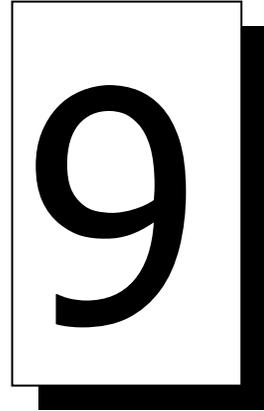


Facility Location



Unit Introduction

Location decisions represent an integral part of the strategic planning process of virtually every organization. Although it might appear that location decisions are one-time problems pertaining to new organizations, existing organizations often have a bigger stake in these kinds of decisions than new organizations. Location decisions are critical at several levels. At the national level, retail analysts screen and select metropolitan and regional market for new store entry. At the metropolitan level, not only are prime retail sites important but also an optimal distribution of those locations is needed to serve the marketplace. The location of the non-manufacturing operation helps determine how conveniently customers can conduct business with the company. Location of the manufacturing and non-manufacturing company operations can have a great impact on operating cost, thereby affecting profit and perhaps the price at which goods or services can be offered. This unit examines location analysis. It begins with a brief overview of the reasons firms must make location decisions, the nature of these decisions, and a general procedure for developing and evaluating location alternatives.

Lesson One: Facility Location Decisions and Its Theories & Principles

Lesson Objectives

After completing this lesson you will be able to:

- Explain the importance of location decision
- Identify the objectives and needs of proper factory location
- Discuss the phases of plant location theory
- Identify the principle nature of factory location
- Describe the revenue and cost effects of location decisions

Plant Location Decisions

Before getting into location decisions, it will be helpful for you to understand the terms related to plant location decisions. *Plant* means any set-up, for the purpose of business, which is engaged in any kind of production operation and yields semi-finished or finished goods as end results. *Location*, on the other hand, means any place or region of any set-up or concern in which the set-up or concern is situated. Thus *plant location decisions* are those, made by managers, which are aimed to the selection of a location for the settlement of any intended plant of the concern business. Plant Location decisions are usually based on factors as labor supply condition, raw materials supply condition, distance with the market place, and a lot of others of this type.

Objective of Location Decisions

As a general rule, profit-oriented organizations base their decisions on profit potential, whereas nonprofit organizations strive to achieve a balance between cost and the level of consumer service they provide. It would seem to follow that all organizations attempt to identify the best location available. However, this is not necessarily the case. In many instances, no single location may be significantly better than the others. There may be numerous acceptable locations from which to choose, as shown by the wide variety of locations where successful organizations can be found. Furthermore, the number of location that would have to be examined to find the best location may be too large to make an exhaustive search practical. Consequently, most organizations do not set out with the intention of identifying the one best location; rather, they hope to find a number of acceptable locations from which to choose – and to avoid choosing a location that will create future problems.

Profit-oriented firms set-up their location based on profit potential and nonprofit firms strive to achieve balance between cost & services.

Activity: If you want to open a computer sales and service center then do you think *selection of location* is an important factor for you? Why or why not? Discuss your opinion from the point of objectives of location decision.

The Need for Location Decisions

Existing organizations become involved in location decisions for variety of reasons. Firms such as banks, fast food chains, supermarkets, and retail stores view locations as part of *marketing strategy*, and they look for locations that will help them expand their markets. Basically, the location decisions in those cases reflect the addition of new locations to an existing system.

A similar situation occurs when an organization experiences a *growth in demand* for its products or services that cannot be satisfied by expansion at an existing

A new location to complement an existing one is often a realistic alternative.

location. The addition of a new location to complement an existing one is often a realistic alternative. Some firms face location decisions through *depletion of basic inputs*. For example, fishing and logging operations are often forced to relocate due to the temporary exhaustion of fish and forest at a given location. Mining and petroleum operations face the same sort of situation, although usually over a longer horizon. For others firms, a *shift in markets* causes them to consider relocation, or the costs of doing business at a particular location reach a point where other locations begin to look more attractive.

Importance of Location Decisions

There are two primary reasons that location decisions are a highly important part of production system design.

- One is that they entail a long-term commitment, which makes mistakes difficult to overcome.
- The other is that location decisions often have an impact on investment requirements, operating costs and revenues, and operations itself.

For instance a poor choice of location might result in excessive transportation costs, a shortage of qualified labor, loss of competitive advantage, inadequate supplies of raw materials, or some similar condition that is detrimental to operations. For services, a poor location could result in loss of customers and/or high operating costs.

Phases of Plant Location Theory

The problem of plant location can be defined as the determination of that location which, when confederating all factors, will provide minimum delivered-to-customer cost of the product(s) to be manufactured. Plant location theory can be considered to have passed through four phases:

1. The *Least Production Cost Site* phase: In this phase interests were concentrated on location factors directly affecting cost of production.
2. The *Nearness of Market* phase. In this phase more realistic concepts are introduced, such as the effect of uneven population, uneven resource distribution, imperfect competition and the independence of firms within a multi-market economy.
3. The *Profit Maximization* phase. This phase stressed that the firm's optimum location was determined by the difference between total revenue and total cost.
4. The *Least Costs to Customer* phase. This is similar to the profit maximization phase, but decision data were related to delivered costs to customers. Greater emphasis is given on analytical models, such as linear programming models and delivery time to customers.

A general theory of Plant Location may be of little value in treating a specific concrete problem encountered in the real world. A general theory may serve as a guide, but must be extensively supplemented, or replaced, by techniques that are operational under the conditions of the specific case.

Location Principles

Before looking at approaches to location study, certain principles to good plant location need to be established. These are:

- Objectively determine the needs of the plant or other facilities. Each alternative location provides its own particular combinations of services

and conditions. The prime objective is to select the location whose services and conditions best satisfy plant requirements. The degree of satisfaction can be determined only if needs are well defined.

- Objectively determine the characteristics of the site that may affect the effectiveness of the operations following location. As with plant needs, factual and complete data are required. The selected location can only be as good as the plant and location data on which the decision is based.
- Separate location studies from site studies.
- Bring to bear the specific and different talents necessary to most effectively conduct or supplement the different phases of the problem.

Activity: In case of setting up a computer sale and service center you will be influenced by what theory & principle of selection of location? Discuss your opinion.

The Nature of Location Decision Options

Location decisions for many types of business are made frequently, but they tend to have a significant impact on the organization. Here we shall look at the nature of location decisions, the usual objectives managers have when making location choices, and some of the options that are available to them. Manager can consider four options in location planning.

- a) One is to *expand an existing facility*. This option can be attractive if there is adequate room for expansion, especially if the location has desirable features that are not readily available elsewhere. Expansion costs are often less than those of other alternatives.
- b) Another option is to *add new locations while retaining existing ones*, as is done in many retail operations. In such cases, it is essential to take into account what the impact will be on the total system. Opening a new store in a shopping mall may simply draw customers who already patronize an existing store in the same chain rather than expand the market. On the other hand, adding locations can be a defensive strategy designed to maintain a market share or to prevent competitors from entering a market.
- c) A third option is to *shut down at one location and move to another*. An organization must weigh the costs of a move and the resulting benefits against the costs and benefits of remaining at the existing location. A shift in markets, exhaustion of raw materials, and the cost of operations often cause firms to consider this option seriously.
- d) Finally, organizations have the option of *doing nothing*. If a detailed analysis of potential locations fails to uncover benefits that make one of the previous three alternatives attractive, a firm may decide to maintain the status quo, at least for the time being.

Effects of Location on Revenue and Costs

- a. **Effects of location on revenues:** In some industries, revenues depend on having the facility near potential customers. For example, a barbershop cannot operate when the customers find the shop inaccessible. Again, for manufacturing firms that supply customers who themselves are manufacturers and assemblers, delivery time can be a crucial component of the strategic mission and the continued commitment of the organization, resulting in revenues.

Firm's revenues depend on having the facility near to the customers.

For service industries, the situation is somewhat different. Location is not so important for stored services, as those are not directly consumed. Federal Reserve banks, automotive repair shops, and manufacturers who repair appliances are often quasi manufacturers, and they don't necessarily have to be located near consumers. On the other hand, for firms that offer directly consumed services, location can be critical. Moving theaters, restaurants, banks, apartments, dry cleaning stores, and even public recreation areas obviously must be located for public convenience. Otherwise, consumers will go elsewhere, and revenues will decline.

The choice of new or better facilities involves consideration of costs of renovation of new or existing plants.

- b. **Effects of location on fixed costs:** New or additional facilities entail fixed initial costs, usually incurred only once, which must be recovered out of revenues if the investment is to be profitable. Acquiring new or additional facilities involves costs for new construction, purchase and renovation of other existing plants, or rental. Once they are acquired, more money must be spent on equipment and fixtures. The magnitude of these costs may well depend on the site that is selected. A chosen merchandising in corner location in downtown area like Motijheel, Dhaka requires a totally different capital outlay from one in suburban area. Construction costs also vary greatly from one place to another.
- c. **Effects of location on variable costs:** Once built, the new facility must be staffed and operated, and these costs, too, depend on location. For labor-intensive conversion processes, the availability of labor and local expectations for wages are major concerns. Management must also consider proximity to sources of raw materials (inputs) and to markets for finished goods (outputs), which can vary transportation and shipping costs. In Bangladesh textile facilities sprung up in places like Narayanganj, Savar because of availability of inputs like labor, threads and large areas of land.

Activity: In order to choose a suitable location you should put emphasis on – maximization of profit or minimization of cost or both? Justify your opinion with any example.

Reasons for Location Change

Long-range forecasts and capacity plan may reveal the need for additional capacity in some areas. If a company has excess capacity in one location or excess shipping cost to some areas, relocation of some facility or facilities may be desirable. At least four aspects of the facility question must be addressed:

- The types of facilities needed,
- The location of those facilities,
- The necessary capacity, and
- The design and layout of the facilities.

In addition to the need for greater capacity, there are other reasons for changing or adding locations.

- Changes in resources may occur. The cost or availability of labor, raw materials, and supporting resources (such as subcontractors) may change. The type of labor available may also change from skilled to semi-skilled;

inputs like raw materials, technological availability may also change over time.

- The geography of demand may shift. As product markets change, it may be desirable to change facility location to provide better service to customers. The facility should be with customers. If the consumer market changes then it is desirable that the facility changes its location.
- Companies may merge, making facilities redundant. To prevent overlapping of efforts some facilities may become useless and need to be streamlined. As a result some facilities are reduced in capacity or even permanently shut down.
- New products may be introduced, changing the availability of resources and markets. Technological changes in the methods of production can cause a location to become less attractive.
- Political and economic conditions may change. This intangible reason plays a major role in our country.

Discussion questions

1. Do you think location decisions can be an important strategic advantage for any business? Why or why not?
2. Differentiate between plant and plant location. Why is plant location important?
3. 'No single location may be significantly better than others.' Explain.
4. Discuss the emphasis given on different location theories.
5. What are the important principles of plant location?
6. What are the different options of location planning? Name some important reasons for location change.
7. Discuss the effects of location on revenue and cost.

Lesson Two: Regional and Community Factors Affecting Location Decisions

Lesson Objectives

After completing this lesson you will be able to:

- Explain the factors that affect factory location decision
- Discuss the importance of community for selecting the factory location
- Identify the trends in future location selection strategies

Regional factors for Selecting Factory Location

Many factors affect location decisions. However, it often happens that one or a few factors are so important that they dominate the decision. For example, in manufacturing, the potentially dominating factors usually include availability of an abundant energy and water supply and proximity to raw materials. In service organizations, possible dominating factors are market-related and include traffic patterns, convenience, and competitors' locations, as well as proximity to the market. Such as *car rental agencies* locate near airports or mid city where their customers are. Once the most important factors have been determined, an organization will try to narrow the search for suitable alternatives to one *geographic region*. Then a small number of *community and site alternatives* are identified and subject to detailed analysis. Community and site location factors are often so intertwined that it makes sense to consider them jointly. The primary regional factors involve (a) raw materials, (b) markets, (c) competitors and (d) labor considerations.

a) Raw materials

Firms locate near or at the source of raw materials for three primary reasons. These are necessity, perishability and transportation costs. Mining operations, farming, forestry, and fishing fall under *Necessity*. Obviously such operations much locate close to the raw materials. Firms involved in canning or freezing of fresh fruit and vegetables, processing of dairy products, baking, and soon must consider *Perishability* when considering location.

Firms locate near to the source of raw materials for the reasons of necessity, Perishability and transportation costs.

Transportation costs are important in industries where processing eliminates much of the bulk connected with a raw material after processing. Examples include aluminum reduction, cheese making, and paper production. When inputs come from different locations, some firms choose to locate near the geographic center of the sources. For instance, steel producers use large quantities of both coal and iron ore, and many are located somewhere between the coalfields and iron ore mines. Transportation costs are often the reason why vendors locate near their major customers. Moreover, supermarkets and other retail operations to supply multiple outlets use regional warehouses. Often the choice of new locations and additional warehouses reflects the locations of existing warehouses or retail outlets.

b) Markets

Profit oriented firms often locate near the markets they intend to serve as part of their competitive strategy, whereas nonprofit organizations choose locations relative to the needs of the users of their services. Other factors include distribution costs or the perishability of finished products. Retail sales and services are usually found near the center of the markets they serve. Examples include fast-food restaurants, service stations, dry cleaners, and supermarkets.

Retail sales & services are usually found near to the center of the markets where they serve.

Quite often their products and those of their competitors are so similar that they rely on convenience to attract customers. Hence, these businesses seek locations with high population densities or high traffic. The competition / convenience factor is also important in locating banks, hotels, and motels, auto repair shops, drugstores, newspaper kiosks, and shopping centers. Similarly, doctors, dentists, lawyers, barbers, and beauticians typically serve clients who reside within a limited area.

c) Competitive pressures

Large stores often locate near each other and small stores like to shopping centers.

For retail operations can be extremely important factors. In some cases, a market served by a particular location may be too small to justify two or more competitors (e.g., one hamburger franchise per block), so that search for potential locations tends to concentrate on locations without competitors. The opposite might also be true. It could be desirable to locate near the competitors. Large departmental stores often locate near each other and small stores like shopping centers that has large department stores as anchors. The large stores attract large number of shoppers who become potential purchasers in the smaller stores or in the other large stores.

Some firms must locate close to their market because of the *perishability* of their products. Examples include bakeries, flower shops and fresh seafood stores. For other type of firms, distribution costs are the main factor in closeness to market. For example, sand and gravel dealers usually serve a limited area because of the high distribution costs associated with their products. Still other firms require close customer contact, so they too tend to locate within the area that they expect to serve. Typical examples are tailor shops, home remodelers, home repair services, rug cleaners, and lawn and garden services.

Locations of many government services are near the markets. They are designed to serve, hence post offices are typically scattered throughout large metropolitan areas. Police and emergency health care locations are frequently selected on the basis of client needs. For instance, police patrol often concentrates on high crime areas, and emergency health care facilities are usually found in central locations to provide ready access from all directions.

d) Labor factors

Labor costs are very important for labor-intensive organization.

Primary labor considerations relate to the cost and availability of the labor (or wage rates) in an area, labor productivity and attitudes towards work and whether unions are serious political problems. Labor costs are very important for labor-intensive organizations. Skill of potential employees may be a factor although some companies prefer to train new employees rather than solely on previous experience. Increasing specialization in many industries make this possibility even more likely than the past. Worker attitude toward turnover, absenteeism, and similar factors may differ among potential locations – workers in large urban centers may exhibit different attitudes than workers in small towns or rural areas. Furthermore, worker attitudes in different parts of the country or in different countries may be markedly different.

The major factors in regional analysis

- Market availability both from concentration and time to delivery stand points.
- Raw materials availability both present and future.

- Transportation systems- Variety, concentrations, and costs.
- Power- present and future- availability and costs.
- Climatic influences- primarily affecting construction, heating and cooling costs, as well as personnel influence.
- Labor and wages.
- Taxation policies and other statutory influences.

Activity: Comment, *Dhaka City* as the location for computer and car manufacture firms.

Community and Site Considerations

Many communities actively try to attract new businesses because they are viewed as potential sources of future taxes and new job opportunities. However, communities do not, as a rule, want firms that will create pollution problems, or otherwise lessen the quality of life in the community. Local groups may actively seek to exclude certain companies on such grounds, and a company may have to go great length to convince local officials that it will be a “responsible citizen.” Furthermore, some organizations discover that even though overall community attitude is favorable, there may still be considerable opposition to specific sites from nearby residents who object to possible increased levels of noise, traffic or pollution.

Many communities actively try to attract only pollution free business and industry.

Some significant works point towards the following steps in making site selection

1. Forecast future requirements by planned stages of development, if applicable.
2. Develop and define location criteria.
3. Conduct site survey which will measure the site by measure of the criteria:
 - a) Look at past, present and future trends.
 - b) Tabulate the results in a manner that will permit comparison of one location to another in as objective a manner as feasible or reasonable.

The first problem arises in the selection of criteria, or as more often designated factors, for the location study. A number of factor checklists have been developed. These include a list proposed by “*Industrial Development*” which includes the following 10 major factors:

Markets (9-63)**	Financing (5-40) **
Labor (18-128)**	Water and Waste Disposal (10-72) **
Materials and Services (4-31) **	Power and Fuel (5-38) **
Transportation (12-82) **	Community Characteristics (26-181) **
Government and Legislation (8-54) **	Individual Sites (12-64) **

***The numbers in the parenthesis represents the number of sub-factors and sub-sub-factors under each of the classification.*

In summary at different levels (regional, community and site) the factors and considerations are shown in table: 9.2.1.

Table: 9.2.1 Levels, factors and considerations for plant locations

Level	Factors	Considerations
Regional	<i>Location of raw material</i>	Proximity, modes and costs of transportation, quantity available.
	<i>Location of markets</i>	Proximity, distribution costs, target market, trade practices/restrictions.
	<i>Labor</i>	Availability, age distribution of labor, work attitudes, union or nonunion, productivity, wage scales, unemployment compensation laws.
Community	<i>Facilities</i>	Schools, churches, shopping, housing, transportation, entertainment.
	<i>Service</i>	Medical, fire, and police
	<i>Taxes</i>	State / local, direct and indirect
	<i>Environmental regulation</i>	State / local
	<i>Utilities</i>	Cost and availability
	<i>Development support</i>	Bond issues, tax abatement, low-cost loans, and
Site	<i>Land</i>	Cost, degree of development required, soil characteristics and drainage, room for expansion, parking.
	<i>Transportation</i>	Type (access road, rail spurs, air freight)
	<i>Environmental/legal</i>	Zoning restrictions

Activity: Why is community an important factor for selection of location? Justify your opinion from the point of Bangladeshi garment sector.

Trends in Locations and Possible Future Strategies

Recent trends in locating facilities, particularly manufacturing facilities, reflect a combination of competitive and technological factors. One trend has been that of foreign producers, especially automotive firms, to locate in foreign lands. As for example, United States represents a tremendous market for cars, trucks, and recreational vehicles. By locating in the United States, these firms can shorten delivery time and reduce delivery costs. Furthermore, they can avoid any future tariffs or quotas that might be applied to imports. A development that affects location decisions was the passage of GATT in 1994. One of its provisions was the reduction and elimination of various tariffs. Consequently, location within borders of a country to escape tariffs is much less of an issue.

Another trend is just in time manufacturing techniques that encourage suppliers and customers to locate near each other to reduce supplier lead times. For this reason, some US firms are reconsidering decisions offshore. Moreover, in light manufacturing (e.g. electronics), low cost labor is becoming less important than nearness to markets; users of electronics components wants suppliers that are close to their manufacturing facilities. One offshoot of this is the possibility that the future will see a trend toward smaller factories located close to markets. In some industries, small, automated micro factories with narrow product focuses will be located near major markets to reduce response time.

By choosing strategic location a firm can reduce delivery time and costs.

The JIT manufacturing techniques encourage supplies and customers to locate near each other to reduce supplier lead times.

It is likely that the information high way will have a major impact on location planning. Advances in information technology will enhance the ability of manufacturing firms to gather, track, and distribute information that links purchasing, marketing, and distribution with design, engineering and manufacturing. These will reduce the need for these functions to be located close together, thereby permitting a strategy of locating production facilities near major markets.

Information high way will have a major impact on location planning.

Other factors are causing companies to locate manufacturing in countries that contain their markets, e.g. Japanese auto companies establishing factories in United States. One is to counter negative sentiments such as (not made in this country). Thus, Japanese factories in the United States produce cars made by US workers. A second factor relates to currency fluctuation and devaluation. These changes can have a significant impact on demand and, hence, on profits. Changes in currency value alter the price of foreign goods, but not the price of goods produced within a country. For instance, if the value of a country's currency falls relative to that of other countries', prices within the country don't change but foreign produced goods become more expensive. If demand is elastic, then demand for those foreign goods will fall. Furthermore, currency changes may result in increased costs of parts supplied by foreign producers. By locating and selling within a country and buying from suppliers in that country, manufacturers can avoid the impact of currency change.

Discussion questions

1. “Raw materials, market, competitive pressures, and labor are important regional factors for plant location,” discuss.
2. How can community play a vital role in site selection? Explain.
3. Name a region, a community and a site that will be important locations for specific plants.

Lesson Three: Steps and Procedures for Facility Location Decisions

Lesson Objectives

After completing this lesson you will be able to:

- Explain the steps and procedures that are required for factory location
- Evaluate the alternatives for plant location decisions
- Identify the steps required for facility location decisions

Following are the major steps necessary in the overall location strategy:

1. Development of the major objectives of the firm necessitating location selection by the management.
2. Isolation of pertinent variables affecting the choice of location.
3. Development of accurate and timely information on each of the variables selected in step 2
4. Design for the location system with detailed timetable for implementation.
5. Completing the location move in an effective and efficient manner by review, testing and feedback control.

1. Development of location objectives

The initial setup in solving location problem concerns the identification of the chief managerial objectives promoting the selection. Generally, the location decision is determined not by operations managers alone but in conjunction with top management decisions. Consequently, the objectives may include several areas of administrative interest that cannot be contained in the operations framework. Some managerial objectives for the proposed location movement may include the following:

- Additional growth-space and layout;
- Better transportation network;
- Reduction in plant operations and service costs;
- Cordial labor situation;
- Better environment in terms of water, air, and land;
- Better community and public relations;
- Greater inter-plant coordination and centralized control;
- Improved logistics; and
- Increased future plant profitability.

These location objectives are not altogether confined to the economics of plant operation. They include several other significant categories of sociological, historical, cultural, religious, and political dimensions to the locational issues. In most instances, the ultimate decision to locate will be an eclectic one and in the final analysis, it will be based upon several reasons.

2. Isolation of pertinent variables

The choice of location will involve substantial research and documentation on the variables, which affect the location decision. Following are the suggested variables to be researched (Table: 9.3.1).

Location decisions are taken by the operations managers with the top management.

Table: 9.3.1 Variables for location decision

<p style="text-align: center;">Site Variables</p> <ul style="list-style-type: none"> • Proximity to market • Proximity to railroad • Proximity to road transportation • Proximity to other plants • Proximity to warehouse • Land and terrain • Climate • Zoning 	<p style="text-align: center;">Resource Variables</p> <ul style="list-style-type: none"> • Available manpower • Available water supply • Available energy sources • Housing facility • Public transportation • Communications
<p style="text-align: center;">Financial Variables</p> <ul style="list-style-type: none"> • Cost of equipment and machinery moves • Cost of land and site acquisition • Interest, rent, and depreciation on existing facilities • Moving costs of employees • Cost of temporary operations in dual locations • Advertising costs • Structure of local taxes • Cost of site construction and engineering. 	<p style="text-align: center;">Image Variables</p> <ul style="list-style-type: none"> • Public relations in existing plant • Public relations and image building in new site • Employee welfare in location • Alternative absorption plans for non-located employees • Favorable (or adverse) reaction in the government • Overall community feelings toward moves • Publicity and campaign.
<p style="text-align: center;">Government Interface Variables</p> <ul style="list-style-type: none"> • Relations with the director of industries in existing site • Relations with the director of industries in new sites • Government restrictions on moves (political pressures) • Structure of long-term capital debts owed to government and what the move will do to these loans • Informal governmental leader's pressure both for and against such moves • Taxes– direct and indirect, deferment and allowances. 	<p style="text-align: center;">Industry Variables</p> <ul style="list-style-type: none"> • Proximity to other competitors • Heavy geographical concentration in few areas • Industry representative associations strategy for and against such moves • Future development programs for the area.

3. Development of accurate and timely information

In this phase a detailed analysis of the relevant factors obtained in step two are made. Care should be taken in the respect of accuracy and timeliness of the data.

4. Design of location system

The fourth step in facilities location system involves the actual preparation of a blueprint for the location. The suggested blueprint includes the following major items:

- Gross design for the plant
- Detailed departmental layout design
- Materials flow design
- Utilities flow design
- Communication flow design
- Finished goods inventory and storage design
- Auxiliary services design

- Recreational facilities design
- Machinery, equipment and tooling design
- Freight, railroad heads, and docking design
- Logistic design
- Other miscellaneous services (and products) design

The next step after completing the design concepts listed above is the preparation of a timetable showing the sequential procedure of the location move. It should be noted that such moves could never be accomplished in one single step. If it is a relocation, it does not mean program the closure of all existing facilities, waiting for the pick-up vans to arrive, transfer of all equipment simultaneously, and the erection of the new plant at the relocation site. Such a program will be time consuming and extremely unprofitable since it involves the closure of all plant activity while the fixed cost mount. Therefore, a timetable of sequential procedure is recommended which will incorporate the following:

The location move can never be accomplished in one single step.

- Provision for existing plant to function with a skeleton, staff and equipment
- Provisions for gradual shifting of equipment from the existing to the new site
- Initial construction and erection to be completed prior to equipment transfer
- Provision for overlapping production cycle to phase out the existing production program over a period of time
- Provisions for completing the relocation in several phases as opposed to a single phase
- Overall provision for elapsed time extension

5. Review and feedback control

The fifth (and last) step in the location selection process involves the completion of the relocation move by establishing proper review points and control in the industrial relocation system itself. This step ensures that the location has been completed according to established location plans and within specified time. This enables the operation management to determine the efficiency of the total move in terms of production man-hours lost, output curtailed and total cost in terms of equipment and manpower transfers. Non-operational issues such as sociological problems of the transfer, individual employees' psychological process of readjustment in the new setting and cultural shock to the transferred families can also be observed in this review step. In case of genuine employee hardship and personal difficulties, the management can strive to take appropriate corrective action by the feedback process of information from the aggrieved employees.

Review or feedback enables to determine the efficiency of production man-hours lost, output curtailed and total cost.

Activity: Do you think if you want to establish a garment factory in Bangladesh then should you need to consider all the above steps? Why or why not? Discuss your opinion.

General Procedures for Facility Location Planning

The general procedure for making location decision consists of the following steps:

- Decide on the criteria that will be used to evaluate location alternatives, such as increased revenues or community service
- Identify important factors, such as location of market or raw materials
- Develop location alternatives:

- Identify the general region for a location
 - Identify a small number of community alternatives
 - Identify site alternatives among the community alternatives
 - Evaluate the alternatives
- iv. Make a decision

A preliminary screening to identify feasible sites begins the planning process. For some kinds of facilities, particularly environmental or labor considerations are crucial. Breweries, for example, require an adequate supply of clean water. Aircraft manufacturers must be located near a variety of subcontractors; primary aluminum producers need electrical power. The following Table: 9.3.2 shows the resources and local conditions to be considered before finalizing facility location planning. After identifying several key location requirements, management undertakes a search to find alternative locations that are consistent with these requirements.

Table: 9.3.2 Resources and local conditions for facility location planning

Resources	Local Conditions
Labor skills and productivity	Community receptivity to business
Land availability and cost	Construction costs
Raw materials	Organized industrial complexes
Subcontractors	Quality of life: Climate, housing, recreation
Transportation facilities	School
Utility availability and rates	Taxes

Finally, it should not be forgotten that decisions about capacity are inseparable from decisions about location, since capacity depends upon demand and demand often depends on location. Obviously this decision affects the revenues, operating costs, and capital costs of the organization.

Evaluating Location Alternatives

The following are utilized when evaluating location alternatives:

- a) Location Cost-Volume Analyses
- b) The Transportation Model
- c) Factor Rating

a) Location cost-volume analyses

Break-even analysis is a graphical and algebraic representation of the relationships among volume of the output, cost and revenues. The analysis helps to relate costs and revenues to facility location. It identifies the level of output that must be reached in order to recover through revenues all the costs of operation.

The procedure for location cost-volume analysis involves these steps:

- Determine the fixed and variable costs associated with each location decisions.
- Plot the total cost lines for all location alternatives on the same graph.
- Determine which location has the lowest total cost for the expected level of output.

The method assume the following:

- Fixed costs are constant for the range of probable output

- Variable costs are linear for the range of probable output
- The required level of output can be closely estimated
- Only one product is involved

b) The transportation model

Transportation costs sometimes play an important role in location decisions. These can stem from the movement of either raw materials or finished goods. If a facility will be the sole source or destination of shipments, the transportation costs can be included in a location cost-volume analysis by incorporating the transportation cost per unit being shipped into the variable cost per unit. The Transportation Model also known as distribution method is particularly useful in location planning. Here, overall transportation cost is the criterion used for performance evaluation. It is more helpful after initial screening phase has narrowed the feasible alternative sites.

Transportation costs can be included in a location cost-volume analysis.

Activity: Discuss the importance of transportation model from the Bangladesh economic point.

c) Factor rating

Factor ratings are frequently used to evaluate location alternatives. It is a decision procedure in which each alternative is rated according to each factor relevant to the decision, and each factor is weighed according to importance. It is used as it is simple and brings diverse location considerations into the evaluation process. Moreover it fosters a consistency of judgment. The value of factor rating is that it provides a rational basis for evaluation and facilitates comparison among alternatives by establishing a composite value for each alternative that summarizes all related factors. Factor rating enables decision-makers to incorporate their personal opinions and quantitative information into the decision process.

Factor rating enables decision-makers to incorporate personal opinions & quantitative information into the decision process.

The following procedure is used to develop a factor rating:

- Determine which factors are relevant (e.g., location market, water supply, parking facilities, revenue potential).
- Assign a weight to each factor that indicates its relative importance compared with all other factors. Typically, weights sum to 1.00.
- Decide on common scale for all factors (e.g., 0 to 100).
- Score each location alternative.
- Multiply the factor weight by the score for each factor, and sum results for each location alternatives.
- Choose the alternative that has the highest composite score.

Finally, it is obvious that facilities are located where their requirements are met in terms of inputs, outputs, costs, etc. Organizations are serious about the placement of their facilities in proper locations. A good location will enable effortless arrival of inputs and at the same time smooth distribution of finished goods. It is also obvious that it entails a multiplicity of technological, economic and behavioral dimensions. The location decision falls under long term planning. The problem of selecting a proper facility location calls for a detailed study of the cost aspects as well as the intangible aspects. So it means that location planning represents a major effort on behalf of operations managers. However, this effort is justified, as operations managers must remember the slogan - *The three most important decisions in the life of a business are: location, location and location.*

**Case
Analysis**

Red River Blood Center

Red River is a community of 65,000 people in which there are three hospitals with a total of 287 beds. The Red River Blood Center was formed four years ago to provide the needed whole blood and plasma for emergency and surgical use within the three hospitals. The Blood Center is also part of a statewide network that shares blood resource. The center is located downtown next to the largest of the three hospitals. It is on the fourth floor of a doctor's office building.

Given the size of the Red River community, the blood center does relatively poorly in attracting a sufficient number of blood donors. The administrator of the Red River Blood center is constantly calling on other members of the network to provide blood needed in emergency cases. On the other hand, Red River is very seldom able to help other members of the network in their emergencies. During the initial two years of operations, the administration believed that newness of the center was the cause for "substandard" donor performance. But, now that the center has been operating for four years, that "excuse" will no longer hold up. Donors have often complained of the horrible traffic conditions downtown and the fact that parking is so scarce.

One of the lab technicians who recently moved from a larger community commented about the use of a mobile blood unit and setting up temporary clinics in meeting halls and other public facilities. She indicated that numerous civic and religious organizations had helped in organizing blood drives through their memberships. The new assistant administrator even commented about the possibility of moving from the downtown location to an out-laying shopping center. The administrator argued that the blood center was located where it was to be close to the hospitals.

Case questions

1. What location trade off has been made here?
2. Comment on the "demands" made by the blood center's constituents.
3. What factors should be considered in comparing the benefits and costs of mobile or temporary units with a shopping center based unit?

Discussion questions

1. Name the major steps necessary in the overall location strategy. Why is “isolation of pertinent variables” an important step in plant location?
2. Explain why companies should carefully plan location before organizing or controlling.
3. What is the role of size of an organization in location decision?
4. What is the correlation between demand, capacity and location of a facility?
5. What factors should be considered in locating an airport in a metropolitan area?
6. What is the role of size of a facility, in location of the facility?
7. What role does good transportation facilities play in location decisions?
8. Do you think a tannery in Hazaribagh of Dhaka is a good location? What trade-offs are made here?