Outlines of CH-4

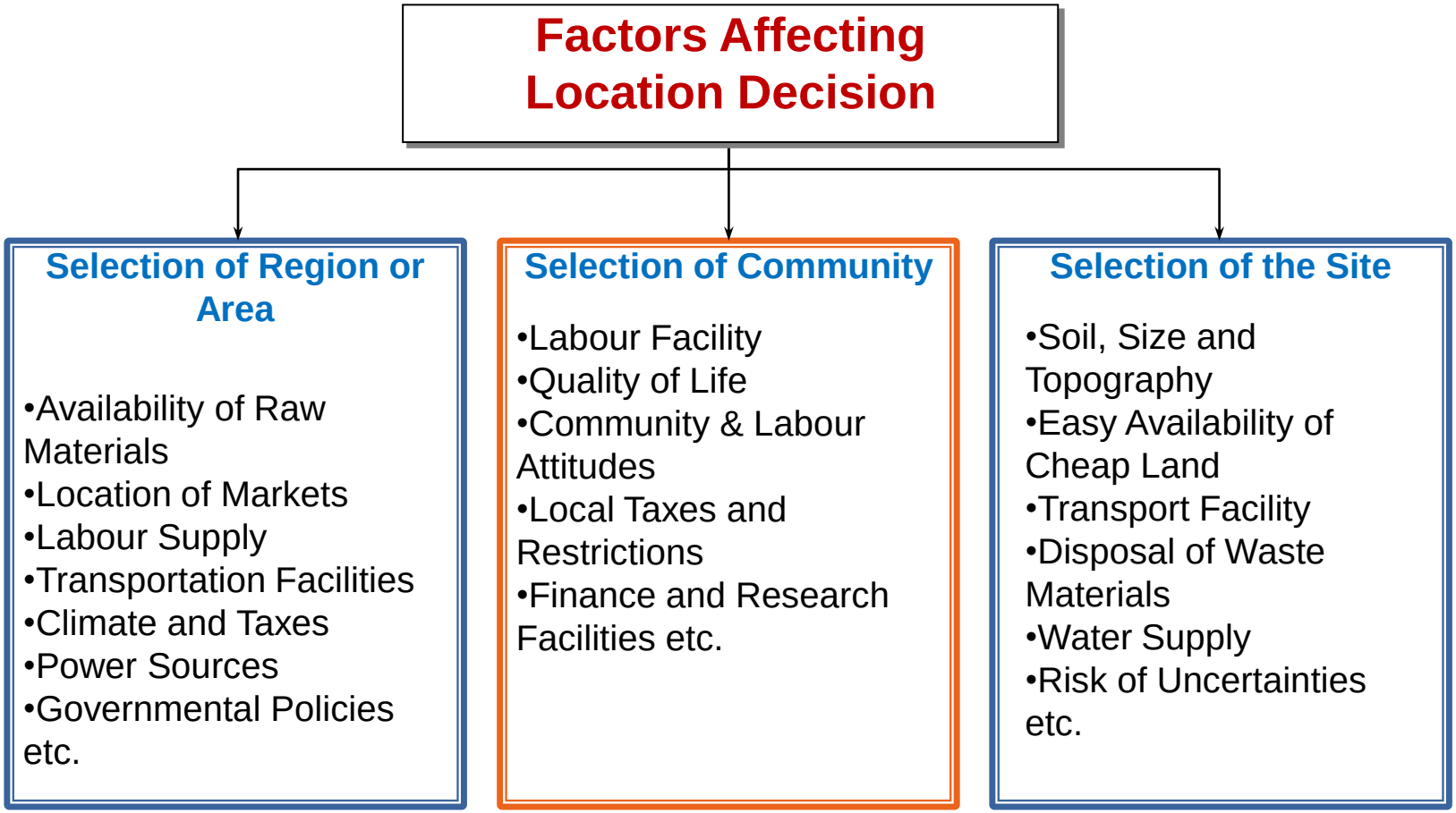
- Reasons and Importance of location decisions
- Factors affecting location decision of service, and manufacturing organizations
- Techniques of location analysis: Qualitative and quantitative analysis;
- Concept on layout
- Types of layout: Product layout , process layout , cellular layout , fixed position layout;
- Designing process layout.

Reasons and Importance of Location Decisions

- The need and importance of location decision often depends on the **type of business.**
- For industrial location decisions, the strategy is usually **minimizing costs, although innovation and creativity may also be critical.**
- For retail and professional service organizations, the location strategy **focuses on maximizing revenue.**
- Warehouse location strategy, however, may be driven by a **combination of cost and speed of delivery.**
- Firms such as **banks, fast-food chains, supermarkets, and retail stores** view locations as part of marketing strategy, and they look for locations that will help them to **expand their markets.**
- The objective of location strategy is to **maximize the benefit of location to the firm.**
- Location decisions often have an **impact in investment requirements, operating costs and revenues, and operations.**
- A poor choice of location might result in **excessive transportation costs, a shortage of qualified labor, loss of competitive advantage, inadequate suppliers of raw materials,** or some similar condition that is **unfavorable to operations.**

- Some basic reasons/importance of location decision can be highlighted with the help of following point:
  - Production and operating cost reductions
  - **Quality and timely production are possible.**
  - **Helps in value and profits increment.**
  - Helps in **expanding their business or to set up new branches.**
  - **Helps in best utilization of available resources.**
  - Helps in adopting **changes and development of new technology**.
  - Helps in increasing **goodwill or image** of organization.
  - Helps in increasing **competitiveness.**
  - Helps in gaining **competitive advantages.**

Factors Affecting Location decisions



Methods of Location Decision

1. Simple Comparative Chart Analysis

Simple comparative chart is one of the techniques of analyzing intangible factors for selecting facilities location. The following steps should be followed:

Step 1: Recognize the critical intangible factors affecting location decision. For example: labour supply, business climate, community attitude, union activities, employee morale, competence of managers, reputation of enterprises, goods public relation.

Step 2: Compare and rank all alternative locations on the basis of these factors like good or bad, favourable or unfavourable, important or not important, etc.

Step 3: Select the best location for organization.

Intangible factors	Location A	Location B	Location C
Labour supply	Suitable	Suitable	Unsuitable
Business climate	Good	Good	Worst
Community attitude	Unfavourable	Favourable	Favourable
Union activities	Important	Less important	Important

Decision: On the basis of above simple comparative chart, location 'B' is selected as the best location than 'A' and 'C'.

2. Factor/Point Rating Method

- Factor rating method is also used for evaluating wide range of intangible factors associated importantly with location.
- It is improved technique than simple rating method because simple comparative chart method does not break down factors into sub-factors but factor rating method breakdowns factors into sub-factors for evaluation and analysis.
- Factor rating method is a kind of survey technique which follows following steps:
- **Step 1:** Identify the sensitive factors for location decisions. For example, direct materials, direct labour, power, taxes, insurance etc.
- **Step 2:** Rate each factor from 1(very poor) to 5 (very good) according to their merit basis. For example, Factor rate – 4, 3, 2, 5, 1.
- **Step 3:** Rate the alternative location from 1 (very low) to 10 (very high) according to their merits of each characteristics. For example, 10, 6, 8, 4, 2, so on.
- **Step 4:** Multiply the factor rate and alternative location rate and find the total score of each alternative location.
- **Step 5:** Select the location with highest score.

- Analysis of Location under Factor Rating Method.

Factors	Location A			Location B		
	Factor Rate	Location Rate	Total	Factor Rate	Location Rate	Total
Direct Materials	5	10	50	2	8	16
Direct Labour	4	9	36	3	10	30
Climate	3	7	21	4	7	28
Transportation	2	5	10	5	5	25
Power	1	4	4	1	3	3
Taxes	5	2	10	2	2	4
Insurance	4	1	4	3	4	12
Total			135			118

Decision: From above analysis, location A is the best location because it has the maximum score i.e. 135.

3. Centre Gravity Method

- Centre of gravity or weight centre is a technique of quantitative method for locating a facility such as a warehouse at the centre of movement in a geographic are based on **weight and distance.**
- It is a mathematical technique that can be used for locating a distribution centre that will **minimize distribution cost.**
- This method identifies a set of coordinates designating a central location on a map relative to all other locations. This has following steps:
- **Step 1:** Place location on a coordinate system.
- **Step 2:** Determine the centre of gravity using following equations/formula:

$$X\text{ -Coordinate value} = \frac{\Sigma XW}{\Sigma W}$$

$$Y\text{ -Coordinate value} = \frac{\Sigma YW}{\Sigma W}$$

Where,

X, Y= Coordinates of existing facility.

W = Annual weight shipped from facility.

Example: A Himalayan Company is investigating which location could be best as a centre relative. Following are the information that has been collected for that purpose.

Location	XY-Coordinates (in miles)	Tons per year
A B C D	(10, 20) (20, 30) (5, 10) (20, 40)	10 20 5 10

- Identify the center gravity value.

Solution: Let's identify the information for the requirement of formula given.

Location	XY-Coordinates (in miles)	Tons/ Year (W)	XW	YW
A	(10, 20)	10	100	200
B	(20, 30)	20	400	600
C	(5, 10)	5	25	50
D	(20, 40)	10	200	400
	Total	45	725	1250

Now, applying formulas, we will get the results as:

$X\text{-Coordinate value} = \frac{\Sigma XW}{\Sigma W} = \frac{725}{45} = 16.11$

$Y\text{-Coordinate value} = \frac{\Sigma YW}{\Sigma W} = \frac{1250}{45} = 27.78$

Decision: Calculated XY-coordinate value is (16.11, 27.78). Location B should be selected as a best location because calculated XY coordinate value is nearer to given XY coordinate value of Location B (16.11, 27.78 : 20, 30).

4. Least Cost /Locational Break-Even-Analysis (BEA) Method

- Least cost /Locational Break-even analysis is the use of cost-volume analysis to make an economic comparison of location alternatives.
- By identifying fixed and variable costs and graphing them for each location, we can determine which one provides the lowest cost.
- It is particularly useful when the operation manager wants to define the ranges over which each alternative is best.
- Locational break-even analysis can be done mathematically or graphically.
- The graphic approach has the advantage of providing the range of volume over which each location is preferable. The steps to locational break-even analysis are as follows:

  Step 1: Determine the fixed and variable cost for each location.

  Step 2: Plot the total cost for each location, with costs on the vertical axis of the graph and annual volume on the horizontal axis.

  Step 3: Select the location that has the lowest total cost for the expected production volume.

- **Example:** Lalu, owner of Hallmark Shopping Mall, is considering three locations-Lajimpat, Baneshwor and Boudha. He wishes to find the most economical location for an expected volume of 2,000 units per year.

Location	Fixed cost($)	Variable cost ($)
Lajimpat	30,000	75
Baneshwor	60,000	45
Boudha	1,10,000	25

Solution

- For each of the three locations, total cost is calculated with 2000 units of volume of production.

We know,

Total cost = Fixed cost + Cost per unit × Volume of production.

- **For Lajimpat,**

$$\text{Total cost} = \$\ 30000 + \$75 \times 2000 = \$\ 180{,}000$$

- **For Baneshwor,**
  Total cost = $60000 + $45 × 2000 = $150,000

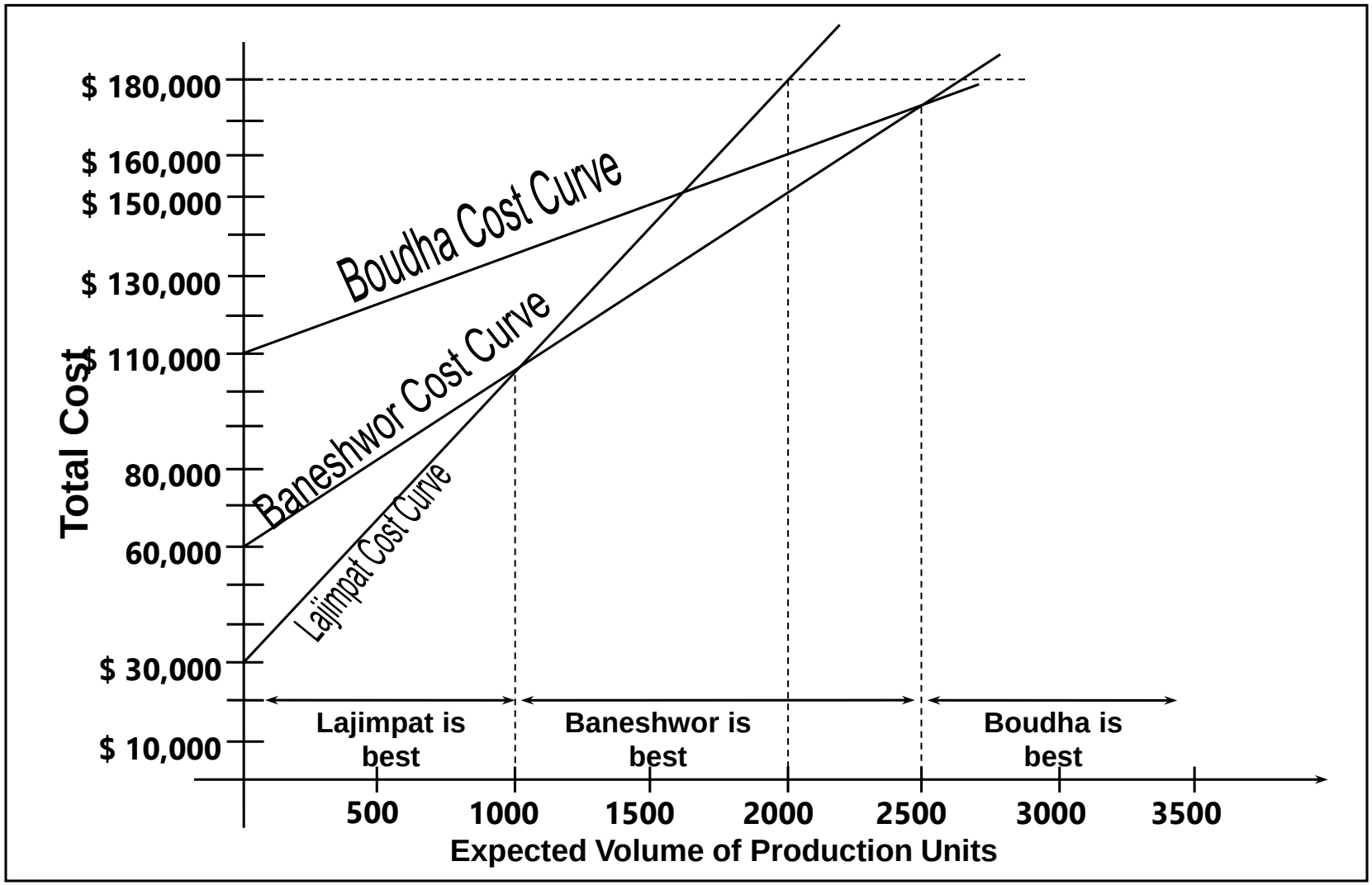
- **For Boudha,**
  Total cost = $110000 + $25 × 2000 = $ 160,000

Hence, with an expected volume of 2000 units per year, Baneshwor provides the lowest cost location. So, Baneshwor is selected as best location.

- Calculating the Cross-Over Point

- **For Lajimpat and Baneshwor**
  $30000 + 75x = 60000 + 45x$
  or, $30x = 30000$
  $x = 1000$ units.

- **For Baneshwor and Boudha**
  $60000 + 45x = 110000 + 25x$
  or, $20x = 50000$
  $x = 2500$ units



Summarized Table for Location Decisions

Volume range	Lowest cost location
0–999 units	Lajimpat
1000 Units	La or Ba
1001–2499 units	Baneshwor
2500 Units	Ba or Bou
≥ 2500 units	Boudha

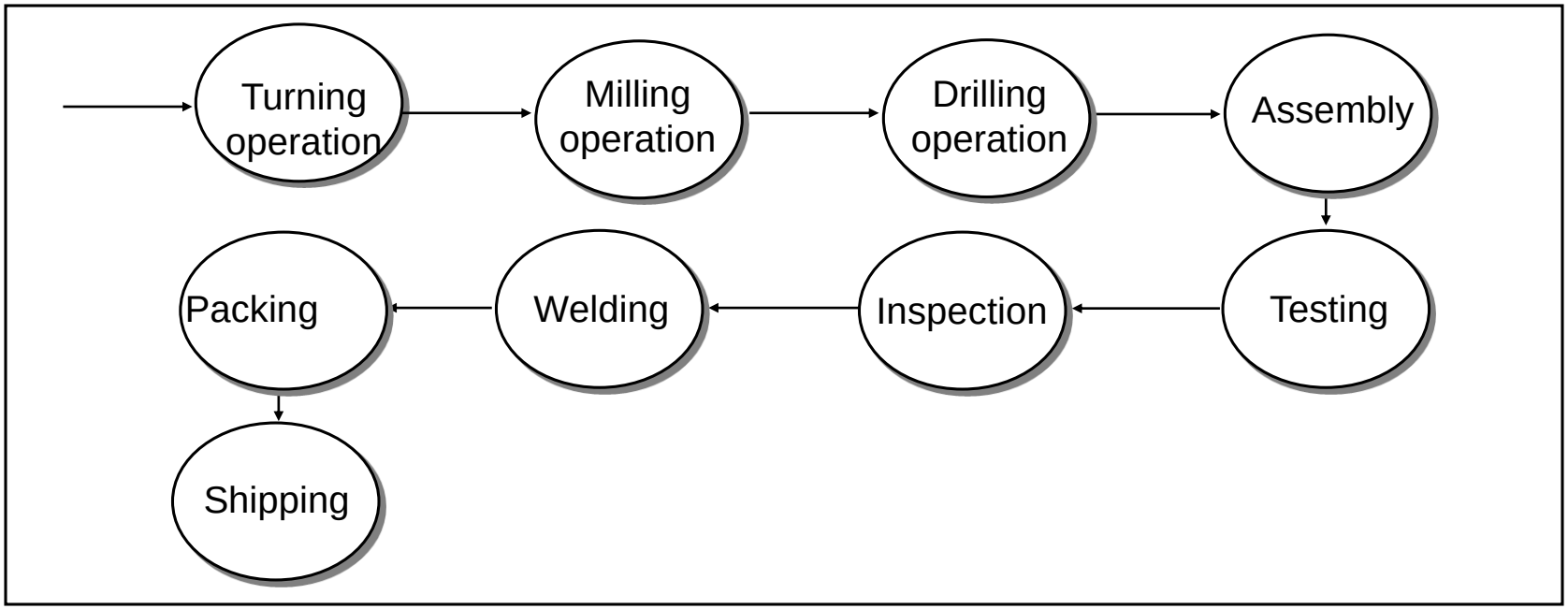
Facility Layouts

- Layout is the **physical arrangement of plant or industrial facility in selected location** either in existing or in new one. It is related to a number of aspects of production and operations management.
- Layout is **a method of allocation of department** upon a site, workgroup and equipment within department, workstations, machines and stock-holding points within production facilities.
- Therefore, it is concerned with **configuration of department, work centers and equipment in the conversion process.**
- The plant layout is important due to following reasons:
  - Proper **utilization of space or area.**
  - Cost minimization and **resource optimization.**
  - Maintain and **retain quality of goods and services.**
  - **Simplification of work complexity.**
  - **Safety and quality of work life for human and non-human** physical properties.

Types of Layouts

1. **Repetitive Processing: Product Layouts / Line Layout**

- Product layout is an **arrangement of facilities and equipment in the same sequence,** as the order of the operations needed to complete each unit of the product, or the service offered.
- Product layouts are **used to achieve a smooth and rapid flow of large volumes of goods** through a system.
- This is made possible by **highly standardized goods** that allow highly standardized, repetitive processing.
- The work is divided **into a series of standardized tasks, permitting specialization of equipment and division of labor.**
- The large volumes handled by these systems usually **make it economical to invest** substantial sums of money in equipment and job design.
- For instance, if a portion of a manufacturing operation required the sequence of cutting, smoothing, and painting, the **appropriate pieces of equipment would be arranged in that same sequence.**
- And because each item follows the same sequence of operations, it is often **possible to utilize fixed-path material-handling equipment** such as conveyors to transport items between operations.
- **For example:** automobiles, sugar, steel, biscuit, soap etc. companies.



Advantages

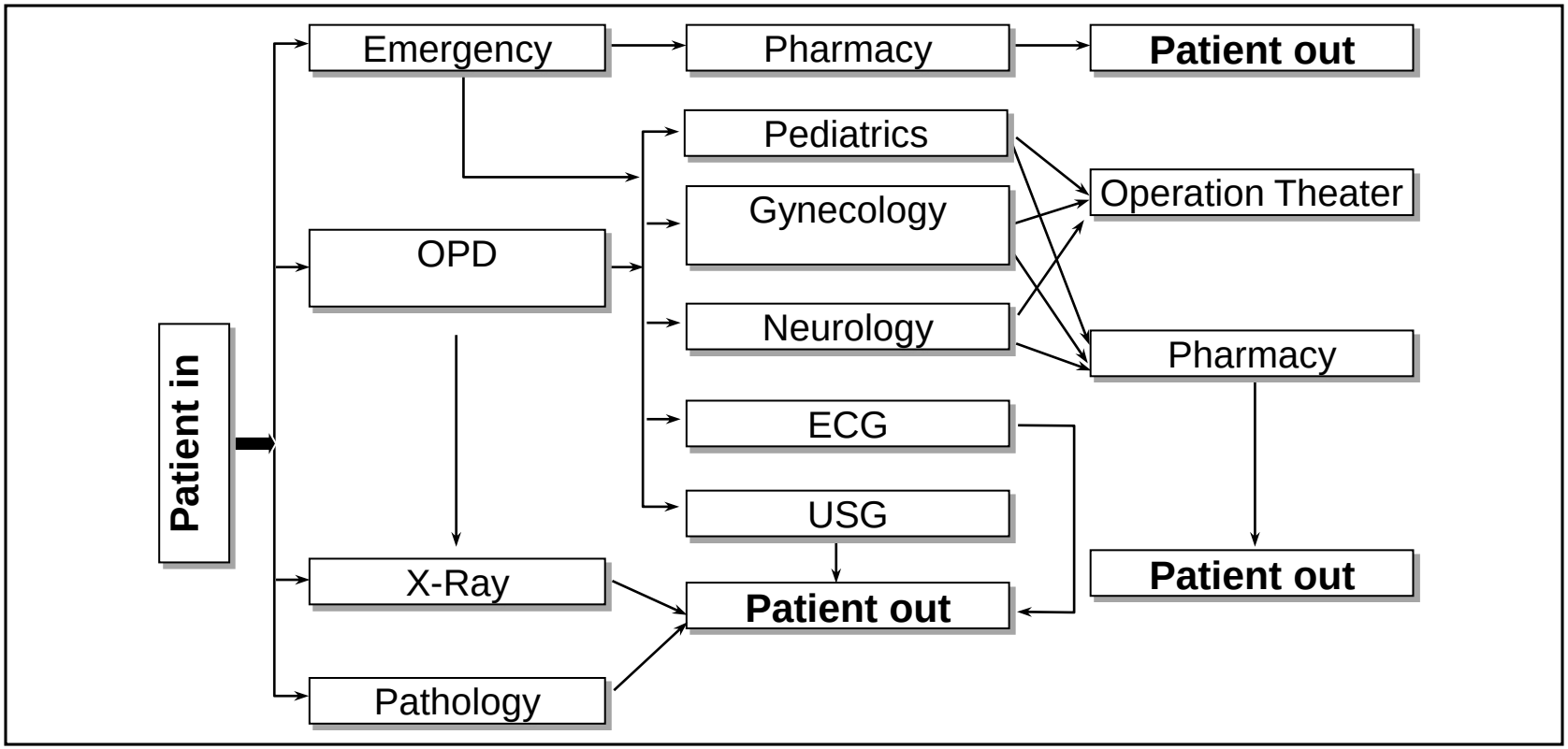
- ✓ Less space for same volume of product in comparison to process layout.
- ✓ It reduces the wastage due to continuous production.
- ✓ Product completes in lesser time, less inventory in process.

Disadvantages

- ✓ Once one machine is out of duty, all product process is interrupted.
- ✓ Supervisors should be expert which may raise cost.
- ✓ One mechanism can produce single type of product once.

2. Non-repetitive Processing: Process Layouts/Functional Layouts

- Process layouts (functional layouts) are designed to process items or provide services that involve **a variety of processing requirements.**
- The variety of jobs that are processed **requires frequent adjustments to equipment.**
- This causes **a discontinuous work flow**, which is referred to as intermittent processing.
- Items that require those operations **are frequently moved in lots or batches to the departments in a sequence** that varies from job to job.
- Consequently, **variable-path material handling equipment** (trucks, jeeps) is needed to handle the variety of routes and items.
- The use of general purpose **equipment provides the flexibility** necessary to handle a wide range of processing requirements.
- Workers who operate the equipment are **usually skilled or semiskilled.**
- **For example:** hospitals, banking and insurance, hotel and restaurant, service centers etc.



Advantages

- ✓ Flexibility of equipment and personnel.
- ✓ Higher utilization of production facilities.
- ✓ Variety of job makes the job challenging and interesting.

Disadvantages

- ✓ Material handling cannot be mechanized which adds to cost.
- ✓ Production planning and control is difficult.
- ✓ More space is required.
- ✓ Lowered productivity due to number of set ups.

3. Fixed-Position Layouts

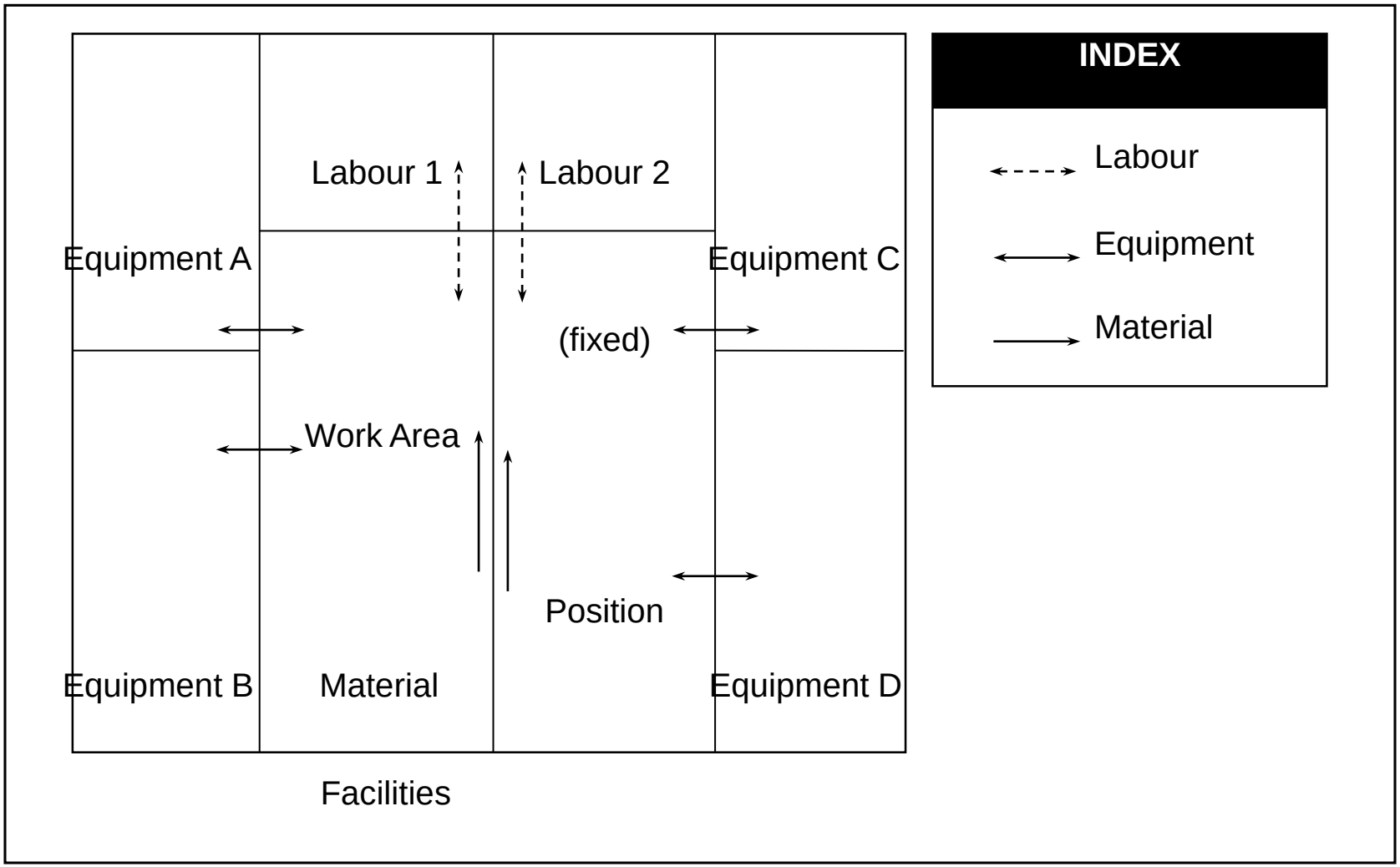
- In fixed-position layouts, the **item being worked on remains stationary, and workers, materials, and equipment** are moved about as needed.
- In other words, fixed position layout is an arrangement of facilities and equipment, which **facilities the flow of resources needed such as workers, equipment, materials, etc.** to the term under production, or the item which is being serviced.
- Almost always, the nature of the **product dictates this kind of arrangement:** Weight, size, bulk, or some other factor makes it undesirable or extremely difficult to move the product.
- Fixed-position layouts are **used in large construction projects (buildings, power plants, dams),** shipbuilding, and production of large aircraft and space mission rockets.

Advantages

- ✓ People can be assigned from starting to end of process.
- ✓ It involves very longer movement of materials.
- ✓ It ensures maximum flexibility of adjustments.

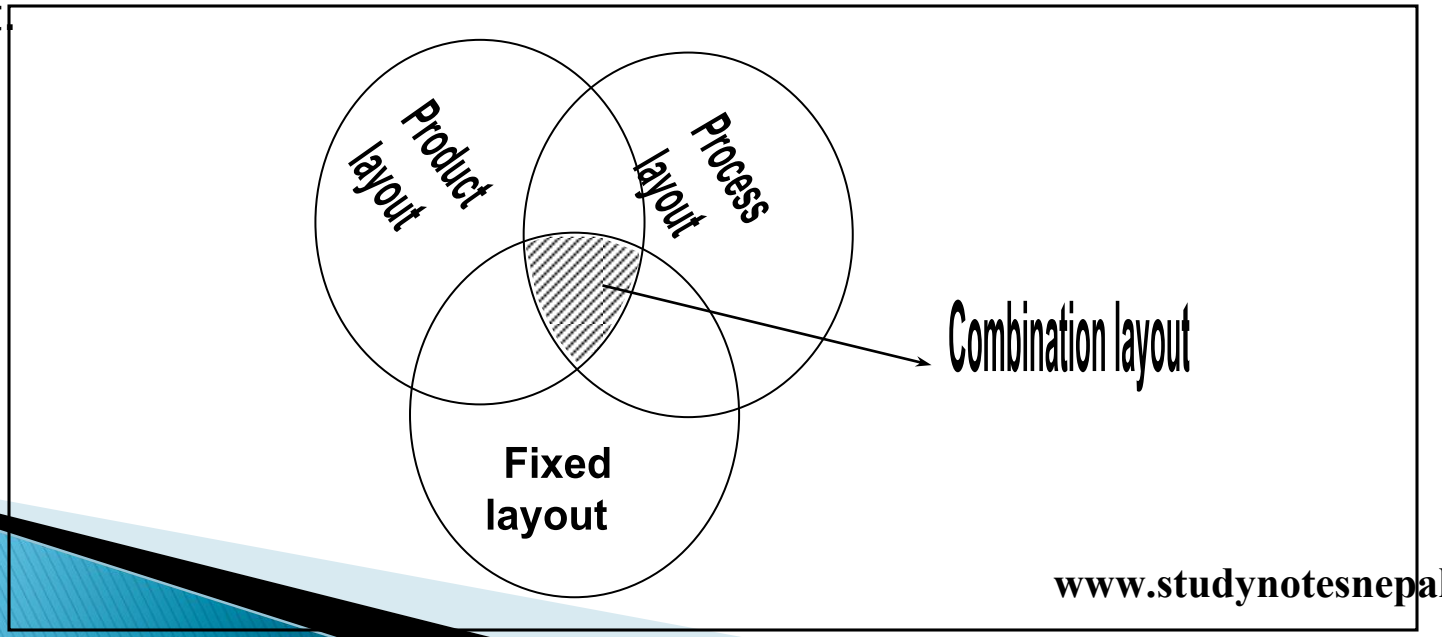
Disadvantages

- ✓ It needs huge investments and very hard to co-ordinate people and machines.
- ✓ It involves high equipment handling cost.
- ✓ It may not have easy maintenance service on spot (site).



4. Combination Layouts

- The three basic layout types are ideal models, **which may be altered to satisfy the needs of a particular situation.**
- It is not hard to find layouts that represent some **combination of these pure types.**
- For instance, **supermarket layouts** are essentially process layouts, yet we find that most use fixed-path material-handling devices such as roller-type conveyors in the stockroom and belt-type conveyors at the cash registers.
- **Hospitals** also use the basic process arrangement, although frequently patient care involves more of a fixed-position approach, in which nurses, doctors, medicines, and special equipment are brought to the patient.



5. Cellular Layouts

- Cellular layout is a type of layout in which **workstations are grouped into what is referred to as a cell.**
- Groupings are determined by **the operations needed to perform work for a set of similar items, or part families, that require similar processing.**
- **All parts follow the same route** although minor variations (e.g., skipping an operation) are possible.
- Moreover, there is little effort or need to identify **part families.**
- Cellular manufacturing **enables companies to produce a variety of products** with as little waste as possible.
- A cell layout provides **a smooth flow of work through the process** with minimal transport or delay.
- Benefits frequently associated with cellular manufacturing include **minimal work in process, reduced space requirements and lead times, productivity and quality improvement, and increased flexibility.**