**Production Management:**

"Production management deals with decision-making related to production processes so that the resulting goods or service is produced according to specification, in the amount and by the schedule demanded and at minimum cost."

**Factors Affecting Plant Location**

**1. Selection of Region:**

The selection of a region or area in which plant is to be installed requires the consideration of the following:

**Availability of Raw Materials:**

Proximity of sources of raw materials is the obvious explanation of the location of majority of sugar mills in Uttar Pradesh. This means that the raw material should be available within the economical distance. Easy availability of supplies required for maintenance and operation of the plant should also be considered.

**Proximity to Markets:**

Cost of distribution is an important item in the overhead expenses. So it will be advantageous to be near to the center of demand for finished products. Importance of this is fully realized if the material required for the manufacturing of products are not bulk and fright charges are small.

Consumer industries like cycles, sewing machines, radio televisions and other luxury goods etc. are set up near the marketing centers whereas producer industries like steel mills are located near the vicinity of raw material.

For this purpose market analysis should be carried out keeping in view the following points:

(a) Market trend and competition regarding product to be manufactured.

(b) Industrial market

(c) Consumer habits and income

(d) Population

(e) Scope of export to neighbouring countries.

**Transport Facilities:**

Since freight charges of raw materials and finished goods enter into the cost of production, therefore transportation facilities are becoming the governing factor in economic location of the plant. Depending upon the volume of the raw materials and finished products, a suitable method of transportation like rail, road, water transportation (through river, canals or sea) and air transport is selected and accordingly plant location is decided. Important consideration should be that the cost of transportation should remain fairly small in comparison to the total cost of production.

**Availability of Power, Fuel or Gas:**

Because of the wide spread use of electrical power the availability of fuel or gas has not remained a deciding factor in most of the cases for plant location. The location of thermal power plants (like Bokaro Thermal Plant) and steel plants near coal fields are for cutting down cost of the fuel transportation. The reliability of continuous supply of these facilities is an important factor.

**Water Supply:**

Water is required for processing as in chemical, sugar and paper industries and is also used for drinking and sanitary purposes. Investigation for quality and probable source of supply is important, since the cost of treating water is substantial so the chemical properties like hardness, alkalinity and acidity.

Presence of dissolved gases and organic material etc. should be thoroughly investigated. In case of water supply form an external source such as municipality, dependability of the source, pumping and storage capacity for present and future demands should be found out.

**Disposal Facility for Waste Products:**

Thorough study should be made regarding disposal of water like effluents, solids, chemicals and other waste products likely to be produced during the production process.

**Climatic and Atmospheric Conditions:**

The climate of the region/ area where the plant is to be located has an important bearing on both the capital and operational costs.

**Normally following aspects are considered:**

(a) Rain fall or snow fall in the area concerned

(b) Ambient temperatures

(c) Humidity

(d) Wind velocities and direction

(e) Incidence of cyclones, storms etc.

**Availability of Labour:**

Potential supply of requisite type of labour governs plant location to major extent. Some industries need highly skilled labour while other need unskilled and intelligent labour. But the former type is difficult in rural areas in comparison with industrially developed location.

**Momentum of an Established Industry:**

Already established industry in a certain area will produce skilled labour in that trade. Thus future industries in that area will have no difficulty with respect to the skilled labour e.g. Ludhiana is famous for cycle industries and Faridabad for engineering industries.

**Preference of Outstanding Businessmen and Government Subsidies:**

Some of the factory locations do not consider the above factors but locate industries in a particular district or area just to develop that area. It may be due to State Government policies regarding workers, pollution and smoke control requirements, waste disposal rules for industries etc.

**2. Township Selection:**

The factors to be considered regarding township selection are:

(i) Availability of men power of requisite skill

(ii) Competitive wage rates of workers

(iii) Other enterprises which are complementary or supplementary regarding raw materials, other input, labour and skill required.

(iv) Moderate taxes and the absence of restricting laws.

(v) A favourable cooperative and friendly attitude towards the industry.

(vi) Favourable living conditions and standards keeping in view the availability of medical and educational facilities, housing, fire service, recreational facilities, cost of living etc.

**3. Question of Urban and Rural Area:**

Question of urban and rural area should be decided in view of the following:

**Advantages of Rural Area:**

(i) The initial cost of land, erection cost of building and plant is less in rural area as compared to urban or city area.

(ii) Acquisition for additional area for extension work expansion of plant is possible without much difficulty whereas urban area being congested; the additional land is not easily available.

(iii) Rural areas are free form labour trouble which is most common in towns and cities.

(iv) Over crowding of working class population in cities is avoided.

**Advantages of Urban Area:**

(i) Better modes of transportation for collection and distribution of materials and finished products.

(ii) Availability to requisite type of labour for special and specific jobs is there.

(iii) Utilities like water, power, fuels etc. are easily available.

(iv) Industries do not need to construct colonies to provide residential facilities to their workers since houses are available on rental basis whereas in rural areas, houses have to be build for workers.

**4. Location of a Factory in a Big City:**

Generally factories are located in big cities for obvious reasons of skilled labour, market proximity for both raw materials and end products.

Its advantages and disadvantages are mentioned below:

**Advantages:**

(i) Existence of educational and recreational facilities is advantageous for children and dependents of workers.

(ii) Facilities for technical/ industrial education and training for children of workers are available.

(iii) Evening classes facilities are available.

(iv) Discussion opportunities and facilities for exchange of thoughts are available for interested people in societies and clubs.

(v) All types of skilled man power is available.

(vi) Repair, maintenance and service facilities for various utilities are available in abundance.

(vii) Banking facilities regarding finance (loan etc.) for industry in case of necessity are available.

(ix) Big markets for sale of products available.

(x) Better transport facilities for movement of raw materials, finished products and workers are available.

(xi) Many similar industries/plants exist in nearby areas.

(xii) Housing facilities workers & employees.

(xiii) Police and fire protection facilities available in near by area.

**Disadvantages:**

(i) Insurance and taxation rates are high.

(ii) Due to higher living standards, cost of consumer goods and wage rates are high.

(iii) Possibilities of expansion are minimum due to scarcity of land.

(iv) Cost of land is more if needed for expansion of the plant etc.

(v) Building costs very high in comparison to rural or semi urban areas.

(vi) Atmospheric conditions not very pleasant rather suffocating.

(vii) Local bye laws present a problem for future, working & expansion etc.

Thus, small plants may find location in big cities that too in upper stories of the buildings. Such accommodation may be utilized in view of availability of requisite type of labour in big cities.

**5. Location of an Industry in Small Town:**

There are some industries which are located in the rural areas or small towns specifically for the want of raw material and cheap labour.

Its advantages and disadvantages are mentioned below:

**Advantages:**

(i) Less labour trouble and co-ordinal employee-employer relation.

(ii) Suitable land for current and future requirements easily available.

(iii) Local bye laws do not impose problem in working of the unit.

(iv) No resistance from existing industries.

(v) Possibility of tax exemptions exist.

(vi) Not much congestion.

(vii) Lower rents in comparison to big cities and urban areas.

(viii) Lower wage rates for labour/ employees / workers.

(ix) Less fire risks.

(x) Noise not much problem.

**Disadvantages:**

(i) Scarcity of skilled labour of requisite type.

(ii) Lack of recreational and amusement facilities for staff.

(iii) Facilities like evening classes and industrial training do not exist.

(iv) Employees, workers do not get accustomed to factory life easily.

(v) Specialized services needed for various purposes are not available.

(vi) Police and fire protection less satisfactory.

(vii) Transportation and marketing facilities not satisfactory as required.

**6. The Sub-urban Location for a Factory:**

Such a location generally provides advantages of both the large city and small towns.

Benefits of such a locality may be summarized as follows:

(i) Land is easily and cheaply available in comparison to big cities.

(ii) Lower tax rates in comparison to big cities and urban areas.

(iii) Transportation facilities equal to big cities available.

(iv) Good living accommodation to enjoy advantages of big cities available for workers/employees.

(v) Unskilled labour cheaply available.

(vi) Recreational facilities of cities available due to easy transport facilities.

**7. Site Selection:**

The third step is to select the exact plant site with the following considerations:

(i) The cheap availability of land for current and future requirements, soil characteristics sub soil water, availability or possibility of economic drainage and waste disposal system are desirable parameters.

(ii) The site should be easily accessible to various modes of transport as required so that apart from input materials, employees can also reach the site conveniently.

(iii) The site should be free from zonal restrictions like from railways or civil aviation restrictions.

**8. Current Trends in Pant Location:**

1. Location in Proximity of Cities:

First tendency is to locate the industries or enterprises in the proximity of cities rather than in rural or urban areas. These sub-urban sites offer today practically all advantages, facilities and services available in cities and towns with the added advantage of land required for future expansion on cheap rates.

2. Planned Industrial Centres:

While industrial towns may be planned and developed by big industrial houses or govt., the late trend is to develop areas as industrial estates and sell these to people interested in starting their units at various places. Noida and Faridabad are the examples of this type of development.

3. Competition for Development of Industries:

In order to generate the employment opportunities the state and central govt. offer concessions to attract industrialists to set up industries in their states or territories.

**9. Appropriate Site Selection:**

Appropriate site selection is important because of the following:

(i) A good location may minimize the cost of production and distribution to a considerable extent. Such reduction in the cost of production helps in elevating either the competitive strength or the profit margin of the business.

(ii) Initiation of an enterprise involve a relatively large permanent investment. If the selected site is not proper, all the money invested on factory building, installation of machinery etc. will go waste and the owner will have to suffer a great loss.

(iii) Location put constraints for the physical factors of the overall plant designs heating, ventilation requirements, storage capacity for raw materials, transportation requirements for input material and finished products, energy requirements cost of labour, taxes and construction costs.

(iv) Location of plant decides the nature of investment cost to be incurred.

(v) Government policies sometimes play an important role in site selection.

(vi) Probably no location is so perfect as to guarantee success but locations can be so bad as to bankrupt an enterprise.

**10. The Design of Factory Plant Building:**

After a plant location has been decided upon, management’s next problem deals with the design of building. A building is designed and built to protect the property and employees of an organization. This basic fact is mostly overlooked in planning the requirement for building structures.

For those plants where employees, materials and infrastructure facilities require protection, the problems involved in designing and constructing effective and economical structures are many.

Good building design and planning can reduce manufacturing cost due to following reasons:

1. Reduction of work-in process inventory.

2. Lowering down material handling cost.

3. Reducing storage costs.

4. Reducing the manufacturing cycle time

5. Simplifying manufacturing and employees control procedure.

6. Reducing plant repair & maintenance costs.

7. Decreasing work stoppage and interruptions during production cycle.

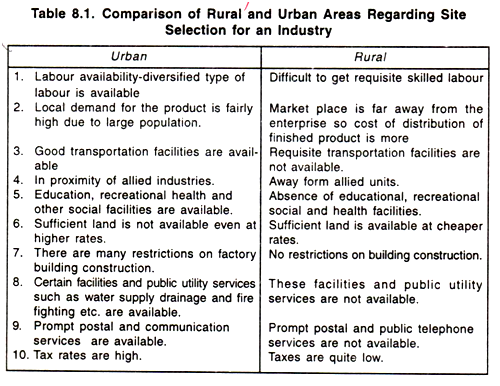
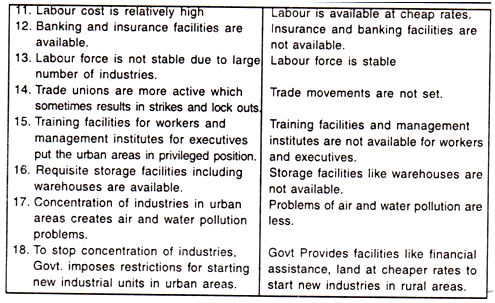
8. Increasing plant flexibility and utilization.

9. Reducing employee hiring and training cost.

10. Increasing morale of workers and reducing employee turnover.

Practically in all industrial situations, plants or building is composed of rectangular or square area. The combinations result commonly in building of the shape L, T, U, G, H, F, E, I, O and polygonal. Generally speaking a square building is cheaper to construct than a rectangular building because the square will have less perimeter per square meter of usable area. This reduction in perimeter length results in lower foundation and outside site and boundary wall costs.

At the same time however the square shape of the building normally does not suit to efficient production or assembly lines patterns. Furthermore, the cost of structural steel for floor and roof supports in the square building will likely to exceed that for a rectangular building and may offset the possible savings in foundation and wall costs.

[](http://cdn.yourarticlelibrary.com/wp-content/uploads/2014/04/image81.png)[](http://cdn.yourarticlelibrary.com/wp-content/uploads/2014/04/image82.png)

Most industrial building can be categorised into three groups as mentioned below:

**Single Storey Building:**

The trend today is towards the construction of single storey buildings particularly where land is available a reasonable price.

**Following are the advantages offered by single storey building:**

(i) It provides the cheapest overall cost per square meter of operating space of the plant.

(ii) It is easily and quickly constructed.

(iii) Greater flexibility in layout of the plant possible.

(iv) Truss construction makes for unimpaired operating space.

(v) Minimum vibrations from floors being on the ground.

(vi) Ease of ventilation, heating and air conditioning of the space.

(vii) Elimination of costs and maintenance of stairways.

(viii) Easy to expand by removing walls.

(ix) All equipment is on the same level, providing easier, more effective layout and control.

(x) Unrestricted floor load capacities available.

(xi) Supervision on one floor easy.

Following are the limitations of single storey buildings:

(i) Cost of heating and ventilation is more.

(ii) Roof maintenance cost is higher.

(iii) Longer ground runs for drainage required.

(iv) Water storage less convenient.

(v) Maintenance of glasses and lights is expensive affair.

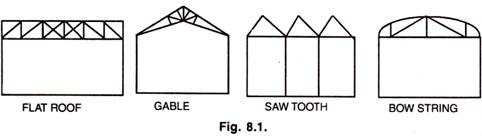
Single storey building’s roof structure are of the following four types:

(i) Flat

(ii) Gable

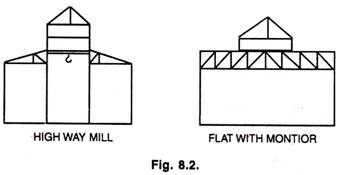
(iii) Saw tooth

(iv) Bow string.

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High bay and Monitor Type Buildings:

These types of single storey buildings are designed to give maximum overhead space for a given floor space if properly designed and constructed almost all the vertical walls can have windows for natural illumination.

[](http://cdn.yourarticlelibrary.com/wp-content/uploads/2014/04/clip_image00327.jpg)

The monitor type building is usually found in companies requiring good natural ventilation and considerable overhead room for operating cranes and other overheads facilities. Buildings for foundries and steel mills are often of the monitor or highway type enabling the firms to take advantage of the natural ventilation resulting from the high roof.

**Multistory Building:**

Following are the advantage of multistory buildings:

(i) Less roof repairs.

(ii) Heating and ventilation cost less.

(iii) Small ground runs for drainage.

(iv) More compact layout.

(v) Provides for maximum operating floor space per square meter of land.

(vi) Easily adopted for the manufacture of light goods.

Following are the limitations of multistory buildings:

(i) These present problems in heavy goods industries.

(ii) Material handling can be relatively expensive for bulky materials because of the vertical transfer between floors.

(iii) Natural illumination in the center of a multistory building is after poor.

(iv) Flexibility is hampered in multistory buildings because changes in the width and length of floor are usually impossible except at ground level.

**Product Layout**

Machines and equipment are arranged in the way in which they would be used in the process of manufacture of the product or group of related products. The arrangement of machines in this type of outlet may be either in U shape or in the line shape as depicted below:

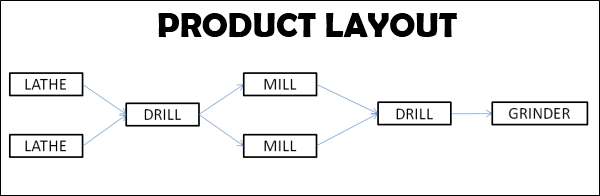
[](https://secureservercdn.net/166.62.112.219/m3a.5ff.myftpupload.com/wp-content/uploads/2016/01/Product-Layout-Chart.jpg)

Image: Product Layout Chart

Machines are placed in such a way that the output of one machine becomes the input of the next machine.

### 1. Product or Line Layout:

If all the processing equipment and machines are arranged according to the sequence of operations of the product, the layout is called product type of layout. In this type of layout, only one product of one type of products is produced in an operating area. This product must be standardized and produced in large quantities in order to justify the product layout.

The raw material is supplied at one end of the line and goes from one operation to the next quite rapidly with a minimum work in process, storage and material handling.

**SUITABILITY OF PRODUCT LAYOUT**

This type of layout is suitable for manufacturing units which carry out continuous production. Raw materials are fed at one end and the finished products arrive at the other end. It requires long production runs of identical products with a high degree of automation. It is useful for industries manufacturing cement, steel, sugar, cigarettes, fertilizers, automobiles, metal extraction etc.

**ADVANTAGES OF PRODUCT LAYOUT**

The following are the advantages of product layout:

1. Smooth flow of production: The entire production process is integrated. Therefore the possibility of stoppage of production at different stages of production is eliminated. So smooth flow of production is ensured.

2. Lower material handling costs: Since machines are arranged based on the sequence of operations, there is no backtracking (back and forward movement) or criss-crossing of materials. Therefore, cost and time involved in handling of materials is minimized. Transportation cost involved in transporting materials from one machine to another is eliminated

3. Lesser work-in-progress: Since the production process is continuous and uninterrupted, work-in-progress is less. Investment in work-in progress is less and the storage space required is also minimized.

4. Optimum space utilization: Since all machines are arranged sequentially, space available can be utilized in an optimum manner. Even in case of congested space, arrangement of machines would not be a problem, because the machines can be arranged in U shape.

5. Effective utilization of resources: Product layout ensures effective utilization of resources by ensuring:

minimum movement of workers

continuous production process and reduced wastage

less working-progress and

mechanization of materials handling,

6. Effective supervision: Since production process is integrated and continuous, [supervision](https://accountlearning.com/supervision-definition-functions-of-supervisor/) and control of the manufacturing process is easy. Inspection points are integrated into the production line.

7. Production control: Since the production process is continuous, production control is facilitated. The management can plan for the operations and adopt measures to complete the work according to the plans.

8. Savings in time: Time spent for transporting materials can be minimized. Since machines are arranged based on the sequence of operations, mechanized equipment such as conveyor belts can be used for transporting materials. This results in significant saving of time.

**DISADVANTAGES OF PRODUCT LAYOUT**

The following are the disadvantages of product layout

1. Rigidity: The layout is not flexible. Since the operations are performed in a sequential manner, adjustments in the course of production cannot be made.

2. Expansion is difficult: It is difficult to expand production beyond the capacity of each line of production.

3. Costly: This type of layout is costly. Machines in this type of layout are arranged on the basis of sequence of operations and not according to functions. Therefore it results in duplication of similar type of machines needed for different lines of production.

4. Supervision difficult: Under this layout, there are no departments for various types of work. Therefore specialization in supervision is difficult.

5. Complete stoppage during breakdown: Since output of one machine is the input of the next machine, any breakdown of one machine results in the complete stoppage of work.

6. Monotony: Since workers are engaged in repetitive nature of work, it results in monotony. Workers may lose interest in the job. The labor force has very little opportunity to display its talent.

7. High labor cost: Since workers work on specific machines, they lack knowledge to work on other machines. Therefore in case of absenteeism of a worker engaged in any particular work, the entire workflow may get affected. The organization may need to employ and train surplus workers who can work on any machine.

**PROCESS LAYOUT.**

In a process layout similar machines and equipment of the same functional type are arranged in one department. The processes are segregated and the machines of each process are kept together while each process is kept separately.

For example all the milling equipment would be arranged in the milling department, all the grinding machines in the grinding department and welding machines in the welding department. It requires large amount of specially designed plant operated by a small workforce.

**SUITABILITY OF PROCESS LAYOUT**

The process layout is suitable in the case of job order production, i.e., production is based on customer orders in which different varieties of goods are produced in small quantities. It is suitable in the case of catalytic crackers used in the refining of crude oil into petrol, kerosene, wax, rolling mills, wire drawing, chemical plants etc.

**ADVANTAGES OF PROCESS LAYOUT**

The important advantages offered by a process layout are as follows:

1. Flexibility

It is more flexible when compared to a [product layout](https://accountlearning.com/product-layout-suitability-advantages-disadvantages/). Changes in operations as well as their order can be made without disturbing the existing layout. Any new operation can be added.

2. Lower investment

General purpose machines which are usually of low cost are used. Duplication of machinery is avoided. Further general purpose machines do not become obsolete as rapidly as special purpose machines.

3. No stoppage of production

In case of breakdown of any machine, the whole process does not come to a standstill. Work of the machine which suffers from breakdown can be transferred to the other machines.

4. Scope for expansion

Different capacity lines can be expanded under this type of layout. New machines and labor can be added without upsetting the existing order of arrangement.

5. Full utilization of equipment

Process layout facilitates full utilization of equipment. General purpose machines are used in each department which can perform a variety of jobs. There is no need to provide a separate machine for each product line.

6. Better supervision

Because of specialization in operation, an efficient and Better supervision is possible.

**DISADVANTAGES OF PROCESS LAYOUT**

The following are the disadvantages of process layout:

1. Inefficient material handling

Materials have to be carried forward and backward quite frequently. Mechanization of [material handling](https://accountlearning.com/material-control-meaning-objectives-advantages/) becomes difficult. Fixed path material handling equipment like conveyor belts, chutes etc cannot be used and cost of material handling is quite.

2. High space requirement

Space requirement is more than product layout. More storage space is to be provided around machines for waiting material to be processed.

3. High investment in inventory

Due to the lack of continuous flow of production there is high in-process inventory. Frequently materials have to be carried back and forth. This results in delays and therefore the investment in inventory is high.

4. High supervision cost

Cost of supervision is high because the number of employees per supervisor is less resulting in reduced span of control. Further, the work is to be checked after each operation.

5. Longer production time

Time required for production is more in the case of product layout.

6. Skilled labor required

Skilled labor needs to be employed to perform variety of operations in general purpose machines.