Chapter 4

LAYOUT STRATEGY

1. Introduction

FACILITY LAYOUT

Arrangement of machines, departments, workstations, storage areas, aisles & common areas within existing/proposed facility. facility

OBJECTIVES OF FACILITY LAYOUT

+ Minimize material handling costs reduce distance between storehouse and production line
+ Utilize space efficiently convenience of worker + customer + more seats.
+ Utilize labor efficiently
+ Eliminate bottlenecks
+ Facilitate communication and interaction among workers – supervisors – customers
+ Reduce manufacturing cycle time or customer service time layout of store
+ Eliminate waste or redundant movement tool need near

1. Introduction

FACILITY LAYOUT

Arrangement of machines, departments, workstations, storage areas, aisles & common areas within existing/proposed facility

OBJECTIVES OF FACILITY LAYOUT

+ Facilitate the entry, exit, and placement of material, products, or people
+ Incorporate safety and security measures
+ Promote product and service quality
+ Encourage proper maintenance activities
+ Provide a visual control of operations or activities
+ Provide flexibility to adapt to changing conditions

1. Introduction

BASIC TYPES OF LAYOUTS: 3 types

1. Process Layout (***functional layout***) our university layout

+ grouping similar activities together in department according to the process/function they perform

2. Product Layout (***assembly lines***) serve 1 king of customer, 1 kind of product

+ arranging activities in a line according to the sequence of operations for a partilar product

3. Fixed Position Layout

+ used in projects where the product cannot be moved

1. Introduction

	PRODUCT LAYOUT	*PROCESS LAYOUT*
1. Description	Sequential arrangement of machines	**Functional grouping** of machines
2. Type of process	**Continuous** (mass production, assembly)	**Intermittent** (job shop, batch production, fabrication)
3. Product	Standardized, make-to-**stock**	**Varied, make-to-order**
4. Demand	Stable	Fluctuating
5. Volume	High	Low
6. Equipment	Special purpose	General purpose
7. Workers	Limited skills	Varied skills

sản xuất phân chiếc
sản xuất theo đơn
sản xuất phân khối lớn

1. Introduction

	PRODUCT LAYOUT	*PROCESS LAYOUT*
8. Inventory	Low work-in-process, high finished goods	High work-in-process, low finished goods
9. Storage	Small	Large
10. Material handling	Fixed path (conveyor)	Varied, make-to-order (forklift)
11. Aisles	Narrow	Wide
12. Scheduling	Part of balancing	Dynamic
13. Layout	Line balancing	Machine location
14. Goal	Equalize work at each station	Minimize material handling cost
15. Advantage	Efficiency	Flexibility

1. Introduction

HYBRID LAYOUTS: Modifying/mixing basic layout types

1. Cellular layouts

group machines into machining cells

2. Flexible manufacturing systems (FMS)

automated machining & material handling systems

3. Mixed-model assembly lines

produce *variety of models* on one line

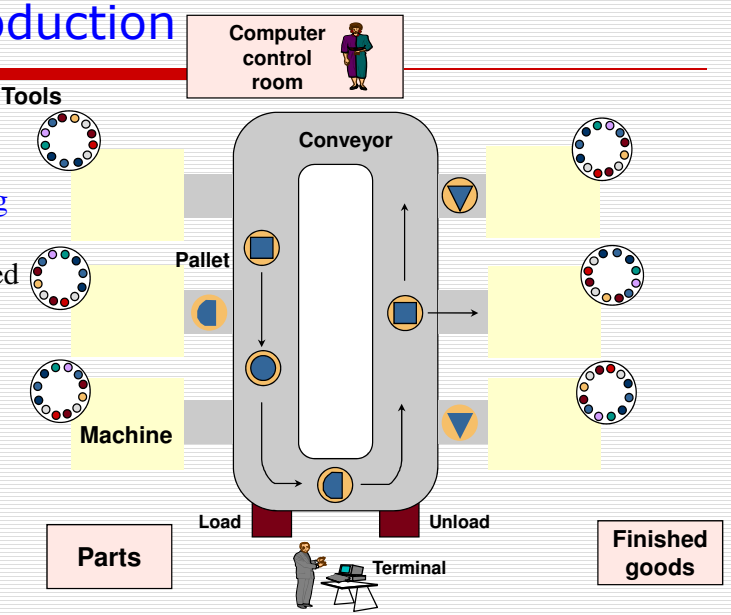
1. Introduction

+ Overall approach for physically producing goods & services ➔ **decisions:**

- Capital intensity: mix of capital & labor resources
- Process flexibility: resources adjusted
- Vertical integration: complexity or not
- Customer involvement: specific or not

1. Introduction

Flexible manufacturing system: computer aided based system.



2. Characteristics

These can be identified in a production plant:

+ **FUNCTIONAL:** production facilities grouped by functions

(all furniture drilling machines together, all sanding & finishing machines together)

Orders are routed through the functional departments where each operation is required & performed → job sheets/cards

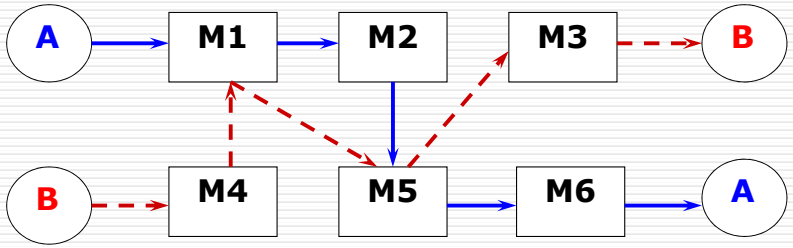
The benefits of *'collective expertise'* are obtained but the operators are *'task specialists'* → maybe skillful workers

→ This can result in motivation and attitudinal problems.

Functional organisation is flexible but needs much close control and information on the progress of 'batches' between shops.

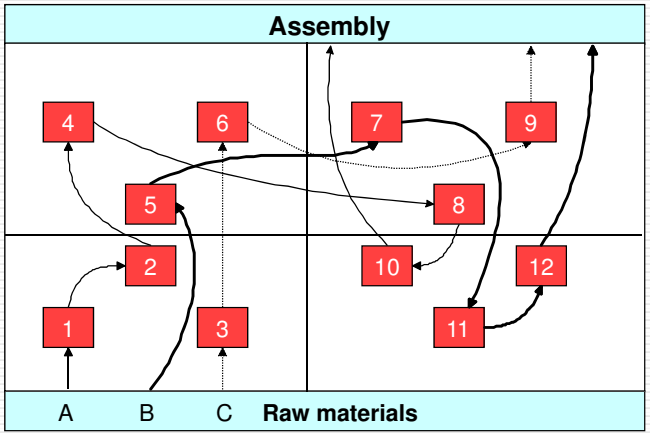
2. Characteristics

Process layout (functional)



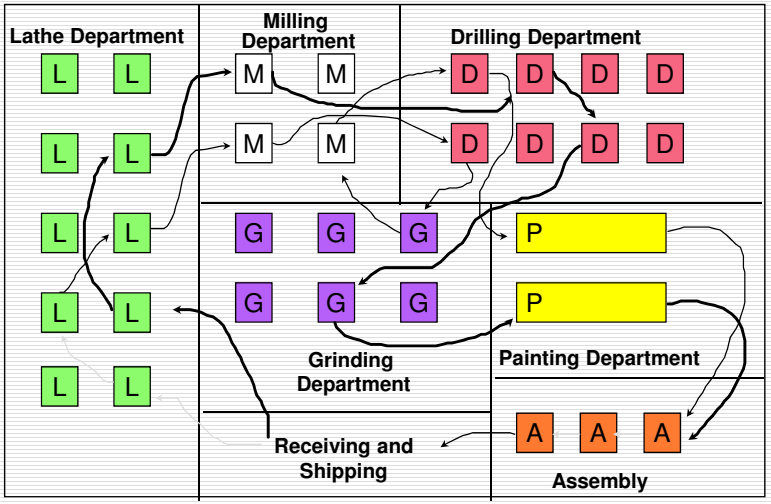
2. Characteristics

Process layout (functional)



2. Characteristics

process layout



2. Characteristics

These can be identified in a production plant:

+ **LINE:** materials flows through the manufacturing facilities are uni-direction and any product flowing along the line usually requires all the facilities on the line.

With computer control of materials movements far more flexibility vis a vis exactly what components go into each product as it passes down the line can be built in.

2. Characteristics

These can be identified in a production plant:

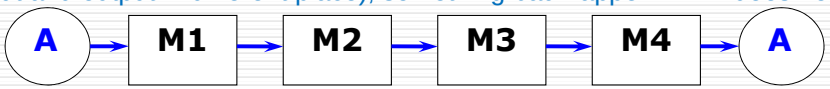
This is a feature of the modern computer controlled car assembly line where so long as the car is a Micra different versions (E, L, GLS, Turbo etc) will sit side by side on the line.

➔ This type needs a well trained, flexible workforce with supervisors and workers on the shop-floor possessing up-to-the-minute information. When the product type is changed - complex resetting is necessary.

2. Characteristics

Straight-lines

ad: continous flow, visual control (easy to supervise), apply in medical and food (input and output in different place), something bad happen in M1 does not affect M4.



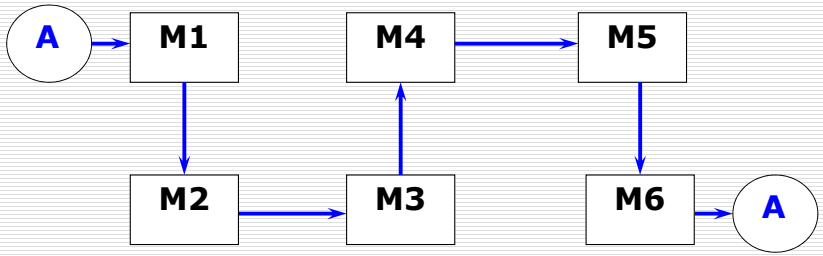
Dis: take a lot of space

➔ Short production lines or less workstations

2. Characteristics

zig-zag

ad: Save space, apply in food and medicine, shorten distance material delivery



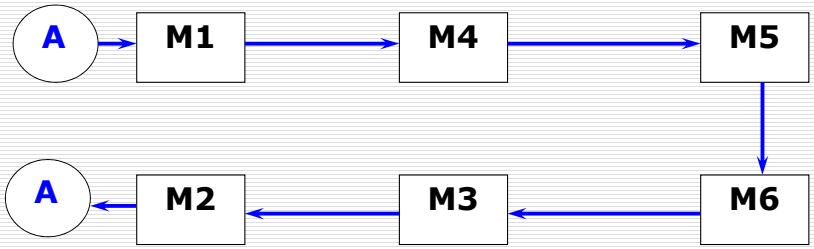
Longer production lines

Not good for accident: M3 fire, M2, M4, M6 can be affected

2. Characteristics

U sharp

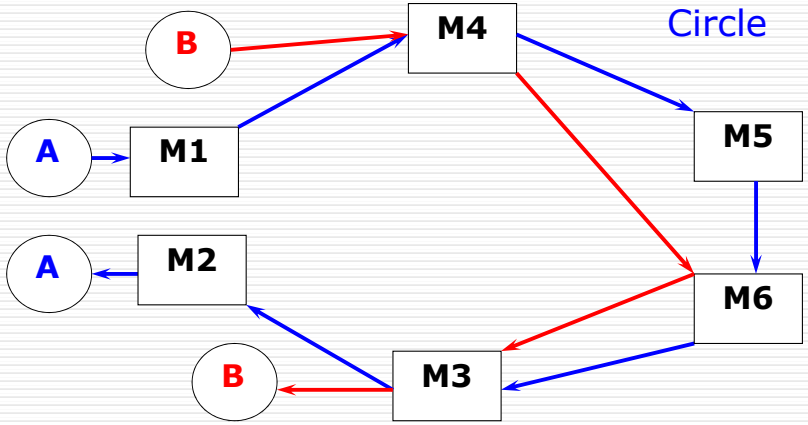
Ad: save space,



Longer production line

Disad: not good for accident, input and output at same place, cant apply for medicine and food industry,

2. Characteristics



Longer production line

2. Characteristics

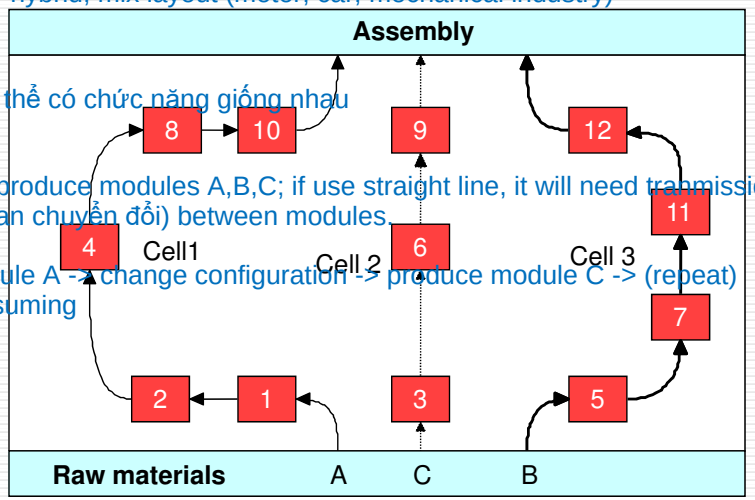
Cellular layout

hybrid, mix layout (motor, car, mechanical industry)

các máy có thể có chức năng giống nhau

shorten time produce modules A,B,C; if use straight line, it will need tranmission delay (thời gian chuyển đổi) between modules.

Produce module A -> change configuration -> produce module C -> (repeat) => Time-consuming



2. Characteristics

ADVANTAGES OF CELLULAR LAYOUTS

+ Reduced material handling and transit time

+ Reduced setup time

+ Reduced work-in-process inventory

+ Better use of human resources process layout need more skill woker-> train -> one worker one module -> less train

+ Easier to control

+ Easier to automate

2. Characteristics

DISADVANTAGES OF CELLULAR LAYOUTS

+ Inadequate part families

+ Poorly balanced cells

+ Expanded training and scheduling of workers

+ Increased capital investment

2. Characteristics

These can be identified in a production plant:

+ **CONTINUOUS PROCESS:** is a special form of line organization that is - plant dominated.

The operation of the system is defined almost completely when the plant is designed (chemical plant, nuclear power station etc).

Constant control of the process is needed for efficient control operations e.g. to adjust temperatures

2. Characteristics

These can be identified in a production plant:

+ **GROUP ORGANISATION:** is similar to LINE except that a group or cell of facilities processes a range of items with similar facility requirements.

All items (not physically similar necessarily) produced by the group won't need all the facilities.

2. Characteristics

These can be identified in a production plant:

Different facilities within the group will be working on different items. again material flows should be uni-directional as possible and immediate information on work flows and priorities is needed by the supervisors and workers.

These modes of production have substantial implications in terms of ability to control stocks, supplier-customer relationships an the sophistication of purchasing systems.

3. Comparing Physical Organisations

Manual assembly of products for stock in high volumes is usually line organization because of use of semi-skilled staff, size of work-in-progress inventories, training time and the efficiency of the work design.

However unit assembly by small group or individual is more likely to be MTO or jobbing work.

Component manufacture (medium volume) is usually batch or functionally organized because of the need for machine stations and the inflexibility of machine cycle times.

3. Comparing Physical Organisations

Low utilization of facilities is a problem.

The flexibility of functional organization has a cost of high work-in-progress inventories to stabilize uneven workflow.

Line organizations (inflexible) have efficient throughput rates with low inventories.

The use of computers to minimize the inefficiencies of each is therefore obvious.

3. Comparing Physical Organisations

Example: Functional Organisation

+ An order requires 10 operations with a total batch work content time of 20 hours only (*planning*).

+ However, work in progress queues may involve 2 days waiting at each work centre (*realistic*).

→ order takes 3 weeks (10 operations * 2 days) → greater than required time (only 20 hours).

Throughput Efficiency = 20 hours ----> 3 weeks

→ Thus a typical functional organisation will have a T.E. of 10-20% rarely higher.

Suppose: 8 hours/working day → 20 days x 8 hours = 160 hours

Then TE = 20 / 160 = 12.5%

4. Problems in MTO & MFS

MTO: make to order → the system operates based on orders from customers directly → more *customization* → meet customers' demand from production.

MFS (MTS): make for (to) stock → the system operates before orders from customers → products move to the warehouse → more *standardization* → satisfy customers' demand from stores

4. Problems in MTO & MFS

Controllables

1. Capacity (output rate)
2. Finished stock levels (inventory investment)
3. Customer delivery times.

The Operations Manager needs data on these to manipulate efficiency to the best

4. Problems in MTO & MFS

Examples

Poor quality control at Jaguar Cars in the 70's led to considerable employee alienation. The company's high quality standards now and emphasis on employee excellence (participation and training) are reaping dividends.

A restaurant chain decides to re-design its franchise outlets so that only a limited range menu is offered (*for fast, efficient service*). Any change in eating habits or in the cost structure of the menu will render the design partial