management Organizations

Modern materials management organizations have evolved from traditional purchasing departments. This evolution reflects the broader scope and strategic importance of procurement functions within organizations.

8. Impact of External Factors

Various external factors, such as post-war shortages, cyclical swings in supply and demand, rising material costs, heavy competition and the expansion of global markets, further underscore the importance of effective purchasing practices in navigating complex and dynamic business environments.

5.3 The Objectives of Purchasing:

1. Obtain Best Value at Reasonable Prices

Purchasing aims to secure materials and services at reasonable prices while obtaining the best possible value. This involves negotiating favorable terms and executing commitments in line with the company's financial objectives and budgetary constraints.

2. Maintain Optimal Inventory Levels

Purchasing seeks to keep inventory levels at an optimal balance to ensure uninterrupted production while minimizing carrying costs and avoiding excess or obsolete inventory.

3. Develop and Maintain Supplier Relationships

Building and maintaining satisfactory relationships with suppliers are crucial objectives of purchasing. This involves identifying reliable sources of supply, fostering trust and establishing mutually beneficial partnerships to ensure consistent and timely deliveries.

4. Ensure Vendor Performance:

Purchasing endeavors to secure good vendor performance by holding suppliers accountable for meeting delivery schedules, providing products of acceptable quality and addressing any issues promptly and effectively.

5. Source New Materials or Products:

Purchasing seeks to attract, retain and develop high-caliber personnel capable of effectively managing procurement activities. Investing in training and professional development enables staff to reach their full potential and contribute to the Purchasing is tasked with continuously exploring and evaluating new materials or products to meet changing business needs, technological advancements, or market demands.

6. Establish Effective Procedures and Policies:

Developing and implementing effective purchasing procedures, along with appropriate controls and policies, is essential to ensure consistency, transparency and compliance with organizational standards and regulations.

7. Implement Cost Reduction Initiatives

Purchasing aims to reduce costs through initiatives such as value analysis, cost analysis and make-or-buy decisions. These efforts focus on identifying opportunities for cost savings and optimizing purchasing strategies to enhance efficiency and profitability.

8. Attract and Develop Talent

Purchasing seeks to attract, retain and develop high-caliber personnel capable of effectively managing procurement activities. Investing in training and professional development enables staff to reach their full potential and contribute to the department's success.

9. Economical Department Operations

Maintaining an economical purchasing department involves optimizing resource utilization, streamlining processes and minimizing overhead costs while ensuring high performance and service quality.

10. Keep Management Informed

Purchasing plays a vital role in keeping top management informed of material developments, market trends and industry dynamics that could impact the company's profitability or performance.

11. Promote Interdepartmental Cooperation

Purchasing aims to foster a high degree of cooperation and coordination with other departments within the organization. This collaboration ensures alignment of purchasing activities with overall business objectives and facilitates cross-functional synergy and efficiency.

The Four Types of Purchasing Systems:

1. Purchase Made as Per Requirement

This type of purchasing system involves procuring goods only when there is a specific need or demand for them. No purchases are made in advance and procurement occurs as and when the need arises. This method is typically employed for emergency requirements or for goods that are needed infrequently. For example, a manufacturing company may use this approach to purchase spare parts for machinery that are only needed in case of breakdowns or repairs.

2. Contract Purchasing

Contract purchasing involves entering into agreements with suppliers or agencies to provide specific materials or goods over a predetermined period. These contracts often stipulate pricing, delivery schedules and quality standards. Contract purchasing is advantageous for materials whose costs fluctuate significantly, as it provides stability and predictability in pricing. For instance, a construction company may enter into a contract

with a steel supplier to purchase a certain quantity of steel at a fixed price over a specified timeframe.

3. Market Purchase

In a market purchasing system, goods are procured directly from the market or various suppliers to take advantage of price fluctuations. This approach allows organizations to leverage market dynamics and secure materials at competitive prices. Market purchasing is suitable for commodities with prices that are subject to frequent changes. For example, a retailer may regularly purchase seasonal merchandise from wholesalers based on prevailing market prices to ensure competitive pricing for customers.

4. Schedule Purchasing

Schedule purchasing involves establishing a predetermined schedule or cycle for procuring materials. This method is used for commodities whose prices are relatively stable and do not fluctuate significantly over time. A schedule of purchases is planned based on anticipated demand and production requirements. For instance, a manufacturing company may implement schedule purchasing for raw materials such as plastics or metals that have consistent pricing and demand patterns. This approach helps streamline procurement processes and ensures timely availability of materials without the need for constant market monitoring.

5.4 Purchasing Procedures:

1. Creating Purchasing Projects and Tasks

Purchasing planning begins with identifying and defining purchasing projects and tasks. This involves determining what needs to be procured, whether it's raw materials, equipment, or services. Projects and tasks are created based on organizational needs, production schedules, inventory levels and other factors influencing procurement requirements.

2. Providing Related Information

Relevant information such as files, links, notes, specifications and requirements associated with purchasing projects and tasks are gathered and documented. This information helps procurement teams make informed decisions and ensures clarity and alignment throughout the procurement process.

3. Assigning Purchasing Tasks to Concerned Personnel

Once projects and tasks are defined and necessary information is gathered, purchasing tasks are assigned to designated personnel or procurement teams responsible for their execution. Assignments consider factors such as expertise, workload and availability to ensure tasks are handled efficiently

4. Setting Task Priorities, Start/Finish Dates, etc.

Priorities are assigned to purchasing tasks based on urgency, importance and dependencies. Start and finish dates are determined considering project timelines, delivery schedules and production requirements. This helps establish a clear timeline for task completion and ensures alignment with organizational objectives.

5. Assigning Supervisors

Supervisors or team leads are assigned to oversee and manage purchasing tasks and projects. They provide guidance, support and direction to procurement teams, monitor progress and address any issues or challenges that may arise during the execution of tasks.

6. Setting Reminders

Reminders are set to alert personnel of upcoming deadlines, milestones, or critical tasks within the purchasing process. These reminders help ensure timely completion of tasks, prevent delays and maintain momentum throughout the procurement cycle.

7. Control and Evaluation

Control mechanisms are established to monitor and evaluate the progress and performance of purchasing projects and tasks. This involves tracking key metrics such as cost, quality, delivery times and supplier performance. Deviations from planned targets are

identified, analyzed and addressed through corrective actions to ensure alignment with organizational goals and objectives.

5.5 The Purchasing Process:

1. Market Survey

Market survey involves researching and analyzing the market to identify potential suppliers, products and pricing options. This stage includes gathering information on supplier capabilities, product specifications, pricing trends and market conditions. Market surveys help procurement teams make informed decisions and select the most suitable suppliers and products to meet organizational needs.

2. Requisitioning

Requisitioning involves initiating the formal request for materials or services needed by the organization. This stage typically begins with internal stakeholders, such as department managers or project leads, submitting purchase requisitions detailing their requirements. Requisition forms include information such as item descriptions, quantities, delivery deadlines and budget allocations.

3. Approving

Approval of purchase requisitions involves obtaining authorization from relevant stakeholders or department heads to proceed with the procurement process. Approval ensures that purchases are aligned with organizational objectives, budgetary constraints and compliance requirements. Appropriate authorization levels and approval workflows are established to ensure accountability and control.

4. Studying Market

Studying the market involves conducting in-depth analysis and evaluation of supplier proposals, quotations and contract terms. Procurement teams assess factors such as pricing, quality, lead times, payment terms and supplier reliability to make informed decisions. Comparative analysis helps identify the most competitive offers and negotiate favorable terms with suppliers

5. Making Purchase Decision

Making the purchase decision involves selecting the preferred supplier and finalizing the terms of the purchase agreement. This stage considers various factors such as price negotiations, contract terms, delivery schedules and quality assurances. Procurement teams collaborate with stakeholders to ensure alignment with organizational requirements and objectives.

6. Placing Orders

Placing orders entails formalizing the purchase agreement with the chosen supplier by issuing purchase orders or contracts. Purchase orders detail the specific goods or services to be procured, quantities, prices, delivery instructions and terms and conditions. Orders are sent to suppliers electronically or via traditional methods, depending on established communication channels.

7. Receipting Goods and Services Received

Upon delivery, goods and services received are inspected and verified against the purchase order to ensure compliance with specifications and quality standards. Receipting involves recording the receipt of materials or services in the organization's inventory or procurement system. Any discrepancies or damages are documented and addressed promptly through communication with the supplier.

8. Accounting Goods and Services

Accounting for goods and services involves recording and documenting procurement transactions in the organization's accounting systems. This stage includes updating inventory records, allocating expenses to relevant cost centers or projects and reconciling accounts payable. Accurate accounting ensures transparency, compliance and financial reporting integrity.

9. Receiving Invoices and Making Payment

Upon receipt of goods or completion of services, suppliers issue invoices for payment. Invoices are reconciled with purchase orders and receipt documentation to verify

accuracy and ensure adherence to agreed-upon terms. Payments are processed promptly according to payment terms negotiated with suppliers to maintain positive supplier relationships and avoid late payment penalties.

10. Credit Note in Case of Material Defect

In case of material defects or non-conformities, suppliers may issue credit notes to compensate for the discrepancy. Credit notes serve as adjustments to the original invoice amount and are processed through the accounts payable system. Procurement teams coordinate with suppliers to resolve issues and facilitate the issuance and reconciliation of credit notes.

5.6 The Purchasing Management Process:

1. Purchasing Planning

Purchasing planning involves defining procurement objectives, strategies and requirements to support organizational goals. This stage includes analyzing demand forecasts, assessing inventory levels and identifying sourcing opportunities. Procurement plans are developed based on factors such as budget constraints, market conditions, supplier capabilities and product specifications. Strategic sourcing strategies are formulated to optimize supplier relationships, mitigate risks and achieve cost savings. Planning also encompasses establishing procurement policies, procedures and performance metrics to guide purchasing activities and ensure alignment with organizational objectives.

2. Purchasing Tracking

Purchasing tracking involves monitoring and managing procurement activities throughout the procurement cycle. This stage includes tracking purchase requisitions, orders and deliveries to ensure timely fulfillment of requirements. Procurement teams use tracking systems and tools to monitor order status, supplier performance and compliance with contractual obligations. Key performance indicators (KPIs) such as on-time delivery, supplier responsiveness and cost savings are tracked to assess procurement performance and identify areas for improvement. Tracking also involves managing changes, risks and

exceptions that may arise during the procurement process to maintain project timelines and budget adherence.

3. Purchasing Reporting

Purchasing reporting entails analyzing procurement data and generating reports to provide insights into purchasing performance and trends. This stage involves compiling and analyzing information on purchasing activities, expenditures, savings and supplier performance. Reports are generated regularly to communicate procurement outcomes, variances and opportunities to key stakeholders, such as senior management, finance and operations teams. Reporting helps evaluate the effectiveness of purchasing strategies, identify areas for optimization and support decision-making processes. Visualizations such as dashboards and scorecards may be used to present data in a clear and actionable format.

4. Negotiate

Negotiation is a critical stage of the purchasing management process where procurement teams engage with suppliers to secure favorable terms and conditions. This stage involves discussing pricing, payment terms, delivery schedules, quality standards and other contractual terms to reach mutually beneficial agreements. Negotiation strategies may include leveraging market intelligence, analyzing supplier proposals and conducting competitive bidding processes to achieve cost savings and value optimization. Effective negotiation skills, communication and relationship-building are essential for successful outcomes. Negotiated agreements are documented in contracts or purchase orders to formalize the terms of the procurement transaction and ensure clarity and compliance.

5.7 The Purchasing Cycle/System:

1. Get Requirement from User Department with Proper Specification

The purchasing process begins with the user department submitting a requisition detailing their requirements for goods or services. This requisition includes specifications such as quantity, quality, delivery deadlines and any other relevant details necessary for procurement.

2. Send the Inquiry to the Vendors (Suppliers and Request Quotation)

Once the requirements are identified, the purchasing department sends inquiries or requests for quotations (RFQs) to potential vendors or suppliers. The RFQ includes the specifications provided by the user department and asks for pricing, terms and conditions for supplying the requested goods or services.

3. Get the Quotations from Vendors

Vendors respond to the RFQ by submitting quotations that outline their proposed prices, delivery schedules, payment terms and any other relevant terms and conditions. The purchasing department collects and reviews the quotations received from various vendors to evaluate options and make informed decisions.

4. Make Comparative Statement

After receiving quotations from vendors, the purchasing department prepares a comparative statement or analysis. This statement compares the prices, terms and conditions offered by different vendors to identify the most favorable option in terms of cost, quality and other relevant factors.

5. Negotiate, Fix the Price and Terms & Conditions

Negotiation may take place between the purchasing department and the selected vendor to finalize the price and negotiate other terms and conditions of the purchase agreement. This stage aims to achieve the best possible deal while ensuring alignment with organizational requirements and objectives.

6. Place the Order to the Right Vendor

Once negotiations are complete and terms are agreed upon, the purchasing department issues a purchase order (PO) to the selected vendor. The PO formalizes the agreement and provides instructions for delivering the goods or services, including quantity, delivery date, shipping details and any other relevant information.

7. Follow Up with Vendor

After placing the order, the purchasing department may follow up with the vendor to confirm receipt and acknowledge any special instructions or requirements. Regular communication with the vendor helps ensure smooth execution of the order and addresses any issues or concerns that may arise.

8. Receipt & Inspection (GRN - Goods Receipt Note)

Upon delivery of the goods or completion of services, the receiving department inspects the items to verify compliance with the purchase order and specifications. If the goods meet the required standards, a Goods Receipt Note (GRN) is issued to acknowledge receipt and initiate the payment process.

9. Storage & Record-Keeping (Batching)

The received goods are stored in designated areas and recorded in inventory systems for tracking and management purposes. Batch numbers or serial numbers may be assigned for traceability and inventory control. Accurate record-keeping ensures transparency, accountability and efficient inventory management.

10. Invoice & Payment

The vendor submits an invoice for the delivered goods or completed services based on the agreed-upon terms and conditions. The purchasing department verifies the invoice against the PO and GRN to ensure accuracy and completeness. Once validated, payment is processed according to the payment terms negotiated with the vendor, completing the purchasing cycle

5.8 The Purchasing Procedure:

1. Receipt and analysis of requisition to assess the need and description of requirement

This initial step involves receiving a purchase requisition from the department that needs materials or services. The purchasing team carefully analyzes the requisition to understand the exact requirements, including specifications, quantity and urgency. They assess whether the request is justified and aligns with the organization's needs and budget.

If any clarifications are needed, the purchasing team communicates with the requisitioning department. This step is crucial as it sets the foundation for the entire purchasing process and ensures that only necessary and appropriate purchases are initiated.

2. Selection of possible sources of supply

Once the requisition is approved, the purchasing team identifies potential suppliers who can fulfill the requirement. This involves researching existing supplier databases, seeking recommendations from other departments and exploring new suppliers in the market. The team considers factors such as supplier reputation, quality of products or services, pricing, delivery capabilities and past performance. They may also issue requests for information (RFIs) to gather more details about potential suppliers. The goal is to create a shortlist of reliable suppliers who can meet the organization's needs effectively and efficiently.

3. Determining the time, price, quality and quantity

This step involves a detailed analysis of the purchase requirements in terms of delivery timeline, pricing, quality standards and quantity needed. The purchasing team collaborates with the requisitioning department to confirm these details and ensure they align with the organization's objectives. They may conduct market research to understand current pricing trends and quality standards in the industry. The team also considers factors like bulk purchasing discounts, lead times for delivery and quality certifications required. This information is crucial for creating accurate and comprehensive purchase orders and for evaluating supplier proposals effectively.

4. Placing the Order

After finalizing the details, the purchasing team prepares and issues a formal purchase order (PO) to the selected supplier. The PO includes all relevant information such as item descriptions, quantities, agreed prices, delivery dates, payment terms and any special instructions. Before sending the PO, it is typically reviewed and approved by authorized personnel according to the organization's procurement policies. The PO serves as a legally binding document between the organization and the supplier. The purchasing

team ensures that the PO is clear, complete and accurately reflects the agreed terms to avoid any misunderstandings or disputes later.

5. Following up and expediting of the order

Once the order is placed, the purchasing team actively monitors its progress to ensure timely delivery. They maintain regular communication with the supplier to track the order status and address any potential issues or delays proactively. If delays are anticipated, the team works with the supplier to find solutions and keeps the requisitioning department informed. They may use order tracking systems or request periodic updates from the supplier. In cases of critical or time-sensitive orders, the team may employ expediting techniques to accelerate the delivery process. This step is crucial for maintaining smooth operations and preventing disruptions due to late deliveries.

6. Checking the invoice and receiving the order

When the order arrives, the receiving department carefully inspects the goods or services against the purchase order and packing slip. They verify that the correct items have been received in the right quantity and condition. Any discrepancies are immediately reported to the purchasing team. Simultaneously, the purchasing team checks the supplier's invoice against the PO and receiving report to ensure accuracy in pricing, quantities and terms. They verify that any agreed-upon discounts have been applied correctly. This step is critical for maintaining accurate inventory records and ensuring that the organization only pays for what it has actually received in satisfactory condition.

7. Processing discrepancies and rejections after inspection

If any discrepancies are found during the receiving process or if items fail quality inspection, the purchasing team initiates a formal resolution process. They communicate with the supplier to report the issues and negotiate a solution, which may involve returns, replacements, or price adjustments. The team documents all communications and actions taken. If items are rejected, they coordinate the return process and arrange for replacements if necessary. They also update relevant departments about the status of the order and any

expected delays. This step is crucial for maintaining quality standards and ensuring that the organization receives full value for its purchases.

8. Communicating with accounts' section for payment

Once the invoice has been verified and any discrepancies resolved, the purchasing team forwards the approved invoice to the accounts payable department for payment processing. They provide all necessary documentation, including the PO, receiving report and any notes on resolved discrepancies. The team ensures that payment terms are adhered to, taking advantage of early payment discounts where applicable. They may also coordinate with accounts payable to resolve any payment-related queries from the supplier. This step is essential for maintaining good supplier relationships through timely payments and for accurate financial record-keeping.

9. Closing completed records

After the payment has been processed and the order fully received and accepted, the purchasing team closes out the purchase order in their system. They ensure that all relevant documents are properly filed, including the original requisition, PO, receiving reports, inspection reports, invoices and payment records. They update supplier performance records based on the transaction. This step is important for maintaining organized and accessible procurement records, which can be crucial for audits, future reference and supplier performance evaluation.

10. Maintenance of records and files

The final step involves ongoing maintenance of procurement records and files. The purchasing team organizes all documentation related to each purchase in a systematic manner, whether in physical files or digital systems. They ensure that records are kept for the required retention period as per organizational policies and legal requirements. Regular audits of these records may be conducted to ensure completeness and accuracy. The team may also use this data to generate reports on purchasing trends, supplier performance and cost savings. Proper record maintenance is crucial for transparency, audit compliance and informed decision-making in future procurement activities.

5.9 Dynamic Purchasing

Dynamic Purchasing Systems (DPS) are electronic procurement processes designed for the efficient and flexible purchase of commonly used goods, works, or services. Unlike traditional frameworks, DPS allows suppliers to join at any time during its duration, ensuring continuous access to new market participants. This approach enhances competition, ensures transparency and simplifies the procurement process through standardized procedures. DPS is particularly beneficial for sectors with rapidly changing needs, enabling swift adaptation to market conditions. Overall, it represents a modern, dynamic approach to procurement that fosters innovation and cost effectiveness.

5.10 Features of Dynamic Purchasing:

Electronic Procurement

DPS operates entirely through electronic means, utilizing digital platforms and tools for the entire procurement process. This ensures greater transparency, as all transactions and communications are documented and accessible. It also enhances efficiency by speeding up processes such as tendering, evaluation and awarding contracts. Additionally, electronic procurement reduces paperwork, minimizes human errors and facilitates easier access to procurement opportunities for suppliers.

Openness

One of the distinctive features of DPS is its openness, allowing suppliers to join the system at any time during its operational period, as long as they meet the established criteria. This contrasts with traditional frameworks, where suppliers can only join at the initial setup. Continuous entry opportunities ensure that the DPS remains dynamic and responsive to market changes. It also encourages a broader range of suppliers, including SMEs, to participate, thereby increasing diversity and innovation in the supplier base.

Flexibility

DPS offers buyers the ability to issue specific contracts, known as call-offs, at any point during its duration. This flexibility is crucial for adapting to changing organizational

needs and market conditions. Buyers can tailor call-offs to specific requirements, ensuring that they procure exactly what is needed at the right time. This also allows for more frequent and smaller scale procurement, which can be more manageable and better, aligned with operational needs.

Standardization:

Goods, works, or services procured through a DPS are generally standardized, meaning they adhere to predefined specifications and criteria. Standardization simplifies the procurement process by reducing the complexity of tendering and evaluation. It ensures consistency in quality and performance, which can lead to better outcomes and easier management. Standardization also helps suppliers understand requirements more clearly, reducing ambiguities and the risk of noncompliance.

Competition

Each call-off within a DPS is open to all suppliers who have been admitted to the system, fostering a competitive environment. This continual competition drives suppliers to offer their best prices and highest quality services, potentially leading to better value for money for the buyer. It also encourages innovation and efficiency among suppliers as they strive to stand out in a competitive field. The frequent opportunities for competition ensure that the procurement process remains dynamic and responsive to market conditions.

5.11 Phases of Dynamic Purchasing System:

A. Establishment Phase

The establishment phase is the initial phase where the DPS is set up and suppliers are invited to join. This phase involves several key steps

1. Advertisement

The DPS is advertised to potential suppliers, informing them about the opportunity to join the system. The advertisement can be published through various channels such as

official procurement websites, industry publications and direct invitations to known suppliers. The advertisement includes details about the DPS, the types of goods or services needed the criteria for admission and instructions on how to apply. The goal is to attract a wide range of suppliers to ensure a diverse and competitive pool.

2. Selection

Suppliers who respond to the advertisement are evaluated against preset criteria. Interested suppliers submit their applications, which typically include information about their capabilities, experience, financial stability and compliance with relevant standards. The evaluation process involves reviewing these applications to ensure that suppliers meet the necessary qualifications and standards. This step ensures that only capable and qualified suppliers are considered for admittance to the DPS.

3. Admittance

Notice includes detailed specifications, requirements, timelines and evaluation criteria for the procurement. Suppliers on the DPS are notified and invited to submit bids or proposals. To procure goods, works, or services as needed in a timely and Suppliers that meet the selection criteria are admitted to the DPS. Admitted suppliers are added to the DPS and can start participating in procurement opportunities. They receive access to the DPS portal where they can view and respond to call-offs. To establish a qualified and reliable supplier base that can meet the needs of the procuring organization throughout the DPS's duration.

B. Operational Phase

The operational phase is the ongoing phase where the DPS is actively used for procurement. This phase includes issuing tenders, conducting competitions and awarding contracts.

1. Call-offs

Buyers issue specific tenders or procurement requests for their requirements. When a buyer identifies a need, they issue a call-off notice through the DPS platform. This notice

includes detailed specifications, requirements, timelines and evaluation criteria for the procurement. Suppliers on the DPS are notified and invited to submit bids or proposals. To procure goods, works, or services as needed in a timely and efficient manner.

2. Mini competitions

All suppliers on the DPS can compete for each specific contract. Once a call-off is issued, suppliers submit their bids or proposals. A mini competition is then conducted where these submissions are evaluated based on the criteria outlined in the call-off notice. This may involve scoring proposals on factors such as price, quality, delivery time and other relevant aspects. To ensure that the best value for money is achieved through competitive bidding among prequalified suppliers.

3. Award

Contracts are awarded based on the criteria set out in the mini competition. After evaluating the bids or proposals, the buyer selects the supplier that best meets the criteria. The contract is then awarded to this supplier, formalizing the agreement to deliver the specified goods, works, or services. To finalize the procurement process and secure the required products or services from the best suited supplier.

5.12 Advantages of Dynamic Purchasing:

Continuous Access to New Suppliers

DPS allows new suppliers to join at any time throughout its duration, provided they meet the specified criteria. This feature increases the diversity of the supplier base, fostering a competitive environment that drives innovation and improves the quality of goods and services. It also ensures that the latest market entrants, including startups and SMEs, can participate, bringing fresh ideas and solutions to the table.

Efficient Procurement Process

The use of standardized and electronic processes streamlines procurement activities. This efficiency reduces the time and administrative effort required for both buyers and suppliers. The standardized processes ensure consistency and clarity, minimizing errors and misunderstandings. Automated workflows and digital communication further expedite procurement activities, leading to quicker and more effective sourcing.

Enhanced Competition

Each procurement under a DPS involves mini competitions among prequalified suppliers. Frequent mini competitions encourage suppliers to continually offer their best prices and highest quality services. This competitive pressure leads to better value for money for buyers and ensures that suppliers remain motivated to maintain high standards.

Transparency and Fairness

DPS processes are conducted electronically, ensuring transparency in all procurement activities. Electronic records and communications provide a clear audit trail, ensuring that all transactions are transparent and can be reviewed if needed. This transparency helps build trust among suppliers and ensures fair treatment for all participants, reducing the risk of corruption and favoritism.

Adaptability

DPS can quickly adapt to changing market conditions and organizational needs. The ability to issue call-offs as needed allows buyers to respond promptly to new requirements or market changes. This flexibility ensures that procurement activities remain aligned with organizational objectives and external conditions, enabling more strategic and responsive sourcing

5.13 Challenges of Dynamic Purchasing:

Initial Setup

Establishing a DPS involves significant upfront effort and resources. Setting up the electronic systems, defining criteria and processes and conducting initial supplier evaluations can be resource intensive. This requires careful planning and investment in technology and human resources to ensure a successful implementation.

Supplier Management

Ongoing management of the supplier pool is necessary to maintain the system's integrity and performance. Regular monitoring and evaluation of suppliers are needed to ensure they continue to meet the required standards and deliver high quality goods or services. This can be time consuming and requires effective management practices to address any issues promptly and maintain supplier relationships.

Technological Dependence

DPS relies heavily on electronic systems for its operation. Reliable and secure electronic systems are essential for the DPS to function effectively. This dependence on technology means that any technical issues, such as system failures or cyber attacks, can disrupt procurement activities. Additionally, organizations need the technical expertise to manage and maintain these systems.

Training and Awareness:

Both buyers and suppliers need to be well trained to participate effectively in the DPS. Ensuring that all participants understand the DPS processes and can use the electronic systems proficiently requires comprehensive training programs. This training needs to be ongoing to accommodate new participants and updates to the system. Lack of awareness or understanding can lead to inefficiencies and reduced participation.

5.14 The Six Major Principles of Purchasing:

1. Right Quality

Purchasing the right quality refers to procuring materials that meet the required specifications and standards for their intended use. This involves assessing the suitability of materials based on factors such as physical properties, chemical composition and performance characteristics. Quality can be evaluated through various methods including physical tests, chemical analysis and adherence to industry standards. Establishing standard specifications and utilizing reputable suppliers help ensure consistent quality. Additionally, the purchasing department collaborates with other departments to understand specific quality requirements for different materials.

2. Right Quantity

Procuring the right quantity of materials involves determining the optimal order quantity to meet production needs while minimizing costs. Economic Order Quantity (EOQ) calculations help identify the quantity that balances ordering and carrying costs. Factors such as demand variability, storage capacity and market conditions influence quantity decisions. Bulk ordering may be employed for cost efficiencies, while arbitrary ordering considers uncertain market conditions. Maintaining an appropriate inventory level ensures uninterrupted production while avoiding overstocking and associated costs.

3. Right Time

Timing is critical in purchasing to ensure materials are available when needed for production. Reorder levels are set to trigger replenishment orders at the appropriate time. Prompt action is taken when inventory levels reach the reorder point to avoid stockouts. Coordination between the materials control department and purchasing department facilitates timely procurement. Delays in material delivery can disrupt production schedules, highlighting the importance of timely sourcing.

4. Right Source

Selecting the right source involves identifying suppliers capable of meeting quality, quantity and timing requirements consistently. Suppliers with a proven track record of reliability, financial stability and integrity are preferred. Proximity to the buyer's organization minimizes transportation costs and enables better communication and after-sales service. Direct engagement with suppliers fosters closer relationships and quality improvement opportunities. Factors such as supplier location, infrastructure, workforce relations and quality control practices are considered during supplier selection

5. Right Price

Determining the right price involves obtaining materials at a cost that offers the best value for money. Factors such as quality, delivery time, competition and market conditions influence price negotiations. Value analysis helps assess whether a proposed purchase represents optimal value. Market prices provide benchmarks for price determination and negotiations between the purchasing department and suppliers aim to achieve mutually beneficial agreements. Evaluating various pricing factors ensures cost-effective procurement while maintaining quality standards.

6. Right Place

Ensuring materials are available at the right place involves selecting sourcing locations that minimize transportation and handling costs. Local suppliers are preferred when they meet quality and cost requirements. Effective logistics management optimizes the supply chain to minimize transportation costs and lead times. Strategic placement of sourcing locations enhances operational efficiency and cost-effectiveness. Selecting the right place for material acquisition contributes to overall supply chain performance and profitability.

5.15 Import Substitution:

Import substitution is a strategic economic policy adopted by nations to reduce dependence on imported goods and promote domestic production. In the context of India, this policy is crucial for achieving self-reliance and improving the balance of payments by reducing the outflow of foreign exchange. Various government departments and large

public sector organizations play a significant role in facilitating import substitution efforts. However, despite these efforts, several challenges hinder the progress of import substitution in the country.

1. Challenges of Import Substitution

Technical experts within organizations may be hesitant to take risks associated with adopting indigenous items. This reluctance could stem from concerns about the quality, reliability, or compatibility of locally produced goods compared to imported alternatives.

2. Lack of Technical Documentation

Drawings and technical specifications for certain items may not be readily available, making it difficult for manufacturers to replicate or produce them domestically. This lack of documentation can impede the development of indigenous substitutes.

3. Limited Indigenous Production Facilities

Insufficient infrastructure and production facilities for certain goods hinder the ability to manufacture them domestically. The absence of necessary machinery, technology, or skilled labor can delay or prevent the establishment of domestic production lines.

4. Inadequate Inspection Facilities

The absence of local inspection facilities may lead to dependence on foreign inspection services, resulting in delays and increased costs. This reliance on external inspection processes can hinder the competitiveness of domestically produced goods.

5. Economies of Scale and Demand

Some items may have low demand or require specialized production processes, making domestic manufacturing economically unviable. The limited market size may not justify the investment required to establish or scale up production facilities, resulting in continued reliance on imports.

6. Higher Production Costs

Domestic production costs, including labor, raw materials and energy, may be higher compared to imported goods. This cost disparity can make domestically produced items less competitive in the market, discouraging their adoption by consumers or businesses.

7. Foreign Collaborator Influence

Foreign collaborators or investors may discourage the adoption of indigenous items in favor of imported alternatives, either due to contractual obligations, profit motives, or perceptions about the quality of domestically produced goods.

5.16 Issues in Import Substitution

1. Tight Specifications and Standards

One major issue is the imposition of very tight specifications and standards by authorities without considering the limitations or conditions specific to India. Often, these standards are borrowed from foreign countries and may not be suitable for Indian circumstances. To make them relevant, there is a need for a review and adaptation of these standards. However, this revision is often neglected, leading to a mismatch between imported standards and indigenous capabilities.

2. Performance Guarantees and Quality Assurance

Indian manufacturers of machinery, tools and equipment may struggle to offer performance guarantees and assure high quality comparable to imported items. This lack of assurance works in favor of imported capital equipment, as buyers tend to favor items with established performance records and quality assurances. The comparison between indigenous and imported items often puts the former at a disadvantage, leading to a preference for imported goods.

3. High Image of Foreign Brands

The strong brand reputation of foreign companies can pose a challenge to import substitution efforts. Consumers and businesses may perceive foreign brands as superior in

quality and reliability, leading to a preference for imported products over domestically produced alternatives, even if the latter meets their needs adequately

4. Influence of Foreign Collaborators

Foreign collaborators, driven by commercial interests and their nature of business, may be reluctant to support the development of indigenous items. Their preference for imported components, spares and technical know-how aligns with their business interests and may undermine efforts towards import substitution by perpetuating dependence on foreign sources

5. Unhelpful Licensing Rules and Controls

Rigidity in licensing rules and controls can hinder import substitution by creating unnecessary bureaucratic hurdles and delays. These rules need to be examined closely and revised or removed where necessary to facilitate the development of indigenous alternatives. Simplifying licensing procedures and reducing regulatory barriers can encourage domestic production and innovation.

5.17 Vendor Rating:

Vendor rating is a critical process within supply chain management that involves evaluating suppliers based on various performance metrics to determine their standing or classification within the vendor network. In essence, it is a methodical assessment aimed at gauging the reliability, efficiency and overall quality of goods or services provided by suppliers.

Factors considered in vendor rating typically include the supplier's track record in meeting delivery deadlines, the consistency of product or service quality, adherence to pricing agreements and responsiveness to inquiries or concerns. These criteria collectively contribute to the establishment of a supplier's performance level, which can range from poor to excellent, with intermediate rankings reflecting varying degrees of achievement.

Organizations may choose to implement vendor rating systems in different forms, ranging from hierarchical rankings to more nuanced approaches such as award systems or

certifications. For instance, some companies may grant preferential treatment or incentives to top-performing suppliers, while others may recognize outstanding suppliers through formal certification programs.

The emphasis on vendor rating has grown significantly, particularly with the widespread adoption of just-in-time (JIT) manufacturing practices. JIT emphasizes the importance of seamless coordination and collaboration between buyers and suppliers to ensure timely delivery of goods and minimize inventory holding costs. As such, vendor rating serves as a strategic tool for organizations to foster and maintain strong buyer-supplier relationships, thereby enhancing supply chain efficiency and overall business performance.

5.18 Importance of Vendor Rating:

I Price Factor

1. Competitive Pricing

Vendors should offer prices comparable to competitors for similar products or services. Quote requests should demonstrate favorable pricing compared to other vendors.

2. Price Stability

Prices should remain relatively stable over time, minimizing fluctuations that could impact budgeting and forecasting.

3. Price Accuracy:

Invoices should accurately reflect purchase order prices, with minimal discrepancies between quoted and invoiced amounts.

4. Advance Notice of Price Changes

Vendors should provide sufficient advance notice of any changes in pricing to allow buyers to adjust their budgets accordingly.

5. Cost Sensitivity

Vendors should demonstrate an understanding of the buyer's financial constraints and suggest potential cost-saving measures. They should also possess market knowledge and share insights with the buyer.

6. Billing Accuracy

Vendor invoices should be accurate, easy to understand and promptly issued. Credit memos should be processed in a reasonable timeframe and invoice estimates should closely match the final invoice amounts.

II Quality Factor:

1. Compliance with Purchase Orders

Vendors should adhere to the terms and conditions outlined in purchase orders and demonstrate an understanding of buyer expectations.

2. Conformity to Specifications

Products or services should meet the specifications outlined in requests for proposal and purchase orders. They should perform as expected without deviations.

3. Reliability

Products should demonstrate reliability, with a low rate of failure within acceptable limits.

3. Repair Reliability

Repairs and reworks should be conducted effectively, ensuring the continued functionality of the product.

4. Durability

Products should have a reasonable lifespan before requiring replacement.

5. Support:

Vendors should provide timely and effective support, addressing any issues promptly and resolving them satisfactorily.

6. Warranty

Warranty provisions should be reasonable and vendors should promptly address any warranty-related concerns or issues.

7. State-of-the-Art Products/Services

Vendors should offer products or services that are consistent with industry standards and continuously refresh their offerings with enhancements. Collaboration with buyers on new product development is also desirable.

III. Delivery Factors:

1. Timeliness

Vendors should consistently deliver products and services on time, aligning with promised delivery dates and lead times.

2. Quantity Accuracy

Deliveries should include the correct items in the contracted quantity.

3. Lead Time

Average delivery times should be comparable to those of other vendors for similar products and services.

Packaging

Packaging should be robust, appropriate, properly labeled and undamaged, with pallets sized correctly and without overhang.

Documentation

Vendors should provide accurate documentation, including packing slips, invoices, technical manuals, etc., with correct material codes and purchase order numbers.

Emergency Delivery

Vendors should demonstrate flexibility and effort in meeting urgent delivery requests.

IV. Service Factors:

1. Vendor Representatives

Vendor representatives should exhibit a sincere desire to serve, displaying professionalism, courtesy and effectiveness in handling complaints. They should provide updated catalogs, pricing and technical information and act as advocates for the buying firm within the supplying firm

2. Inside Sales

Inside sales personnel should be knowledgeable about buyer needs and assist with inquiries related to order confirmation, shipping schedules, discrepancies and invoice errors.

3. Technical Support

Vendors should offer technical support for maintenance, repair and installation, providing instructions, documentation and training on product usage.

4. Emergency Support:

Vendors should provide emergency support for the repair or replacement of failed products.

Problem Resolution:

Vendors should respond promptly to resolve any issues and provide follow-up on the status of problem correction.

5.19 .7 C's of Vendor Rating**1. Competency**

The competency of a supplier encompasses various aspects, including their managerial, technical, administrative and professional abilities. A supplier with strong managerial competence efficiently organizes resources and personnel to meet customer demands. Technical competence ensures that products or services meet specifications and industry standards. Administrative competence reflects the efficiency of processes like order processing and documentation. Lastly, professional competence entails courteous and effective interactions with customers, enhancing overall satisfaction and trust in the supplier's capabilities.

2. Capacity

Supplier capacity entails their ability to meet demand across physical, intellectual and financial dimensions. Physical capacity encompasses production capabilities, facilities and infrastructure to fulfill orders effectively. Intellectual capacity relates to innovation, knowledge and adaptability to industry changes. Financial capacity reflects the supplier's stability, liquidity and access to capital resources, crucial for sustaining operations and investments in growth initiatives.

3. Commitment

Supplier commitment refers to their willingness to allocate resources and establish long-term partnerships with customers. A committed supplier demonstrates a readiness to invest physical, intellectual and financial resources to meet customer needs effectively. Furthermore, they prioritize building enduring relationships based on shared goals and objectives, fostering collaboration, trust and mutual success over time.

4. Control

Supplier control encompasses effective management and information systems to manage operations and mitigate risks. Strong management control systems ensure efficient resource allocation and adherence to processes and procedures. Information systems provide accurate and timely data for decision-making and performance tracking, enhancing transparency and accountability. Additionally, robust quality control mechanisms ensure consistent adherence to quality standards and prompt resolution of deviations or non-conformities.

5. Cash Resources

Cash resources represent the financial strength and stability of the supplier, influencing their ability to fulfill orders and invest in growth initiatives. A supplier with ample financial resources demonstrates profitability, liquidity and access to capital, providing assurance of their ability to sustain operations and withstand economic fluctuations. Financial stability, reflected in metrics like ROI, ROE and asset turnover ratio, further reinforces confidence in the supplier's long-term viability.

6. Cost

Total acquisition cost considers all expenses associated with acquiring and using a supplier's products or services, beyond the initial purchase price. Evaluating value for money ensures that customers assess the overall quality, reliability and performance relative to the total cost incurred. By considering factors like maintenance, support and lifecycle costs, organizations can make informed decisions that optimize value and minimize total cost of ownership.

7. Consistency

Supplier consistency entails delivering quality and reliability consistently over time. Quality consistency ensures that products or services consistently meet or exceed specifications and customer expectations. Reliability consistency reflects the supplier's track record of on-time delivery, adherence to specifications and responsiveness to customer needs. By maintaining high standards of quality and reliability consistently,

suppliers enhance customer satisfaction, trust and loyalty, contributing to long-term success and partnership.

5.20 Rating Criteria/Factors:

Vendor rating involves evaluating suppliers based on a comprehensive set of criteria to ensure that they meet the organization's standards and requirements. The factors assessed can vary widely depending on the specific needs and priorities of the organization. Here is a detailed look at common rating criteria used in vendor evaluations

1. Price:

The costs of goods or services were provided by the vendor. Organizations assess whether the price is competitive and aligns with the market rates.

2. Discounts Received

The frequency and amount of discounts are offered by the vendor. This can include bulk purchase discounts, early payment discounts, or promotional discounts.

3. Maintenance of Specifications

The vendor's ability to adhere to the agreed-upon product or service specifications. Consistency in meeting these specifications is crucial for maintaining quality standards.

4. Compliance with Other Specifications

The vendor's compliance with regulatory requirements, industry standards and any additional specifications set by the organization.

5. Promptness of Delivery

The vendor's track record for delivering goods or services on time. Timely delivery is essential to avoid production delays and maintain smooth operations.

6. Freight and Delivery Charges

The cost associated with shipping and delivery. Evaluating these charges helps in understanding the total cost of procurement.

7. Installation Cost

Costs incurred for installing equipment or setting up services provided by the vendor. This includes labor, materials and any additional expenses related to installation.

8. Service

The quality and responsiveness of the vendor's customer service and support. This includes availability, communication and problem-solving abilities.

9. Market Information

The vendor's ability to provide relevant and timely market information. This can help the organization stay informed about market trends, price fluctuations and new product developments.

10. Co-operation

The vendor's willingness to collaborate and work closely with the organization. This includes flexibility in negotiations and adaptability to changing requirements.

11. Management Competence

The effectiveness and professionalism of the vendor's management team. This can impact the overall reliability and efficiency of the vendor's operations.

12. Credit Terms

The payment terms are offered by the vendor. Favorable credit terms can improve cash flow management for the organization.

13. Employee Training

The vendor's commitment to training and developing their employees. Well-trained employees can enhance service quality and innovation.

14. Disposition of Rejects

The vendor's process for handling defective or rejected products. Efficient and fair handling of rejects is important for maintaining trust and minimizing losses.

15. Cost Reduction Suggestions

The vendor's proactive approach to suggesting cost-saving measures and efficiency improvements. This can include process optimization, alternative materials, or new technologies.

16. Adjustment Policies

The vendor's policies regarding adjustments for discrepancies or issues in the delivered products or services. Clear and fair policies are essential for resolving conflicts.

17. Financial Position

The financial stability and strength of the vendor. A strong financial position indicates the vendor's ability to sustain operations and fulfill long-term commitments.

18. Inventory Plans

The vendor's inventory management strategies. Effective inventory planning can reduce lead times and ensure the availability of products.

5.21 Tools and Techniques of Vendor Rating:

The hallmark of an effective purchase department is the quality of suppliers selected. The purchaser's prime interest lies in getting the best value from his Suppliers. This implies that he should be in a position to assess and rate their performance against what is expected

from an ideal supplier. The absolute standard is difficult to define with exactness but there should be some method for evaluating suppliers and grading them.

The ability to select reliable vendors is the primary objective of a planning department. The familiar saying "Tell me who your friends are and I will tell you what you are" can be applied to purchasing also. Rather it should be: Tell me who your vendors are and I will tell you what kind of purchasing department you have". It is not always easy to identify good vendors; in many cases, purchasing department is criticized without any justification because of poor vendor performance.

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A drawback to vendor rating is that despite considerable effort to set up good system, the end results have too often been a group of antagonized suppliers and an impractical, meaningless mass of data which take too much effort to compile and is worthless to the purchasing department. Some companies make the mistake of adopting, without appropriate changes, a rating plan which was developed for another company when, obviously, each system must be applied to the specific requirements of a particular organization. Too often, also in attempting to ensure precision, the goal of improving quality and reliability of purchased item is lost. No system can be of any value unless it results in better vendor performance. Nor can it work well unless the people involved understand it and are convinced that is worthwhile having it.

The responsibility of vendor rating is normally entrusted with a committee comprising Chief commercial manager, Quality control manager, Accounts Manager and Chief Production Engineer. The committee meets every quarter to review each vendor's performance. It classifies the vendors as class A B or C based on their performance. Alternatively, they are also graded as First, Second or Third class vendors. Future enquiries

shall not be sent to class 'C' (Third grade) vendors. A price preference of 5% to A class (First grade) and 2% to class 'B' (Second grade) vendors shall be accorded over the prices of class C (Third grade) vendors.

5.22 Methods of Evaluation of Suppliers:

In a large store and material organization, where a large number of parts and components are supplied by different vendors, it becomes difficult to keep track on their 1. 80 points and above out of 100 is considered excellent 2. Between 70 -79 points is considered very good performances. Therefore, in order to compare the performances of various vendors, it is essential to rate them individually. The rating may be done on different parameters such as quality performance, service performance (timely delivery, delivery of specified quantity) price performance, etc. After the performance factors have been selected, a specific procedure must be developed for measuring actual vendor performance on each individual factor. Supplier performance on each factor must be expressed in quantitative terms, there are various ways in which a supplier can be evaluated, five of these viz and the categorical method, the weighted method, the cost-ratio method, the critical incidents method and the check list system are the most popular. These are described below:

I Categorical Method

The buyer makes out a list of all the factors which he/she considers necessary for evaluation and at periodic intervals, say, once a quarter, he /she makes out a performance report. The buyer may also seek the help of others concerned such as stores, production, or quality control departments, in order to determine the grading to be given. A performance standard may be decided upon a six-point scale category. For example, a vendor who gets

1. 80 points and above out of 100 is considered excellent
2. Between 70 -79 points is considered very good
3. Between 60 - 69 points is considered good
4. Between 50 - 59 points is considered satisfactory

5. Between 40 - 49 points is considered average
6. Below 40 points is considered poor.

On the basis of this evaluation, three meetings should be held with the suppliers. Who should be given a clear appraisal of their performance? Those with low ratings should be informed firmly to improve their performance and even then if they do not show any sign of improvement, their names should be deleted from the approved list of vendors.

Though one might say that the method is subjective, it has several merits. One such merit is that the buyer, in order to arrive at a judgement, would per force keep a watch and records the performance. This becomes important especially since he/she has to discuss about the performance with the vendors. It is not an expensive method and detailed performance records need not be maintained.

Since, it relies mainly on the memory and judgement of the individual buyer, this method can be practiced easily. However, if the buyer is indifferent and does not evaluate at regular intervals, it can deteriorate into a routine and lose all its importance and validity. This is not a very scientific method and no quantitative measurement is done. The method depends heavily on the experience and ability of the buyer and the charge is, therefore, made that the evaluation can be very subjective.

II Critical Incidents Method

Evaluating vendors under this method requires that a record of events and occurrences related to the buyer-vendor relationship is maintained in each vendor's file. The data and comments recorded should be important and not trivial in nature. They should reflect the positive and negative aspects of an actual performance. This kind of documentation can be used as basis for discussing ways and means for overcoming difficulties, improving performance, determining the competence of a vendor and if necessary, considering his termination. As this method is relatively easy to implement, it is very useful for small organizations.

III Checklist System

Some companies use a simple checklist to evaluate their vendors. Designed to facilitate vendor rating from the stand point of financial strength, size, product service, price, quality, etc., the checklist system is quite useful in evaluating suppliers.

A typical checklist is given below:

Buyers' Checklist for Evaluating Vendors

A. Reliability

1. Is the supplying company reputed, stable and financially strong?
2. Are the supplier's ability and integrity proved | by past performance?
3. Does supplier help in reducing expenditure by product improvement?

B. Technical Capabilities

1. Will supplier provide engineering assistance?
2. Will supplier provide design assistance?
3. Can supplier handle special needs and designs?
4. Does supplier contribute to general advancement through basic research?

C. After Sales-Service

1. Does supplier have an effective service back-up?
2. Is emergency service available?
3. Will renewal parts be available whenever needed?

D. Availability

1. Will supplier assure timely delivery?
2. Are stocks available locally at short notice?

3. Is supplier's location an advantage to buyer?
4. Does supplier plan shipment to minimize buyer's inventory?
5. Can supplier be depended upon to provide a steady flow of products or materials?

E. Buying Convenience

1. Does supplier offer a full range of related products?
2. Does supplier pack his product conveniently for buyer's use?
3. Does supplier have a local sales contact? Is he qualified to assist buyer? Can he call upon specialists for buyer's difficult problems?
4. Will supplier help buyer to cut acquisition costs such as qualifying visits, telephone calls, lab tests, incoming inspections, spoilage and waste, rejects and complaints.

F. Sales Assistance

1. Does the supplier help develop mutual markets? Will he recommend buyer's products?
2. Will the appearance of supplier's product enhance the appearance of buyer's product?

Check Your Progress

Choose the Correct Answer:

1. Purchasing means

- a) Selling goods
- b) Buying goods and services for an organization
- c) Transporting goods
- d) Producing goods

Answer: b

2. The first step in the purchasing procedure is

- a) Receiving materials
- b) Identifying the need for materials
- c) Payment to supplier
- d) Inspection

Answer: b

3. Dynamic purchasing mainly focuses on

- a) Traditional buying methods
- b) Modern and flexible purchasing strategies
- c) Reducing production
- d) Selling products

Answer: b

4. Which principle emphasizes buying the right quality materials?

- a) Right price
- b) Right quantity

- c) Right quality
- d) Right source

Answer: c

5. Vendor rating means

- a) Advertising suppliers
- b) Evaluating supplier performance
- c) Increasing product price
- d) Hiring employees

Answer: b

6. Which factor is commonly used in vendor rating?

- a) Delivery performance
- b) Supplier colour
- c) Employee salary
- d) Office size

Answer: a

7. The main objective of purchasing management is to

- a) Reduce sales
- b) Ensure continuous supply of materials
- c) Increase advertising
- d) Reduce employees

Answer: b

8. Selecting the best supplier is part of

- a) Production management

- b) Vendor management
- c) Marketing management
- d) Financial management

Answer: b

9. The principle of purchasing includes

- a) Right time
- b) Right price
- c) Right source
- d) All of the above

Answer: d

10. Vendor management helps organizations to

- a) Improve supplier relationships
- b) Reduce product quality
- c) Increase waste
- d) Stop production

Answer: a

Small Questions – LOCF Mapping Table

S.No	Small Question	CO	Bloom's Level	PO
1	What is Purchasing?	CO1	Remember	PO1
2	What are the steps in the purchasing procedure?	CO2	Understand	PO2
3	What is Dynamic Purchasing?	CO3	Remember	PO3
4	What is Vendor Rating?	CO4	Understand	PO4
5	What are the principles of purchasing?	CO5	Understand	PO5

Big Questions – LOCF Mapping Table

S.No	Big Question	CO	Bloom's Level	PO
1	Explain the concept and importance of Purchasing Management.	CO1	Understand	PO1
2	Describe the purchasing procedure followed in an organization.	CO2	Analyze	PO2
3	Discuss the principles of purchasing in detail.	CO3	Understand	PO3
4	Explain the concept of Dynamic Purchasing and its advantages.	CO4	Analyze	PO4
5	Explain Vendor Rating and Vendor Management with suitable examples.	CO5	Analyze	PO5
