PERENCANAAN LAYOUT

LEARNING OBJECTIVES:

1. Identify and Define
    - Fixed-position layout
    - Process-oriented layout
    - Office layout
    - Retail layout
    - Warehouse layout
    - Product-oriented layout

2. Identify and Define
    - Work cells
    - Assembly line factory

3. Describe and Explain
    - Precedence diagram
    - Optimisation using precedence diagram

THE STRATEGIC IMPORTANCE OF LAYOUT DECISIONS

- Layout is one of the key decisions that determines the long-run efficiency of operations management.
- Layout has numerous strategic implications because it establishes an organisation’s competitiveness in regard to capacity, processes, flexibility, and cost, as well as quality of work life, customer contact, and image.
- An effective layout can help an organisation achieve a strategic advantage that supports differentiation, low cost and quick response.

LAYOUT DESIGN CONSIDERATION

In all cases, layout design must consider how to achieve the following issues:

- Higher utilisation off space, equipment, and people
- Improved flow of information, materials, or people
- Improved employee morale and safer working conditions
- Improved customer/client interaction
- Flexibility (whatever the layout is now, it will need to alter one day)

LAYOUT DESIGN

1. Fixed-position layout
2. Process-oriented layout
3. Office layout
4. Retail work
5. Warehouse layout
6. Product-oriented layout

1. FIXED-POSITION LAYOUT

This type of layout addresses the layout requirements of large, bulky projects such as ships and buildings.

(Design is for stationary project)

In a fixed-position, the project remains in one place and workers and equipment come to that one work area.

(Workers and equipment come to site)

FIXED-POSITION LAYOUT (Cont)

The techniques for addressing the fixed-position layout are not well-developed and are complicated by three factors:

- *Limited space at site*
- *Different materials are needed at different stages*
- *Volume of materials is dynamic*

Examples of this type of project are a ship, a highway, a bridge, a house, and an oil well.

2. PROCESS-ORIENTED LAYOUT

- A layout that deals with low-volume, high-variety production; like machines and equipment are grouped together.

- This is a traditional way to support a product differentiation strategy. It is most efficient when making products with different requirements or when handling customers.

2. PROCESS-ORIENTED LAYOUT (Cont)

Advantage:

- A big advantage of process-oriented layout is its flexibility in equipment and labour assignments. The breakdown of one machine, need not halt an entire process, work can be transferred to other machines.

Disadvantage:

- The process-oriented layout comes from the general-purpose equipment. Orders take more time to move through the system, because of difficult scheduling, changing setups, and unique material handling. It requires high labour skills, and work-in-process inventories are higher because of imbalances in the operations process.

STEPS IN DEVELOPING A PROCESS-ORIENTED LAYOUT

Step-1: Construct a “from-to matrix”

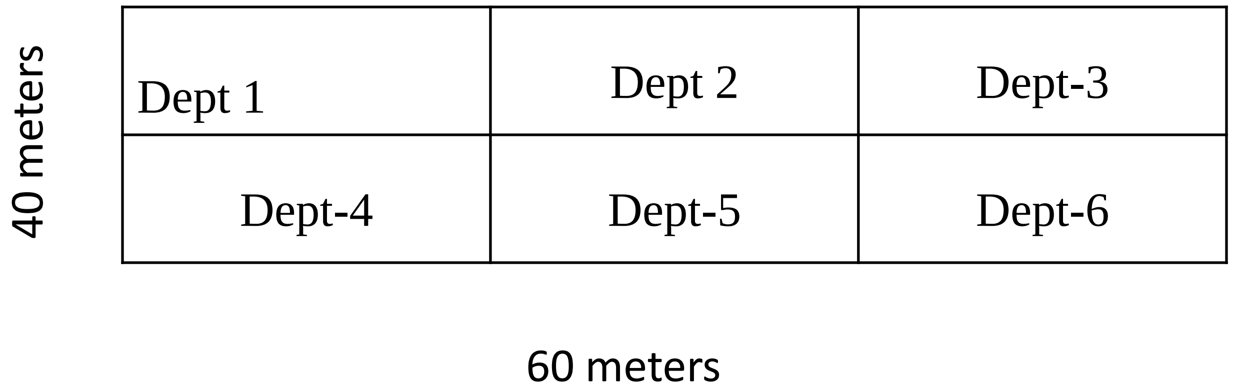
(showing the flow parts or materials from department to department)

Number of load

Dept	1	2	3	4	5	6
1		50	100	0	0	20
2			30	50	10	0
3				20	0	100
4					50	0
5						0
6						

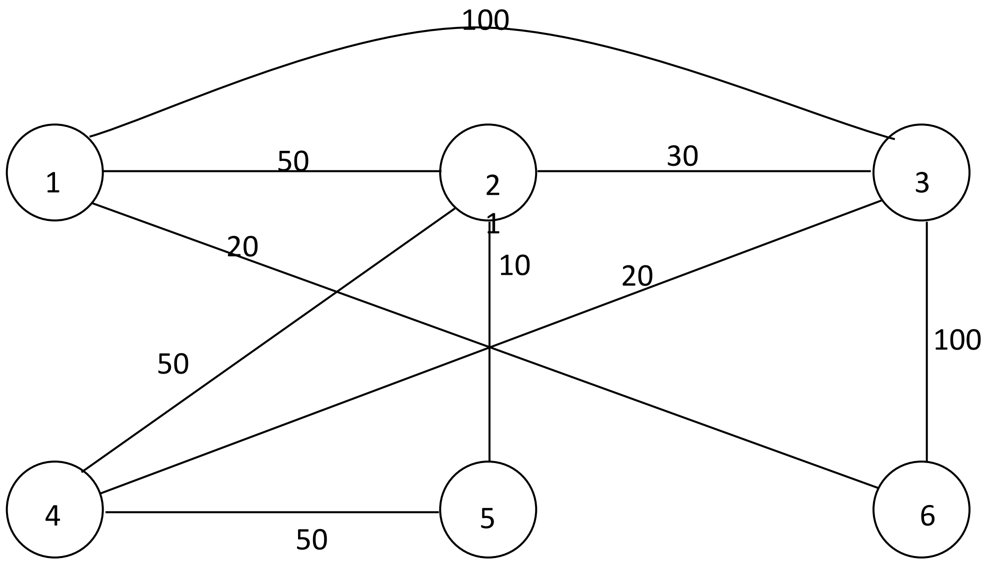
Step 2 Determine the space requirements

(showing available plant space for each department)



Step-3: Develop an initial schematic diagram

(Showing the sequence of departments through which parts must move. Try to place departments with heavy flow of materials or parts next to one another)



Step-4: Determine the cost of the layout

(by using the material handling cost equation)

$$\text{Cost} = \sum_{i=1}^{n}\sum_{j=1}^{n} X_{ij}C_{ij}$$

- n : total number of work depts
- i,j : individual depts
- X_{ij} : number of loads moved from dept i to dept j
- C_{ij} : cost to move between dept i and dept j

Example:

- The cost to move one load between adjacent departments is estimated Rp.1000000. Moving a load between nonadjacent departments costs Rp.2000000.

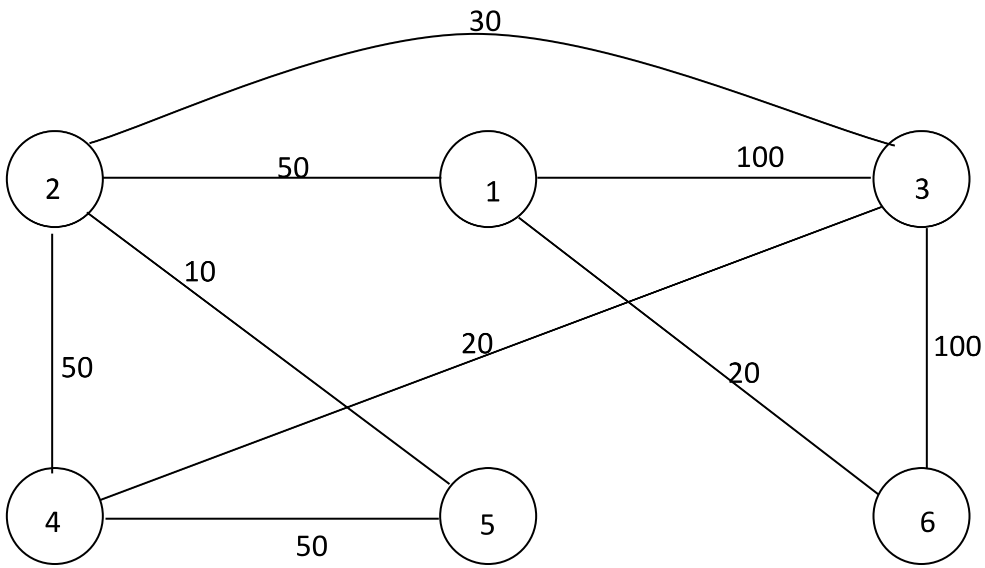
- Cost (in million) = 50 + 200+40+30+50+10

  +40+100+50

  = 570

Step-5: By trial and error to improve the layout

- (or by a more sophisticated computer program approach to find the lowest cost)



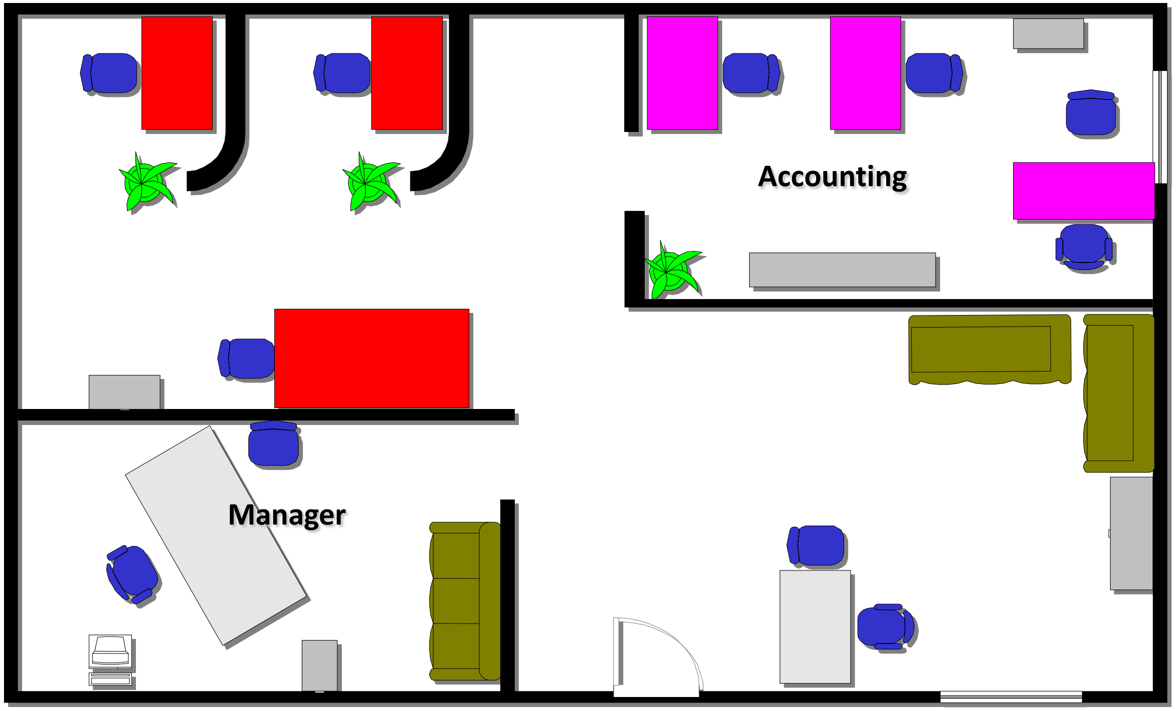
- Cost (in million) = 50+100+20+60+50+10+40+100+50
  = 480

Step-6: Prepare a detailed plan from the previous step.

Dept 2	Dept 1	Dept-3
Dept-4	Dept-5	Dept-6

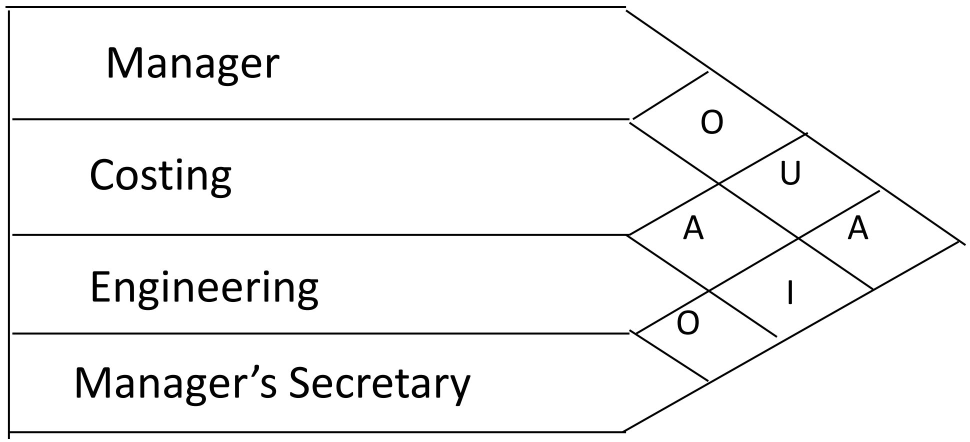
3. OFFICE LAYOUT

- The grouping of workers, their equipment, and spaces to provide for comfort, safety and movement of information.



OFFICE RELATIONSHIP CHART

- A useful tool to analyse the importance of information movement among departments.

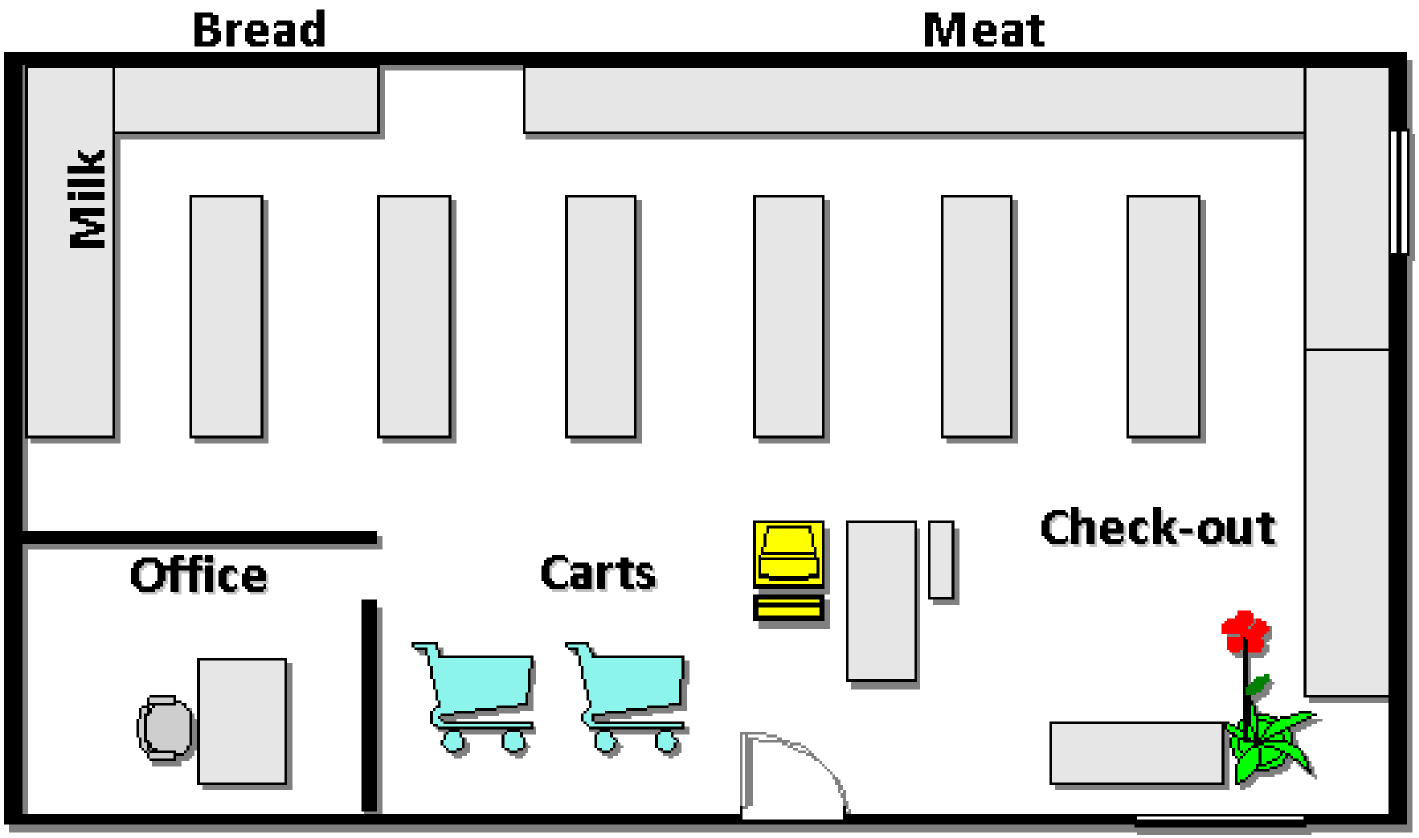


Value	Closeness
A	Absolutely necessary
I	Important
O	Ordinary closeness
U	Unimportant

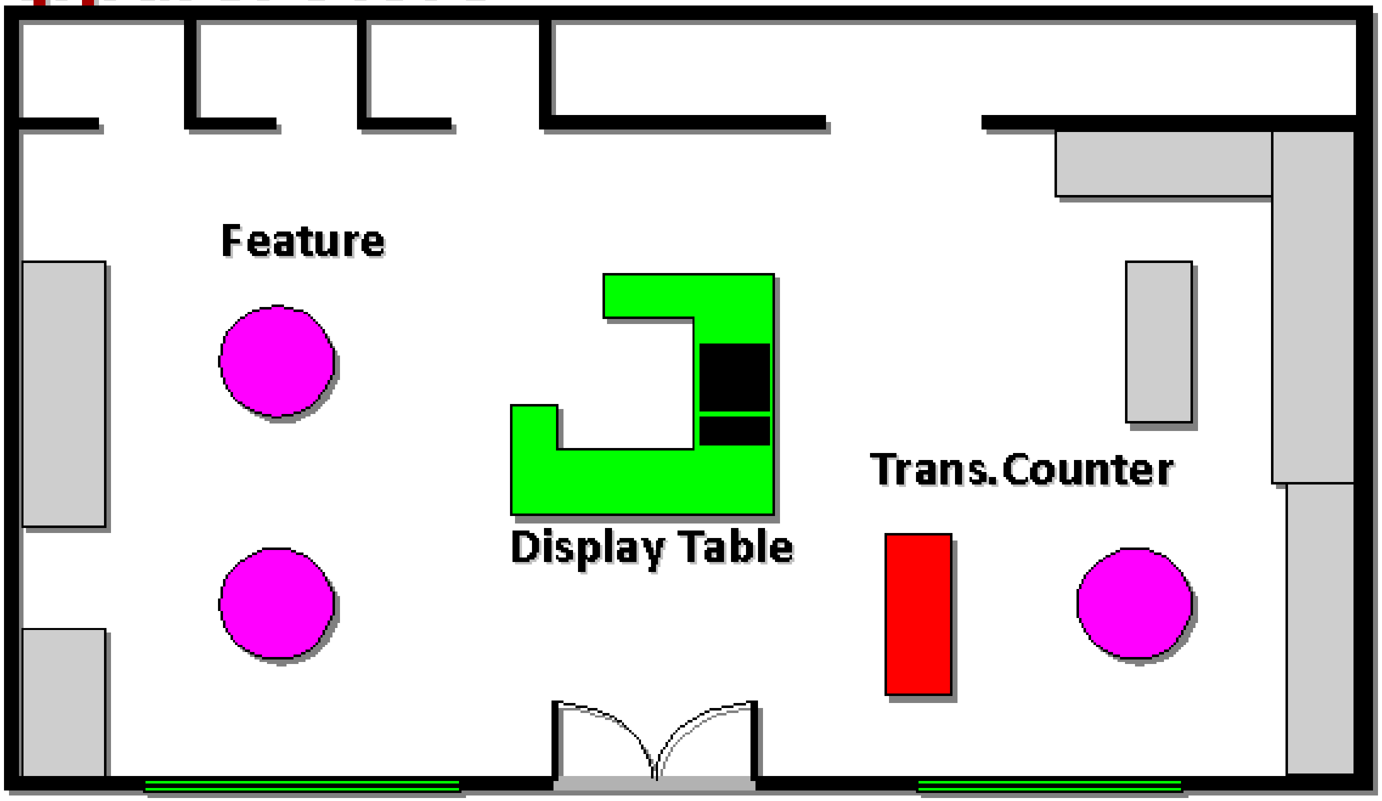
4. RETAIL LAYOUT

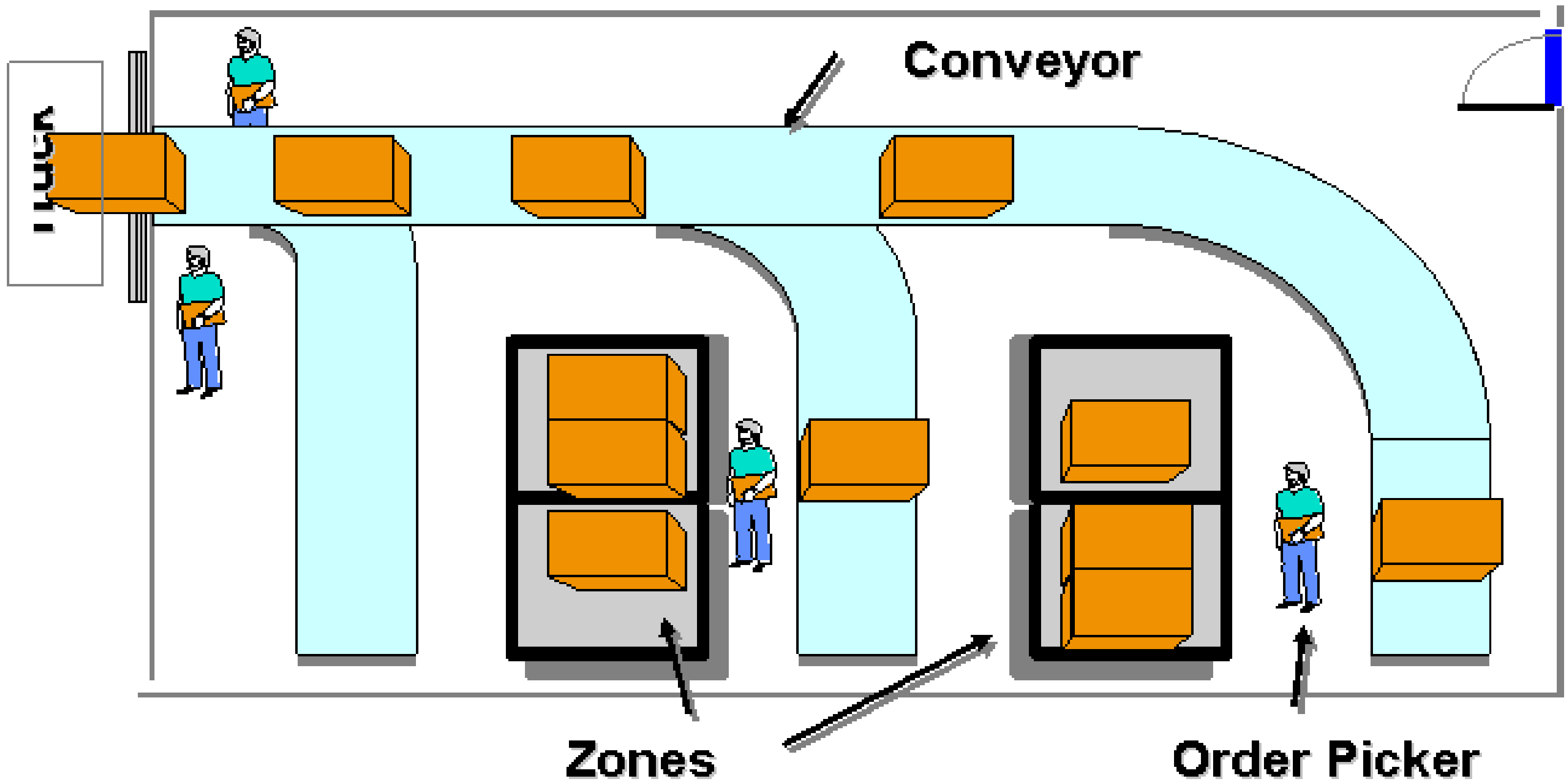
- An approach that addresses flow, allocate space, and responds to customer behaviour.
- Retail layouts are based on the idea that sales and profitability vary directly with customer exposure to products. Thus, most retail operations managers try to expose customers to as many products as possible. ***The greater the rate of exposure, the greater the sales, and the higher the return on investment.***

Grocery Store



Apparel Store



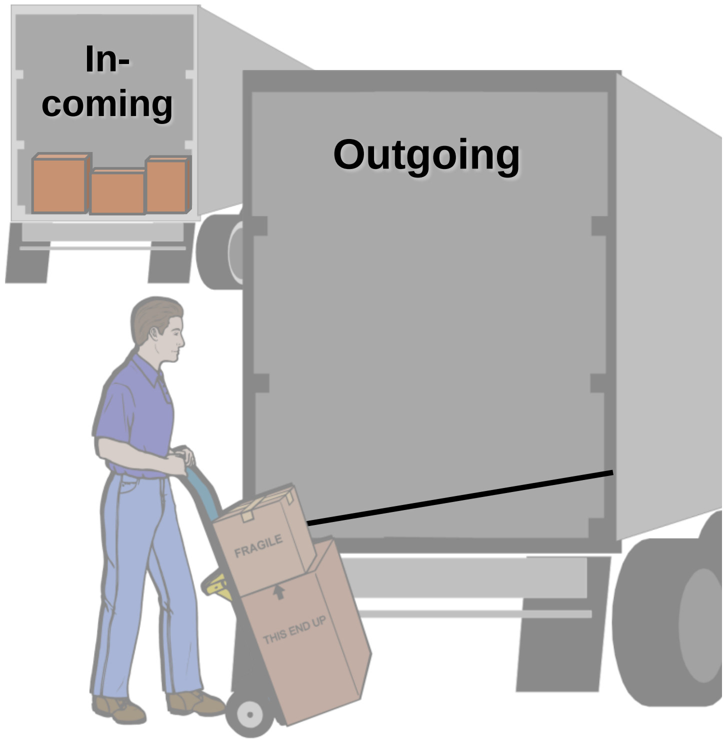


STORAGE LAYOUT Floor Plan

5. WAREHOUSE AND STORAGE LAYOUT

- A design that attempts to minimise total cost by addressing trade-offs between space and materials.
- Automated storage and retrieval systems are reported to improve productivity by an estimated 500% over manual methods.

Cross docking



Avoiding the placing of materials or supplies in storage by processing them as they are received fro shipment.

Random Stocking:

- Used in warehouse to locate stock whenever there is an open location. This technique means that space does not need to be allocated to particular items and the facility can be more fully utilised.
- Automatic identification systems (AIS), usually in the form of bar codes, allow accurate and rapid item identification.
- Computerised random stocking systems often include the following tasks:
  1. Maintain a list of open locations
  2. Maintain accurate records of existing inventory and locations
  3. Sequence items on orders
  4. Combining orders to reduce picking time
  5. Assign certain items to particular warehouse areas

Customising:

- Using warehousing to add value to the product through component modification, repair, labelling and packaging.

6. PRODUCT-ORIENTED LAYOUT

This approach seeks the best workers and machine utilisation in repetitive or continuous production.

Product-oriented requirement:

1. Standardised product
2. High production volume
3. Stable production quantities
4. Uniform quality of raw materials and components

Fabrication line:

- A machine-paced, product oriented facility for building components.

Assembly line:

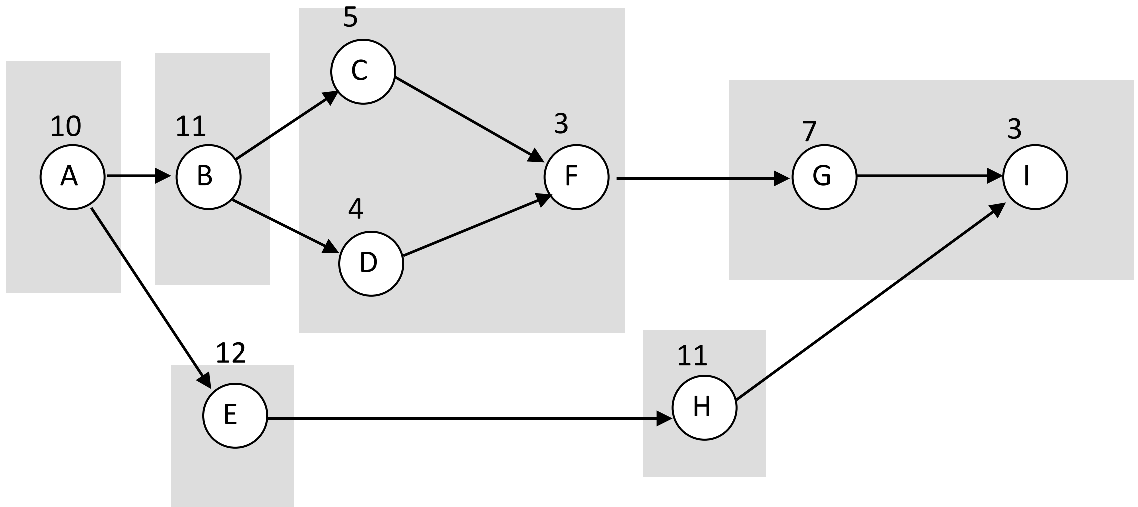
- An approach that puts fabricated parts together at a series of workstations; used in repetitive processes.

PRECEDENCE RELATIONSHIPS

Precedence data:

Task	Performance Time	Task must follow task listed below
A	10	-
B	11	A
C	5	B
D	4	B
E	12	A
F	3	C,D
G	7	F
H	11	E
I	3	G,H
	Total time : 66	

Precedence diagram:



$$\text{Cycle Time} = \frac{\text{Production time available per day}}{\text{Demand per day or production rate per day}}$$

$$\text{Min number of work stations} = \frac{\sum_{i}^{n} \text{Time for task } i}{\text{Cycle time}}$$

i = Task number
n = the number of assembly task

$$\text{Efficiency} = \frac{\sum_{i}^{n} \text{Task time}}{\text{actual number of workstations x assigned cycle time}}$$

Example:

A firm determine that there are 480 productive minutes of work availability per day. Production schedule requires that 40 units be completed as output from the assembly line each day.

- Cycle time = 480 minutes/40 units = 12 minutes per unit
- Minimum number of workstations = total time /cycle time

  = 66 / 12

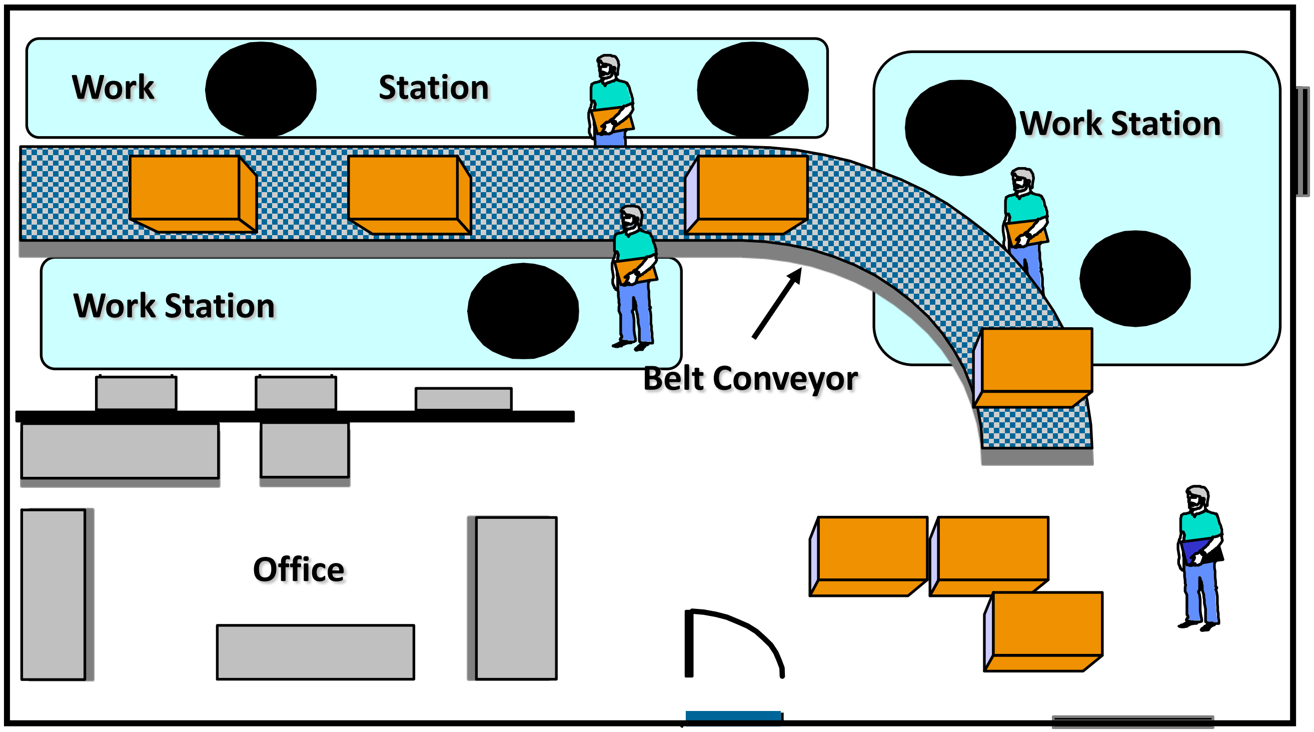
  = 5.5 or 6 workstations

- Efficiency (%) = total time / (act. workstations x cycle time)

  = 66 / (6 x 12)

  = 91.7 %

Product-oriented layout floor plan:



Note: 5 tasks or operations; 3 work station