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# Layout Design Guidelines



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# Agenda

- Introduction to layout
- Type of layouts
- Cellular manufacturing
- Layout design tools
- Flow requirements
- Common mistakes

# Definition – Layout

**Plant Layout** is a design of premises in a such a way to perform manufacturing activity and produces products and services.

Plant layout changes as per the manufacturing sequence of products and also it varies industry to industries. As per lean manufacturing guidelines value stream mapping is a one of the best helpful tools for designing plant layout for utilizing optimum resources.

Usually, 2D CAD is used to draw the layout and actual dimensions of the site, machine footprint, people movement etc is considered during the design of the layout.

# Layout Types

- Product layout
- Process layout
- Fixed position layout
- Combined layout

# Product Layout

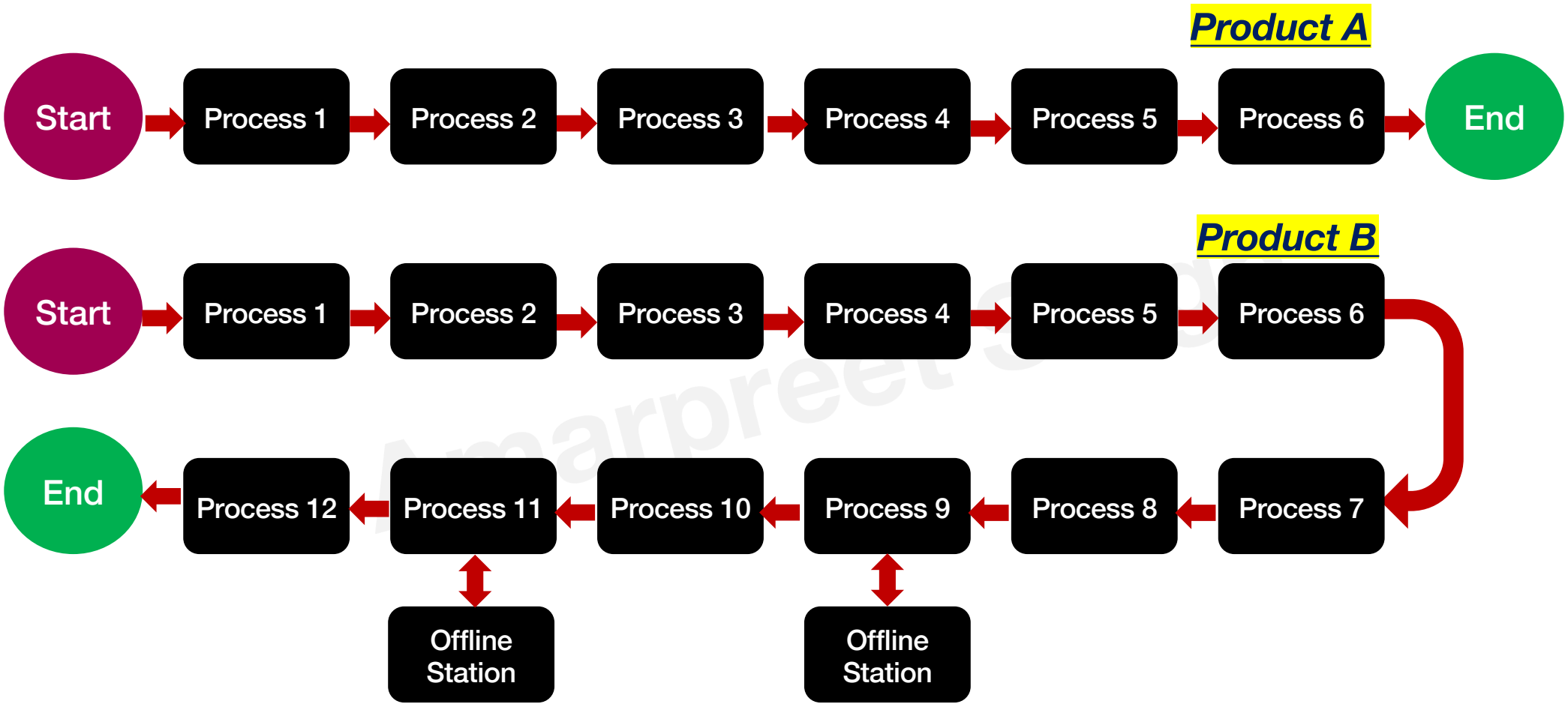
Product layout is designed consider the sequence of operations, which are going to happen on a certain product. This type of layout is usually designed for high volume products.

The layout is designed for a product and certain volumes, there is very low requirement for flexibility. Majority of the raw material is supplied to the layout from one end and the output in the form of FG is collected from the other end of the layout.

**PRO** - This is a very efficient way of designing layout for a high-volume line as we can balance the line to the best possible level and achieve the best possible manufacturing cost of the product.

**CON**- The drawback of the product layout is that if one of the process or machine is down, it will impact the production of the whole line. Typical example of this layout is mobile phone manufacturing.

# Product Layout - Examples



# Process Layout

Process layout is also referred as functional layout. Process layout is designed based on product and process requirements.  This layout is generally applied for mixed type of product or batch product.

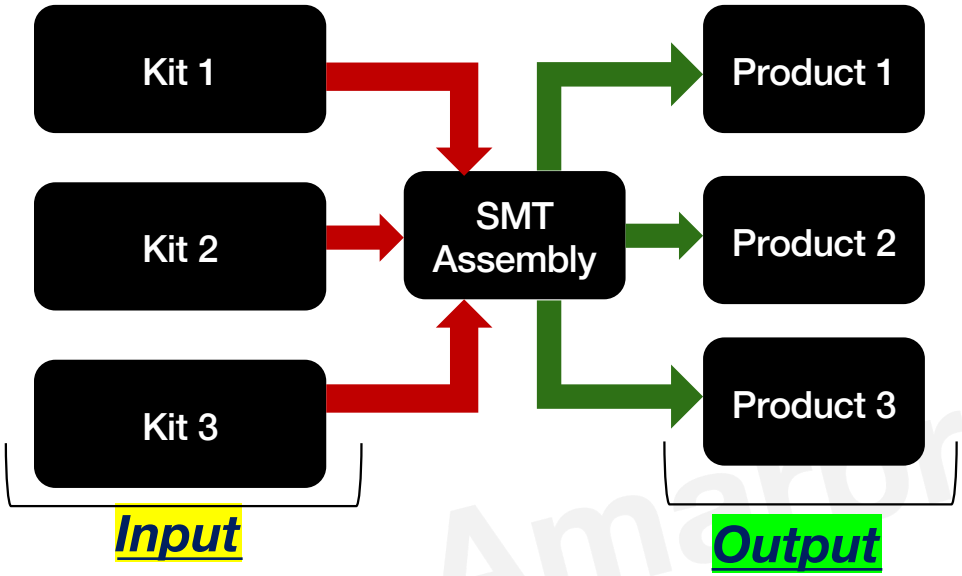
The whole shop floor is divided into different zones as per the process to be carried in that Zone.

**PRO** – We can save money on CAPEX for the equipment's. It also provides appropriate utilization of high Capex machines and provides specialization of processes.

**CON's**-

1. It reduces material handling efficiency, as there will be WIP waiting for the specific machine.
2. Throughput time is high as the overall production is controlled by certain processes.
3. Complex flow can be difficult to control.

# Process Layout - Examples




**SMT Area** for a High or Medium Mix production shop floor is designed to cater all the products.

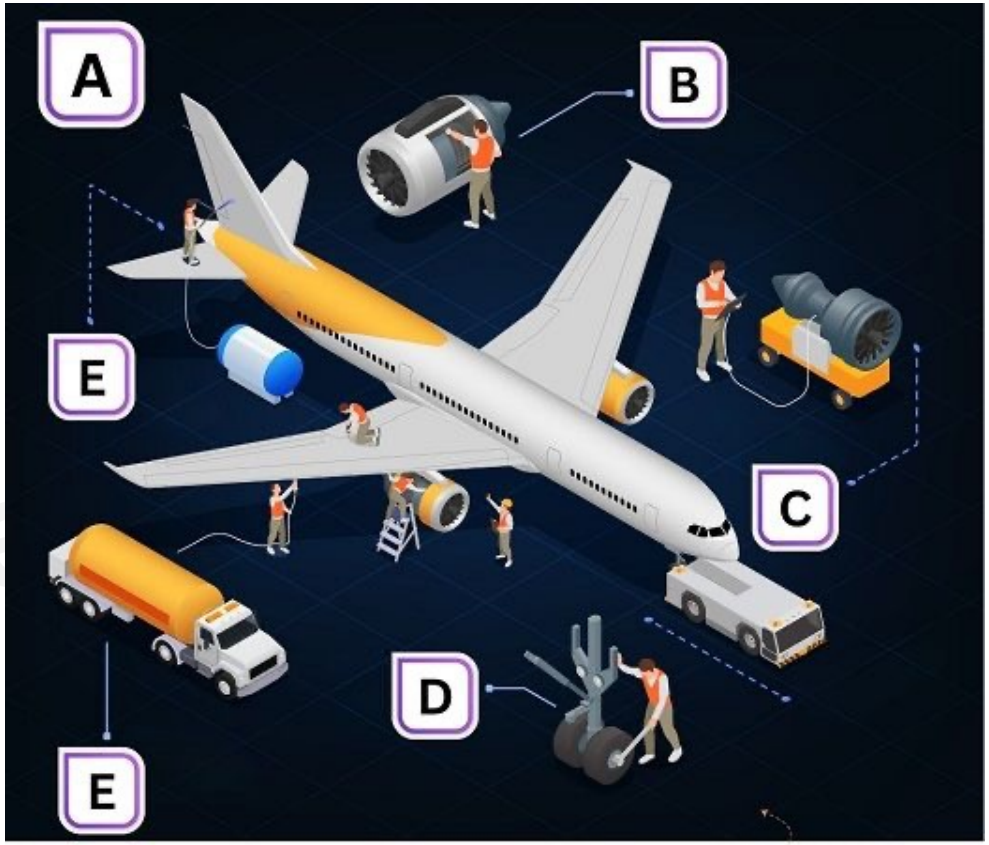
The kits for various products are scheduled as per customer requirements and pulled by the backend assembly team on completion.

There is always a WIP in the SMT area.

# Fixed Position Layout

- Fixed position layout is generally used for product-based Industries, which involves bigger or heavy product and movement of product is restricted.
- In fixed position layout job or product is fixed and machine or equipment will be movable.

***Example***

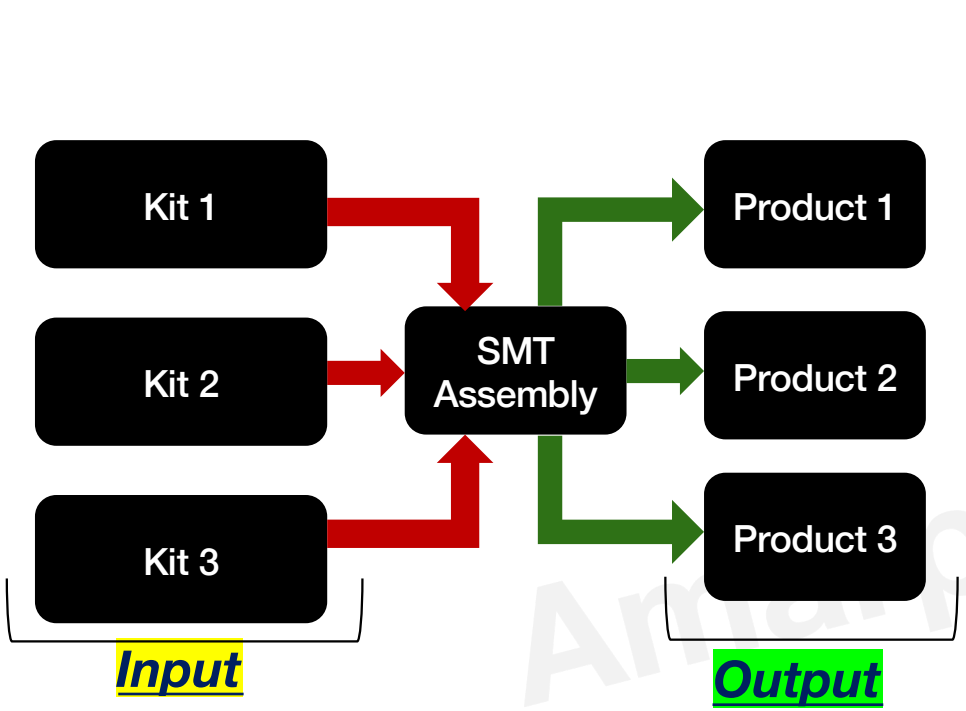


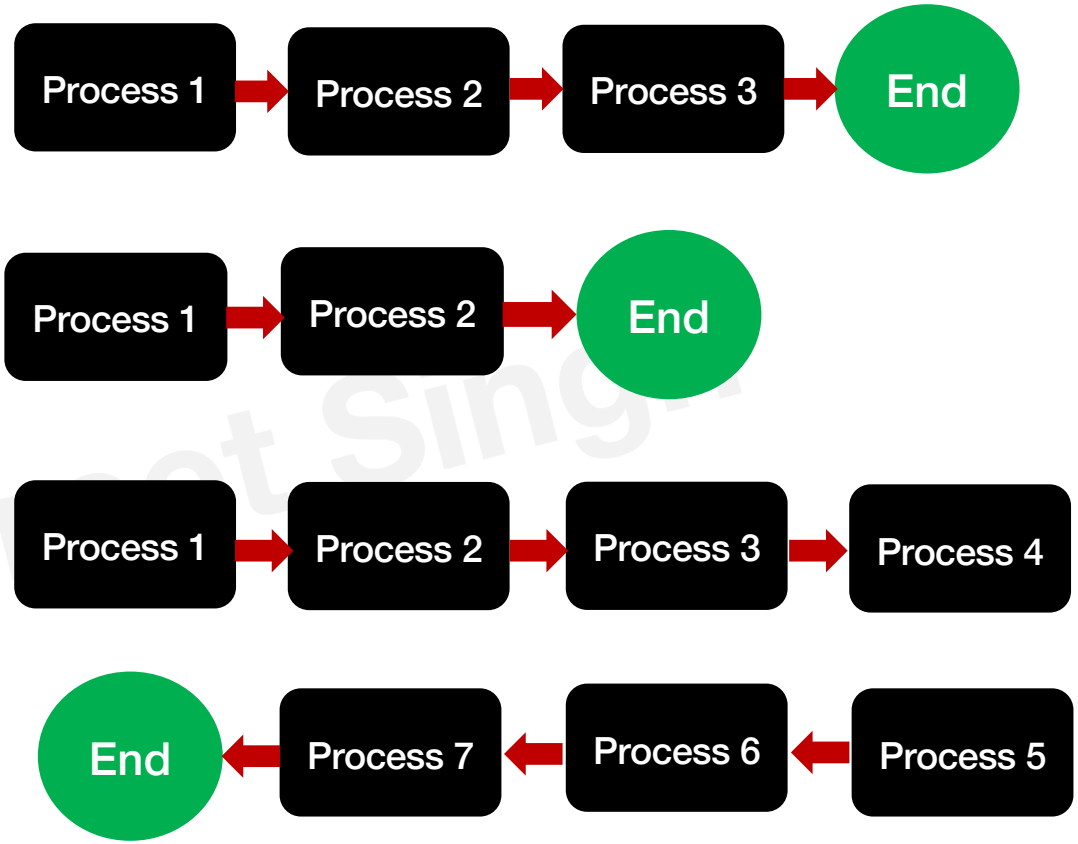

A = Workstation, B,C,D,E = Jobs or Processes

# Combined Layout

- A combination layout is a blend of process layouts, product layouts and fixed-position layouts. Professionals in manufacturing often call these layouts "hybrid layouts" as they draw components from the various major layout types.
- With a mixture of components, combination layouts may allow organisation to maximize efficiency depending on the different processes they must perform, the type of products they're handling and the variety of products they deal with on a day-to-day basis.
- To design operation premises with combined layout, the goal is to minimize material handling and increase flexibilities during production.

# Combined Layout - Example



# Cellular Manufacturing

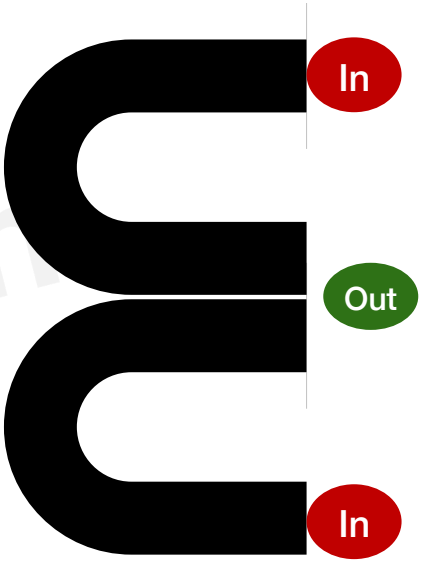
**Cellular Manufacturing** - In cellular manufacturing layout developed multiple cells in an operation premises based on product category such as assembly line.

Each cells consists variety of machines which fulfil product functional requirements and generally its design based on u shape for considering minimum material handling as well as minimum manpower movements.

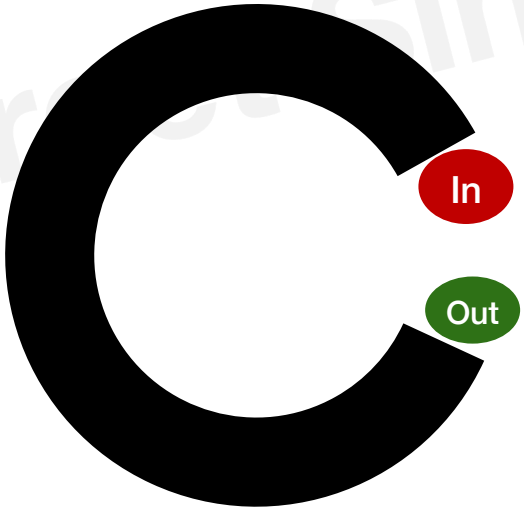
The advantage of cellular manufacturing are increased flexibility, minimize lead time and optimize space utilization.

***Cellular Layout Examples***


***C Shape Cell***




***E Shape Cell***




***Circle Shape Cell***

# Layout Design Tools

Various lean manufacturing tools are used during the layout design. Some of the tools used during the layout design are

- **Value Stream Mapping** - VSM is basically design the plant layout based on measure the process with data collection, analyse the data, generate ideas with brainstorming activities and developed several layout proposals for modification.

In value stream mapping material handling, inventory levels, machine or equipment utilization, manpower, material and information flow, space utilization and many more parameters will be measured, analysed and implemented.

# Layout Design Tools

- **Single Piece Flow -** One-piece flow is suggesting to design the layout based on operation sequence wise with maintaining minimum WIP at workstation and minimize the manufacturing throughput time and increase production. Single piece flow helps to avoid over production, control defects in real time and achieve the production quantities in a smooth way.

- **Line Balancing** – All the work-stations in the assembly line should have same cycle time. The cycle time is matched with the takt time, which helps to meet the customer demand on time. line balancing is also helpful to minimize WIP between workstation as well as maintain the operation sequence during production.

# Layout Design – Flow Requirements

## Raw Materials

- Storage Space Requirement
- Kanban Levels ( Visual )
- Close to work-station
- Access for the material movement
- Close to the work-station

## Work In Progress

- WIP Levels ( Visuals )
- WIP movement
- In process rejection ( Visual )

## Finished Goods

- FG Movement
- FG Storage on the floor
- FG Levels ( pull production )

## People Movement

- Space allocated for every operator
- People movement
- Ergonomics
- Visual management

## Information

- Shop floor visual management
- Real time displays for quality, quantity, voice of customers etc

## Waste Management

- Access to the waste generated
- Movement of waste through the cells
- Segregation of good Vs bad materials

# Common Mistakes

- **Ignoring the customer requirements –** We cannot design a layout, while Ignoring the customer requirements. The plant and cell layout should be designed to meet the customer demand, quality and delivery flexibility requirements of the customer. It should also be flexible to adapt changes in the market and customer preferences.

- **Failing to optimize the product flow –** Another common mistake companies make is failing to optimize the product flow during the layout design. A plant layout should minimize the distance, time, and cost of transporting the product between different stages of the production process.

It should also eliminate unnecessary movements, bottlenecks, and interruptions that may cause delays, waste, and defects. A plant layout that optimizes the product flow can improve the productivity, quality, and profitability of the plant operation.

# Common Mistakes

- **Occupying all the available space –** A plant layout should make the best use of the space that is available for the production process. It is not advisable to utilise all the space available and leave no space for expansion of future products. It should avoid overcrowding, underutilization, and inefficient allocation of the space. It should also consider the future expansion and growth of the plant operation.

- **Overlooking the environmental conditions –** Another mistake that plant operators make is overlooking the environmental conditions. Environmental conditions are the physical and psychological factors that affect the performance and well-being of the workers and the equipment.

A plant layout should ensure the environmental conditions are suitable for the production process. It should provide adequate lighting, ventilation, temperature, humidity, noise, and safety measures. It should also comply with the relevant laws and regulations regarding the environmental impact of the plant operation.

# Common Mistakes

- **Ignoring Ergonomics –** Ergonomics is the science of designing the workplace to fit the workers and the tasks. A plant layout should consider the ergonomics by providing comfortable and efficient workstations, tools, and equipment. It should also reduce the physical and mental stress, fatigue, and injuries of the workers.

- **Material Handling** - Material handling is the movement, storage, and control of materials and products within the plant. A plant layout should facilitate the material handling by providing adequate and accessible storage areas, conveyors, lifts, and other equipment. It should also reduce the frequency, distance, and weight of the material handling.

# Thank You

Do you have more questions on topic ?

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