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BUSINESS ORGANIZATION – UCM12

UNIT - 3

Location of Industry

Syllabus - UNIT – 3: Location of Industry

Plant Location: Meaning - Theories of Location - Factors Influencing Location – Plant Layout: Definition - Meaning – Objectives - Characteristics of Good Layout - Size of Firm: Meaning - Concept of Size - Measures of Size.

Expected Learning Outcome

After studying this lesson, you should be able to:

- Describe the concepts of plant location and plant layout
- Identify the various factors to be considered for selection of plant location from state/area to the specific site
- Distinguish among the alternative patterns of plant layout
- Discuss the various factors influencing the choice of an initial layout and its subsequent modification
- Understand the optimum size of firm

PLANT LOCATION

Plant: A plant is a place, where men, materials, money, machinery etc. are brought together for manufacturing products.

"Plant location refers to the choice of region and the selection of a particular site for setting up a business or factory".

But the choice is made only after considering cost and benefits of different alternative sites. It is a strategic decision that cannot be changed once taken. If at all changed only at considerable loss, the location should be selected as per its own requirements and circumstances. Each individual plant is a case in itself. Businessman should try to make an attempt for optimum or ideal location.

Definitions

Some of the renowned definitions on plant Location are given below:

"The function of determining where the plant should be located for maximum operating economy & effectiveness"-R.C. Davis

"That spot where, in consideration of the business as a whole, the total cost of production & delivering goods to all the consumers is the lowest."-Bethel Smiths & Atwater

Situations for the need of location decision

The impetus to embark upon a plant location study can be attributed to reasons as given below:

1. It may arise when a new plant is to be established.
2. In some cases, the plant operations and subsequent expansion are restricted by a poor site, thereby necessitating the setting up of the facility at a new site.
3. The growing volume of business makes it advisable to establish additional facilities in new territories.
4. Decentralization and dispersal of industries reflected in the industrial policy resolution so as to achieve an overall development would necessitate a location decision at a macro level.
5. It could happen that the original advantages of the plant have been outweighed due to new developments.
6. New economic, social, legal or political factors could suggest a change of location of the existing plant.

What is an ideal location?

An ideal location is one where the cost of the product is kept to minimum, with a large market share, the least risk and the maximum social gain. It is the place of maximum net advantage or which gives lowest unit cost of production and distribution. For achieving this objective, small-scale entrepreneur can make use of locational analysis for this purpose.

THEORIES OF PLANT LOCATION

A. Alfred Weber's industrial location in

B. Sargent Florence's Theory

A. WEBER'S THEORY OF LOCATION

Alfred Weber, a German economist, enunciated a systematic theory of industrial location in 1909. Weber's theory of location is purely deductive in its approach. He analyzed the factors that determine the location of industry and classified these factors into two divisions. These are:

(i) Primary causes of regional distribution of industry (regional factors)

(ii) Secondary causes (agglomerative and deglomerative factors) that are responsible for redistribution of industry.

I. Primary Causes (Regional Factors)

According to Weber, **transport costs and labour costs are the two regional factors on which his pure theory is based**. Assuming that there are no other factors that influence the distribution of industry, except transportation costs. Then it is clear that the location of industry will be pulled to those locations which have the lowest transportation costs. The key factors that determine transportation costs are

(i) the weight to be transported and

(ii) the distance to be covered.

Weber lists some more factors which influence the transportation costs such as

(a) the type of transportation system and the extent of its use,

(b) the nature of the region and kinds of roads,

(c) the nature of goods themselves, i.e., the qualities which, besides weight, determine the facility of transportation.

However, the location of the place of production must be determined in relation to the place of consumption and to the most advantageously located material deposits. Thus, 'locational figures' are created. These locational figures depends upon

(a) The type of material deposits and

(b) The nature of transformation into products.

Weber classifies and calls those raw materials, which are available practically everywhere as 'ubiquities' (like brick-clay, water, etc) and 'localised' (like iron-ore, minerals, wood, etc) which are available only in certain regions. It is clear that localized materials play a more important role on the industry than the ubiquities. Further, regarding the nature of the transformation of materials into products, Weber categorized the raw materials as 'pure' and 'weight losing'. Pure materials impart their total weight to the products (eg. cotton, wool, etc) and the materials are said to be 'weight losing' if only a part enters into the product (eg. wood, coal, etc.). Hence, the location of industries using weight-losing materials is drawn towards their deposits and that of industries using pure-materials towards the consumption centres.

Weber further examines the cause of deviation of industrial location from the centres of least transport costs. The existence of differences in labour costs leads an industry to deviate from the optimal point of transport orientation. Geographical distribution of the population would give rise to differences in wages for labour. Naturally, the transport oriented location of an industry is drawn out and attracted towards the cheaper labour centres. Such migration of an industry from a point of minimum transport costs to a cheaper labour centre may be likely to occur only where the savings in the cost of labour are larger than the additional costs of transport which it ought to incur.

II. Secondary Causes (Agglomerative and Deglomerative Factors)

An agglomerative factor is an advantage or a cheapening of production or marketing which results from the fact that production is carried on at one place. A deglomerative factor is a cheapening of production which results from the decentralization of production

i.e., production in more than one place. To some extent these agglomerative and deglomerative factors also contribute to local accumulation and distribution of industry. These factors will operate only within the general framework formed by the two regional factors, i.e., costs of transportation and costs of labour. The advantages which could be derived in this context are external economies.

The pulls which the agglomerative factors possess to attract an industry to a particular point are mainly dependent on two factors. Firstly, on 'the index of manufacture' (the proportion of manufacturing costs to the total weight of the product) and secondly, on the 'locational weight' (the total weight to be transported during all the stages of production). To deduce a general principle, Weber uses the concept of "co-efficient of manufacture" which is the ratio of manufacturing cost to locational weight. Agglomeration is encouraged with high co-efficient of manufacture and deglomeration with low co-efficient of manufacture and these tendencies are inherent in their nature.

Split Location:

Productive activities could be divided depending on the nature of raw-materials, industry and market. Weber considers the location for an industry at more than one place. According to Weber, a split of production into several locations will be the rule for productive process which can technically be split. For instance, the first stage of production may be near the raw material deposits and the subsequent stages near the place of final consumption. Likewise, in a paper industry the manufacture of pulp may be carried on near the supplies of the raw materials and the second stage of paper manufacture near the consumption outlet.

Locational Coupling:

Weber also conceived the advantages of setting up different types of industries in the same locality. The production of quite different articles may be combined in one plant because several raw materials may diverge from a common source. This may be either due to technical or economic reasons: for instance, certain chemical industries, garments factories which manufacture over-coats, shawls, blouses, etc. Locational coupling may also occur due to connection through materials. If the by-product of an industry happens

to be the raw material of another industry, then the two industries may select a single place of location. For instance, the dye-stuff industry is connected with other industries using coke, because coal tar (upon which the dye-stuff industry is based) is a by-product of the burning coke.

Criticisms:

Weber's theory of location has been criticized on various grounds which may be summarized as follows:

1. Weber has been criticized for his unrealistic approach and deductive reasoning. According to Sargant Florence, vague generalizations cannot provide suitable solutions to the theory of location as non-economic considerations will also influence which are not mentioned in the pure theory. He says that Weber's theory fails to explain locations resulting from historical and social forces.
2. A.Predohl criticizes Weber's theory as more a selective theory than a deductive theory. The very distinction between primary and secondary is itself artificial, illogical and arbitrary.
3. Weber assumes fixed labour centres and unlimited supplies of labour which are unrealistic. The rise of industry may create new labour centres and we cannot assume unlimited labour supplies at any centre.
4. In a competitive market structure, the assumption of fixed points of consumption is unrealistic. Country-wise scattering, usually, of consuming public is a reality and there may be a shift in the consuming centres with a shift in industrial population.
5. A. Robinson also considers Weber's division of raw materials into 'ubiquities' and 'localised' as artificial.

Weber's deductive theory of location, in spite of the shortcomings, is the only theory which has been no enjoying the universal acceptance and application, as all the other alternative suggestions are neither complete or comprehensive.

B. SARGENT FLORENCE'S THEORY

Professor Sargent has followed the inductive method in formulating his theory of location. Sargent's theory is more practical and realistic than that given by Weber. After properly analyzing statistical data, Sargent tried to ascertain the tendency of location of industries. On the basis of production census he has tried to find out the statistical measures of location and has not accepted the traditional view of the geographical context, not the region or area as such but the working population in that area is more important. Sargent has used two new concepts in his theory of location.

Factors:

They are:

(i) Location factor and

(ii) Coefficient of localization.

(i) Location factor:

Location factor indicates the centralization or otherwise of an industry. If the location factor index is greater than unity, there is a tendency of centralization; on the other hand, if it is less than unity, the otherwise is true. In case of unity, a state of evenness exists this indicates that there is neither centralization nor decentralization.

ii. Coefficient of localization:

Coefficient of localization indicates the propensity of concentration of industries.

The coefficient is the sum (divided by 100) of the deviations of the regional percentages of workers in the particular industry from the corresponding regional percentages of workers in all country.

Criticism of Sargent Florence's Theory:

Following are the points of criticism against the theory of location given by Florence:

1. Ignorance of causes of location:
2. The theory tells only whether the industry is centralized or decentralised but does not give the causes of such a tendency.
3. Difficulty of knowing propensity of localization:
4. It is difficult to know only on the basis of coefficient of localization whether there is propensity of centralization or decentralization.
5. Ignorance of favourable local conditions:
6. The theory does not care for the favourable local factors influencing centralisation of industries.
7. 4. Absence of knowledge of productive capacity:

The theory given by Florence emphasizes the number of workers in calculating the index and coefficient but ignores production. It is difficult to know the productive capacity of different areas. In spite of these deficiencies the theory at least suggests a way to know the tendency of localization of industries.

FACTORS INFLUENCING PLANT LOCATION

Generally, location of industries is influenced by economic considerations though certain non-economic considerations also might influence the location of some industries. Maximisation of profit which also implies cost minimization is the most important goal in their choice of particular places for the location of industries. There are several factors which pull the industry to a particular place. Some of the major factors influencing location are discussed below:

Factors affecting Plant Location

- Nearness to Raw Material
- Transport Facilities
- Nearness to Markets
- Availability of Labour
- Availability of Fuel & Power
- Availability of Water
- Climatic conditions
- Financial & other aids
- Land
- Community Attitude
- Presence of related industries
- Existence of Housing facilities, Hospitals, Schools, Banks etc.
- Local bye laws, taxes
- Facilities for expansion
- Security

1. Availability of raw materials: In determining the location of an industry, nearness to sources of raw material is of vital importance. Nearness to the sources of raw materials would reduce the cost of production of the industry. For most of the major industries, the cost of raw materials form the bulk of the total cost. Therefore, most of the agro-based and forest-based industries are located in the vicinity of the sources of raw material supply.

2. Availability of Labour: Adequate supply of cheap and skilled labour is necessary for and industry. The attraction of an industry towards labour centres depends on the ratio of labour cost to the total cost of production which Weber calls 'Labour cost of Index'. The availability of skilled workers in the interior parts of Bombay region was one of the factors responsible for the initial concentration of cotton textile industry in the region.

3. Proximity to Markets: Access to markets is an important factor which the entrepreneur must take into consideration. Industries producing perishable or bulky commodities which cannot be transported over long distance are generally located in close proximity to markets. Industries located near the markets could be able to reduce the costs of transport in distributing the finished product as in the case of bread and bakery, ice, tins, cans manufacturing, etc. Accessibility of markets is more important in the case of industries manufacturing consumer goods rather than producer goods.

4. Transport Facilities: Transport facilities, generally, influence the location of industry. The transportation with its three modes, i.e., water, road, and rail collectively plays an important role. So the junction points of water-ways, roadways and railways become humming centres of industrial activity. Further, the modes and rates of transport and transport policy of Government considerably affect the location of industrial units. The heavy concentration of cotton textile industry in Bombay has been due to the cheap and excellent transportation network both in regard to raw materials and markets.

5. Power: Another factor influencing the location of an industry is the availability of cheap power. Water, wind, coal, gas, oil and electricity are the chief sources of power. Both water and wind power were widely sought at sources of power supply before the invention of steam engine. During the nineteenth century, nearness to coal-fields became the principal locating influence on the setting up of new industries, particularly, for heavy industries. With the introduction of other sources of power like electricity, gas, oil, etc. the power factor became more flexible leading to dispersal and decentralization of industries.

6. Site and Services: Existence of public utility services, cheapness of the value of the site, amenities attached to a particular site like level of ground, the nature of vegetation and location of allied activities influence the location of an industry to a certain extent. The government has classified some areas as backward areas where the

entrepreneurs would be granted various incentives like subsidies, or provision of finance at concessional rate, or supply of power a cheaper rates and provision of education and training facilities. Some entrepreneurs induced by such incentives may come forward to locate their units in such areas.

7. Finance: Finance is required for the setting up of an industry, for its running, and also at the time of its expansion. The availability of capital at cheap rates of interests and in adequate amount is a dominating factor influencing industrial location. For instance, a review of locational history of Indian cotton textile industry indicates that concentration of the industry in and around Bombay in the early days was mainly due to the presence of rich and enterprising Parsi and Bhatia merchants, who supplied vast financial resources.

8. Natural and Climatic Considerations: Natural and climatic considerations include the level of ground, topography of a region, water facilities, drainage facilities, disposal of waste products, etc. These factors sometimes influence the location of industries. For instance, in the case of cotton textile industry, humid climate provides an added advantage since the frequency of yarn breakage is low. The humid climate of Bombay in India and Manchester in Britain offered great scope for the development of cotton textile industry in those centres.

9. Personal Factors: In deciding location of industrial units, sometimes an entrepreneur may have personal preferences and prejudices against certain localities. For instance, Mr. Ford started to manufacture motor cars in Detroit simply because it was his home-town. In such cases, personal factor dominates other considerations. However, this kind of domination is rare.

10. Strategic Considerations: In modern times, strategic considerations are playing a vital role in determining industrial location. During war-time a safe location is assuming special significance. This is because in times of war the main targets of air attacks would

be armament and ammunition factories and industries supplying other commodities which are required for war. The Russian experience during the Second World War provides and interesting example.

11. External Economies: External economies also exert considerable influence on the location of industries. External economies arise due to the growth of specialized subsidiary activities when a particular industry is mainly localized at a particular centre with port and shipping facilities. External economies could also be enjoyed when a large number of industrial units in the same industry were located in close proximity to one another.

12. Miscellaneous Factors: Historical incidents also play a dominating role in determining the location of industries in certain cases. The development of cotton-textile industry in Lancashire provides an interesting example for this. Further, the size of and industrial unit would also have much influence in choosing location. This is because the size of industrial units depends upon the radius of the circle within which they can profitably distribute their goods and upon the density of population living within the circle.

PLANT LAYOUT

"A good layout results in comforts, convenience, appearance, safety, and profits. A poor layout results in congestion, waste, frustration, and inefficiency."

Definition - Meaning – Objectives:

Plant layout is a plan for effective utilisation of facilities for the manufacture of products; involving a most efficient and economical arrangement of machines, materials, personnel, storage space and all supporting services, within available floor space.

Definition:

"Plant layout is a plan of optimum arrangement of facilities including personnel, equipment's, storage space, material handling equipment and all other supporting services along with the decision of best structure to contain all these facilities."

Points of comment:

Certain useful observations on the concept of plant layout are as follows:

(i) Plant layout is very complex in nature; because it involves concepts relating to such fields as engineering, architecture, economics and business management.

(ii) Most of managers now realize that after the site for plant location is selected; it is better to develop the layout and build the building around it – rather than to construct the building first and then try to fit the layout into it.

Importance of a plant layout:

Designing a proper layout is important because it has a direct relationship with efficiency of operations and cost of production. A poorly designed layout will result in inefficiencies and losses throughout the existence of the plant. As Decisions regarding plant layout cannot be taken once and for all. Changes in process and techniques of production necessitate changes in plant layout. It is therefore important to design the layout in such a way that it is flexible to change

Objectives/Advantages of Plant Layout:

Following are the objectives/advantages of plant layout:

(i) Streamline flow of materials through the plant

(ii) Minimise material handling

(iii) Facilitate manufacturing progress by maintaining balance in the processes

(iv) Maintain flexibility of arrangements and of operation

(v) Maintaining high turnover of in-process inventory

(vi) Effective utilisation of men, equipment and space

(vii) Increase employee morale

(viii) Minimise interference (i.e. interruption) from machines

(ix) Reduce hazards affecting employees

(x) Hold down investment (i.e. keep investment at a lower level) in equipment.

Principles of Plant Layout

While designing the plant layout, the following principles must be kept in view:

(i) Principle of Minimum Movement:

Materials and labour should be moved over minimum distances; saving cost and time of transportation and material handling.

(ii) Principle of Space Utilization:

All available cubic space should be effectively utilized – both horizontally and vertically.

(iii) Principle of Flexibility:

Layout should be flexible enough to be adaptable to changes required by expansion or technological development.

(iv) Principle of Interdependence:

Interdependent operations and processes should be located in close proximity to each other; to minimize product travel.

(v) Principle of Overall Integration:

All the plant facilities and services should be fully integrated into a single operating unit; to minimize cost of production.

(vi) Principle of Safety:

There should be in-built provision in the design of layout, to provide for comfort and safety of workers.

(vii) Principle of Smooth Flow:

The layout should be so designed as to reduce work bottlenecks and facilitate uninterrupted flow of work throughout the plant.

(viii) Principle of Economy:

The layout should aim at effecting economy in terms of investment in fixed assets.

(ix) Principle of Supervision:

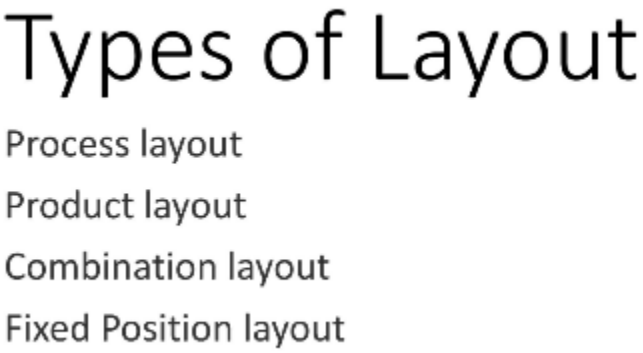
A good layout should facilitate effective supervision over workers.

(x) Principle of Satisfaction:

A good layout should boost up employee morale, by providing them with maximum work satisfaction.

Types of Plant Layout

Two basic plans of the arrangement of manufacturing facilities are – product layout and process layout. The only other alternative is a combination of product and process layouts, in the same plant.



Following is an account of the various types of plant layout:

(a) Product Layout (or Line Layout):

In this type of layout, all the machines are arranged in the sequence, as required to produce a specific product. It is called line layout because machines are arrange in a straight line. The raw materials are fed at one end and taken out as finished product to the other end.

Special purpose machines are used which perform the required jobs (i.e. functions) quickly and reliably.

Product layout is depicted below:

Advantages:

1. Reduced material handling cost due to mechanized handling systems and straight flow

2. Perfect line balancing which eliminates bottlenecks and idle capacity.

3. Short manufacturing cycle due to uninterrupted flow of materials

4. Simplified production planning and control; and simple and effective inspection of work.

5. Small amount of work-in-progress inventory

6. Lesser wage cost, as unskilled workers can learn and manage production.

Disadvantages:

1. Lack of flexibility of operations, as layout cannot be adapted to the manufacture of any other type of product.

2. Large capital investment, because of special purpose machines.

3. Dependence of whole activity on each part; any breakdown of one machine in the sequence may result in stoppage of production.

4. Same machines duplicated for manufacture of different products; leading to high overall operational costs.

5. Delicate special purpose machines require costly maintenance / repairs.

Suitability of product layout:

Product layout is suitable in the following cases:

1. Where one or few standardized products are manufactured.

2. Where a large volume of production of each item has to travel the production process, over a considerable period of time.

3. Where time and motion studies can be done to determine the rate of work.

4. Where a possibility of a good balance of labour and equipment exists.

5. Where minimum of inspection is required, during sequence of operations.

6. Where materials and products permit bulk or continuous handling by mechanical parts.

7. Where minimum of set-ups are required.

(b) Process Layout (or Functional Layout):

In this type of layout, all machines performing similar type of operations are grouped at one location i.e. all lathes, milling machines etc. are grouped in the shop and they will be clustered in like groups.

A typical process layout is depicted below:

Advantages:

1. Greater flexibility with regard to work distribution to machinery and personnel. Adapted to frequent changes in sequence of operations.

2. Lower investment due to general purpose machines; which usually are less costly than special purpose machines.

3. Higher utilisation of production facilities; which can be adapted to a variety of products.

4. Variety of jobs makes the work challenging and interesting.

5. Breakdown of one machine does not result in complete stoppage of work.

Disadvantages:

1. Backtracking and long movements occur in handling of materials. As such, material handling costs are higher.

2. Mechanisation of material handling is not possible.

3. Production planning and control is difficult

4. More space requirement; as work-in-progress inventory is high-requiring greater storage space.

5. As the work has to pass through different departments; it is quite difficult to trace the responsibility for the finished product.

Suitability of process layout:

Process layout is suitable in the following cases, where:

1. Non-standardised products are manufactured; as the emphasis is on special orders.

2. It is difficult to achieve good labour and equipment balance.

3. Production is not carried on a large scale.

4. It is difficult to undertake adequate time and motion studies.

5. It is frequently necessary to use the same machine or work station for two or more difficult operations.

6. During the sequence of operations, many inspections are required.

7. Process may have to be brought to work, instead of **"vice-versa"**; because materials or products are too large or heavy to permit bulk or continuous handling by mechanical means.

(c) Combination Layout:

In practice, plants are rarely laid out either in product or process layout form. Generally a combination of the two basic layouts is employed; to derive the advantages of both systems of layout. For example, refrigerator manufacturing uses a combination layout.

Process layout is used to produce various operations like stamping, welding, heat treatment being carried out in different work centres as per requirement. The final assembly of the product is done in a product type layout.

(d) Fixed Position Layout:

It is also called stationary layout. In this type of layout men, materials and machines are brought to a product that remains in one place owing to its size. Ship-building, air-craft manufacturing, wagon building, heavy construction of dams, bridges, buildings etc. are typical examples of such layout.

Steps involved in designing a plant layout

Since decisions regarding layout design have considerable impact in the efficiency and profitability of a firm it requires careful consideration. The following are the steps involved in designing a layout:

1. Collection of required data

Data about the size of the plant, type of products to be produced, method of production to be adopted, extent of space available, extent of mechanization etc are to be collected.

2. Preparation of blueprint for the floor plan

Based on the data gathered, a blue print has to be prepared for the floor plan. Care should be taken to ensure,that the layout provides for unhindered movement of men and materials with minimum possible effort and time.

3. Preparation of process chart and flow diagram

The process chart and flow diagram depicting the various activities to be performed and the linkages between them has to be prepared.

4. Preparation of draft layout

A draft layout needs to be prepared clearly depicting the positioning of men and materials and the process flow. The draft layout should be circulated and discussions held with employees inviting suggestions for improvement. Flaws pointed out need to be corrected and suggestions received incorporated after due discussions.

5. Test run

A test run is important to understand the efficiency of the layout in a real time work environment. Problems not noticed in the earlier stages can occur at this stage. The initial problems noticed need to be modified and test runs should be continued for at-least a few times to ensure that the layout is able to facilitate maximum production at minimum cost.

Characteristics or Features of a good layout

1. Efficient space utilization.
2. Flexibility.
3. Accessibility.
4. Economy in handling.
5. Minimum movement.
6. Ensuring Co-ordination.
7. Visibility.
8. Reduced discomfort.

1. Efficient space utilization

Real estate costs are rising by the day. An ideal layout should utilize the available space in an effective way. Wastage of space should be avoided at all costs. The arrangement of equipment, service points and workers should be done in such a way that space is properly utilized.

2. Flexibility

Manufacturing operations are dynamic in nature. There is continuous innovation in types of products manufactured as well as in equipment, techniques and processes of production. Therefore the layout should be designed in such a way that the layout is flexible enough to adapt to changes.

3. Accessibility

Manufacturing, maintenance and servicing facilities should be easily accessible without any hindrance. To achieve this purpose, there must be sufficient space between equipment so that raw materials, machines and men are able to move freely from one place to another.

4. Economy in handling

The layout should facilitate economies in handling materials, work-in-progress and finished stock. Handling should be reduced by the optimal use of hoists, chutes, trucks lifts, conveyors etc.

5. Minimum movement

The layout should be so designed that there is, minimum movement of men and machines. Movements should be direct as far as possible. Indirect handling of materials would unnecessarily add to the cost without any value addition. Therefore indirect handling should be avoided as far as possible.

6. Ensuring Co-ordination

A good layout would be able to co-ordinate all operations. The layout should be designed taking into account the inter-relationships between various equipment, departments and personnel. It is therefore important that while planning the layout the complete picture of the organization is considered.

7. Visibility

Work should be arranged in such a way that there is no problem in supervision, co-ordination and control. Raw materials, work in progress and finished goods should have specific storage points and must be visible at all times. This would reduce the problem of pilferage, theft etc.

8. Reduced discomfort

The layout should be designed in a way that there is minimum discomfort to the workers. It should provide for proper lighting, ventilation and reduce the impact of heat, noise, vibrations, dust, fumes, odours etc.

9. Adherence to statutory regulations

The layout should adhere to the regulations of the Factories Act with regard to health, safety and welfare of employees. Adherence to the above regulations would minimize accidents, reduce absenteeism due to sickness contributing to improved productivity.

10. Preservation of materials and equipment

The layout should contain safeguards against fire, moisture, theft and general deterioration of equipment and materials. There should be adequate and safe storage locations. There should be provision for storing inflammable materials separately and in a safe manner.

Requirements for Plant Layout planning

The information required for plant layout includes

- Dimensions of work places
- Sequence of operations
- Flow pattern of materials
- Storage space for raw materials
- In-process inventory
- Finished goods
- Offices, toilets, etc.

Size of Firm

Meaning - Concept of Size - Measures of Size.

The size of a business unit means the size of a business firm.

It means the scale or volume of operation turned out by a single firm. The study of the size of a business is important because it significantly affects the efficiency and profitability of the firm. .One of the most important entrepreneurial decisions in organizing a business is realizing its 'size' as it affects in company and profitability of business enterprises.

The term' size of businesses refers to the scale of organization and operations of a business enterprise. It is essential here to have a clear understanding of the terms' size' of the 'plant' size of 'firm' and the size of the industry.'

A ‘plant’ means an establishment of the manufacturing of goods. It represents a production unit where the due provision of all the activities facilitating the production process as made.

A ‘firm’ means as an organization that owns manages and controls a plant or number of plants and also arranges for the marketing of products, provision of finance, and other facilities to run the organization. The term industry’ implies the aggregate of all firm which manufacture similar types of products.

Measures of Size

Business firms vary in size-small, medium, and large. To measure the size of a business unit, the standards of measurement can be grouped into the following two categories.

1. **Measures About Input**

This includes capital employed, net worth, total assets, labor employed, and raw material and power consumed.

a. **Capital employed**

The capital includes owned capital and borrowed capital. The larger the amount of capital employed, the larger the size of the firm.

b. **Net worth**

Net worth is the excess of assets over liabilities, as shown in the **balance sheet of a firm**.

However, for all practical purposes, it refers to the amount of paid-up capital plays reserves and surpluses built up during business.

This measure is appropriate for comparing the size of different firms in an industry or to measure the rate of growth for a particular firm.

c. **Total assets**

Another measure of size if the size of the total assets of a firm.

The value of total assets is calculated by taking into account the amount invested in fixed (land, building, plant, and machinery), current (cash, short-term securities, stock, debtors, etc.) and intangible assets (goodwill, planet, rights, etc.).

d. **Labor employed**

The number of laborers employed in a firm is another measure commonly employed to measure the size of the business, which is producing similar types of goods and which are in the same stage of development.

e. **Amount of raw materials and power consumed.**

The quantity or value of raw materials and power used is yet another measure that can be used to adjudge a firm.

2. Measure about Output

This includes a volume of output, the value of output, and value-added.

a. **The volume of output**

The number of goods produced or services rendered may also serve as a good basis for comparison between firms. The greater the number of goods and services produced, the larger the size.

b. **Value of Output**

The monetary value of goods and services produced by a firm also serves as a basis for measuring the size of a firm.

c. **Value Added**

A useful variation or combination of the two output criteria is the measure of net value-added, calculated by deducting the costs of production from the value of production.

It must be mentioned here that no one measure is fully comprehensive, and the accuracy, adequacy, and utility of each standard will depend upon three factors – nature of industry and character of its output, the uniformity and accuracy of data available, and the purpose for which it is required.

On the whole, the output seems to be the best indicator to measure the size of the firm.

Factors Affecting the Size of the Firm

The main factors that affect the size of the firm are as follows:

1. Nature of Industry

The nature of the industry has a direct influence on the size of the firm. Manufacturing industries are, by and large, bigger compared to trading and service firms.

Manufacturing industries heavy machinery, produce goods on a large scale, make higher capital investments, and therefore large.

2. Nature of Products

When the product is less standardized, the size of the firm is often small when the product is standardized, complex, and durable; the size of the firm is often big.

3. Capital employed

When the capital involved is large, and the firm can raise it, the size of the firm is large, when the capital involved in small, the size of such a unit will be small.

4. Size of the market

If the size of the market is large for the product, the firm will also be large and vice-versa.

5. Quality of management

The competence and integrity of management largely determine the size of a business unit. If the management is competent to manage the complex tasks of modern business, the firm can afford to be large.

Factors Determining Size of the Firm

Every business is striving towards attaining the optimum size. Usually, any business starts as a small entity, and then during its operating period, it expands till it reaches the optimum size.

1. Capital Investment Factor

The capital employed by shareholders in the form of share capital, reserves, and surplus (net worth) determines the size of the business. It is mainly used to compare two firms or more that are producing similar or differentiated products.

2. Number of Employees

The number of employees employed by any business determines its size. This is done by comparing the wages paid to employees with other businesses.

This factor is used where firms produce similar goods. If you use it in comparing firms that are producing differentiated products, then you end up with false results.

3. Power Used

The amount of power used determines the size of the business. Business firms don't rely on this factor as it is inaccurate because of the amount of power used by any business may be more or less.

4. Raw Materials Used

The annual consumption of raw materials of any firm determines its size. It used only on those firms that are producing similar products.

5. The volume of the output

This factor is used for those firms that are producing homogeneous goods.

6. The capacity of Plant

It is used by firms that produce similar products.

7. Total Assets

The total assets of any business determine its size. The value of all assets (current and fixed) is taken as a means of measure. It is used in both similar and differentiated firms.

8. Value of Output

This is another factor that determines the size of any firm; however, this method is only effective in cases where firms produce a variety of products and where price levels remain constant.

In all these factors, the volume of output is the most effective and reliable factor in measuring the size of any business unit.

Various Concepts about the Size of Business Unit

The size of the firm is one of the decisive factors in the achievement of efficiency in its operations. In these days, large-scale production is considered to bring most economic results by the way of lower costs and higher returns. Therefore, there has been a tendency towards increase in the size of the industrial units in order to organise mass production and bulk sales in diversified markets.

The problem of size is intimately connected with the laws of increasing and decreasing returns and the principles of division of labour. Naturally, therefore, economists have been concerned with this problem and they have developed various concepts of the size of business unit.

More important of them are:

(1) The Concept of Representative Firm by Alfred Marshall.

(2) The Concept of Equilibrium Firm by Pigou.

(3) The Concept of Optimum Firm by E.A.G, Robinson.

1. The Representative Firm:

The concept of Representative Firm was introduced by Alfred Marshall.

The representative firm as defined by Marshall is essentially an average firm which has been running with normal success over a sufficiently long period of time. Such a firm can naturally be found

2. The Equilibrium Firm:

The concept of 'Equilibrium Firm' was introduced by Pigou, An equilibrium firm is one which has reached a stage where there is no urge for the entrepreneur to expand further. In other words, a firm is said to be in equilibrium when the entrepreneur is so much

satisfied with its profitability that he does not want any further expansion or reduction in its size.

3. The Concept of Optimum Firm:

The concept of optimum firm has been developed by E.A.G. Robinson. In his words by the optimum firm we must mean that firm which in existing conditions of technique and organising ability has the lowest average cost of production per unit, when all those costs which must be concerned in the long run are included.

So long as the firm has not reached that size it will continue growing. As Beacham wrote: **"In an ideal world all firms should grow upto the point at which they are making the most effective and economical use of productive resources. That is to say, all firms should expand until they reach their optimum size."**

The Optimum Size of Business

From an economic point of view, every business organization should expand as long as its average per-unit cost is just equal to that of its marginal cost. In simple words, when the factors of production-land, labor, capital, and organization can affect maximum returns at their minimum involvement, the economics consider that as the best, and the most desired size of business.

A firm with this-sat and volume of operation may ensure minimum unit cost, but a maximum return is known as the optimum firm.

"By the optimum firm," says E.A.G. Robinson, "we must mean that firm which, in exiting conditions of techniques and organizing ability has the lowest average cost of production per unit, when all those costs which must be covered in the long run are included."

The implications of this definition are as follows;

1. The point to be considered is the average cost of production and not-profits. The average cost means the total cost divided by the total output. Total cost includes all costs, including depreciation, interest, and a reasonable margin of profit.

2. Optimum size is a moving point and depends upon technological and managerial developments. Thus the optimum size is a relative and dynamic concept and static. That is why the optimum size of firms will vary in different industries where different technical, marketing, and financial conditions are encountered.

The Rationale of the Concept of Optimum Size

A firm of optimum size is brought into existence partly by the conscious decisions of a businessman who are considering how they can invest their resources profitably and partly by the forces of competition, which tend to eliminate the inefficient and encourage efficiency.

The optimum size, can, however, be achieved only.

1. If the size of the market is sufficient to absorb the whole production of at least one firm of such a size and

2. If product competition prevails in the market so that prices charged by the firms tend to be equalized.

The state of perfect competition is hardly encountered in practice, and hence the concept of optimum size is generally considered to be of least practice relevance.

However, it is not without practical utility. It motivates the businessmen to bring down the cost of production to the maximum possible extent through the use of better techniques of production and better management methods.

The concept of an optimum firm represents a simple analysis of the problem of determining an efficient size for a firm and the factors which should be taken into account while deciding upon a desirable scale of operations in the process of growth.

REVIEW QUESTIONS

1. What do you understand by Plant Layout?
2. What are the advantages of good plant layout?
3. What is the significance of the Sergeant Florence Theory in decisions related to plant location?
4. What are the classical types of plant layout? What are their advantages and disadvantages ?
5. Explain why business site, selection of equipment, and type of building must be considered simultaneously in the development of plant layout?
6. What points will you bear in mind while constructing the building for factory?
7. Compare advantages and disadvantages of Single and Multi-storied Buildings for a plant.
8. Distinguish between product layout and process layout and explain their advantages and disadvantages.
9. State the factors to be borne in mind while deciding layout of a plant. What are the advantages and limitations of product layout for a plant? Under what conditions you would recommend it?
10. What are the major classes of material handling equipment?
11. What steps should be taken in studying material handling?
12. Can material handling be studied independent of layout and maintenance?
13. What kinds of material handling equipment are appropriate for process layouts?
14. How important is plant location to profitability?
15. Explain the different dimensions of Size of firm
16. What are the concepts in measures of size of a firm?

MULTIPLE CHOICE QUESTIONS

1. Which of the following explain the need for facility location selection?
   a) When the existing business unit has outgrown its original facilities and expansion is not possible.
   b) When a business is newly started.
   c) When the lease expires and the landlord does not renew the lease.
   d) All of these.

2. Which of the following is the first step in making a correct location choice?
   a) Develop location alternatives
   b) (b) Decide the criteria for evaluating location alternatives
   c) (c) Evaluate the alternatives
   d) (d) Make a decision and select the location

3. Which of the following technique emphasizes transportation cost in the determination
   of facility location?
   a) Location rating factor technique
   b) Transportation technique
   c) Centre-of-gravity technique
   d) Both (b) and (c)

4. Transportation cost mainly depends on which of the following factors?
   a) Distance
   b) Weight of merchandise
   c) Time required for transportation
   d) All of the above

5. Which of the following does not cause to production delay?
   a) Shortage of space
   b) Long distance movement of materials
   c) Spoiled work
   d) Minimum material handling

6. Process layout is also known as _____.
   a) Functional layout
   b) Batch production layout
   c) Straight line layout
   d) Both (a) and (b)

7. Which of the following facility layout is best suited for the intermittent type of production, which is a method of manufacturing several different products using the same production line?
    a) Product layout
    b) Process layout
    c) Fixed position layout
    d) Cellular manufacturing layout

8. In which of the following layout type, materials are fed into the first machine and finished products come out of the last machine?
    a) Product layout
    b) Process layout
    c) Fixed position layout
    d) Cellular manufacturing layout

9. Which of the following is not an advantage of using product layout?
    a) Minimum material handling cost
    b) Minimum inspection requirement
    c) Specialised supervision requirement
    d) None of these

10. What is NOT a risk a corporation must consider when planning a location?
    a) Political
    b) **Exporting**
    c) Economic
    d) Cultural Economic

11. What do banks, fast-food chains, supermarkets, and retail stores view locations as?
    a) One in many intricate decisions for their organizations
    b) A crucial part of the marketing strategy.
    c) An easier way to distribute their product or service.
    d) New ideas for future investments.
    e) A second home.

12. In which of the following site selection techniques, a weightage between '0' to '1' is provided to factors that influence its location decision?
    a) Location rating factor technique
    b) Transportation technique
    c) Centre-of-gravity technique
    d) None of these

13. This chart is a graphic representation of all the production activities occurring on the shop floor
    a) Operation process chart
    b) Flow process chart
    c) Templates
    d) All of the above

14. What type of process would a paper mill be most likely to use?
    a) Continuous flow
    b) Project
    c) Job shop
    d) Flow shop

15. A firm is said to be of optimum size when _____.
    a) Average total cost is at a minimum
    b) Marginal cost is at a minimum
    c) Marginal cost is equal to marginal revenue
    d) The firm is maximizing its profit