Chapter 3:
Facility Location and Layout

Chapter Index

Learning Objectives

- Explain the concept of facility location
- Discuss factors affecting facility location decisions
- Explain the procedures and techniques for selecting facility location
- Explain the concept of facility layout
- List the types of facility layouts
- Describe service facility layouts

1. Concept of Facility Location

- Facility location may be defined as a place where the facility will be set up for producing goods or services. The need for location selection may arise under any of the following conditions:

  a. When a business is newly started.

  b. When the existing business unit has outgrown its original facilities and expansion is not possible; hence a new location has to be found.

  c. When the volume of business or the extent of market necessitates th establishment of branches.

  d. When the lease expires and the landlord does not renew the lease.

  e. Other social or economic reasons.

2. Concept of Facility Location

Need for Facility Location Planning

- Facility location planning is also required for providing a cost benefit to the organisation.
- The location planning should help in reducing the transportation cost for the organisation. This ultimately helps in decreasing the cost of production and generating cost advantage for the organisation.
- It is also needed to identify proximity to the sources of raw materials and transportation facilities.
- A facility should ideally be located at a place where raw materials are available. This is necessary for maintaining continuity in the production process.

3. Concept of Facility Location

Factors Affecting Facility Location Decisions

- While selecting a facility location, an organisation should consider various factors that may have significant impact on its performance. These factors are explained below:
  - Availability of power
  - Transportation
  - Suitability of climate
  - Government policy
  - Competition between states
  - Availability of labour

4. Concept of Facility Location

Factors Affecting Facility Location Decisions

- Civic amenities for workers
- Existence of complementary and competing industries
- Finance and research amenities
- Availability of water and fire-fighting facilities

5. Concept of Facility Location

Procedures and Techniques for Selecting Facility Location

- An organisation follows certain steps to make a correct location choice. These steps are:

Decide on the criteria for evaluating location alternatives

Identify important factors

Develop location alternatives

Evaluate the alternatives

Make a decision and select the location

6. Concept of Facility Location

Procedures and Techniques for Selecting Facility Location

- Following are some main techniques used in making location decisions:
  - **Location rating factor technique:** In this technique, first of all an organisation needs to identify the factors that influence its location decision. Next, each factor is provided a weight between '0' to '1' according to the level of importance, where '0' denotes least important and '1' denotes most important.
  - **Centre-of-gravity technique:** This technique emphasises on transportation cost in the determination of facility location. Transportation cost mainly depends on distance, weight of merchandise and the time required for transportation. Centre-of-gravity maps various supplier locations on a Cartesian plane and suggests a central facility location with respect to the locations of suppliers.

7. Concept of Facility Location

Procedures and Techniques for Selecting Facility Location

- **Transportation technique:** In simple words, the transportation technique evaluates multiple transportation routes of shipping goods from multiple origins to multiple destinations and finds or develops the least cost route. The technique is often used in determining facility locations for evaluating transportation costs of routes by selecting different facility locations. In the transportation technique, multiple facility locations fits are identified and their relative transportation costs are calculated. Finally, the location that is related to the lowest cost routes is selected.

1. Concept of Facility Layout

- Facility layout may be defined as the arrangement of machinery, equipment, and other amenities in a facility, which should ensure a smooth movement of materials.
- According to **Moore**, *facility layout is the plan of or the act of planning 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.*

2. Concept of Facility Layout

Objectives of an Effective Facility Layout

- Minimum Material Handling
- Elimination of Bottlenecks
- Shorter Production Cycles
- Reduction in Production Delays
- Improved Quality Control
- Efficient Utilisation of Labour
- Improved Employee Morale

3. Concept of Facility Layout

Types of Facility Layouts

- Process Layout
- Product Layout
- Fixed Position Layout
- Cellular Manufacturing Layout
- Combination or Hybrid Layout

4. Concept of Facility Layout

Types of Facility Layouts

- **Process layout:** Process layout, also called functional layout or batch production layout, is characterised by the grouping together of similar machines, based upon their operational characteristics.
- **Product layout:** In product layout, also called straight line layout, machinery is arranged in one line as per the sequence of production operations. Materials are fed into the first machine and finished products come out of the last machine.
- **Fixed position layout:** This type of facility layout is used to assemble products that are too large, heavy or fragile to move to a location for completion. In the fixed position layout, machinery, men, as well as other pieces of material, are brought to the location where the product is to be assembled.

5. Concept of Facility Layout

Types of Facility Layouts

- **Cellular manufacturing layout:** In Cellular Manufacturing (CM) layout, machines are grouped into cells, which function somewhat like a product layout in a larger shop or a process layout. Each cell in the CM layout is formed to produce a single part family, that is, a few parts with common characteristics.
- **Combination or hybrid layout:** It is difficult to use the principles of product layout, process layout, or fixed location layout in facilities that involve fabrication of parts and assembly. Fabrication tends to employ the process layout, while assembly areas often employ the product layout.

6. Concept of Facility Layout

Factors Affecting a Facility Layout

- Materials
- Product
- Machinery
- Type of Industry
- Management Policies

7. Concept of Facility Layout

Prerequisites for Developing a Facility Layout

- **Developing process charts:** A process chart is the graphical representation of production activities performed by an organisation. Process charts facilitate a systematic analysis and demonstration of the entire production process. These charts are further classified into two categories, namely operation process chart and flow process chart.
- **Making process flow diagrams:** A process flow diagram represents the movement of materials on a floor layout. These diagrams help an organisation in avoiding needless material movement and rearranging facility operations.

8. Concept of Facility Layout

Prerequisites for Developing a Facility Layout

- **Developing machine data cards:** A machine data card helps in developing equipment layout (pieces of equipment layout in relation to everything including the persons using them) by providing information related to power and materials handling requirements and capacity and dimensions of different machines.
- **Visualising the layout:** It represents the most common technique that is deployed for layout planning. It involves creating duplication of machines and equipment and arranging them in two- or three-dimensional plans for determining the effectiveness of a layout.

9. Concept of Facility Layout

Process of Facility Layout Designing

Information Gathering

Production and Material Flow Analysis

Support Services

Implementation and Evaluation

10. Concept of Facility Layout

Techniques for Designing a Facility Layout

- Two main techniques of designing a facility layout are:

Block Diagramming

Richard Muther's Systematic Layout Planning (SLP)

11. Concept of Facility Layout

Techniques for Designing a Facility Layout

- **Block diagramming:** The block diagram can be prepared by following the steps given below:

  1. Analyse the unit load summary that provides information about the average number of unit loads moved between different departments of an organisation.

  2. Calculate the composite movements (back-and-forth movement) of the unit load between the departments and rank them from the highest movement to the lowest movement.

  3. Place the trial layouts, which are designed using the ranking between departments, on a grid. This grid represents the relative distance between the departments.

12. Concept of Facility Layout

Techniques for Designing a Facility Layout

- **Richard Muther's systematic layout planning (SLP):** In this technique, a grid displays the ratings of the relative importance of the distance between different departments of an organisation. This grid is also called 'closeness rating chart'. In this chart, the rating for department A relative to department B is similar to the rating of department B to department A. Closeness ratings are given to departments in the form of codes, which depict the desired closeness of the departments according to the relative strength of their closeness.

13. Concept of Facility Layout

New Approaches to Layout Design

Computerised Relative Allocation of Facilities Technique (CRAFT)

Automated Layout Design Program (ALDEP)

Computerised Relationship Layout Planning (CORELAP)

14. Concept of Facility Layout

Revision of a Current Layout

- The following developments necessitate the revision of the existing layout:

Expansion

Technological Advancement

Improvement of the Layout

1. Service Facility Layouts

- The objectives of service facility layouts differ from those of manufacturing facility layouts.
- This is because a manufacturing facility aims to make on-time delivery of products to customers, whereas customers come to a service facility to receive services.
- Therefore, customers usually prefer a service facility that is close to them, especially when the service delivery process requires considerable customer contact. For example, if you are hungry, you would prefer to go to a restaurant near you.

2. Service Facility Layouts

- Service facility layouts are often categorised under three heads, which are:
  - **Product layout:** This type of layout is used only in cases where services are organised in a sequence.
  - **Process layout:** These layouts are highly common in service facilities as they successfully deal with the varied customer processing requirements.
  - **Fixed position layout:** In this type of service layout, materials, labour and equipment are brought to the customer's place. This layout is used in services like appliance repair, landscaping, home remodelling, etc.

3. Service Facility Layouts

Types of Service Facility Layouts

- **Warehouse and storage layouts:** The layouts of warehouse and storage facilities are designed by considering the frequency of order. Items that are ordered frequently are placed near the facility entrance. However, items that are not ordered frequently are placed at the rear of the facility. Apart from this, correlation between two merchandises is also important while designing a layout for a warehouse and storage facility.

4. Service Facility Layouts

Types of Service Facility Layouts

- **Retail layouts:** A retail store layout refers to a systematic arrangement of merchandise groups within a store. A well-planned retail store layout provides a description of the size and location of each department of the store, fixture locations, and traffic patterns. It also helps consumers find products of their choice in a short time. Different retail layouts are:
  - Grid layout
  - Free-form layout
  - Loop layout
  - Spine layout

5. Service Facility Layouts

Types of Service Facility Layouts

- **Office layouts:** Designing of office layouts is witnessing revolutionary changes as paperwork is now replaced with different modes of electronic communications. Today, office layouts focus more on creating an image of openness. Low-rise partitions are preferred between departments to facilitate easy communication among workers.

Let's Sum Up

- A facility location may be defined as the place where a facility will be set up for producing goods or services.
- Selection of a suitable facility location is important as it decides the fate of a business. A good location may reduce the cost of production and distribution to a considerable extent.
- Once established, a location cannot be changed frequently as it incurs huge costs.
- A facility layout is defined as the arrangement of machinery, equipment and other amenities in a facility to ensure the smooth movement of materials.
- The objectives of service facility layouts differ from those of manufacturing facility layouts. This is because a service operation aims to organise all activities and processes to deliver services to customers.

Thank You