**PLANT LAYOUT:**

Plant layout, also known as **facilities planning** and layout, deals with the orderly and proper arrangement of manufacturing facilities and the use of available resources, including men, money, machines, tools, materials, and methods of production inside the factory. In effect, plant layout is the allocation of space and the arrangement of equipment in such a manner that overall operational cost can be minimized. A well-designed plant layout is concerned with maximum and effective utilization of available resources at minimum operating costs.

Smooth and quick material flow is the essence an ideal manufacturing facility. A systematic planning of the layout allows integration of all movements in a logical overall pattern.

Plant layout can affect the total operation of a company, including the production processes, equipment, storage, dispatch and administration. It has a direct effect upon production efficiency and economics of the operation, the morale of employees and can affect the physical health of operatives.

Plant layout is the most effective physical arrangement, either existing or in plans of industrial facilities i.e arrangement of machines, processing equipment and service departments to achieve greatest co-ordination and efficiency of 4M’s (Men, Materials, Machines and Methods) in a plant.

Layout problems are fundamental to every type of organisation/enterprise and are experienced in all kinds of concerns/undertakings.

The adequacy of layout affects the efficiency of subsequent operations. It is an important pre-requisite for efficient operations and also has a great deal in common with many problems. Once the site of the plant has been decided, the next important problem before the management of the enterprise is to plan suitable layout for the plant.

“Plant layout is a floor plan for determining and arranging the designed machinery and equipment of a plant, whether established or contemplated, in the best place, to permit the quickest flow of material, at the lowest cost and with the minimum handling in processing the product, from the receipt of raw material to the shipment of finished product.”

**Objectives of Good Plant Layout:**

A good rather an optimum layout is one which provides maximum satisfaction to all concerned i.e. shareholders, management employees and consumers.

**The objectives of a good layout are as follows:**

(i) Should provide overall satisfaction to all concerned.

(ii) Material handling and internal transportation from one operation to the next is minimized and efficiently controlled.

(iii) The production bottle necks and points of congestions are to be eliminated so that input raw materials and semi-finished parts move fast from one work station to another.

(iv) Should provide high work in process turnover.

(v) Should utilize the space most effectively; may be cubical utilization.

(vi) Should provide worker’s convenience, promote job satisfaction and safety for them.

(vii) Should avoid unnecessary investment of capital.

(viii) Should help in effective utilization of labour.

(ix) Should lead to increased productivity and better quality of the product with reduced capital cost.

(x) Should provide easy supervision.

### ****Types of Plant Layout:****

1. Product or Line Layout.

2. Process or Functional Layout.

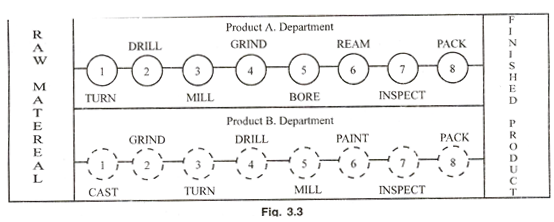
3. Fixed Position Layout.

4. Combination type of Layout.

#### 1. Product or Line Layout:

If all the processing equipment and machines are arranged according to the sequence of operations of a product, the layout is called product type of layout. In this type of layout, only one product or 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. Fig. 3.3 shows product layout for two types of products A and B.

**[](http://cdn.yourarticlelibrary.com/wp-content/uploads/2016/08/clip_image002-4.png)**

**Advantages offered by Product Layout:**

(i) Lowers total material handling cost.

(ii) There is less work in process.

(iii) Better utilization of men and machines.

(iv) Less floor area is occupied by material in transit and for temporary storages.

(v) Greater simplicity of production control.

(v) Total production time is also minimized.

**Limitations of Product Layout:**

(i) No flexibility which is generally required is obtained in this layout.

(ii) The manufacturing cost increases with a fall in volume of production.

(iii) If one or two lines are running light, there is a considerable machine idleness.

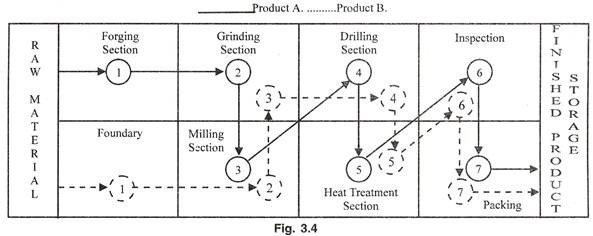
(iv) A single machine breakdown may shut down the whole production line,

(v) Specialized and strict supervision is essential.

#### ****2. Process or Functional Layout:****

The process layout is particularly useful where low volume of production is needed. If the products are not standardized, the process layout is more desirable, because it has greater process flexibility than other. In this type of layout the machines are not arranged according to the sequence of operations but are arranged according to the nature or type of the operations.

This layout is commonly suitable for non-repetitive jobs. Same type of operation facilities are grouped together such as lathes will be placed at one place all the drill machines are at another place and so on. See Fig. 3.4 for process layout. Therefore, the process carried out in any area is according to the machine available in that area.

**[](http://cdn.yourarticlelibrary.com/wp-content/uploads/2016/08/clip_image004-32.jpg)**

**Advantages of Process Layout:**

(i) There will be less duplication of machines. Thus total investment in equipment purchase will be reduced.

(ii) It offers better and more efficient supervision through specialization at various levels.

(iii) There is a greater flexibility in equipment and man power thus load distribution is easily controlled.

(iv) Better utilization of equipment available is possible.

(v) Breakdown of equipment can be easily handled by transferring work to another machine/ work station.

(vi) There will be better control of complicated or precision processes, especially where much inspection is required.

**Limitations of Process Layout:**

(i) There are long material flow lines and hence the expensive handling is required.

(ii) Total production cycle time is more owing to long distances and waiting at various points.

(iii) Since more work is in queue and waiting for further operation hence bottlenecks occur.

(iv) Generally more floor area is required.

(v) Since work does not flow through definite lines, counting and scheduling is more tedious.

(v)Specialization creates monotony and there will be difficulty for the laid workers to find job in other industries.

#### ****3. Fixed Position Layout:****

This type of layout is the least important for today’s manufacturing industries. In this type of layout the major component remain in a fixed location, other materials, parts, tools, machinery, manpower and other supporting equipment are brought to this location.

The major component or body of the product remains in a fixed position because it is too heavy or too big and as such it is economical and convenient to bring the necessary tools and equipment’s to work place along-with the man power. This type of layout is used in the manufacture of boilers, hydraulic and steam turbines and ships etc.

**Advantages Offered by Fixed Position Layout:**

(i) Material movement is reduced

(ii) Capital investment is minimized

(iii) The task is usually done by gang of operators, hence continuity of operations is ensured

(iv) Production centres are independent of each other. Hence effective planning and loading can be made. Thus total production cost will be reduced and

(v) It offers greater flexibility and allows change in product design, product mix and production volume.

**Limitations of Fixed Position Layout:**

(i) Highly skilled man power is required.

(ii) Movement of machines equipment’s to production centre may be time consuming.

(iii) Complicated fixtures may be required for positioning of jobs and tools. This may increase the cost of production.

#### ****4. Combination Type of Layout:****

Now days in pure state any one form of layouts discussed above is rarely found. Therefore generally the layouts used in industries are the compromise of the above mentioned layouts. Every layout has got certain advantages and limitations therefore, industries would not like to use any type of layout as such.

### Flexibility is a very important factor, so layout should be such which can be moulded according to the requirements of industry, without much investment. If the good features of all types of layouts are connected, a compromise solution can be obtained which will be more economical and flexible.

### Factors Influencing (Affecting) Plant Layout

**(i) Nature of the product :** The size, shape, characteristics and many other properties of the product influence the choice of the layout e.g. products having sensitive chemical properties needs more provision for safety equipment. Some products need air-conditioned plants. Efficient material handling system can be used for light products.

**(ii) Size of Output :** If standardized items are to be produced in bulk then product or line layout is more suitable. If some specific products are to be manufactured once in life time, then functional layout will be more appropriate.

**(iii) Nature or Manufacturing System :** For intermittent type of industries functional layout is better and in the case of continuous manufacturing system one can very well use product or line layout.

**(iv) Location of the Plant :** Layout is greatly influenced by the size, shape, climatic conditions and by-laws of the area where plant site is selected. There will be different transport arrangement if site is located near the railway line, otherwise the approach will be different. If floor space is square and too many machines and operations are involved in the production process then layout can be planned in different shapes.

**(v) Machines or Equipment :** Heavy machines making too much movement during operations need stationary type of layout. Layout also depends on the size of the machines.

**(vi) Climatic conditions,** requirements of light, temperature etc. also play an important role in designing a layout.

**(vii) Balancing Production Lines.** It is also very important aspect. The sequence of machines and equipment arranged to produce the desired product is known as Production lines. It should also be maintained so that productivity of plants & equipment may be ensured.

**(viii) Plant environment.** In planning factory layout, heat, light, noise, ventilation and other aspects of plant climate should be given due consideration. For example, paint shops and plating sections should be located on an outside wall so that dangerous fumes may be removed through proper ventilation. Type of machines, materials and equipment used also exercise consider-able influence on plant location.

**(ix) Spatial requirements.** The spatial needs for machines, material handling equipment and available floor space are important influences on plant location. Spatial requirements also depend upon the position and needs of workers. Employee facilities and safety should be duly considered.

**(x) Repairs and maintenance.** Machines and equipment should not be fixed so close to each other that it may create problems in repairs, maintenance and replacement. Access to machine parts for repairs and maintenance should be provided.

**(xi) Balance.** Proper balance between processes helps to avoid bottlenecks. The arrangement of machine capacity should be such as to ensure a uniform flow of work. At the same time the layout should be designed in such a manner that there is minimum possible movement of materials and men.

**(xii) Management policy.** Management policies regarding size, quality, employee facilities and delivery schedules should be considered while deciding plant layout. For example, size (demand forecast) will determine the size of work stations. Need for flexibility should also be considered. The layout designer must have a complete understanding of management policies that have a bearing on plant layout.