2.3. Facility Location And Layout.

Basic Questions
- what to produce?
- when to produce?
- How much to produce?
- **Where to produce?**

↓

Facility location and layout.

Facility → set up required to run operations.

Location → place where facility may be established.

* Need for an appropriate facility location.

a) When Organisation wants:

- to start new business
- Expand existing business
- Increase the scale of operations

b) When business faces complexities such as -
- resource shortage
- expiry of lease agreement
- socio-cultural problems
- legal & political issues
- other economic & social problems

that force orgn to change location.

* Benefits of Good facility location:-

- Cost Benefit (Reduced FC, VC, transportation cost)
- Proximity to market & source.
- Easy & hassle free transport facility.

→ Balance between cost of production & service.
→ Maximize service quality while minimizing the cost.

* Factors Affecting location selection decision.

a) Sourcing
- Availability of RM
- Availability of natural resources, energy & waters.
- Availability of internet connectivity
- Proximity to the key suppliers.
- Connectivity to alternate vendors
- Cross-docking

b) Markets.
- Proximity to market
- Coverage of wide geographical area
- Large customer base
- Lesser time to market
- Connectivity

c) Cost
- Lesser transportation cost & well availability of various transp. modes
- Lesser lease / rental cost.
- Tax & other duties
- Other hidden cost.

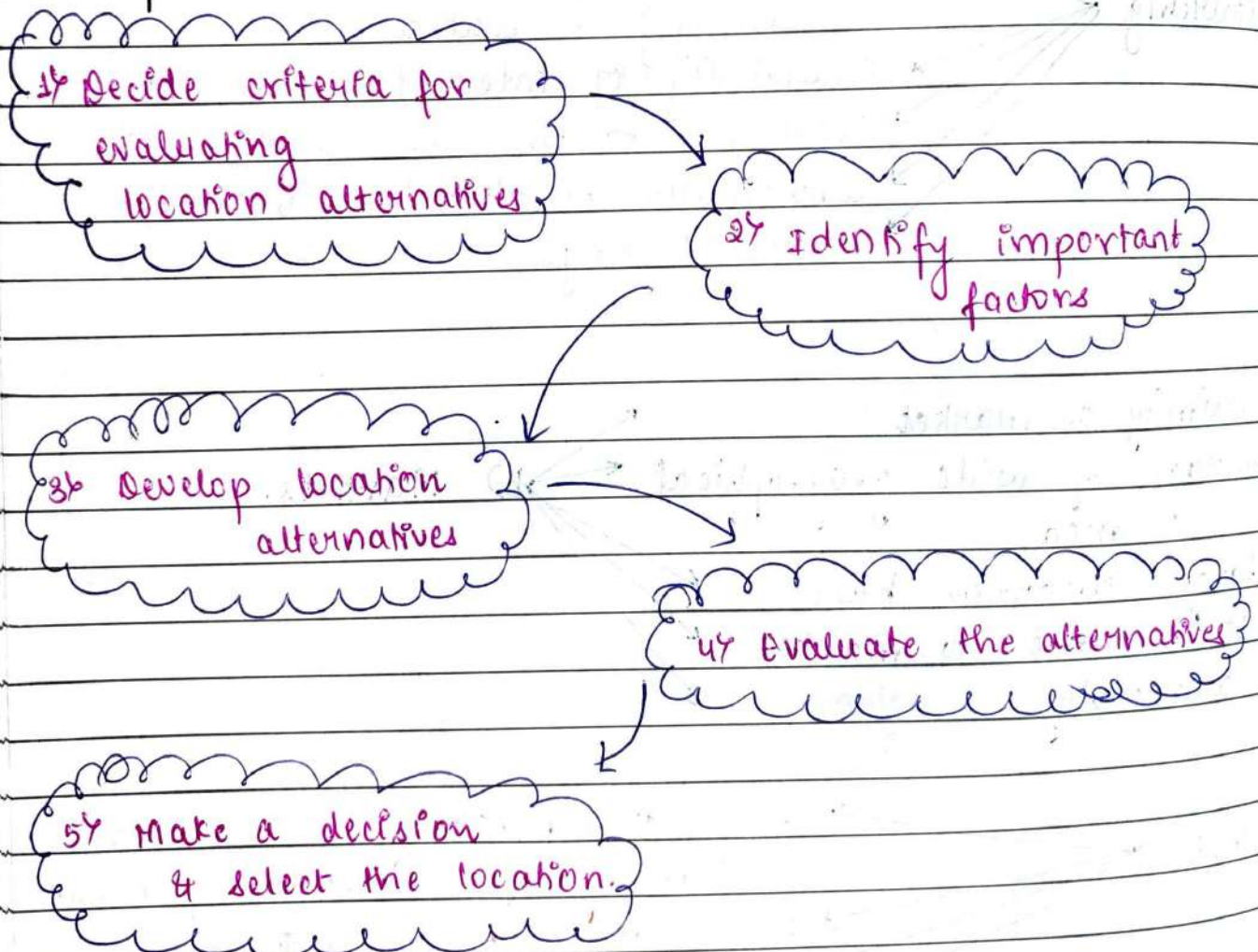
d) Socio-cultural, community & Political Issues.
- → Supportive community
- → Language, Ritual, culture
- → Crime & other disturbances
- → Availability of employees
- → Quality of living
- → Statutory & regulatory rules and regulations.
- → Availability of medical facilities, fire, police etc.

e) Environmental Concerns.

f) Availability of skilled labours.

g) Competitive pressure

* Steps to make correct location choice:-



* Popular Approaches :-

1) Factor Rating Method
2) Centre of Gravity Technique
3) Transportation model
4) Optimization and Heuristic Models

* Facility Layout :-

Plant Layout (Also known as layout of facility)
↓
refers to configuration of departments, work-centres and equipment and machinery
↓
with focus on flow of materials through the production system.

→ Layout planning involves decisions about physical arrangement of economic activity centres within a facility

→ Goal of layout planning is to allow workers & equipments to operate more effectively.

* Location of a centre has two dimensions :-

Absolute Location	Relative Location.
↓	↓
particular space that the centre occupies within the facility	Placement of a centre relative to other centers.

Questions to be addressed in layout planning :-

1) How much space & capacity each centre need.
2) How should each center's space be configured?
3) What centres should the layout include?
4) Where should each centre be located?

* Importance of Layout decisions :-

Most common Reasons

a) To determine long-run efficiency in operations.

b) Layout has many strategic implications.

c) Helps to achieve strategic Advantage

d) Provides an economic layout

* Need for Redesign of Layout.

→ Accidents, health hazards and low safety.
→ changes in environmental / legal requirements.
→ changes in processes, methods or equipments.
→ changes in product design / service design.
→ Product mix changes
→ Inefficient operations
→ Introduction of new products / service
→ Low employee morale.

* Good Plant Layout - Objectives.

→ Efficient utilisation of labour
→ Higher flexibility
→ Higher utilisation of space, equipment & people.
→ Improved employee morale & safe working conditions.
→ Improved flow of materials, information & people.
→ Improved prodn capacity
→ Reduced congestion or reduced bottleneck centres.
→ Reduced health hazards & accidents.
→ To allow ease of maintenance.
→ To facilitate better coordination & F2F communication.
→ To improve productivity
→ To provide ease of supervision.
→ To provide product flexibility & volume flexibility
→ To utilise available space efficiently & effectively

* Choices of Layout :-

helps an organisation's product plans & competitive priorities by :-

a) Facilitating the flow of materials & information.

b) Improving communication.

c) Improving employee morale

d) Increasing customer convenience & sales.

e) Increasing the efficient utilisation of labour & equip.

f) Reducing hazards to employees.

* Layout choices available to managers are :-

- Whether to plan the layout for current / future needs?
- Whether to select a single-story or multistory building design?
- What type of layout to choose?
- What performance criteria to emphasise?

* Factors Influencing Layout choices :- IMP

1) Location :-

→ size & type of site selected for plant.
→ determines mode of transportation from and into the plant.
→ layout should provide facilities for mode of transport used.
→ layout should provide for storage of fuel, rm, power generation etc.

2) Machinery and Equipment :-

type of product
volume of prodn
type of processes
mgmt policy on technology

} determines type of machines & equipments to be installed.

3) Managerial Policies :-

Regarding -
a) volume of production
b) prov. for future expansion
c) extent of automation
d) make-or-buy decisions
e) speed of delivery
f) purchase & inventory policies.

4) Materials :-

a) type of storage areas
b) Racks
c) handling equip (cranes, trolleys, conveyors/pipelines)
d) material used (solid, liquid, light, heavy, bulky, big etc)

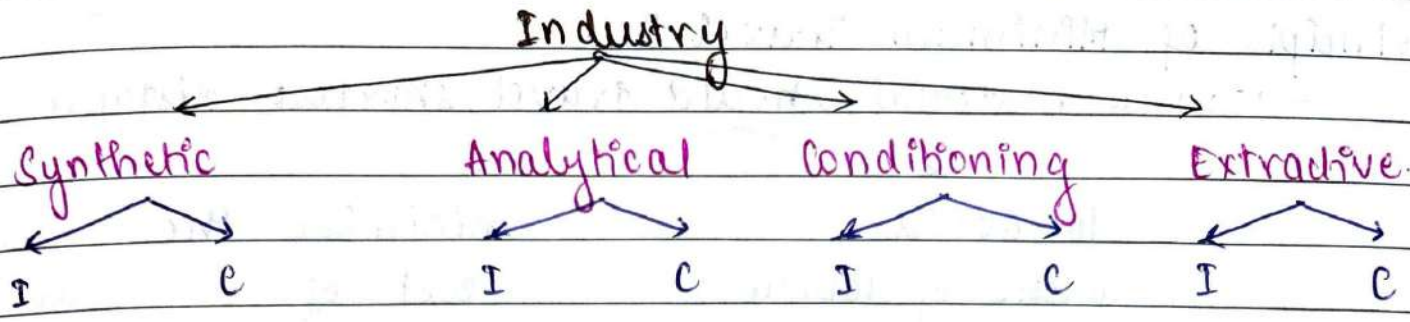
5) Product :-

Type of product
(light or heavy, big or small, liquid or solid etc)

Eg :- Ship building, Aircraft assembly, locomotive assembly → different layout

Refrigerators, cars, scooters, television sets, soaps, detergents, soft drinks → different layout

6) Type of Industry :-



I → is intermittent type of industry.
C → is continuous type of industry.

7) Workers :-

→ gender of employees (men or women)
→ position of employees while working (standing/sitting)
→ employee facilities. (locker rooms, rest rooms, toilets, canteens, coffee/tea etc)

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* Plant Layout - Principles :-

1) Principle of Minimum Travel :-
→ men & material should travel shortest distance.
- to avoid waste of labour & time.
- minimise the cost of materials handling.

2) Principle of Sequence :-
→ Machinery & operations should be arranged in sequential orders.
→ this principle is best achieved in product layout.

3) Principle of Usage :-
→ Every unit of available space should be effectively utilised.

4) Principle of Compactness :-
→ Harmonious fusion of all relevant factors so that final layout looks well integrated & compact.

5) Principle of safety & satisfaction :-
→ layout should contain prov. for safety of workers.
→ it should provide comfort & convenience to workers.

6) Principle of Flexibility :-
→ layout should permit revisions with least difficulty and at minimum cost.

7) Principle of Minimum Investment :-
→ savings in fixed capital investment
→ use of available facilities.

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* Types of Layout.

A Layout refers to the arranging and grouping of machines which are meant to produce goods.

1) Process Layout

(Also called functional layout, layout for job lot manufacture, batch production layout)

→ This layout involves grouping together of similar machines in one department.

Receiving	Milling m/c	Drilling m/c	Grinding m/c
Cutting m/c	Turning m/c	Gear cutting	Plating

→ Machines in each department attend to any product that is taken to them (∵ also called as General Purpose Machines).

→ Process layout preceeds product layout.

→ This type of layout is best suited for intermittent type of production.

While grouping m/c, certain principles should be kept in mind.

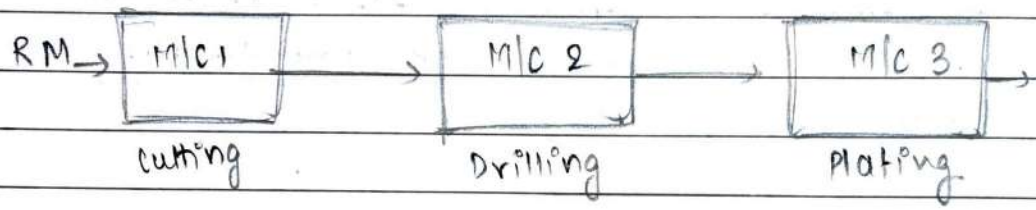
a) Convenience for inspection
b) Convenience for supervision.
c) Distance between departments need to be short.
d) Departments should be in accordance with principle of sequence of operations.

Product layout :

(Also called straight-line layout or layout for serialised manufacture)

→ Arrangement of machines in one line depending upon the sequence of operations.
→ RM in first m/c → FG in last m/c comes out.
→ Output of one m/c becomes input for next m/c.
eg:- Sugar mill, Paper mill.

→ In product layout, if there are more than one line of prodⁿ, there are as many lines of machines. (∵ special purpose machines)



While grouping m/c certain principles should be kept in mind :-

1. All machine tools must be placed in accordance with sequence of operations.

2. All operations, including assembly, testing, packing should be included in line.

3. Material should be fed where required for assembly.

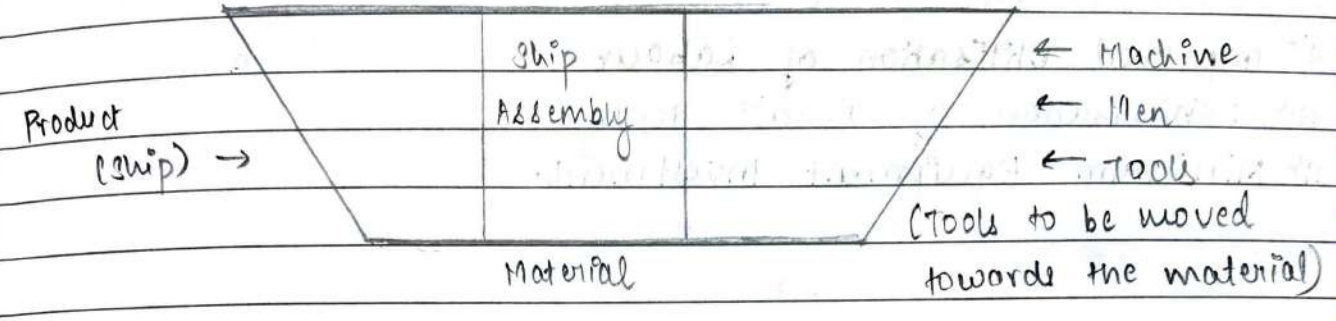
4. There should be no ~~line~~ points where one line crosses another line.

This layout can be used in case prodⁿ of standarised products on mass scale such as chemical, paper, sugar, rubber, refineries & cement industries.

3) Layout in the form of fixed position :-
(Also called static layout)

→ Useful in manufacture of bulky and heavy products (Locomotives, ships, boilers, air crafts, generators)

→ In this layout, material or major component remains in a fixed location and tools, machinery, men etc are brought to this location.



4) Mixed Layout or Combined layout :-

→ Combination of product and process layout.
→ Possible when products manufactured are somewhat similar and not complex.

RM →	Lathes →	Milling →	Grinding	Gear cutting	Grinding	Plating →	FG.

5) Layout of Service Facility :-

Two Types

Those that are almost totally designed around the customer receiving & servicing function
+
eg → Banks.

Those that are designed around the technologies, processing of physical materials & production efficiency +
eg → Hospitals.

* Importance of Layout :-

1) Avoidance of Bottlenecks :-

→ Bottleneck refers to any place in a prodn process where materials tend to pile up or produced at rates of speed less rapid than the previous / subsequent op.

→ Bottlenecks are caused by inadequate machine capacity, inadequate storage space or low speed on the part of operator.

→ Results of bottleneck are delays in prodn schedules, congestion, accidents and wastage of floor area.

→ All these may be overcome with an efficient layout.

2) Avoidance of Unnecessary and costly changes :-

→ A planned layout avoids frequent changes which are difficult and costly.

→ The incorporation of flexibility element in the layout would help in avoidance of revisions.

3) Better Production control :-

→ Prodn control is concerned with prodn of a product of right type at the right time and at reasonable cost.

→ A good plant layout is a requisite of good prodn control and provides the plant control officers with a systematic basis upon which to build organisation and procedures.

4) Better Supervision :-

A good plant layout ensures better supervision in two ways

- Determining the no. of workers to be handled by a supervisor
- & Enabling the supervisor to get a full view of the entire plant at one glance.

A good layout is, therefore the first step in good supervision.

5) Economies in Handling :-

→ Nearly 30-40% of manufacturing cost are accounted for by materials handling.

→ Every effort must be made to cut down this cost.

→ Long distance movement should be avoided and specific handling operations must be eliminated.

6) Effective use of Available Area :-

→ Every unit of the plant area is valuable, especially in urban areas.

→ Efforts should therefore, be made to make use of the available area by planning the layout properly.

7) Improved Employee Morale :-

→ Employee morale is achieved when workers are cheerful and confident.

→ This state of mental condition is vital to the success of any organisation.

→ Morale depends on better working conditions, better employee facilities, reduced no. of accidents and increased earnings.

8) Improved Quality Control :-

→ Timely execution of orders will be meaningful when the quality of the output is not below expectations.

→ To ensure quality, inspection should be conducted at different stages of manufacture.

→ An ideal layout provides ample space to carryout inspection to ensure better quality control.

9) Improved Utilisation of Labour :-

→ A good plant layout makes possible individual operations, the process and flow of materials handling in such a way that the time of each worker is effectively spent on productive operations.

10) Minimisation of Production delays :-

→ Repeat order and new customers will be the result of prompt execution of orders.

→ Every management should try to keep to the delivery schedules by minimising delays in production.

11) Material Equipment Investment :-

Investment on equipment can be minimised by planned machine balance and location, minimum handling distances, by the installation of general purpose machines and by planned machine loading.