DPB50133

OPERATIONS MANAGEMENT

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Diploma in Business Studies

DPB50133

OPERATIONS MANAGEMENT

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Acknowledgement

We would like to record our warm appreciation and thanks to the many parties who have provided encouragement and helpful comments towards the arrangement of this Operations Management eBook. It is our hope that this eBook would help students to gain better understanding of this course.

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Preface

Operation Management is a focused subject in Malaysian institution for higher learning today in support of the government's drive to promote the birth of more local entrepreneurs. As this subject is wide and involves the understanding of many inter-related areas of knowledge, it is a challenge to provide a comprehensive book to reach beginners who do not have a foundation in operation fundamentals.

This book provides an opportunity for students to revise the text as well as increase their knowledge in the area of operation management. The eight chapters covered in this book provide a current overview of the role of operation managers in managing sources in an organization. This book provides explanations and positive views of a quality system whereby an operation department is considered to be one of the most interesting, challenging and important in an organization nowadays.

As this is the second edition, we welcome any constructive comments to further improve this publication.

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TOPIC 1: INTRODUCTION TO OPERATIONS MANAGEMENT

Course Learning Outcome: Apply the concept of operation and quality management in operations management. (CLO1)

Learning Outcome: Interpret operations management and ascertain the productivity in operations management.

What is Operations

'Operations Management is the set of activities that relate to the **creation of goods and services through the transformation of inputs to outputs'**
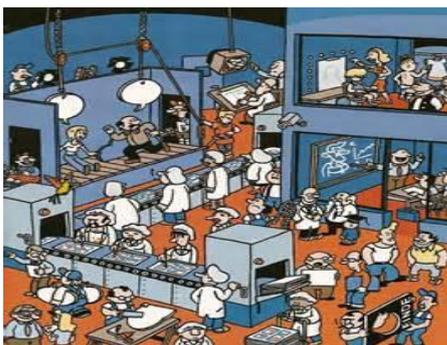
Examples of Operations

Back office operation in a bank

Kitchen unit manufacturing operation

Retail operation
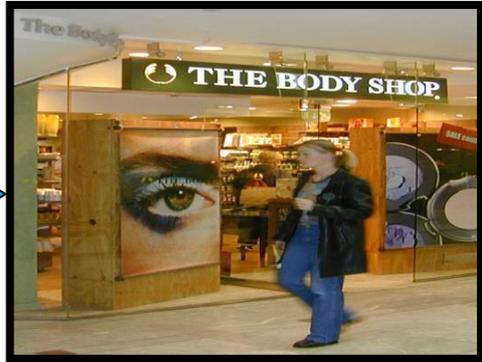
Take out / restaurant operation

They are all *OPERATIONS*

Concept of Operations Management
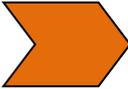
1) The best way to start understanding the nature of '**operation**' is to look around you

2) Everything you can see around you has been *processed* by an *operation*

3) Every service you consumed today (radio station, bus service, lecture, etc.) has also been *produced* by an *operation*

4) Operations Managers *create* everything you buy, sit on, wear, eat, and throw away

Operations Management at IKEA

Design elegant products which can be flat-packed efficiently

Design a store layout which gives smooth and effective flow

Ensure that the jobs of all staff encourage their contribution to business success

Site stores of an appropriate size in the most effective locations

Continually examine and improve operations practice

Maintain cleanliness and safety of storage area

Arrange for fast replenishment of products

Monitor and enhance quality of service to customers

The Activities of Operations Management

Input:
- Human resources
- Raw materials
- Machines
- Personnel
- Capital
- Land/buildings
- Utilities
- Information
- Etc.

Transformation Process

Output
Goods or Services

Feedbacks/ Control

Transformation Process includes:

Cooking
Baking
Stamming
Delivery
Packaging
Construction
Printing
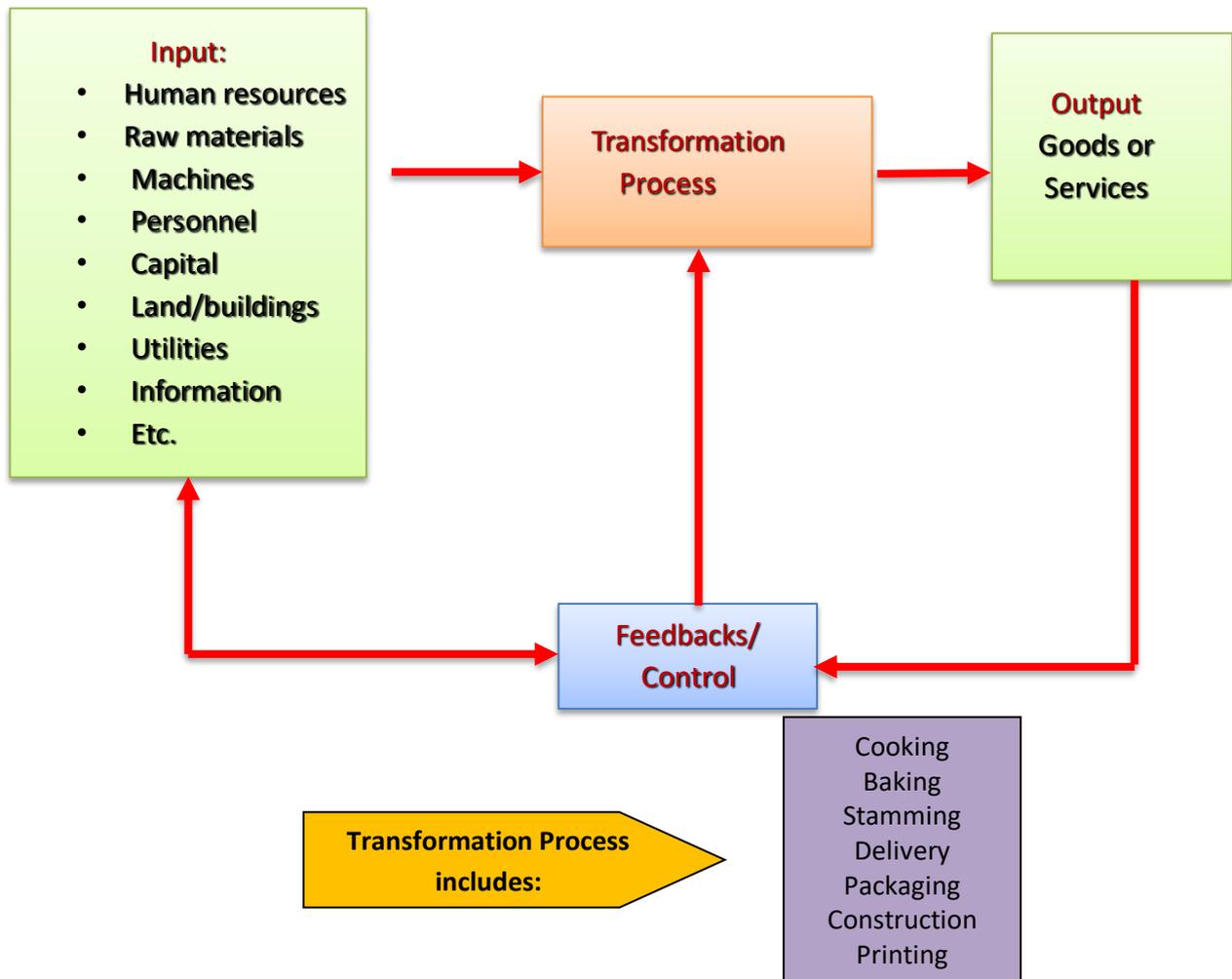
- **Product / Output – It can be goods or services.**

  - **Consumer Goods** – cloths, furniture, cars, books

  - **Industrial Goods** – parts, machines, robots

  - **Producer Goods** – components, material handling equipment

  - **Services** – banking, hotels, insurance, transportation, entertainment

  - **Production/Operations** – The creation of goods and services

The Operations Management System

Inputs
- Workers
- Managers
- Equipment
- Facilities
- Materials
- Services
- Land
- Energy

Operations and processes

1
3
5
2
4

Outputs
- Goods
- Services

3 elements of POM:
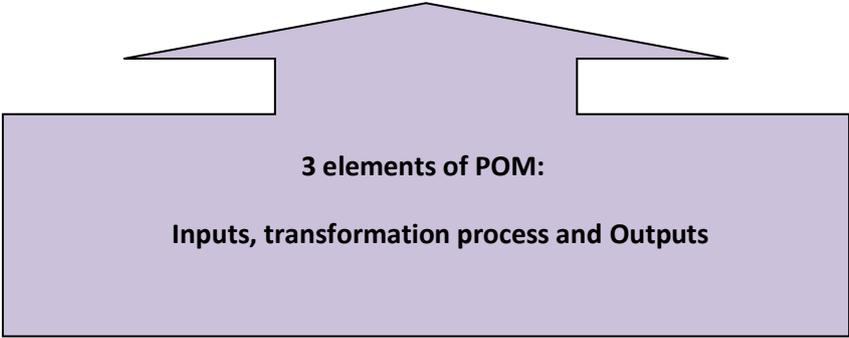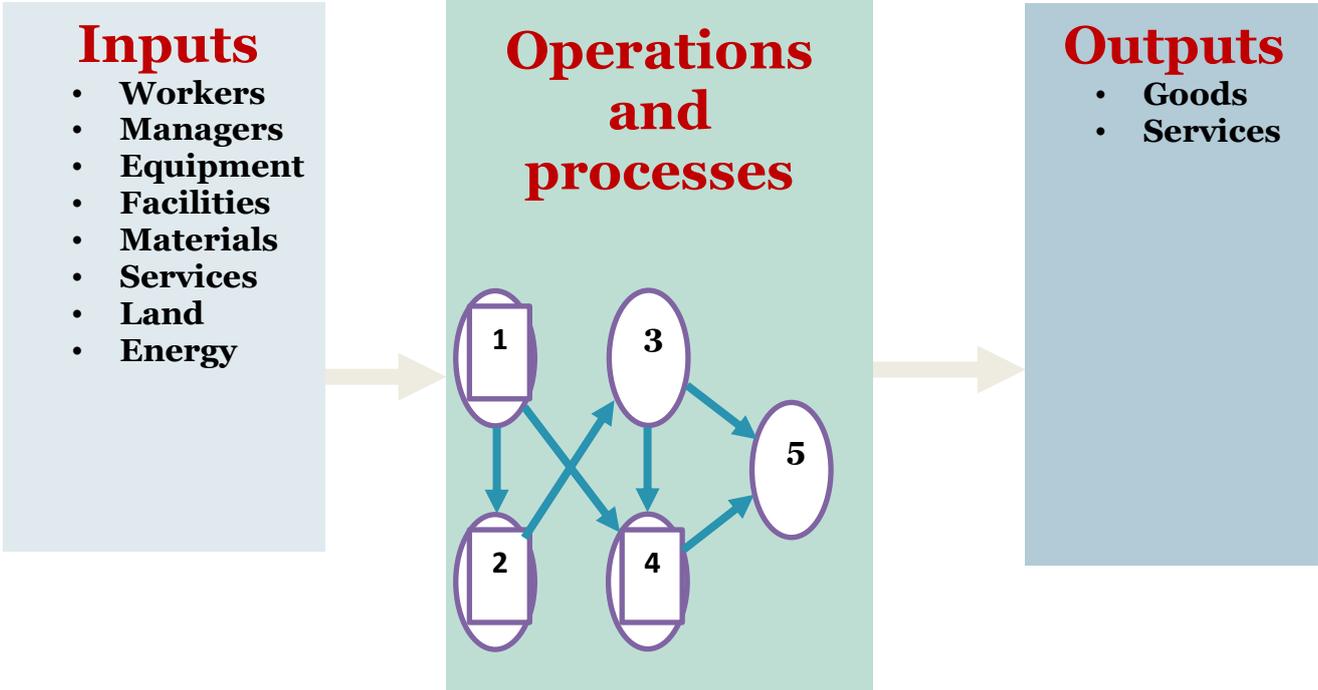
Inputs, transformation process and Outputs

Automobile factory

Input   Output

- steel, plastic   Car
- glass, paint
- tools
- equipment
- machines
- personnel,
- buildings
- utilities, etc.

Transformation Process

University

Input   Output

- students, professors   High Qualification student
- secretaries,
- lab equipment
- dormitories
- staff, computers
- buildings
- etc.

Transformation Process

Why Study POM?

- How people organize themselves for productive enterprise

- How goods and services are produced

- Understand what operations managers do in the company so that we can develop the skills necessary to become a manager

- We study OM because it is such a costly part an organization.

Importance of Operations Management

Helps to achieve the objectives

Improves the productivity of employees

Improves Goodwill

Able to Utilize resources

Presence of the organization

Improve the motivation of employees

ROLES OF OPERATIONS MANAGER

PLANNING → Looking ahead and chalking out future courses of action to be followed

ORGANIZING → Rearranging elements following one or more rules

STAFFING → Managers build an organization through the recruitment, selection and development of individuals as capable employees

LEADING → The use of influence to motivate employees to achieve organizational goals

CONTROLLING → Process of monitoring performance and taking action to ensure desired results

The broad scope of operations management's responsibilities

Technical function

Accounting and finance function

Product/service development function

Process technology needs

Process technology options

Communicating the capabilities and constraints of operations processes

Financial analysis for performance measurement and decision making

Provision of relevant data

New product/ service ideas

Operations function

Communicating human resource needs

Communicating the capabilities and constraints of operations processes

Recruitment, development and training

Communicating information system needs

Market requirements

Human resources (HR) function

Systems for design, planning and control, and improvement

Marketing function

Core functions

Support functions

Information systems (IS) function

GOODS VS SERVICES

Characteristics of Goods

- Tangible product
- Consistent product definition
- Production usually separate from consumption
- Can be inventoried
- Low customer interaction
- Capital intensive
- Long Lead times
- Product quality is objectively determined.

Characteristics of Services
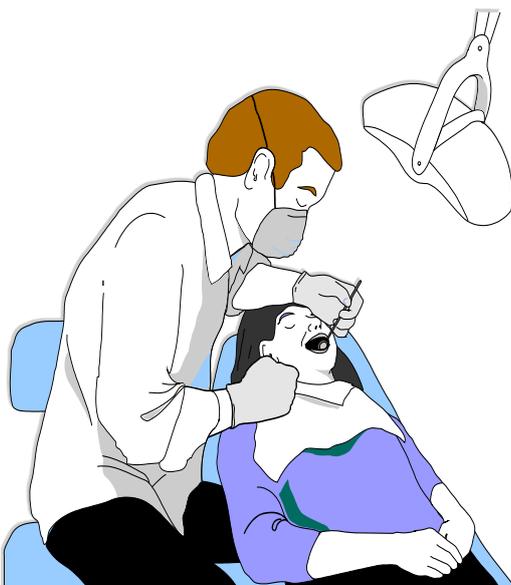
- Intangible product
- Produced & consumed at same time
- Cannot be inventoried
- Often unique
- High customer interaction/labour intensive
- Inconsistent product definition
- Often knowledge-based
- Frequently dispersed
- Service Quality is subjectively determined

What is Productivity?

The ratio of outputs (goods and services) divided by one or more inputs (such as labor, capital or management)

$$\text{Productivity} = \frac{\text{Output}}{\text{Input}}$$

Push for productivity, go for quality
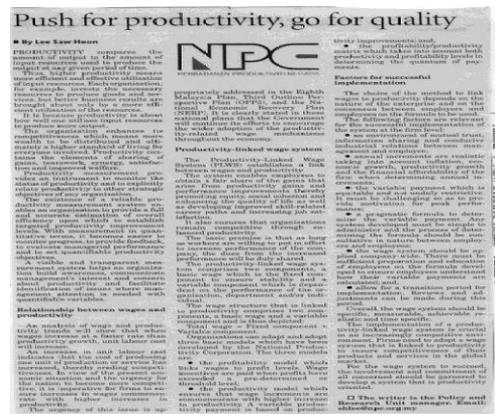
- Measure of process improvement
- Represents output relative to input
- Only through productivity increases can our standard of living improve

Productivity Measurement

$$\text{Productivity} = \frac{\text{Unit produced (outputs)}}{\text{Inputs used}}$$

$$\text{Labor productivity} = \frac{\text{Unit produced}}{\text{Employee hours}}$$

Importance Of Productivity
- Low employement rate
- Improved living standards for nation
- Reduced operating costs and increased revenue
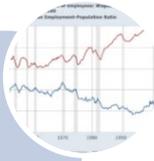
EXERCISES QUESTIONS:

Q1. Define what is operations management

Q2. Discuss the basic components of the production system with the aid of a diagram.

Q3. List two (2) reasons why we need to study operation management.

Q4. Give THREE (3) differences between goods and services.

Q5. Padi Sdn. Bhd generated 70 000 units of output utililzing 1 500 labor- hours (input). Determine the labour productivity of Padi Sdn. Bhd.

Q6. Dina holdings makes 80 000 units of a product to be sold in the market. The finance department reports that for his job the actual costs are RM 7 000 for labour, RM13 000 for materials and RM 8 000 for overhead.

LIVE THE LIFE YOU WANT TO LIVE.
BE THE PERSON YOU WANT TO REMEMBER.
MAKE DECISIONS, MAKE MISTAKES,
AT LEAST YOU TRIED....
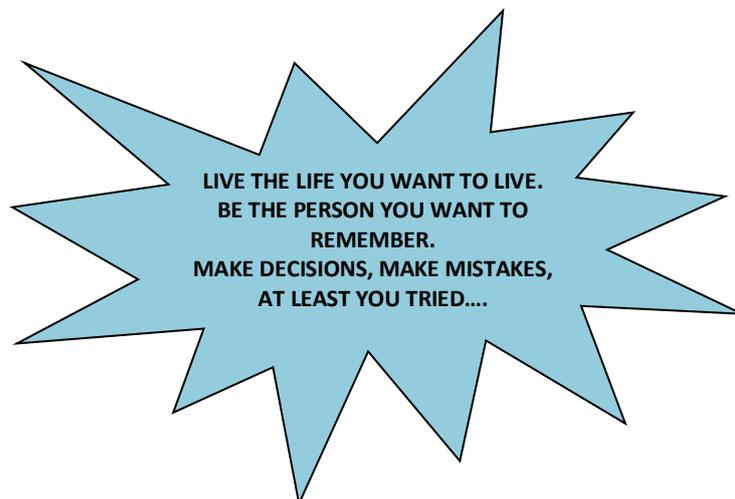
You cannot create experience. You must undergo it.
(A Camus)

TOPIC 2: PLANT LOCATION STRATEGIES

Course Learning Outcome: Analyze various techniques and methods towards decision making in operation management. (CLO2)

Learning Outcome: Explain the factors affecting the selection of plant location and analyze method of evaluating location.

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                                    ┌─────────────────────┐
                                    │  Marketing strategy  │
                                    │  involves expanding  │
                                    │ network of facilities│
                                    └─────────────────────┘
                                    ┌─────────────────────┐
                                    │ Relative costs of doing│
                                    │       business       │
                                    └─────────────────────┘
  ┌───────────────────────┐        ┌─────────────────────┐
  │   There are many factors │ ───── │   Growth in demand   │
  │ that drive location decisions│    └─────────────────────┘
  └───────────────────────┘        ┌─────────────────────┐
                                    │ Shift in demographic │
                                    └─────────────────────┘
                                    ┌─────────────────────┐
                                    │ Depletion of resources│
                                    └─────────────────────┘
                                    ┌─────────────────────┐
                                    │  Resources available │
                                    └─────────────────────┘
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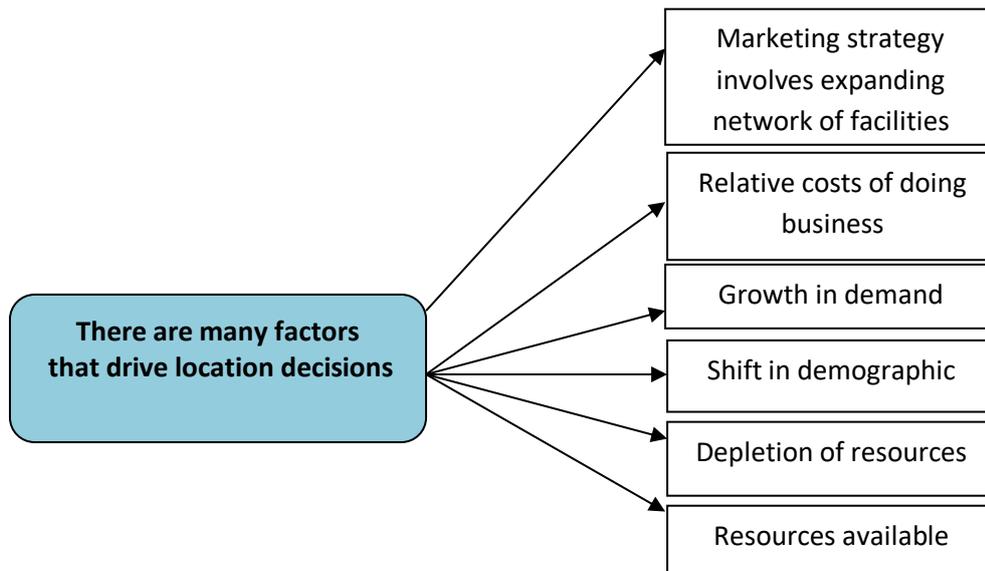
What is plant location?

Means deciding a suitable location, area or place where the plant will start functioning. It refers to the area where the plant will operate to produce goods or services. The choice is made only after considering cost and benefits of different alternatives sites.

Factors Affecting the Selection of Plant Location

Item	Description
National Decision	√ Decision to choose a country in which an organization wants to operate. √ Can be within or outside of the current country.
Regional/community decision	√ To focus on is the region of the chosen country and its community. √ To locate an operation in a particular state within a country.

Site decision	√ Decision to choose a site within a community.
	√ A firm must consider as many factor as possible:
	  a) Size & cost of site
	  b) Facilities available
	  c) Regulation & many more

Proximity to market / customers	√ Business that is closer to its customers is most preferred, especially for a service-oriented organization. √ Customers want to buy products/ services which are easily accessible. √ The proximity helps to ensure that the customers need are incorporated into products developed & built.
Proximity to suppliers	√ Located close to suppliers indicates that the firm is near raw materials. √ Organizations prefer to be near the source of materials for ease during production.

Proximity to competitors	√ Organizations prefer to be close to the competitors.
	√ Reason being:
	  a) Major resources (such as labour
	  b) Material
	  c) Infrastructure & information

Labour supply	√ Require a lot of labour. √ Choose a location that has high availability of labour (skilled labour) √ Purpose is to reduce costs of hiring & training.
Availability of facilities	√ Facilities such as telecommunication & transportation are crucial in selecting a location. √ Accessibility to land, air/finished products easily.
Government incentives	√ Incentives such as subsidies/tax inducements provided by the government in some areas. √ Purpose is to attract firms to base their facilities in that area.

Analyze Method Of Evaluating Location

Factor Rating Technique

- Is a location evaluation technique.
- Considers quantitative and qualitative factors in choosing a location.

QUANTITATIVE FACTORS

- It is essential for the organization to get raw material in right qualities and time in order to have an uninterrupted production.

- This factor becomes very important if the materials are perishable and cost of transportation is very high.

- Effects of raw materials on plant location are:

  ►When a single raw material is used without loss of weight, locate the plant at the raw material source, at the market or at any point in between.

  ►When weight loosing raw material is demanded, locate the plant at the raw material source.

  ►When raw material is universally available, locate close to the market area.

  ►If the raw materials are processed from variety of locations, the plant may be situated so as to minimize total transportation costs.

- Nearness to raw material is important in case of industries such as sugar, cement, jute and cotton textiles.

RAW MATERIAL

LABOR COST

- The problem of securing adequate number of labour and with skills specific is a factor to be considered both at territorial as well as at community level during plant location.

- Importing labour is usually costly and involve administrative problem.

- The history of labour relations in a prospective community is to be studied.

- Prospective community is to be studied. Productivity of labour is also an important factor to be considered.

- Prevailing wage pattern, cost of living and industrial relation and bargaining power of the unions' forms in important considerations.

RENTAL COST

- The organization should aware about rental cost such as building, transportation and others.

- **Cost of land, building and maintenance -** positive correlation with the production cost.

- High rental cost will affect cost of production and at the same time product price increased.
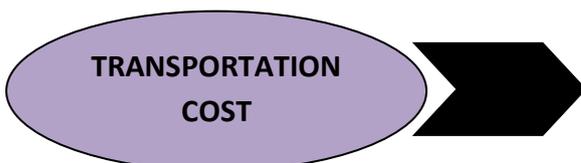
TRANSPORTATION COST

- Speedy transport facilities ensure timely supply of raw materials to the company and finished goods to the customers.

- The transport facility is a prerequisite for the location of the plant.

- There are five basic modes of physical transportation, air, road, rail, water and pipeline.

- Goods that are mainly intended for exports demand a location near to the port or large airport.

- The choice of transport method and hence the location will depend on relative costs, convenience, and suitability.

- Thus transportation cost to value added is one of the criteria for plant location.

Quantitative factors:
Labor cost
Raw material cost
Rental cost
Transportation cost
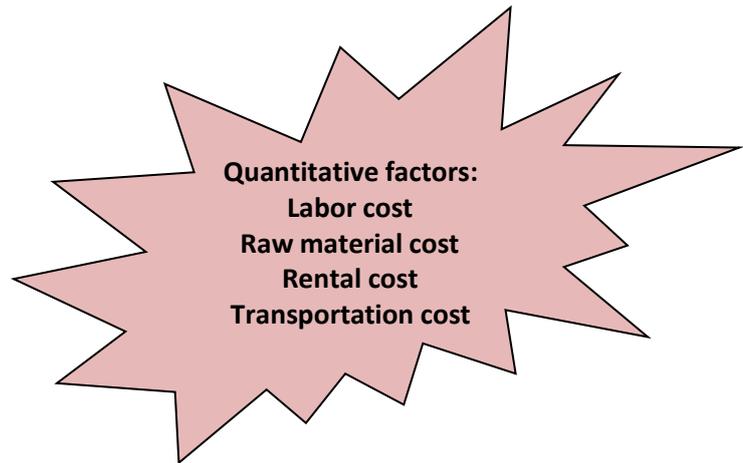
QUALITATIVE FACTORS

- Labour - appropriate and sufficient. Location should be close to resident area. Eg: FELDA = labor force, less educated = rural area (village)

- Land – must suitable with types of business

- Capital – ease of capital flow between countries

- Entreprenuer – responsible to combine the operation factors to produce product or servies. Must grab the opportunities, creative, innovative & others.

- Technology – new technology can create new markets and opportunities for business.

ECONOMIC RESOURCES

PORT AND AIRPORT

- Goods that are mainly intended for exports demand a location near to the port or large airport.

- Strategic plant location also will ensure that energy, time and cost are used effectively.

- The policies of the state governments and local bodies concerning labour laws, building codes, safety, etc., are the factors that demand attention.

- In order to have a balanced regional growth of industries, both central and state governments in our country offer the package of incentives to entrepreneurs in particular locations.

- The incentive package may be in the form of exemption from a sales tax and excise duties for a specific period, soft loan from financial institutions, subsidy in electricity charges and investment subsidy.

- Some of these incentives may tempt to locate the plant to avail these facilities offered

GOVERNMENT SUPPORT

INFRASTRUCTURE FACILITIES

- The location chosen must have basic facilities

- The basic infrastructure facilities like power, water and waste disposal, etc., become the prominent factors in deciding the location.

- Certain types of industries are power hungry e.g., aluminum and steel and they should be located close to the power station or location where uninterrupted power supply is assured throughout the year.

- The non-availability of power may become a survival problem for such industries.

- Process industries like paper, chemical, cement, etc., require continuous.

- Supply of water in large amount and good quality, and mineral content of water becomes an important factor.

- A waste disposal facility for process industries is an important factor, which influences the plant location.

Qualitative factors:
Economic resources
Port and airport
Government support
Infrastructure facilities
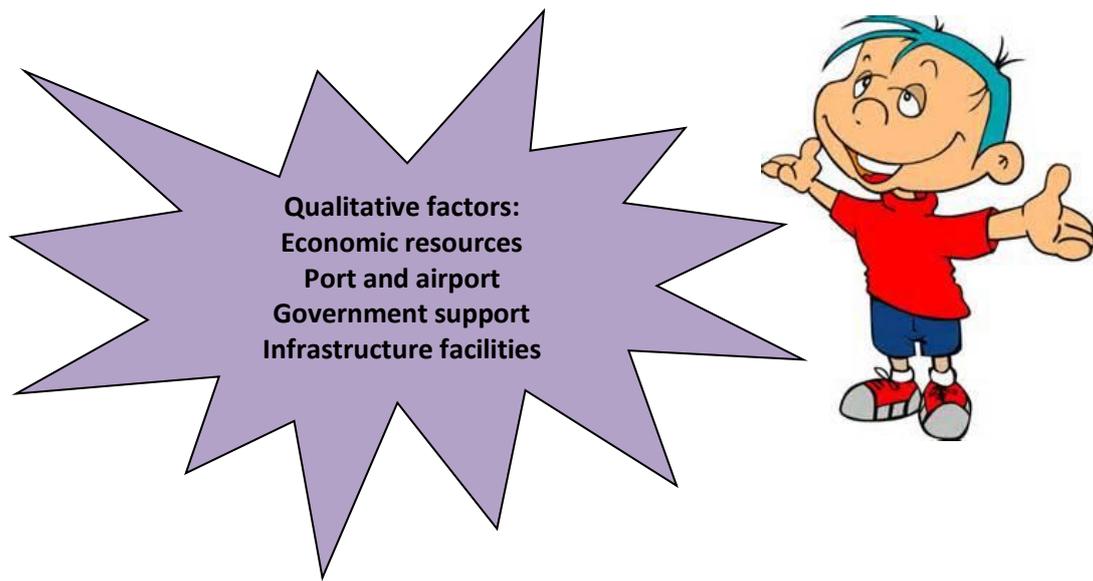
EXERCISES QUESTIONS:

Q1. Define plant location

Q2. Explain the factor affecting the selection plan location

Q3. Describe **FOUR (4)** quantitative factors that is affecting the selection of plant location.

TOPIC 3: FACILITIES LAYOUT AND PROCESS STRATEGIES

Course Learning Outcome: Apply the concept of operation and quality management in operations management. (CLO1)

Organize an autonomy and responsibility in planning, decision making in operation management. (CLO3)

Learning Outcome: Explain the facilities layout, demonstrate basic layout pattern and apply classification of process strategies.
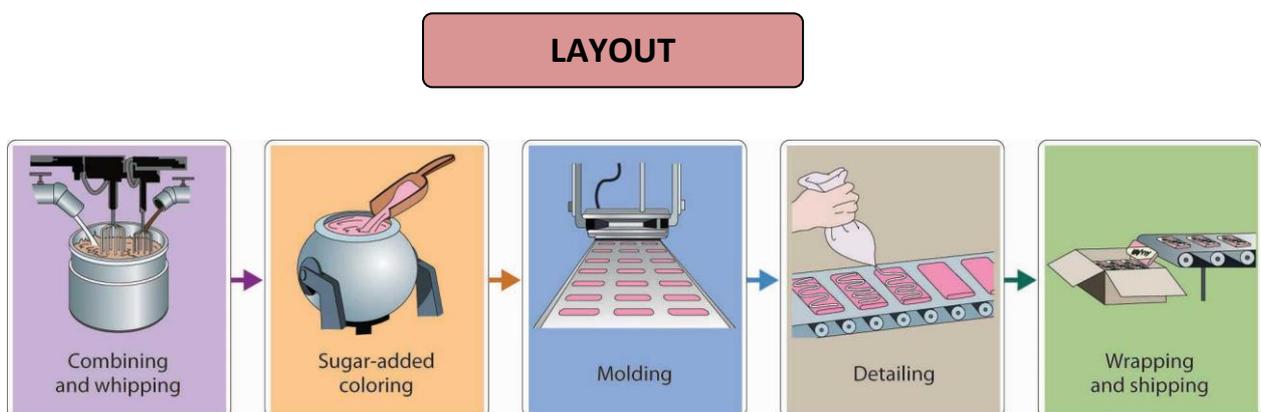
LAYOUT

Facilities Layout

What is facilities layout planning?

- ❖ The process by which the placement of department, workgroups within departments, workstations and machines within a facility is determined.
- ❖ To facilitate the conversation process from inputs into outputs.
- ❖ Facility layout concerns the arrangement of physical facilities.

Objectives of layout planning

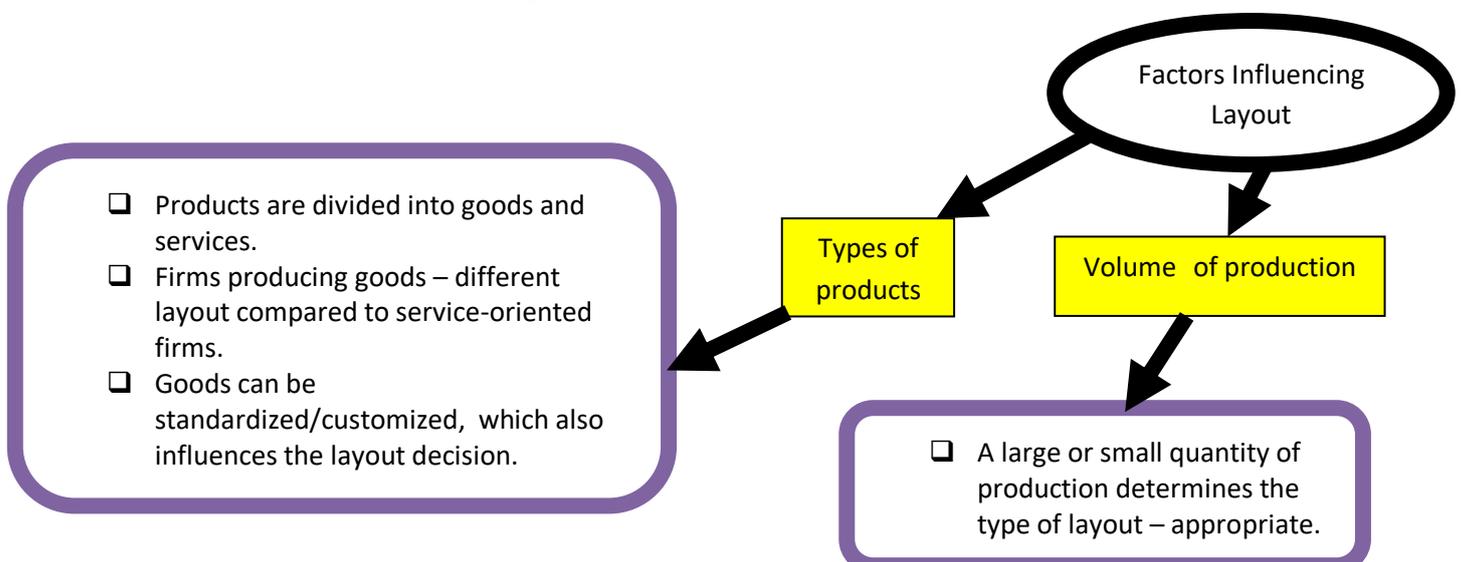| Items	Descriptions
Higher utilization of space	● The more space acquired, the more rental incurred. ● The firm must arrange the facilities in a way that is appropriate, so that every single area is fully used.
Reduced bottlenecks in moving people or material	● Refers to an operation that limits output in the production sequence. It happens because of poor arrangement of facilities, thus causing difficulties in moving people and materials. ● A bottleneck is a situation where the movement of work centres, materials, works. The lowest output line in production line
Improved employee morale and safer working conditions	● Making employee feel comfortable and happy to work. ● Good arrangement of facilities can also provide safer working conditions, where accidents in the workplace are minimized. ● Accidents will occur if facilities are improperly arranged, causing difficulties in the employees' movement.
Efficient use of labour	● Good facility layout can reduce the movement of labour to perform their tasks. ● Without proper facility arrangement, the movement of labour will increase, resulting in underutilization of labour
Improved customer and vendor interaction	● Good facility layout eases communication within various areas of the business. ● Interactions with vendors and customers can be done easily and effectively, as a specific area or space is allocated for serving and entertaining these parties.

The need to layout decision

Factors Influencing Layout

Types of products

Volume of production

❑ Products are divided into goods and services.
❑ Firms producing goods – different layout compared to service-oriented firms.
❑ Goods can be standardized/customized, which also influences the layout decision.

❑ A large or small quantity of production determines the type of layout – appropriate.

A plan of an optimum arrangement of facilities including personnel, operating equipment, storage space, material handling equipment and all other supporting services along with the design of best structure to contain all these facilities.

Basic Layout Patterns

FLOOR LAYOUT
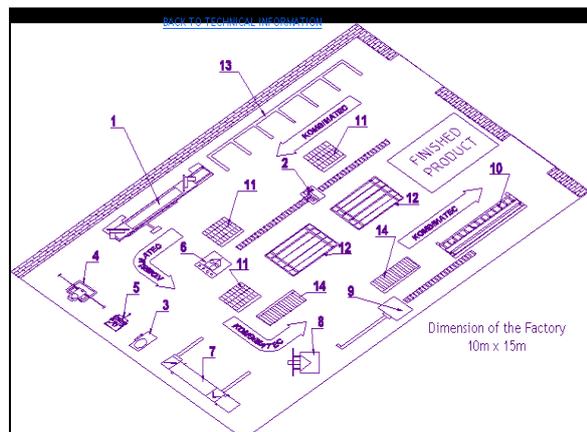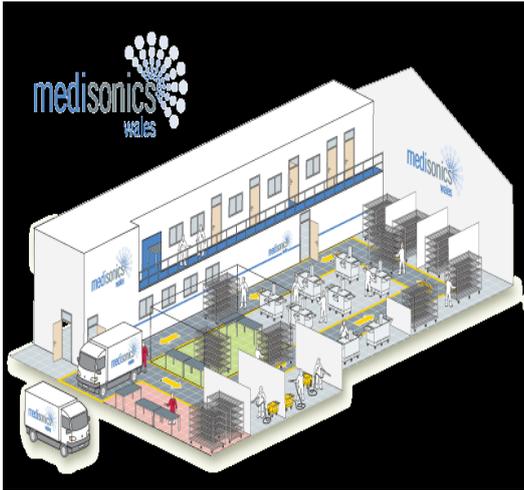
BUILDING LAYOUT
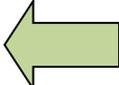
BUILDING LAYOUT
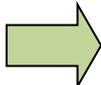
There are three basic types of activity in determining the composition of the department:

1. **Product Layout**
2. **Process Layout**
3. *Fixed-position layout*

A good layout considers the following aspects:

a) Material handling equipment.
b) Capacity and space requirements
c) Environment and aesthetics.
d) Flow of information.
e) Cost of moving between various work areas.

PRODUCT LAYOUT

- also known as <u>activity in the queue (line)</u> and refers to the frequency of the operation.

- Each product has its own line and designed specifically

- Work flow is moving from one workstation to another (assembly line) until the product completed at the end of the line.

Include the manufacture of:

- Small appliances such as toasters, and irons.
- Large appliances such as refrigerators, washing machines, electronic items (computers, CD players).

- ✓ Refers to a production system – workstations & equipment are located along the line of production, as with assembly lines.
- ✓ Known as **flow-shop layout** – work processes are arranged according to the progressive steps taken for the product to be made.
- ✓ If equipment is dedicated to the continual production of a narrow product line, this is usually called a **production line.**

Product 1 NESCAFE	→	Machine A	→	Machine B
Product 2 MILO	→	Machine G	→	Machine H
Product 3 MAGGIE	→	Machine P	→	Machine Q

Combining and whipping → Sugar-added coloring → Molding → Detailing → Wrapping and shipping
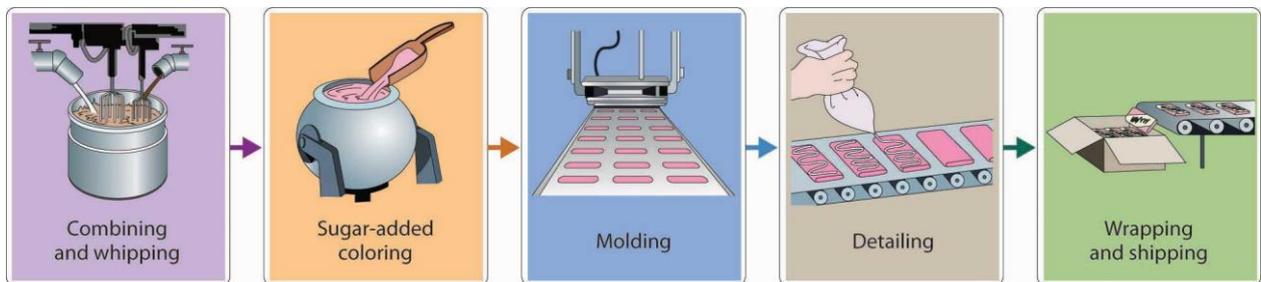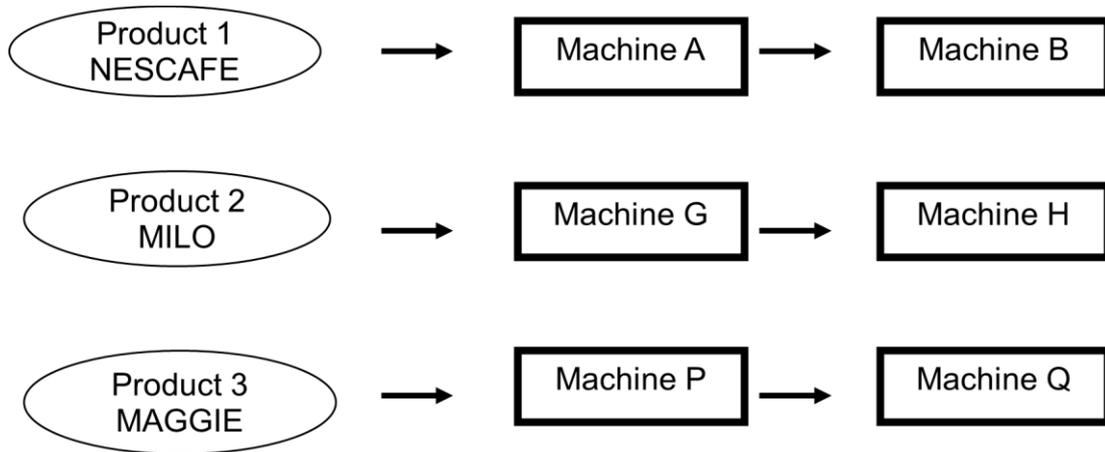
- **Product layouts** are used to achieve a smooth and rapid flow of large volumes of goods or customers through a system.

[Begin]   Work flow →   [End]

Raw materials or customer → Station 1 → Station 2 → Station 3 → Station n → Finished item

Materials and/or labor   Materials and/or labor   Materials and/or labor   Materials and/or labor

| Tray and silver | Desserts | Salads | Main course | Potato and vegetable | Bread and rolls | Beverage | Cashier |
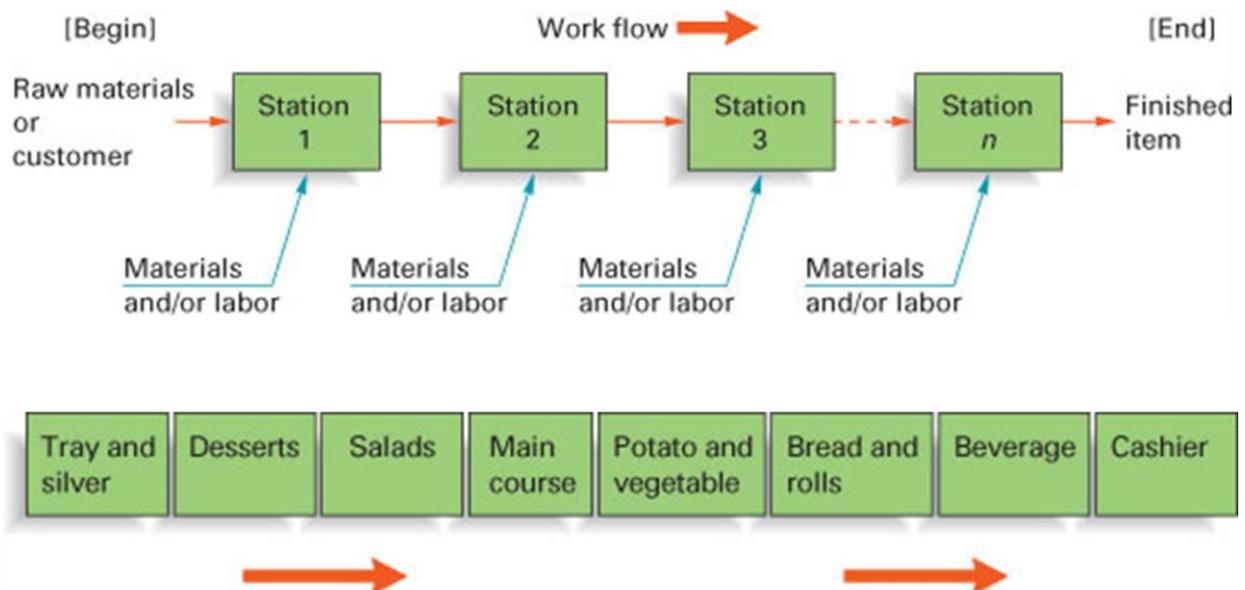
Improving Layouts Using Work Cells

Current layout - straight lines make it hard to balance tasks because work may not be divided evenly
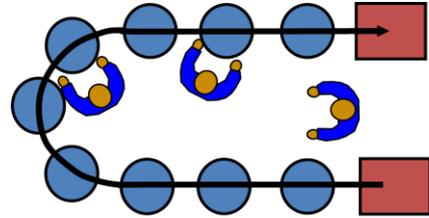
Improved layout - in U shape, workers have better access. Four cross-trained workers were reduced.

U-shaped line may reduce employee movement and space requirements while enhancing communication, reducing the number of workers, and facilitating inspection

Things to consider before choosing Product Layout

1. The function of the machine must be organized and safe.

2. Sketch the layout or location needed

3. The manager should take into account:

   - Which department/section should be in front and backside of the building?
   - Which department should be at the first floor and the second floor?

4. The component which need intensive care, hazardous materials or safety procedures.

5. Department that need high security (needs angle/place that difficult to be seen)

ADVANTAGES	DISADVANTAGES
Low variable cost per unit	High volume is required
Low material handling costs	Work stoppage at any point ties up the whole operation
Reduced work-in-process inventories	Lack of flexibility in product or production rates
Easier training/facilitate and supervision	Workers become bored because of the frequent task
Rapid throughput	Require large costs for the replacement of a new machine.
Able to produce high capacity of goods in a short time.	Lack of flexibility that is difficult to change the existing product. Changes of shape and size of items require the modification of the machine and high cost
Easy to planning and control of the output system.	These systems are interdependent with one another.

PROCESS LAYOUT

- all equipment and employees involved in a process is in a position
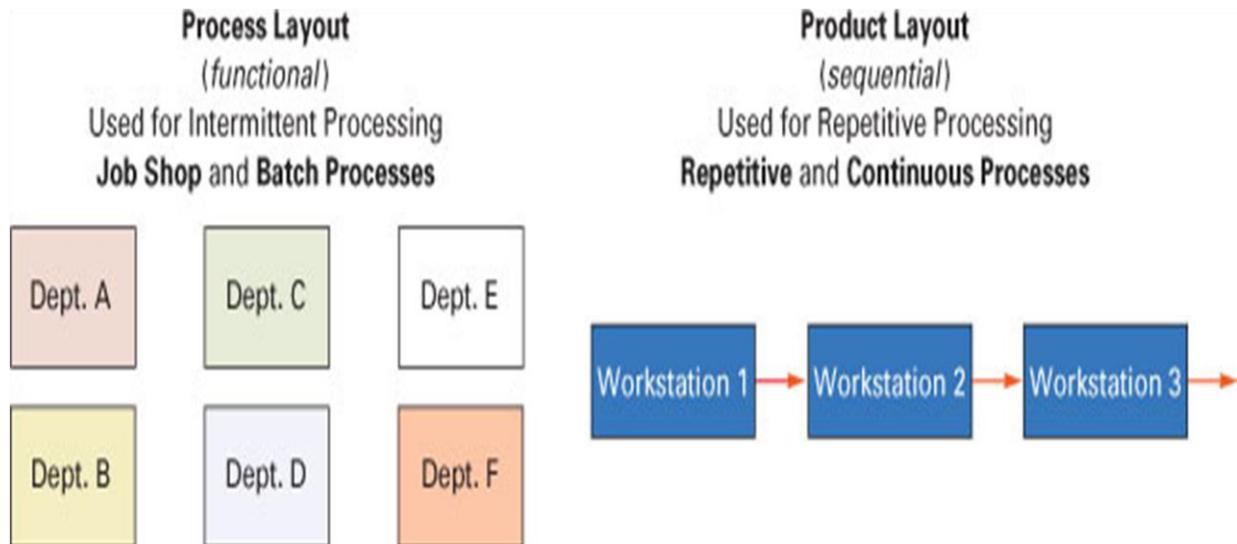
- it exists only in certain times, with small production.

- Compiling all the machine that have similarities in a single place.

- The Process layout is also known as a "Job Shop" or collection by parts.

- This type of plant layout is useful when the production process is organized in batches.

- Personnel and equipment to perform the same function are allocated in the same area.

- The different items have to move from one area to another one, according to the sequence of operations previously established.

- The variety of products to produce will lead to a diversity of flows through the facility.

- The variations in the production volumes from one period to the next one (short periods of time) may lead to modifications in the manufactured quantities as well as the types of products to be produced.

- goods or services to be produced is small. Examples of this system is adopted in the polytechnics, universities, colleges, hospitals, banks and libraries.

- e.g.: The hospital that have many parts which are wards, store, x-ray and surgical rooms and so forth.

- **Process layouts** are designed to process items or provide services that involve a variety of processing requirements.

Process Layout	Product Layout
(functional)	(sequential)
Used for Intermittent Processing	Used for Repetitive Processing
Job Shop and **Batch Processes**	**Repetitive** and **Continuous Processes**

Example Flow Diagram Of Process Layout
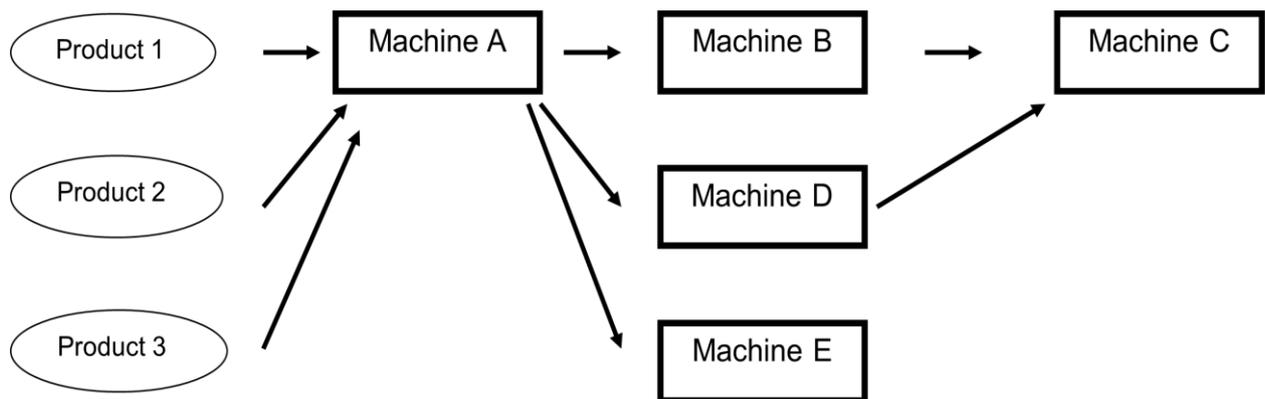
Process-Oriented Layout

Patient A - broken leg

Emergency room admissions

Patient B - erratic heart pacemaker

Surgery

ER triage room

Laboratories

Radiology

ER Beds

Pharmacy

Billing/exit

Manufacturing Process Layout

Lathe Department

Milling Department

Drilling Department

Grinding Department

Painting Department

Receiving and Shipping

Assembly
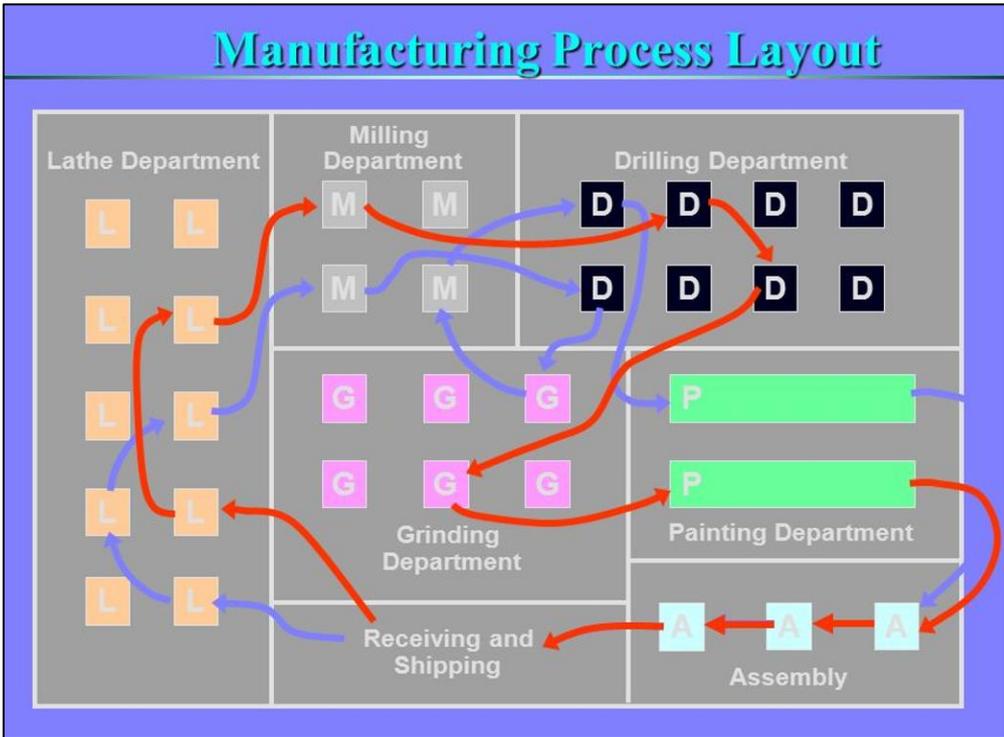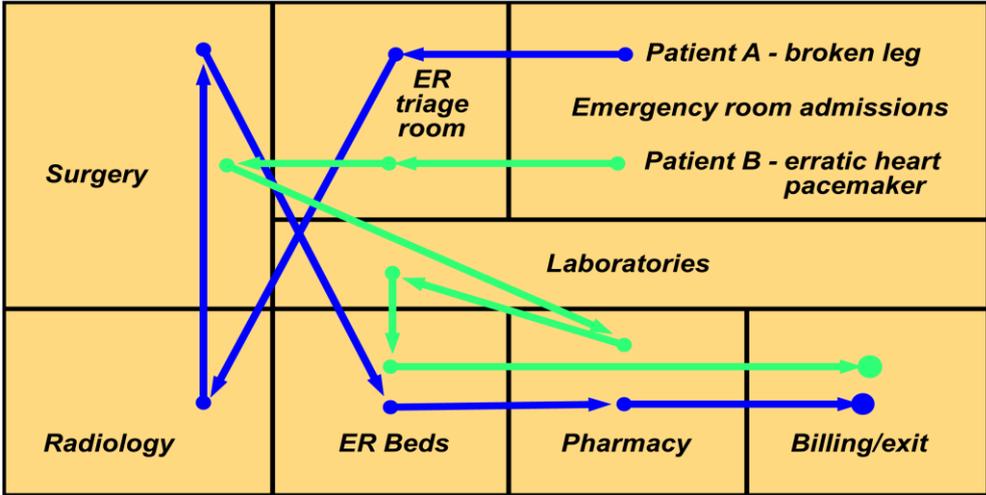
Process Layout Example

Area 1	Area 2	Area 3
Assembly Department (1)	Painting Department (2)	Machine Shop Department (3)
Receiving Department (4)	Shipping Department (5)	Testing Department (6)
Area 4	Area 5	Area 6

40'

60'

ADVANTAGES VS DISADVANTAGES

ADVANTAGES	DISADVANTAGES
Not vulnerable to equipment failures	In-process inventory costs can be high
General-purpose equipment is less costly and is easier and less costly to maintain	Routing and scheduling pose continual challenges / Less efficient scheduling will result in effectiveness.
Possible to use individual incentive systems	Equipment utilization rates are low/not fully utilize
This system can handle a variety of processes by different types of products or services	Material handling is slow and inefficient, and more costly per unit/ High maintenance costs for high tech machine
The Work flow will not disrupted when the other parts have problems	Job complexities reduce the span of supervision and result higher supervisory cost / The bureaucracy system will make the process slow.
	Special attention necessary for each product or customer and low volumes result in higher unit costs
	Accounting, inventory control, and purchasing are much more involved / Payroll costs are higher because they have employees paid by their different expertise.

FIXED POSITION LAYOUT

- In **fixed-position layouts,** the item being worked on remains stationary, and workers, materials, and equipment are moved about as needed.

- workers, materials and equipment brought to the goods or services to be produced.

- Used to create a product or services that is either large or one of a kind.

- The product cannot be moved from function to function or along the assembly line.

- Fixed-position layouts are widely used in farming, firefighting, road building, home building, remodeling and repair, and drilling for oil. In each case, compelling reasons bring workers, materials, and equipment to the "product's" location instead of the other way around.

- The product will be made in one place.

- This type of layout used for a number of factors

- It becomes necessary.

    - For example, such as buildings, bridges, water tanks, ship and the stadium.

- Items are too big, heavy and difficult to be moved

    - Examples of aircraft construction, shipbuilding and railway.

- Required a lot of movement and effective scheduling.

Example of Fixed Position Layout

Example of Fixed Position Layout


```
        Worker                              Machine


                        Construction
                            site


        Raw material                        vehicle
```
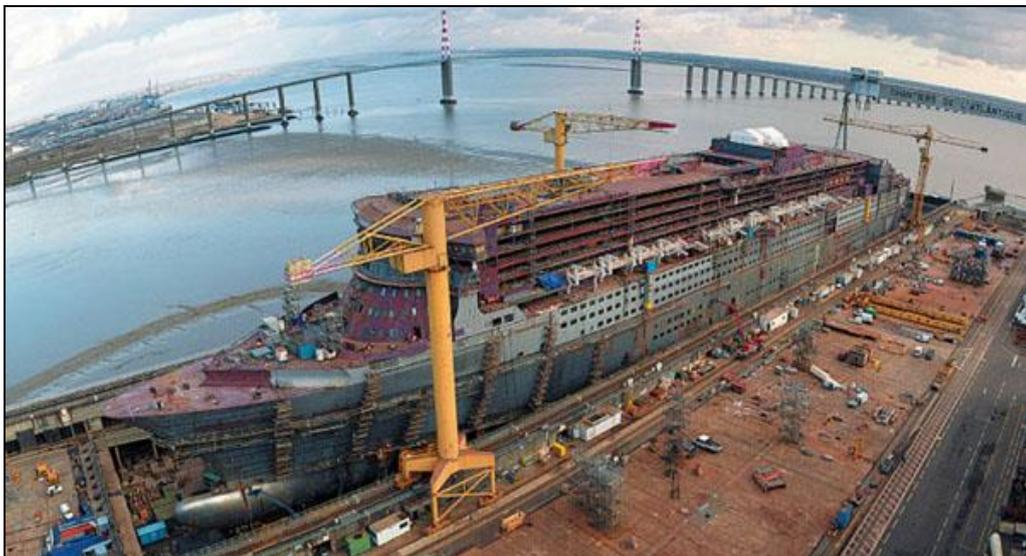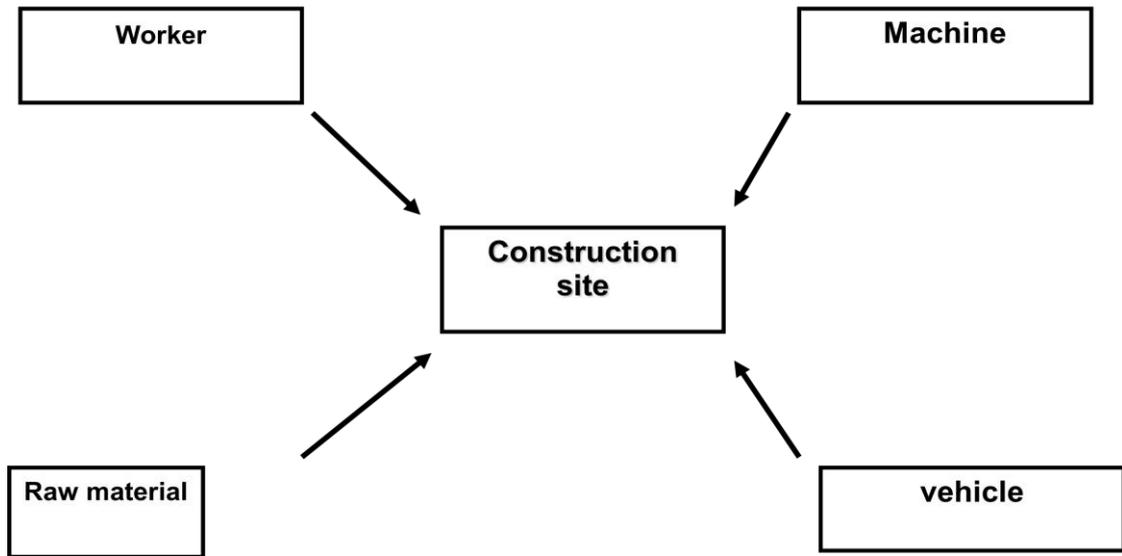

World's largest airplane factory Boeing aircrafts Seattle

Karachi Shipyard & Engineering Works Limited

ADVANTAGES	DISADVANTAGES
Saves time and cost in movement	Production period being very long, capital investment is quite heavy
Flexible as changes in job design can be easily incorporated	Very large space is required for storage of materials and equipment
More economical when several orders in different stages are executed	As several operations are carried simultaneously, possibility of confusion and conflicts are high
Adjustments can be made to meet shortage of materials or absence of workers	Difficult to find skilled workers to stay longer, for example the construction of inland dams
Areas and construction sites are outside the organization. This can reduce the tedium of employees.	Delivery costs are high. E.g. ship
Can reduced delivery cost. E.g. building/bridge	Equipment or machine is not fully utilized

The classification of process strategies

- An organization's approach to transform resources into goods and services.
- Process strategy is the pattern of decisions made in managing processes so that they will achieve their competitive priorities. It involves the use of an organization's resources to provide something of value.
- Major process decisions include:
  - ➢ Process structure
  - ➢ Customer Involvement
  - ➢ Resource Flexibility
  - ➢ Capital Intensity
- Classification of process strategies consists of:
  - a) Process focus
  - b) Repetitive focus
  - c) Product focus
  - d) Mass customization

Process Focus

- Facilities organized by process.
- Low volume, high variety products.
- Products follow many different paths.
- Other names:
  - ➢ Intermittent process.
  - ➢ Job shop.

Machine shop
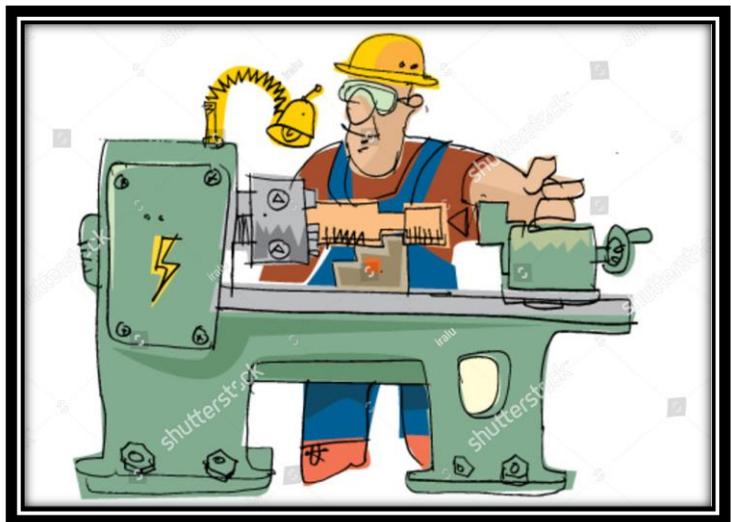
Bank

ADVANTAGES VS DISADVANTAGES

ADVANTAGES	DISADVANTAGES
Greater product flexibility	Hight variable cost per unit.
More general purpose equipment.	More highly trained personnel.
Lower initial capital investment.	More difficult production planning and control.
	Low equipment utilization. (5%-25%)

Repetitive Focus

- ✓ Facilities often organized by assembly line.
- ✓ Characterized by *modules.*
    - ✓ parts & assemblies made previously.
- ✓ Modules combined for many output options.
- ✓ Other names.
    - ✓ Assembly line.
    - ✓ Production line.

Examples
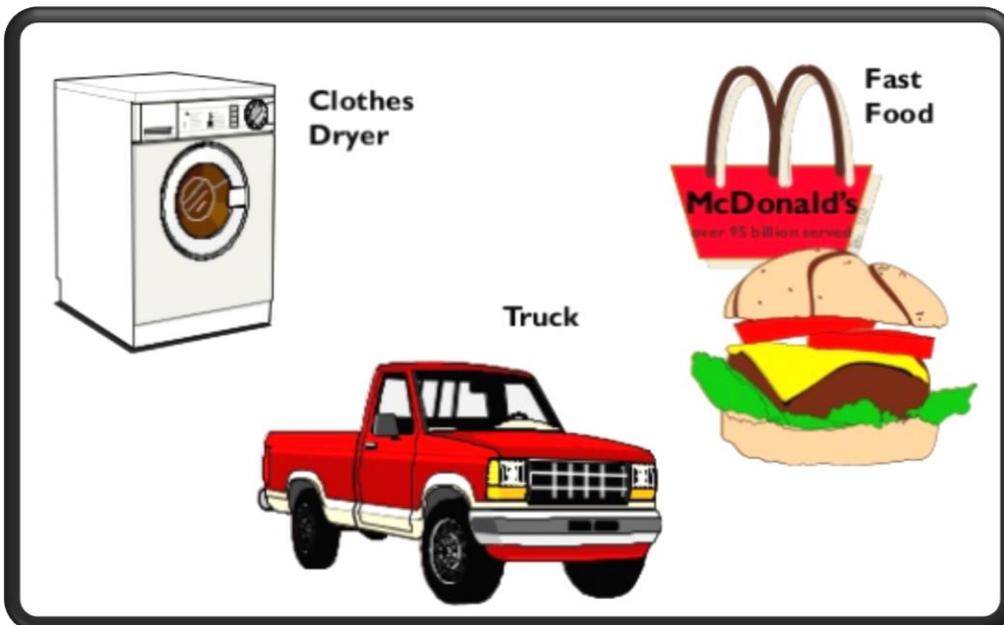
Considerations in repetitive focused strategy.

√ More structured than process-focused, less structured than product focused.
√ Enables quasi-customization.
√ Using modules, it enjoys economic advantage of continuous process, and custom advantage of low-volume, high-variety model.

Product Focus

- ❑ Facilities are organized by product.
- ❑ High volume, low variety products.
- ❑ Where found
    - ❑ Discrete unit manufacturing
- ❑ Other names
    - ❑ Line flow production
    - ❑ Continuous production.
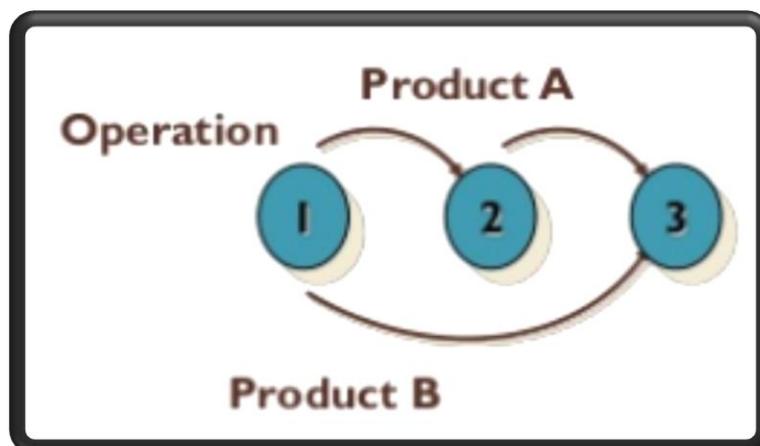
Soft Drinks
(Continuous,
then
Discrete)

SODA

Light Bulbs
(Discrete)

Paper
(Continuous)
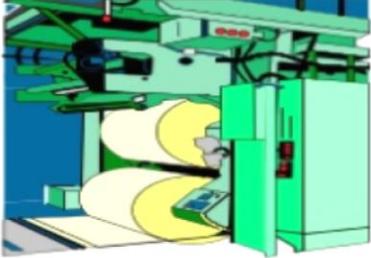
ADVANTAGES
VS
DISADVANTAGES

ADVANTAGES	DISADVANTAGES
Lower variable cost per unit	Lower product flexibility
Lower but more specialized labor skills	More specialized equipment
Easier production planning and control	Higher capital investment
Higher equipment utilization (70% to 90%)	

PROCESS FOCUS	REPETITIVE FOCUS	PRODUCT FOCUS
Product: Small quantity, large variety	Product: Long runs, usually standardized	Product: Large quantities, small variety
Equipment: General purpose	Equipment: Special, assembly line	Equipment: Special-purpose
Operators broadly skilled	Employees modestly trained	Operators less broadly skilled
Many job instructions	Repetitive operations	Few work orders and job instructions: standardization

Mass Customization

- Rapid, low-cost production to fulfil unique customer desires.
- Distinctions between process, repetitive and product focus blur, making variety and volume issues less significant.
- Very hard to achieve.

Mass Customization at Dell Computer Company

❑ Sells custom-built PCs directly to consumer.
❑ Builds computers rapidly, at low cost, and only when ordered.
❑ Integrated the web inti every aspect of business.
❑ Operates with six days inventory.
❑ Research focus on software to make installation and configuration of PCs fact and simple.

EXERCISES QUESTIONS:

Q1. Describe process and product layouts

Q2. Describe the classification of process strategies.

Q3. Explain the fixed position layout.

Always laugh when you can, It is cheap medicine.
(Byron)

TOPIC 4 : FORECASTING AND AGGREGATE PLANNING

Course Learning Outcome: Analyze various techniques and methods towards decision making in operation management. (CLO2)

: Organize an autonomy and responsibility in planning decision and control in operations management. (CLO3)

Learning Outcome: 1. Interpret the forecasting in operation planning.

2. Determine qualitative decision making approaches.

3. Analyze quantitative approaches.

4. Determine the aggregate planning in operations.
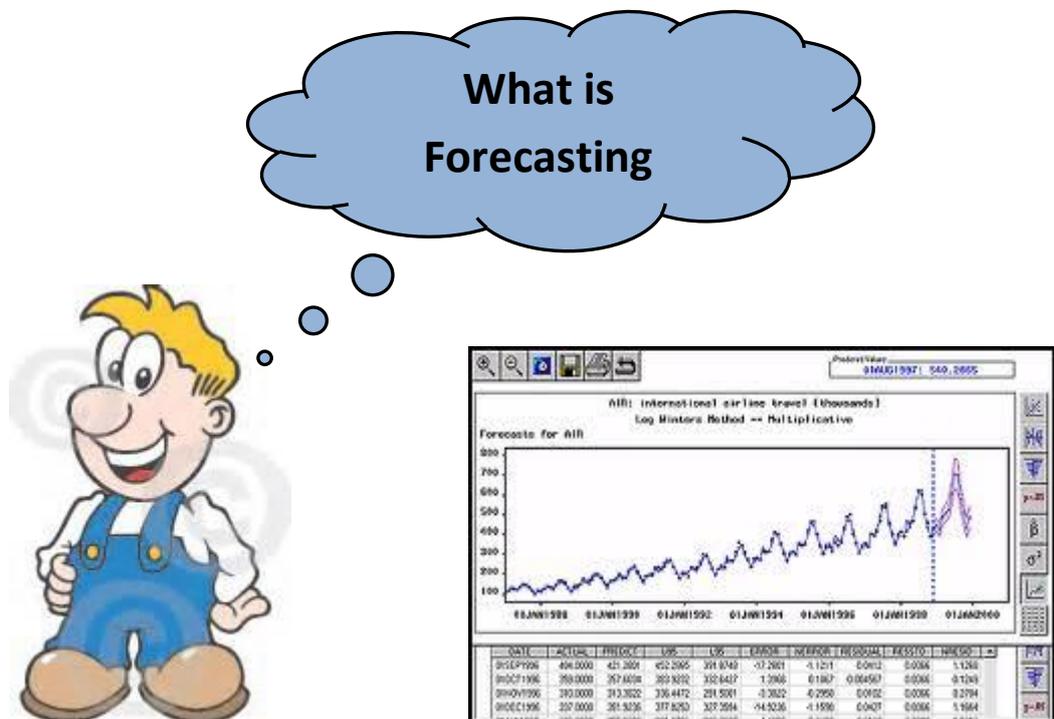
Introduction

Forecasting is an essential aspect of managing any organization planning for the future. The success of a business organization largely depends upon how its manager foresees the future and consequently develop appropriate strategies. Poor forecasts may incur increased costs for the firm.

Definitions of Forecasting

1. 'The art and science of predicting the future.'
2. A statement about the future value of a variable of interest such as demand.

Examples

- **Sales manager** forecasts the expected demand in the next period (day, week, month, quarter of year
- **Production manager** has to forecast how many units of a product are to be produced in the next period.
- **Finance Minister** has to forecast government's revenue in the next financial year before presenting the budget.
- **Meteorologist** forecast regarding the weather for the next day.

Forecasts affect decisions and activities throughout an organization

Accounting	Cost/profit estimates
Finance	Cash flow and funding
Human Resources	Hiring/recruiting/training
Marketing	Pricing, promotion, strategy
MIS	IT/IS systems, services
Operations	Schedules, MRP, workloads
Product/service design	New products and services

The Importance Of Forecasting

- To provide enough human resources.
- To provide enough capacity
- To provide with a good supply chain management.

Forecasting Time Horizon

- Short-range:

    - Less than 3-months
    - Used in planning purchasing, job scheduling, workforce level, job assignment and production level.

- Middle-range :

    - 3 months to 3 years
    - Used to sales planning, production planning and budgeting, cash budgeting.

- Long-range:

    - 3 years and above
    - Used for new product, capital expenditure, facility location/expansion and R&D.

```
                         ╔═══════════════════╗
                         ║    Types Of       ║
                         ║   Forecasting     ║
                         ╚═══════════════════╝

                    ┌─────────────────────────┐
                    │      Forecasting        │
                    │      Techniques         │
                    └─────────────────────────┘
```

Quantitative Model	Time Series Method	Causal Method
Delphi Method	Moving Average	Regressions Analysis
Jury of Executive Opinion	Exponential Smoothing	Multiple Regressions
Sales Force Composite	Trend Projections	
Consumer Market Survey		
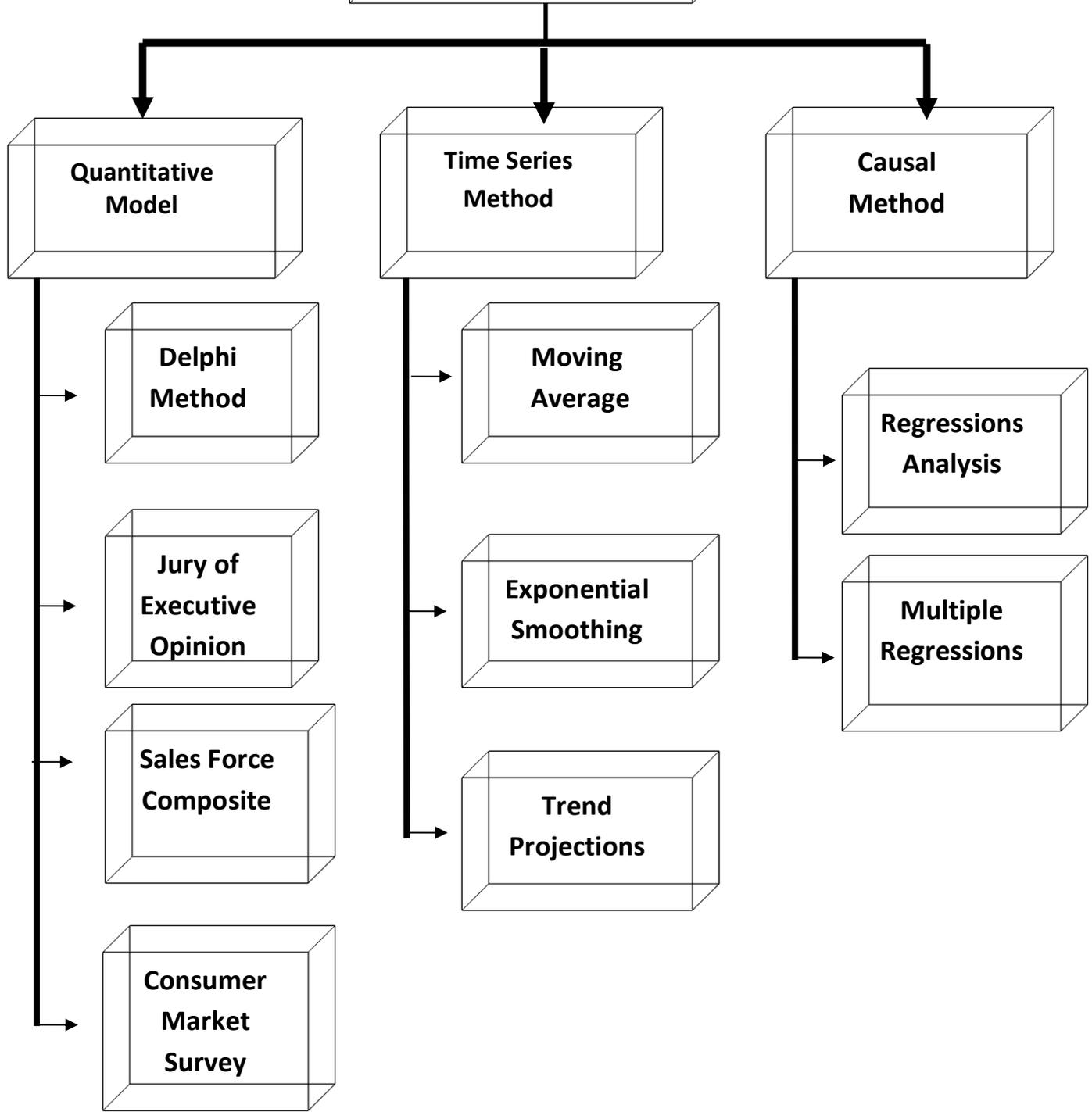
Overview of

Qualitative Methods

Qualitative models attempts to incorporate judgmental or subjective factors into the forecasting model. Qualitative models are especially useful when subjective factors are expected to be very important or when accurate quantitative data are difficult to obtain. There are four different qualitative forecasting methods:

Jury of Executive Opinion

☑ Takes the opinions of a small group of high-level managers

☑ Group estimates demand by working together

☑ Combines managerial experience with statistical models

☑ Relatively quick

☑ 'Group-think' disadvantage

Sales Force Composite

☑ Based on salesperson estimates what sales will be in his or her region

☑ Combined at district and national levels

☑ Sales reps know customers' wants

☑ Tends to be overly optimistic

Delphi Method

☑ This iterative group process allows experts, who may be located in different places to make forecast.

☑ 3 types of participants:

i. Decision makers – usually consists of 5 – 10 experts who will be making the actual forecast.
ii. Staff personnel – assist the decision maker by preparing, distributing, collecting and summarizing a series of questionnaires and survey results.
iii. Respondents- a group of people whose judgments are valued and are being sought. This group provide inputs to the decision makers before the forecast is made.

☑ Iterative group process, continues until consensus is reached

Consumer Market Survey

☑ Solicit input from customers or potential customer about their purchasing plans

☑ What consumers say, and what they actually do are often different

☑ Sometimes difficult to answer

☑ It also help in improving product design and planning for new products


Overview of

Quantitative Methods

Time Series Forecasting

☑ Set of evenly spaced numerical data

☑ Obtained by observing response variable at regular time periods

☑ Forecast based only on past values

☑ Assumes that factors influencing past and present will continue influence in future

Time Series Components

Trend Component

- ☑ Persistent, overall upward or downward pattern
- ☑ Changes due to population, technology, age, culture, etc.
- ☑ Typically several years duration
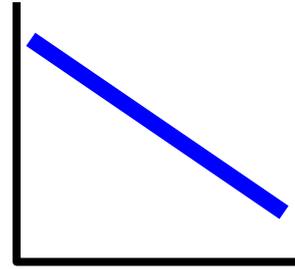
Seasonal Component

- ☑ Regular pattern of up and down fluctuations
- ☑ Due to weather, customs, etc.
- ☑ Occurs within a single year

Cyclical Component

- ☑ Repeating up and down movements
- ☑ Affected by business cycle, political, and economic factors
- ☑ Multiple years duration
- ☑ Often causal or associative relationships
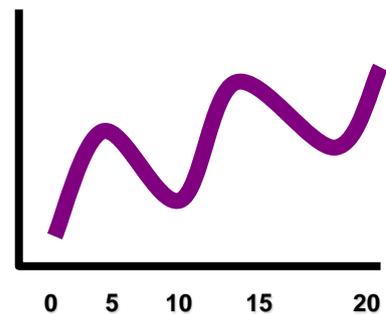
Random Component /Irregular @ Residual Component

- ☑ Erratic, unsystematic, 'residual' fluctuations
- ☑ "blips" in the data
- ☑ Due to random variation or unforeseen events
- ☑ Short duration and non-repeating

☑ Among the time-series models, the simplest is the naïve forecast.
☑ A naïve forecast simply uses the actual demand for the past period as the forecasted demand for the next period. This, of course, makes the assumption that the past will repeat.
☑ Assumes demand in next period is the same as demand in most recent period
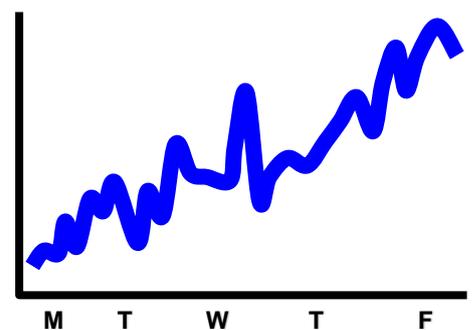☑ e.g., If May sales were 48, then June sales will be 48
☑ Sometimes cost effective and efficient

Example:

Table 1

Naïve Forecasting

Period	Actual Demand (000's)	Forecast (000's)
January	45	
February	60	45
March	72	60
April	58	72
May	40	58
June		40

Simple Moving Average Method

☑ Moving Average is a series of arithmetic means

☑ Used if little or no trend

☑ Used often for smoothing

☑ Provides overall impression of data over time

$$\text{Moving average} = \frac{\sum \text{demand in previous } n \text{ periods}}{n}$$

Example:

Simple Moving Average Example

Month	Actual Shed Sales	3-Month Moving Average
January	10	
February	12	
March	13	
April	16	(10 + 12 + 13)/3 = 11.67
May	19	(12 + 13 + 16)/3 = 13.67
June	23	(13 + 16 + 19)/3 = 16
July	26	(16 + 19 + 23)/3 = 19.33

Weighted Moving Average

☑ Used when trend is present

☑ Older data usually less important

☑ Weights based on experience and intuition

$$\text{Weighted moving average} = \frac{\sum (\textbf{\textit{weight for period n}}) \times (\textbf{\textit{demand in period n}})}{\sum \textbf{\textit{weights}}}$$

Example:

Weight...

Weights Applied	Period
3	Last month
2	Two months ago
1	Three months ago
6	Sum of weights

Month	Actual Shed Sales	3-Month Weighted Moving Average
January	10	
February	12	
March	13	
April	16	$[(3 \times 13) + (2 \times 12) + (10)]/6 = 12.16$
May	19	$[(3 \times 16) + (2 \times 13) + (12)]/6 = 14.13$
June	23	$[(3 \times 19) + (2 \times 16) + (13)]/6 = 17$
July	26	$[(3 \times 23) + (2 \times 19) + (16)]/6 = 20.12$

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Exponential Smoothing

☑ Exponential smoothing is also an averaging method that weights the most recent data more strongly.
☑ It will react more to recent changes in demand.
☑ Is one of the most popular and frequently used forecasting techniques, for a variety of reasons.
☑ New forecast = Last period's forecast + α (Last period's actual demand – Last period's forecast)

$$F_t = F_{t-1} + \alpha (A_{t-1} - F_{t-1})$$

Where:

F_t = new forecast for period t

F_{t-1} = previous period's forecast

A_{t-1} = previous period's actual demand

α = smoothing constant, $(0 \leq \alpha \leq 1)$

Example 1:

Exponential Smoothing Example

Predicted demand = 142 Ford Mustangs
Actual demand = 153
Smoothing constant α = .20

Exponential Smoothing Example

Predicted demand = 142 Ford Mustangs
Actual demand = 153
Smoothing constant α = .20

New forecast $= 142 + .2(153 - 142)$
$= 142 + 2.2$
$= 144.2 \approx 144$ *cars*

Example 2:

Month	Demand	Exponential Smoothing Forecast ($\alpha = 0.4$)
January	61	61 (assumed)
February	66	$(0.4 \times 61) + (0.6 \times 61) = 61$
March	60	$(0.4 \times 66) + (0.6 \times 61) = 63$
April	75	$(0.4 \times 60) + (0.6 \times 63) = 62$
May	71	$(0.4 \times 75) + (0.6 \times 62) = 67$
June	70	$(0.4 \times 71) + (0.6 \times 67) = 69$
July	77	$(0.4 \times 70) + (0.6 \times 69) = 69$
August	80	$(0.4 \times 77) + (0.6 \times 69) = 72$
September	66	$(0.4 \times 80) + (0.6 \times 72) = 75$
October	70	$(0.4 \times 66) + (0.6 \times 75) = 72$
November	75	$(0.4 \times 70) + (0.6 \times 72) = 71$
December	67	$(0.4 \times 75) + (0.6 \times 71) = 73$

34

Linear Regression Analysis

- Regression analysis is a statistical technique used to develop mathematical equation showing how variables are related

    – Variable that is being predicted is called dependent or response variable

    – Variables being used to predict the value of the dependent variable are called independent or predictor variable

Simple Linear Regression

$$y = a + bx$$

where:
- y = Value of the dependent variable
- x = Value of the independent variable
- a = Population's y-intercept
- b = Slope of the population regression line

TIPS:

$$y = a + bx$$

Dependent Variable
(Effect)

Independent Variable
(Cause)

Ex: Demand=Price+Advertising

REGRESSION ANALYSIS FORMULA

$$\hat{y} = a + bx$$

FORMULA 1
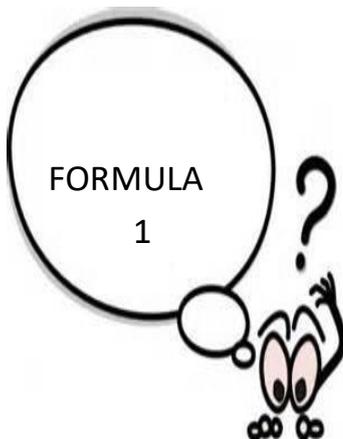
$$\overline{x} = \Sigma \frac{x}{n}$$

$$\overline{y} = \Sigma \frac{y}{n}$$

$$b = \frac{\Sigma xy - n\overline{x}\,\overline{y}}{\Sigma x^2 - n\overline{x}^2}$$

$$a = \overline{y} - b\overline{x}$$

$$b = \frac{\Sigma xy - \dfrac{(\Sigma x)(\Sigma y)}{n}}{\Sigma x^2 - \dfrac{(\Sigma x)^2}{n}} \qquad @ \qquad = \frac{n\Sigma xy - \Sigma x\Sigma y}{n\Sigma x^2 - (\Sigma x)^2}$$

FORMULA 2

$$a = \frac{(\Sigma y)}{n} - b\left[\frac{\Sigma x}{n}\right] \qquad @ \qquad \bar{y} - b\bar{x}$$

Steps To Find Regression

1. Identify the trend.

   Find variable x and variable y
   y=a+bx

2. Develop regression equation

   Construct a table (x,y,xy,x²)

   Determine value of a and b

   Write the regression expression

   Make a forecast

QUESTION:

Bayu Permai restaurant has been spending money to attract new customers at its newly opened outlet at the Batu Pahat, Johor. The following table gives the advertisement expenditure along with the corresponding total sales volume in monetary value.

If Bayu Permai spends RM20,000, what will be the amount of sales?

Month	Adv (1000s)	Sales (1000s)
1	4	23
2	7	49
3	9	48
4	13	58

ANSWER:

x	y	xy	x^2
4	23	92	16
7	49	343	49
9	48	432	81
13	58	754	169
16	61	976	256
Σx = 49	Σy = 239	Σxy = 2597	$Σx^2$ = 571

Find b:

$\overline{X}$ = 49/5 $\overline{Y}$ = 239/5
  = 47.8   = 9.8

b= $\dfrac{2597-(9.8 \times 47.8)5}{571-(9.8 \times 9.8)5}$ b= $\dfrac{254.8}{90.8}$

b= $\dfrac{2597-2342.2}{571-480.2}$ b=2.8062

Find a:

a = <u>239</u> – <u>2.8062 x 49</u>   So, regression equation;
     5   5

a = 47.8 – 27.5008   Y = a + bx

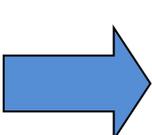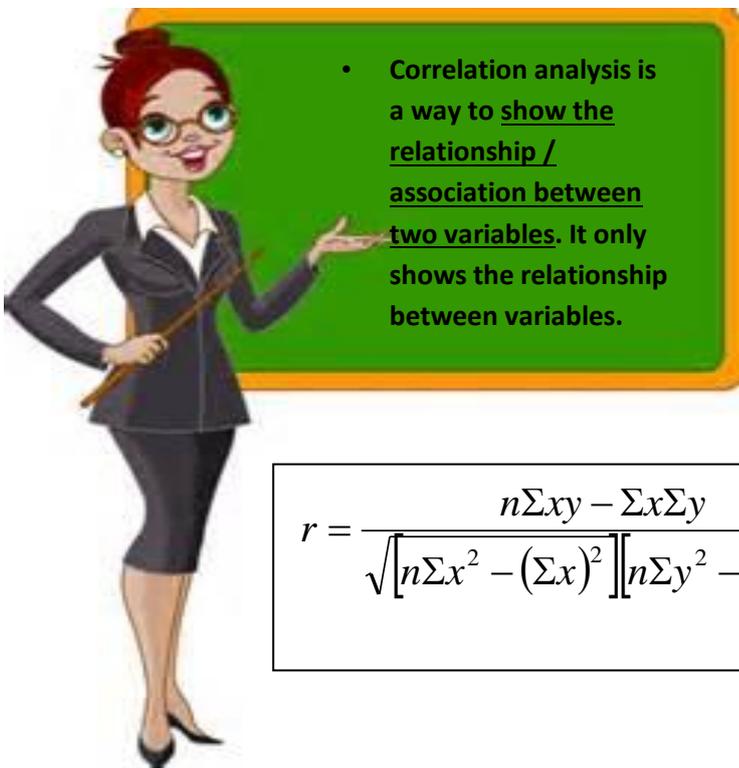a = 20.30   y=20.299 + 2.8062x

If Bayu Permai restaurant spends RM20,000, then he can expect the follwing amount of sales:
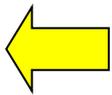Subtitute x to 20,

Y= [20.2992 + 2.8062x20] x1000

  = RM76423

<div align="center">

Correlation Coefficient

</div>

- **Correlation analysis is a way to show the relationship / association between two variables. It only shows the relationship between variables.**
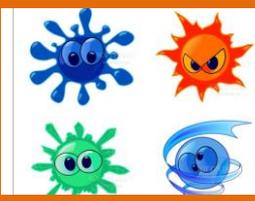
Correlation analysis **measures the degree / linear strength between the two variables** studied.

$$r = \frac{n\Sigma xy - \Sigma x\Sigma y}{\sqrt{\left[n\Sigma x^2 - (\Sigma x)^2\right]\left[n\Sigma y^2 - (\Sigma y)^2\right]}}$$

The correlation is very high with the value of correlation coefficient (r) is between 0.90 - 1.00

The following data is sales data for a Nodel construction

y	x
2.0	1
3.0	3
2.5	4
2.0	2
2.0	1
3.5	7
$\sum y = 15.0$	$\sum x = 18$

Nodel Construction

y	x	x^2	xy	y^2
2.0	1	1	2.0	4.0
3.0	3	9	9.0	9.0
2.5	4	16	10.0	6.25
2.0	2	4	4.0	4.0
2.0	1	1	2.0	4.0
3.5	7	49	24.5	12.25
$\sum y = 15.0$	$\sum x = 18$	$\sum x^2 = 80$	$\sum xy = 51.5$	$\sum y^2 = 39.5$

$$r = \frac{n\Sigma xy - \Sigma x\Sigma y}{\sqrt{[n\Sigma x^2 - (\Sigma x)^2][n\Sigma y^2 - (\Sigma y)^2]}}$$

$$r = \frac{6(51.5) - (18)(15.0)}{\sqrt{[6(80) - (18)^2][6(39.5) - (15.0)^2]}}$$

$$= \frac{309 - 270}{\sqrt{(156)(12)}}$$

$$= \frac{39}{\sqrt{(1,872)}}$$

$$= \frac{39}{43.3}$$

$$= 0.901$$

The correlation coefficient is **0.901**. This means that a ***strong positive linear relationship*** exist between _____ and _____.

EXERCISES QUESTIONS:

Q1:

The manager of MRM System had randomly selected 10 sales representatives and determined the number of sales calls made and the number of units of the product he or she sold last month. The sample of information is reported in table below:

Sales Representative	Number of sales calls	Number of Unit Sold
A	14	28
B	35	66
C	22	38
D	29	70
E	6	22
F	15	27
G	17	28
H	20	47
I	12	14
J	29	68

a) Determine the dependent variable and independent variable from the data.

b) Based on the data given, you are required to build a regression equation.

c) How many units will be sold if new staff make 25 numbers of sales calls?

d) Compute the correlation among both variables and infer your answer?

Q2:

The following table shows the annual sales of a home appliances for Melarik Besar Company at Taman Maju, Jasin.

Year	Sales (RM'000)
2003	150
2004	145
2005	144
2006	154
2007	132
2008	175
2009	161
2010	158
2011	136
2012	159
2013	145

Calculate the sales forecasting of Melarik Besar Company for the year 2014 by using the following methods:

a) Exponential Smoothing with alpha α 0.3. sales forecast for the year 2014 was RM165('000)

b) A Weighted Moving Average where 35% for the most recent year 2014, 30% for the last 2 years, 20% for the last 3 years, 10% for the last 4 years and 5% for the last 5 years.

c) Naive method

d) Simple Moving Average with n = 6

Q3:

The monthly sales for Yamizi Battery Company are as follow:

Month	Sales
1	2000
2	2100
3	1500
4	1400
5	1300

Calculate forecast sales for June using each of the following methods:

i) Naïve

ii) 3 month simple moving average

iii) Exponential smoothing using an α=0.3 and May forecast of 1600 units.

Q4:

As a manager of a company that produces components for tablets 2, Miss Qaireena needs to make a trend analysis of number of units demanded for each year. This will help the company to decide whether a purchase of a new equipment is required. The following data was gathered from the 2006 -2013.

Year	Unit Produced (in thousand)
2006	15
2007	19
2008	20
2009	24
2010	23
2011	19
2012	25
2013	22

Using the linear regression method, calculate the estimated number of units produced in 2014.

Q5:

The following information about actual and forecast sales at Kuching Carpet Centre for year 2021.

Month	Carpet Actual sales (1000meter)	Carpet Forecast sales	Housing Permit
January	6	7	21
Febuary	10	20	36
March	4	7	10
April	3	10	12
May	8	15	17
June	3	14	10
July	12	20	41
August	11	12	15
September	9	9	18
October	14	10	26
November	16	15	22
December	18	12	27

a) Calculate the carpet forecast demand Kuching Carpet Centre for Jan 2021 using method below :

   i)   Naive

   ii)   4 – month Moving Average

   iii) 4 - MWMA with assumption the weight 0.15 (4 months ago), 0.2 (3 months ago), 0.3 (2 months ago) and 0.35 (1 months ago).

   iv)   Exponential smoothing α= 0.35

b) Determine the linear regression for Jan and Feb 2014 which month is the independent variables.

c) Explain **TWO (2)** qualitative method (technique) for demand forecast.

TOPIC 5: WORK MEASUREMENT

Course Learning Outcome: Analyze various techniques and methods towards decision making in operation management (CLO2)

Learning Outcome: To understand and analyze work measurement
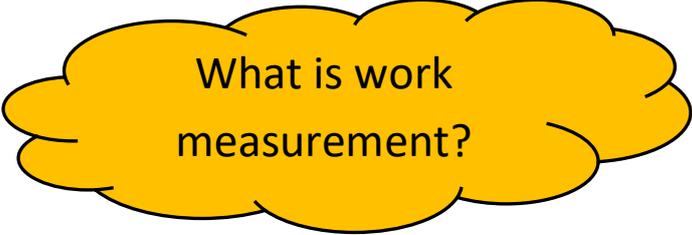
What is work measurement?

- Work measurement is the application of techniques designed to establish the time for an average worker to carry out a specified manufacturing task at a defined level of performance.
- It is concerned with the duration of time it takes to complete a work task assigned to a specific job.

Importance of work measurement

√ **Manpower planning**

Provides information about the number of hours required to carry out the work.

√ **Production planning and scheduling**

The data can be used to set production standards.

√ **Estimating production costs**

Help a manager to estimate the cost of production

√ **Basis for incentives**

Used to create incentive schemes for employees.

√ **Training of employees**

Helps manager to train employees, especially the new hires.

Time study method in measuring work standard

Time study involves recording the time required by a worker to complete the task, taking into consideration the necessary allowances, and then estimating the total time required to do the job.

Purpose of work measurement

Repetitive work – the main operation repeat continuously during the time spent at the job.

Non-repetitive work – involves tasks that are performed irregularly or are being performed for the first time

Methods in measuring work standard

1) Historical experience – how many labour hours are required to do a job the last time it was performed.
2) Predetermined time and motion studies – involves apportioning a particular task into smaller basic elements that already have established times.
3) Work sampling – a statistical technique for determining the percentage of time spent by employees on various work activities.
4) Synthesis – focused on building up the time for a job at a defined level of performance.
5) Time study – involves recording the time required by a worker to complete a task, taking into consideration the necessary allowances and then estimating the total time required to do the job.

3 Concepts in Time Study

- Observed Time
- Basic (Normal) Time
- Standard Time
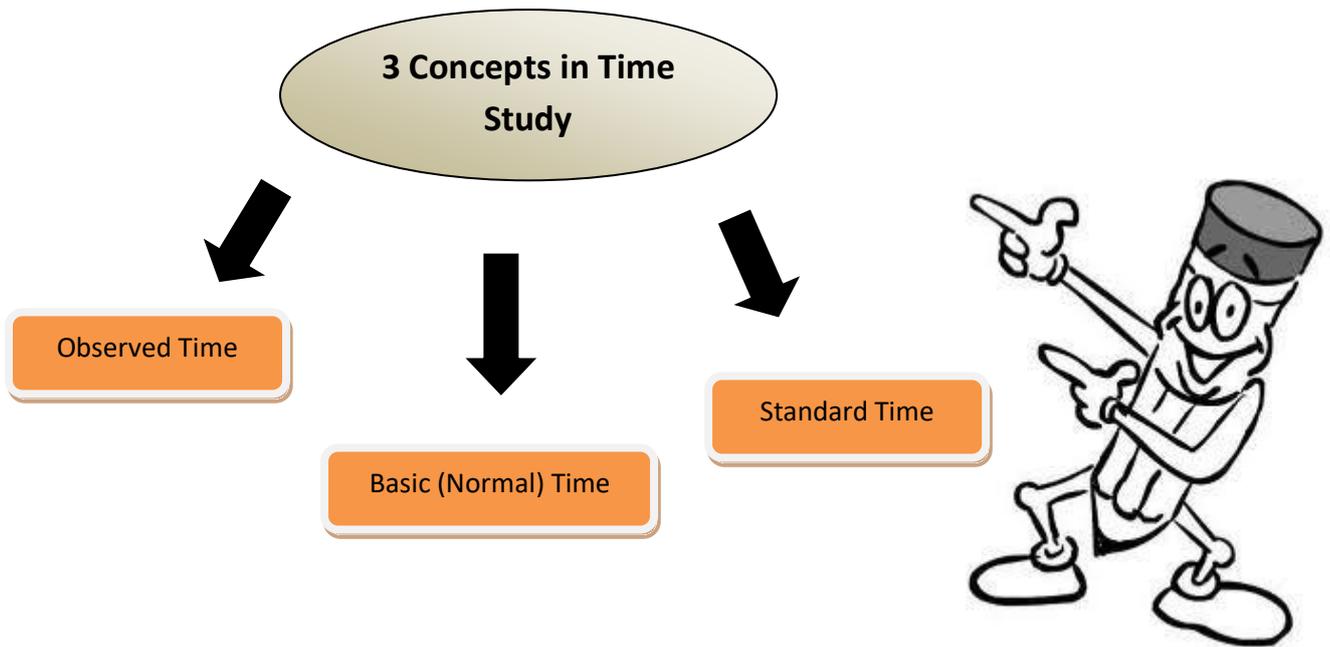
What is allowances?

Giving employees break time to attend to personal needs, such as a lunch break or tea break with the purpose of overcoming tiredness or fatigue. All employees are entitled to allowances. Allowances are the extra time figures which are to added to the basic time of an operation to a account for personal desires, delays, fatigue of operators, any special situation and the policies of the firm or organization.

Types of allowances

- Relaxation
- Process
- Contingency
- Policy
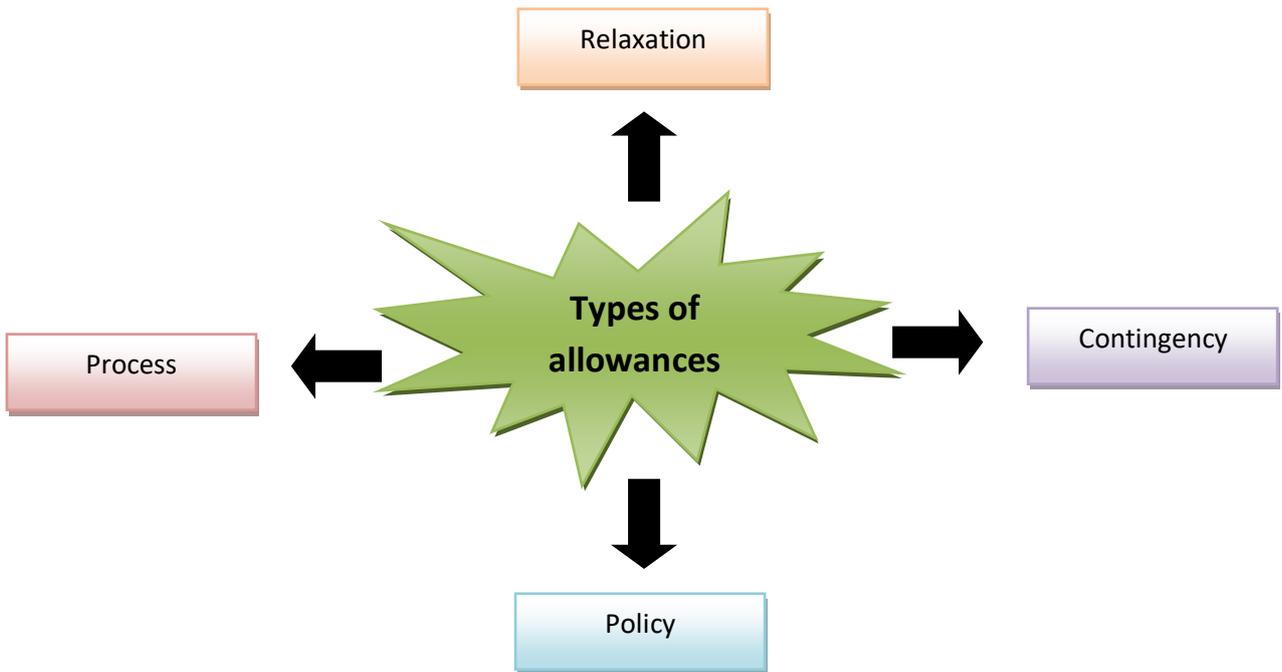
1) Average observed time = $\dfrac{\text{Summation of observed time}}{\text{Number of observations}}$ (exclude abnormal time)

   Abnormal time is the extreme or extraordinary time value, either high or low, for any job element and should be excluded in the calculation.

2) Basic (normal) time = $\dfrac{\text{Average observed time x observed rate}}{\text{Standard rate*}}$

3) Standard time = Basic (normal) time (1 + allowance factor)

4) Allowance factor (%) = $\dfrac{\text{Summation of allowances (in minute)}}{\text{Working hours per day (in minute)}}$ x 100

5) *Daily standard output = $\dfrac{\text{working hours per *day (in minute)}}{\text{Standard time}}$

6) Number of workers required to meet target output per day
   = $\dfrac{\text{Target output per*day}}{\text{*Daily standard output}}$

   * changes accordingly

7) Labour cost per unit = $\dfrac{\text{Standard time x labour cost per hour}}{\text{Minutes per hour}}$

EXERCISES QUESTIONS:

Q1. Define work measurement.

Q2. Explain the importance of work measurement by giving four reasons.

Q3. Describe the methods in measuring work standard.

Q4. Define allowances.

Q5. Explain three concepts of time study method.

*Knowing others is intelligence, knowing yourself is true wisdom.*

(Lao Tse)

TOPIC 6 : ECONOMIC ORDER QUANTITY (EOQ)

Course Learning Outcome: Analyze various techniques and methods towards decision making in operation management. (CLO2)

: Organize an autonomy and responsibility in planning decision and control in operations management (CLO3)

Learning Outcome: 1. Find the concept of inventory
2. Illustrate the concept of inventory model
3. Explain Just In Time Concept (JIT)
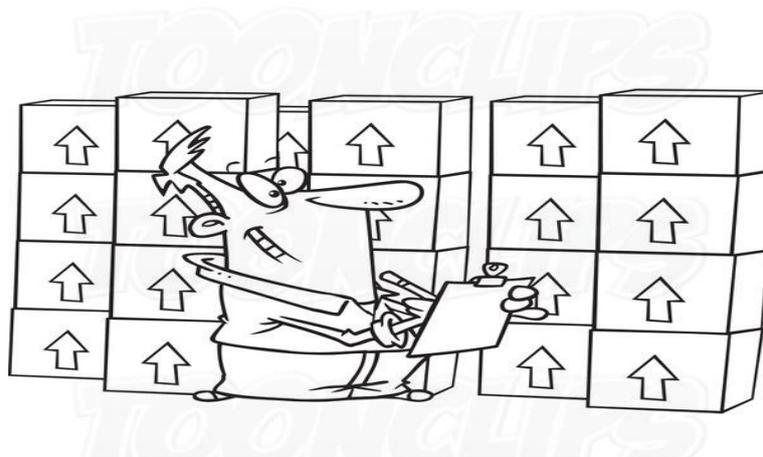
What Is Inventory?

- Inventory generally refers to the materials in stock.
- It is also called the idle resource of an enterprise.
- Inventories represent those items which are either stocked for sale or stocked for further processing

Objective: To achieve satisfactory levels of customer service while keeping inventory costs within reasonable bounds.

Function:

1. To meet anticipated customer demand

 - should be available regardless whether they held for satisfy planned or expected demand.

2. To smooth production requirements

-inventories should be kept at satisfactory level to deal with seasonal periods.

3. To decouple operations

- inventories offer manufacturers some protection from disruption in deliveries caused by the weather or problems with suppliers. Thus inventories act as a buffer that allows other operations to continue temporarily if some operations suffer breakdowns or other problems.

4. To protect against stock outs

-delayed deliveries and unexpected increases in demand increase the risk of shortages. Delays can be due to weather conditions, supplier stock-outs, deliveries of wrong materials, quality problems and so on. The risk of shortages can be reduced by holding safety stocks.

5. To hedge against price increases.

-The ability to store extra goods also allows a firm to take advantage of price discounts for large orders.

1) Raw material inventory
   - Materials that are usually purchased but have yet to enter the manufacturing process
   - E.g. eggs, tin, copper, oil palm, etc.
2) Work in Process (WIP) inventory
   - Products or components that are no longer raw materials but have yet to become finished products.
   - E.g. palm oil, flour, wood block, nails and screws, etc.
3) Finished-goods inventory
   - An end item ready to be sold, but still an asset on the company's books.
4) Maintenance/Repair/Operating
   - Consist of item that are necessary to keep machinery and process productive

Types of Inventory

Raw materials   Components   Work-in-progress   Finished goods   Distribution inventory   Maintenance, repair & operating supplies
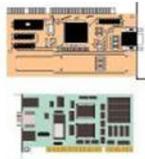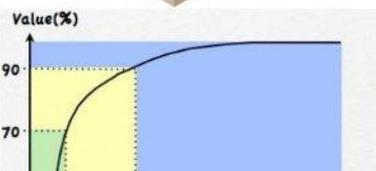
ABC analysis of Inventory

C 15% B 20% A 65%

- Be a Supply Chain Leader

Criteria	Class		
	A	B	C
Number of Items	10%	20%	70%
Value, $	70%	20%	10%
Stock Control	Strict	Moderate	Loose

Value(%)

90

70

What is cycle counting?

- Cycle counting is a way to audit a smaller subset of your inventory in a specified location on a specified day.

- This happens continuously, dependent upon the amount of inventory you have in stock. The cycle count process could take anywhere from a week to several months.

Inventory Record Accuracy

- Operate an effective materials management system
- Maintain customer service
- Operate effectively and efficiently
- Analyse inventory

- *The system is only as good as the data used*

Control of Service Inventories

▶ Can be a critical component of profitability

▶ Losses may come from shrinkage or pilferage

▶ Applicable techniques include

1. Good personnel selection, training, and discipline
2. Tight control of incoming shipments
3. Effective control of all goods leaving facility

What Is Inventory Control

🐞 Inventory control is a planned approach of determining what to order, when to order and how much to order and how much to stock so that costs associated with buying and storing are optimal without interrupting production and sales.

Objectives Of Inventory Control

1. To ensure adequate supply of products to customer and avoid shortages as far as possible.
2. To make sure that the financial investment in inventories is minimum (*i.e.,* to see that the working capital is blocked to the minimum possible extent).
3. Efficient purchasing, storing, consumption and accounting for materials is an important objective.
4. To maintain timely record of inventories of all the items and to maintain the stock within the desired limits.
5. To ensure timely action for replenishment.
6. To provide a reserve stock for variations in lead times of delivery of materials.
7. To provide a scientific base for both short-term and long-term planning of materials.

Inventory Models
Economic Order
Quantity (EOQ)

Economic Order Quantity - an inventory-control technique that minimizes the total of ordering and holding costs.

EOQ is one of the most commonly used inventory –control techniques. This technique is relatively easy to use but is based on several assumptions:

ordering cost = the cost of ordering process
holding or carrying cost = the cost to keep or carry inventory in stock
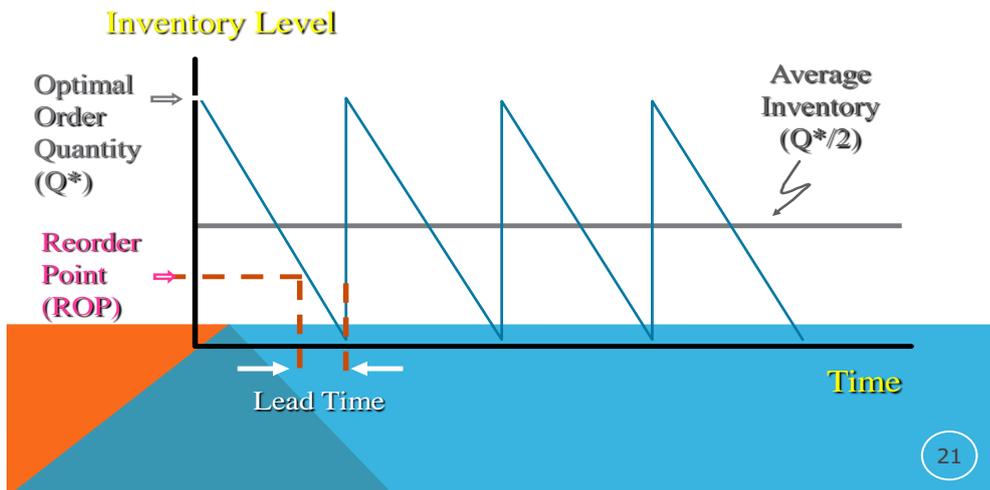
ASSUMPTIONS OF EOQ

o Demand for the product is constant
o Lead time is constant
o Price per unit is constant
o Inventory carrying cost is based on average inventory
o Ordering costs are constant per order
o All demands for the product will be satisfied (no back orders)

Model 1 : Basic EOQ
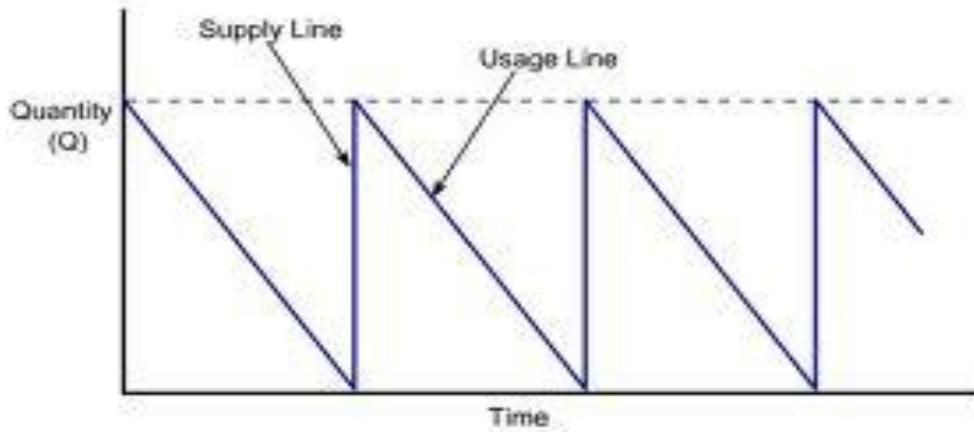
Model 2 : EOQ With Lead Time

No	Definition	Formula
1	Economic Order Quantity (EOQ)	$EOQ = \sqrt{\dfrac{2DCo}{Ch}}$
2	Ordering Cost (Co)	$Co = \dfrac{D}{EOQ} \times Co$
3	Holding Cost (Ch)	$Ch = \left[\dfrac{EOQ}{2} + SS\right] \times Ch$
4	No. of orders placed per year	$N = \dfrac{D}{EOQ}$
5	Expected time between orders or Cycle Time	$T = \dfrac{working\ days\ per\ year}{N}$
6	Total Annual Variable Inventory Cost (TC)	$TC = Co + Ch$
7	Total Annual Variable Inventory Cost, TC (inclusive of cost of material purchased)	$TC = Co + Ch + PD$
8	Average Inventory Level	Max inventory level $\div$ 2 or $SS + EOQ/2$
9	Max inventory level	EOQ + ss
10	Daily demand, d	$D = \dfrac{D}{no\ of\ working\ days\ in\ a\ year}$
11	Reorder Point (without safety stock)	ROP = d x L
12	Reorder Point (with safety stock)	ROP = (d x L) + ss

*Reminder:

Holding cost must be in an annual basis. That means if for example you're given H=Rm 0.002/unit/day, then you need to multiply it to 365 days a year. So in this case, the correct holding cost is:

= RM 0.02/unit/day x 365 days/year

= RM 7.36/unit/year

No	Symbol	Definition
1	Q	Order quantity (no of units per order)
2	D	Annual demand
3	d	Daily demand
4	Co	Ordering cost or setup cost
5	Ch	Holding cost or carrying cost
6	N	No of order per year (how many times we place order per year)
7	T	Time between order
8	P	Price per unit

Example 1:

Ziniria Sdn Bhd a biscuits manufacturer needs 500,000 units of raw material in a year. Handling cost is 20% from its purchase price. Ordering cost is RM 90. Purchase price for the material is RM 2.00 per unit. Management of Ziniria Sdn Bhd has decided to have a safety stock of 15,000 units. Delivery time for the order is 7 days. Assume that Ziniria Sdn Bhd working time is 50 weeks per annum.

Find:
a)   Economic Order Quantity
b)   Number of order per year
c)   Reorder level
d)   Average stock

Solution:

a)   EOQ $= \sqrt{\dfrac{2DCo}{Ch}}$

= √ [2(500 000) (RM90)/ (RM2 x 0.2)]
=√ 225 000 000
= 15 000 units

b)   Number of order per year = N $= \dfrac{D}{EOQ}$

= 500 000/15 000
= 33 times

c)   Reorder level (ROP) = (d x L) + ss

= [7 d x (500 000/ 50w x 7 d)] + 15 000
= [7d x (500 000/350d)] + 15 000
=10 000 + 15 000
= 25 000

d)   Average stock =   SS + EOQ

        = 15 000 + (15 000/2)
        = 7 500 + 15 000
        = 22 500

Example 2:

Resolusi Enterprise, a distributor of spare part TX-ray, offers its customers some quantity discounts as follows:

Discount Schedule	
Range	**Price**
1 – 999	RM 7
1000 – 2999	RM 6.80
3000 or more	RM 6.75

Hanan Company a manufacturer of product X which uses TX-ray presently is looking for a new supplier of the spare part. Having heard Resolusi Enterprise Hanan Company decides to take advantage of its offer. The ordering cost is RM25, while the annual carrying costs are 20% of purchase cost. The company uses 5500 units of TX-ray per year. Help Hanan Company determine an order quantity that will minimize the total cost.

Solution:

1.   Find the EOQ for each price

a. EOQ at RM 6.75 $= \sqrt{\dfrac{2DCo}{Ch}}$

        $= \sqrt{2(5500)(25)/(0.2)(6.75)}$
        = 451 units (not a feasible EOQ)

EOQ at RM 6.80 $= \sqrt{\dfrac{2DCo}{Ch}}$

        $= \sqrt{2(5500)(25)/(0.2)(6.80)}$
        = 450 units (not a feasible EOQ)

EOQ at RM 7.00 $= \sqrt{\dfrac{2DCo}{Ch}}$

        $= \sqrt{2(5500)(25)/(0.2)(7.00)}$
        = 443 units (a feasible, 443 units falls in the RM 7 range 0-999)

2.   Compute the TC for 443 units and compare it to the cost of minimum quantity necessary to obtain a price of RM 6.80 and RM 6.75 per unit.

$$TC = Co + Ch + PD$$

TC@ 443 units =   [(5500/443)(RM25)]+ [(443/2)(0.20)(RM7)] + [(5500)(RM7)]

                =   RM 310.10 + RM 310.38 + RM 38 500

                =   <u>RM 39 120.48</u>

TC@1000 units =

                =

                =

TC@3000 units =

                =

                =

Just In Time

- A production strategy that strives to improves a business return on investment by reducing in-process inventory and associated carrying costs.
- "A technique for the organisation of work-flows, to allow rapid, high quality, flexible production whilst minimising manufacturing waste and stock levels."
  - JIT systems are designed to produce or deliver goods just as they needed.

The Key Features Of JIT

The production line is run on a demand pull basis, so that activity of each work

Set-up time and manufacturing lead time are

The production line is stopped if parts are absent or defective work is discovered. In absence of buffer stock emphasis is placed on 'doing the job right the first time'.

Objective of JIT:

i. Achieve zero level inventory
ii. Meet production requirement accurately
iii. No wastage
iv. Satisfy customer needs

Benefits Of JIT:

- JIT cuts the cost of quality
- Due to less or no inventory, damage inventory cost can be avoided

- JIT improves quality
- JIT reduces waiting time and limits the number of potential errors

- Produce quality product
- Reduce wastage
- Improve relationship between employees within the organization & between company and suppliers

JIT method is a philosophy, which believes that waste can be eliminated by cutting unnecessary inventory and removing non value-added activities in operations. The goals are to produce goods and services are specifications and continuous improvement through value additions.

EXERCISES QUESTIONS:

Q1:

Jubah Muslimah Company has a working system of 360 days a year. The company wants to buy raw materials in bulk to enable the company to get discount. In meeting the customer demand, the company wants to use the raw material of 3000 units per month with RM 30 per unit. The ordering cost is RM 200 and the carrying cost is RM 100 not including the warehouse rental and insurance costs. The warehouse rental cost is RM 150 and insurance cost is RM 50. The buying discounts offered by the suppliers are as follows:

No of Orders	Price Per Unit
1 - 299	RM 42
300 - 599	RM 37
600 +	RM 32

Calculate:

a) The most economic order quantity

b) The total cost for each quantity discount

Q2:

a. Syarikat BB Berhad purchases 8 000 BB1 each year, as component in minicomputer. The unit cost of each BB1 is RM10 and the carrying cost for one BB1 is RM 3. Ordering cost is RM 30 per order. Working days is 365 days. Calculate:

a) The optimal order quantity (EOQ)

b) The number of orders placed each year.

c) The expected time between order

d) The total cost by considering the optimal order quantity.

b. Amazing Manufacturing Co. Makes and sells toy race cars. Amazing Manufacturing Co. Forecast toy race car production will be 1 000 unit next year, with an average daily demand of 4 units. However the production process is most efficient at 8 units per day. So the company produces 8 units per day but uses only 4 units per day. The company wants to solve the optimum number of units per order per year. The setup cost is RM10 and the holding cost is RM0.50. (Note: working days is to 250 days per year).

Compute the optimal order quantity (EOQ)

Q3:

List the four types of inventory.

Q4:

Farm Freshy produces a product for which the annual demand is 10,000 units. Production averages 100 per day, while demand is 40 per day. Holding costs are RM2.00 per unit per year; set-up costs RM200.00. If they wish to produce this product in economic batches, what size batch should be used? What is the maximum inventory level? How many order cycles are there per year? How much does management of this good in inventory cost the firm each year?
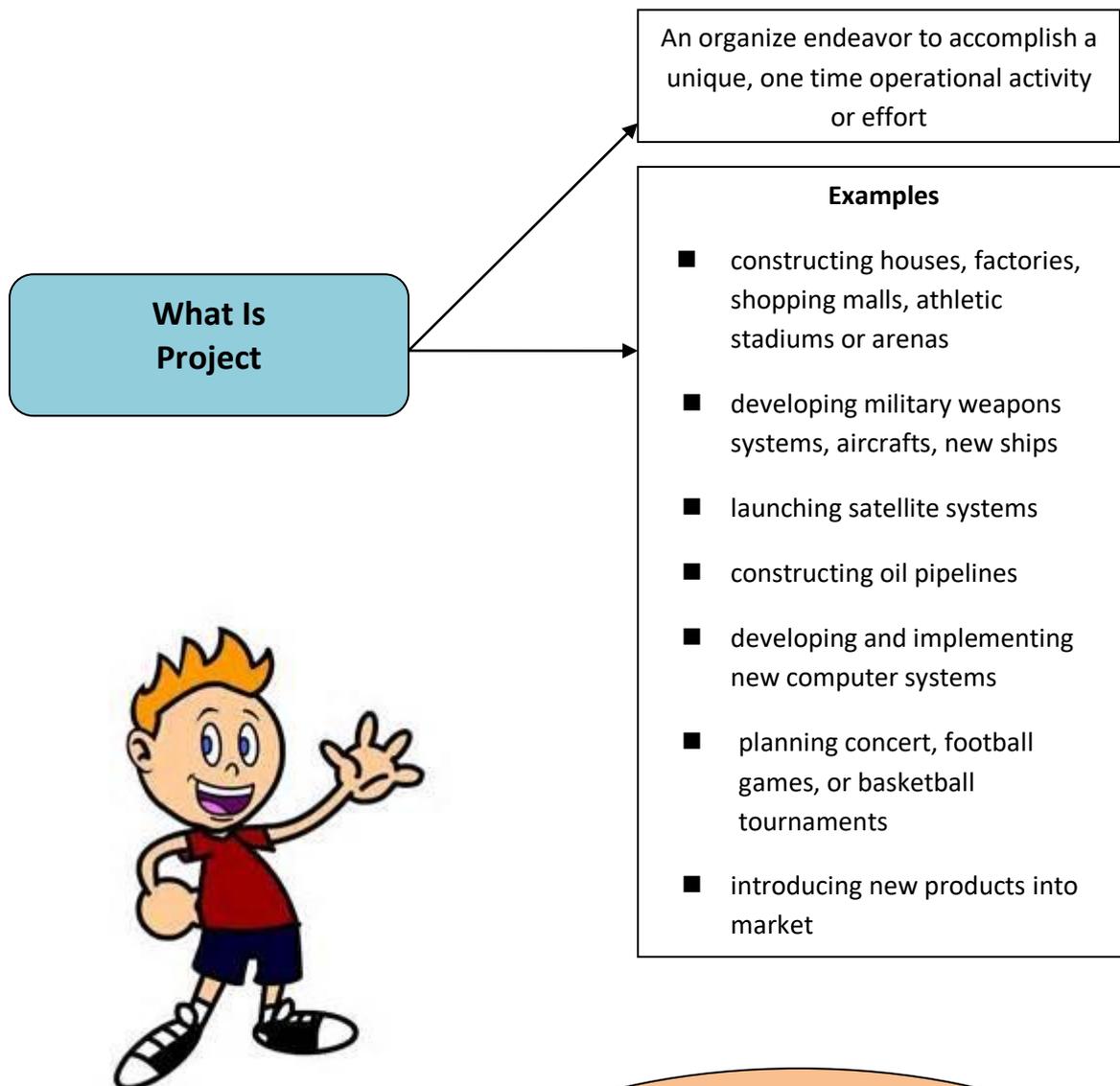

Q5:

Lead time for one of Farm Freshy's fastest moving products is 4 days. Demand during this period averages 100 units per day. What would be an appropriate re-order point?

TOPIC 7: PROJECT SCHEDULING AND SOURCE ALLOCATION

Course Learning Outcome: Apply various techniques and methods towards decision making in operation management. (CLO2)

Learning Outcome: Analyze project management in operations management and determine the importance of maintenance in operations.

An organize endeavor to accomplish a unique, one time operational activity or effort

What Is Project

Examples

■ constructing houses, factories, shopping malls, athletic stadiums or arenas

■ developing military weapons systems, aircrafts, new ships

■ launching satellite systems

■ constructing oil pipelines

■ developing and implementing new computer systems

■ planning concert, football games, or basketball tournaments

■ introducing new products into market

What is Project Management?

● The planning of project and controlling of project activities, subject to resources and budget constraints, in order to keep the project on schedule.

Phases Of Project Management

1. PLANNING

- This phase includes goal setting, defining the project & team organization

2. Scheduling

- This phase relates people, money & supplies to specific activities & relates activities to each other
- Project scheduling involves sequencing & allotting time to all project activities.
- At this stage, manager decides how long each activity will take & compute how many people and materials will be needed at each stage of production.
- Most common project scheduling approach is *Gantt Chart*.
- *Gantt Chart* is a planning chart to schedule resources & allocate time
- *Gantt Chart* helps manager to make sure;

  ➢ Activities are well planned
  ➢ Order of performance is documented
  ➢ Activity time estimates are recorded
  ➢ Overall project time is developed

	Time								
	J	F	M	A	M	J	J	A	S
Design	████████████████								
Prototype			████						
Test				████████					
Revise				████████					
Production						████████████			
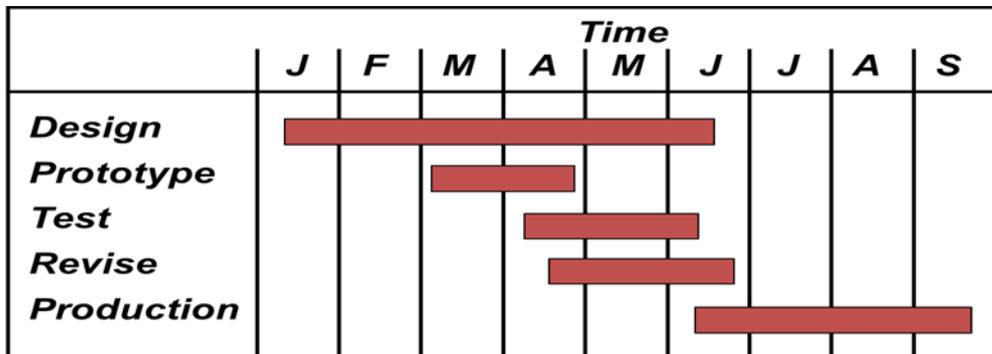
3. CONTROLLING

- Here the firm monitors resources, costs, quality, and budgets.
- It also revises or changes plans and shifts resources to meet time & cost demand.

Planning the Project

Time / Cost / Performance — Set the goals

Define the project

Develop work breakdown schedule

Identify team/ resources

Scheduling the Project

Sequence activities

Assign people — Adams, Smith, Jones

Schedule deliverables — 1.1, 1.2, 2.0, 2.1, 2.11

Schedule resources — June S M T W T F S 1 2 3 4 5 6 7 8 9 10 11 12 13

Controlling the Project

Revise and change plans

Monitor resources, costs, quality — 1.1, 1.2, 2.0, 2.1, 2.11

Shift resources — Adams, Smith, Jones

Before project ——— Start of project / Timeline ——— During project

(Figure 1 project Planning, Scheduling &

Project Management

The Project Manager blamed the Planners!.. She said the whole thing was becoming IMPOSSIBLE, and left town!

FOR SALE
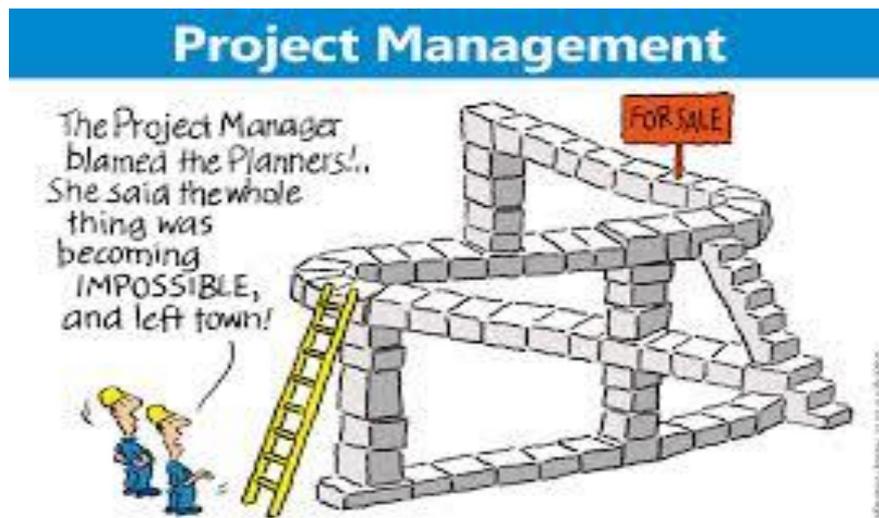
Project Management Techniques

- Program evaluation & review technique (**PERT**) and the Critical Path Method (CPM) were both developed in the 1950s to help managers schedule, monitor & control large & complex projects.
- *PERT* is a project management technique that employs three time estimates for each activity.
- *CPM* is a project management technique that uses only one time factor per activity.
- *Critical Path* is the computed longest time path(s) through a network

Steps In PERT & CPM

1. Define the project & prepare the work breakdown structure
2. Develop the relationships among the activities. Decide which activities must precede & which must follow others
3. Draw the network connecting all the activities
4. Assign time and/or cost estimates to each activity
5. Compute the longest time path through the network. This is called the **critical path**
6. Use the network to help plan, schedule, monitor & control the project

- *Finding the Critical Path is important in controlling a project.*
- *The activities on the critical path represent tasks that will delay the entire project if they are not completed on time*
- *Although PERT & CPM differ to some extent in terminology & in the construction of the network, their objectives are the same.*

Importance Of PERT & CPM

PERT & CPM are important because they can help answer questions about the projects such as:

i.   When will the entire project be completed?

ii. What are the critical activities or tasks in the project – which activities will delay the entire project if they are late?

iii. Which are the non-critical activities – the ones that can run late without delaying the whole project's completion?

iv. What is the probability that the project will be completed by a specific date?

v.   At any particular date, is the project on schedule, behind schedule or ahead of schedule?

Terminology used in Project Management

1.   Activity (symbol: ———————▶ =   arrow)

   (sometimes called task, job or operation)
   Project work/task needed to be completed; consumes times and other resources. The activity that must be performed just before a particular activity is its Predecessor Activity.

2.   Event (symbol : ◯   = node / circle)

   A point in time that represents the start or completion of a set of activities or a point in time at which activities begin or end.

3.   Dummy Activity

   - A fictitious activity consuming no time or other resources but is used merely to indicate a precedence relationship.
   - You may encounter a network that has two activities with identical starting and ending events. Dummy activities and events can be inserted into the network to deal with this problem.
   - The use of dummy activities and events is especially important when computer programs are to be employed in determining the critical path, project completion time and so on. Separate identities are particularly important for computer analysis, because most computer programs identify activities by their endpoint, activities with the same endpoints could not be distinguished from each other, although they might have quite different expected times.
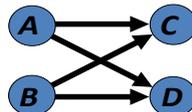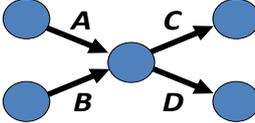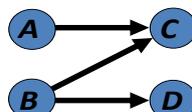   - Dummy activities and events can also ensure that the network properly reflects the project under consideration.

- The first step in a PERT or CPM network is to divide the entire project into significant activities in accordance with the network breakdown structure.
- There are TWO approaches for drawing a project network

  a. Activity-on-node (AON)
     - A network diagram in which nodes designate activities
  b. Activity-on-arrow
     - A network diagram in which arrows designate activities
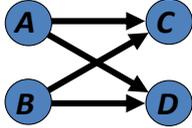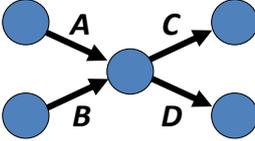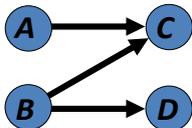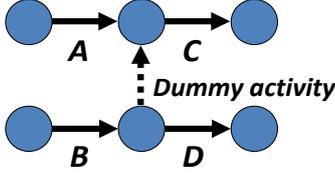
A Comparison of AON and AOA Network Conventions

Activity on Node (AON)	Activity Meaning	Activity on Arrow (AOA)
(a) A → B → C	A comes before B, which comes before C	A → B → C
(b) A, B → C	A and B must both be completed before C can start	A, B → C
(c) A → B, C	B and C cannot begin until A is completed	A → B, C
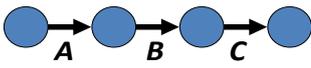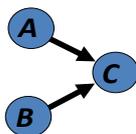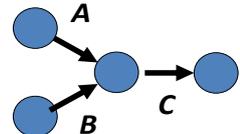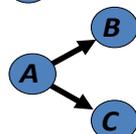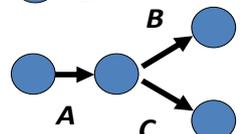
A Comparison of AON and AOA Network Conventions

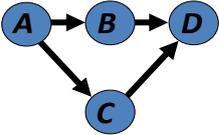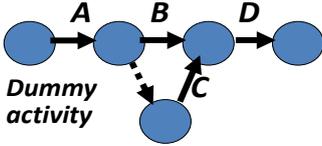| Activity on Node (AON)	Activity Meaning	Activity on Arrow (AOA)
(d) A, B → C, D	C and D cannot begin until A and B have both been completed	A, B → C, D
(e) A → C; B → C, D	C cannot begin until both A and B are completed; D cannot begin until B is completed.	*A dummy activity is introduced in AOA*

A Comparison of AON and AOA Network Conventions

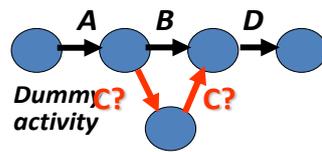| Activity on Node (AON)	Activity Meaning	Activity on Arrow (AOA)
(d)	C and D cannot begin until A and B have both been completed	
(e)	C cannot begin until both A and B are completed; D cannot begin until B is completed. A *dummy activity* is introduced in AOA	Dummy activity

A Comparison of AON and AOA Network Conventions

Activity on Node (AON)	Activity Meaning	Activity on Arrow (AOA)
(f)	B and C cannot begin until A is completed. D cannot begin until both B and C are completed. A dummy activity is again introduced in AOA.	Dummy activity

B and C cannot begin until A is completed. D cannot begin until both B and C are completed. A dummy activity is again introduced in AOA.

AOA

- one arrow represents one activity only.

- Which one activities represent the Dummy?
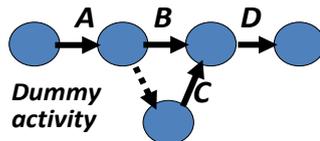
- In (a), activity A must be finished before activity B is started, and B must be completed before activity C begins.
- In (c), illustrate that sometimes **dummy activity** needs to be applied to clarify relationship.
- A dummy activity consumes no time or resources. It is used to facilitate activities linkages.
- But, the number of dummy must be kept at minimum.

PERT Predecessors Schedule

- Divided into **THREE** columns: (1) Activity, (2) Precedent Activity, (3) Time

Example 1:

ACTIVITY	PRECEDENT ACTIVITY	TIME
A	-	3
B	-	5

Example 2:

ACTIVITY	PRECEDENT ACTIVITY	TIME
A	-	4
B	-	1
C	B	1
D	A, C	3

Example 3:

ACTIVITY	PRECEDENT ACTIVITY	TIME
A	-	4
B	-	1
C	A, B	1

3 Time Estimate In PERT

1. **Optimistic Time (a)**
   - The best activity completion time that could be obtained in a PERT network

2. **Pessimistic Time (b)**
   - The worst activity time that could be expected in a PERT network

3. **Most Likely Time (m)**
   - The most probable time to complete an activity in a PERT network

Time (t) and variance (v) can be calculated by using these three time estimates:

$$t = \frac{(a + 4m + b)}{6}$$

Exercise 1:

Activities	Time			Expected Time
	(a)	(m)	(b)	(t)
A	1	2	3	
B	2	3	4	
C	1	2	3	
D	2	4	6	
E	1	4	7	
F	1	2	8	
G	3	4	11	
H	1	2	3	

Critical Path Analysis (CPM)

- As mentioned earlier, the critical path is the *longest* time path through the network.
- To find the critical path, we calculate two distinct starting and ending times for each activity.
- Important terms in PERT and CPM drawings:

    a. Earliest start (ES)
- Earliest time at which an activity can start, assuming all predecessors have been completed

    b. Earliest finish (EF)
- Earliest time at which an activity can be finished

    c. Latest start (LS)
- Latest time at which an activity can start so as to not delay the completion time of the entire project

    d. Latest finish (LF)
- Latest time by which an activity has to finish so as to not delay the completion time of the entire project

Earliest Start Time Rule

- Before an activity can start, all its immediate predecessors must be finished

  ➢ If an activity has only a single immediate predecessor, its ES equals the EF of the predecessor.
  ➢ If an activity has multiple immediate predecessors, its ES is the maximum of all EF values of its predecessors

> ES = Max {EF of all immediate predecessors}

Earliest Finish Rule

- The earliest finish time (EF) of an activity is the sum of its earliest start time (ES) and its activity time

> EF = ES + activity time
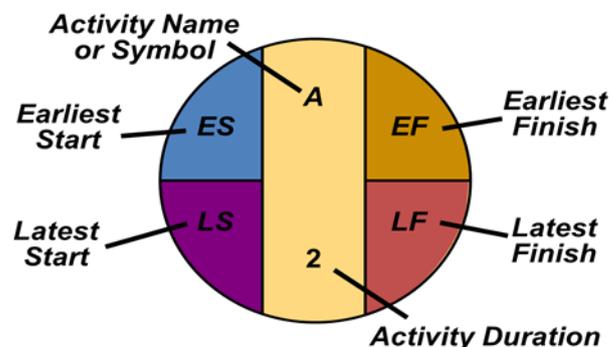
Example: Milwaukee Paper Manufacturing's Activities & Predecessors

Activity	Description	Immediate	Time (weeks)
A	Build internal components	—	2
B	Modify roof and floor	—	3
C	Construct collection stack	A	2
D	Pour concrete and install frame	A, B	4
E	Build high-temperature burner	C	4
F	Install pollution control system	C	3
G	Install air pollution device	D, E	5
H	Inspect and test	F, G	2
	Total Time (weeks)		**25**

Step 1
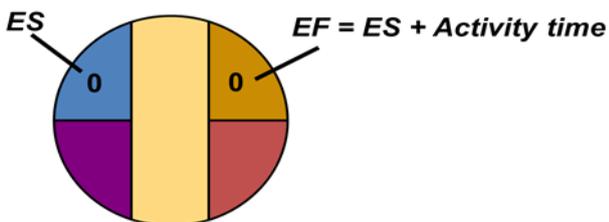
Step2

Step 3
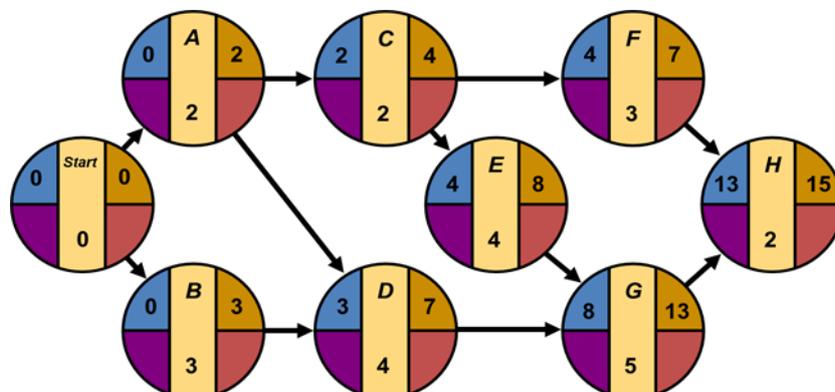
Step 4
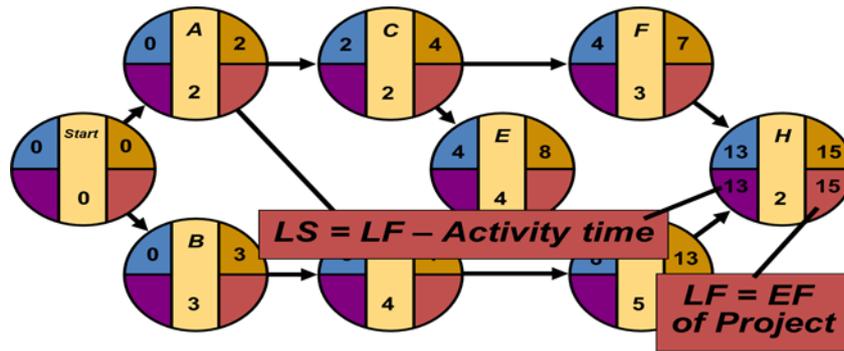

Step 5

= Max (2, 3)
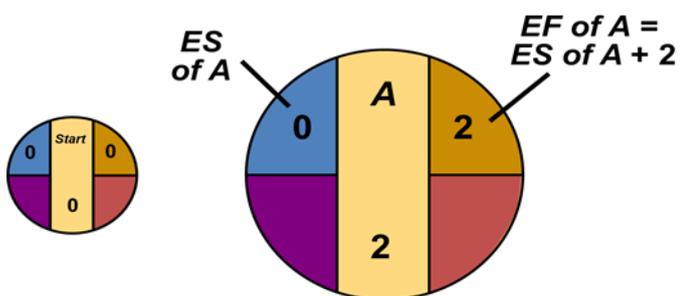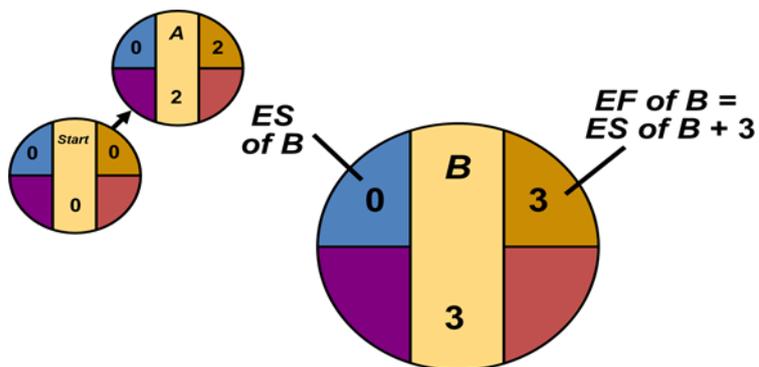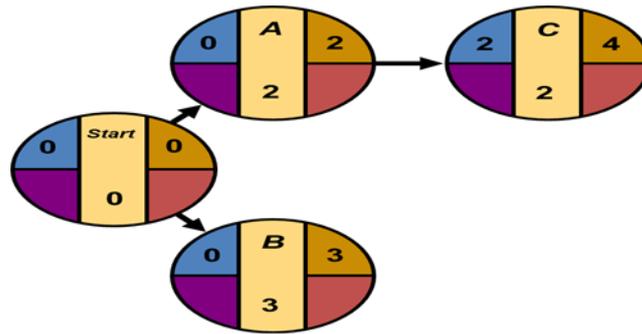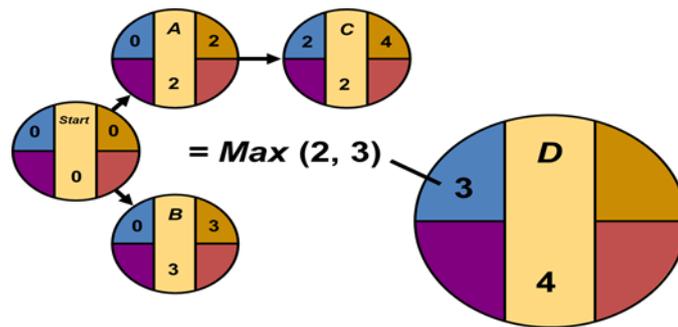
Step 6
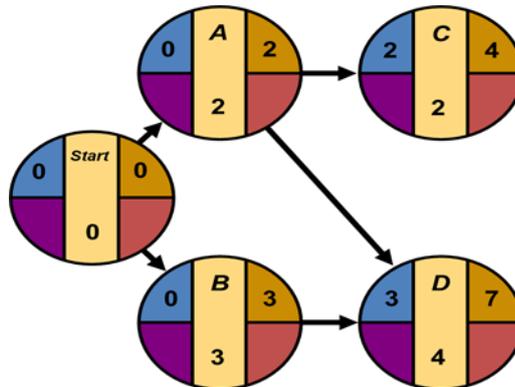
Step 7

Step 8

Calculating Slack Time & Identifying The Critical Path

- Slack is the length of time an activity can be delayed without delaying the entire project

$$Slack = LS - ES \quad or \quad Slack = LF - EF$$

Activity	Earliest Start ES	Earliest Finish EF	Latest Start LS	Latest Finish LF	Slack LS − ES	On Critical Path
A	0	2	0	2	0	Yes
B	0	3	1	4	1	No
C	2	4	2	4	0	Yes
D	3	7	4	8	1	No
E	4	8	4	8	0	Yes
F	4	7	10	13	6	No
G	8	13	8	13	0	Yes
H	13	15	13	15	0	Yes

Thus, the critical path of Milwaukee Paper Manufacturing Project may be determined after slack time has been calculated:
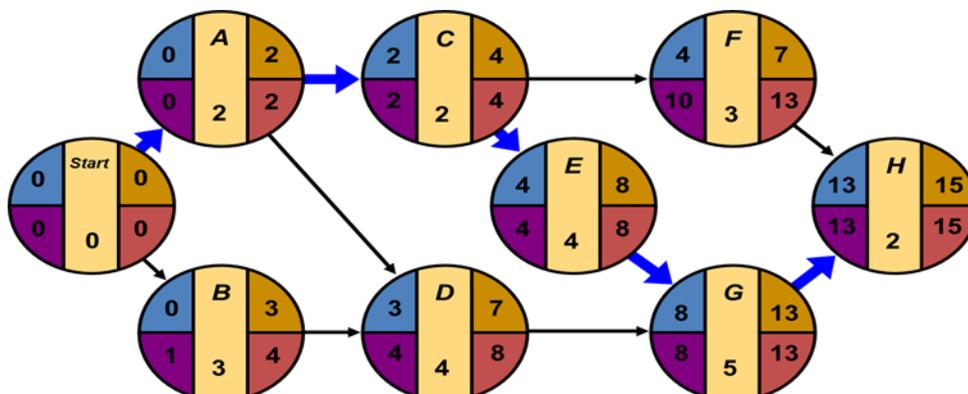
Maintenance In Operations

Definitions:

All activities involved in ensuring that facilities and equipment are in working order.

Importance:

- It maintains the capability of system
- It ensures that production meets the expected quality, specification and target
- It prevents work stoppage caused by equipment malfunctions
- It minimizes costs
- It ensures the entire workplace is safe

Types of maintenance

Preventive Maintenance *before a failure has occurred* **vs** **Corrective Maintenance** *after a failure has occurred*

- Routine inspection and servicing to keep facilities in good repair

- Emergency or priority repairs on failed equipment

COMMON BUILDING MAINTENANCE JOBS

JANITOR | MAINTENANCE TECHNICIAN | MAINTENANCE SUPERVISOR | FACILITY MANAGER

EXERCISES QUESTIONS:

Q1:

LMS Co. is a construction company. This company will construct a building in Kelang area. The schedule below shows the activity and activity time (week) for the project. You are required to:

Activity	Predecessor Activity	Optimistic time	Most likely	Pessimistic time
A	-	5	6	13
B	A	3	4	11
C	A	18	20	28
D	B,C	9	12	15
E	B,C	9	11	19
F	C	4	5	6
G	B	2	4	12
H	G	25	30	35
I	D,G	6	8	10
J	E,F,H,I	9	10	23

a)   Determine the time (t) required for each activity.

b)   Construct a complete project network

c)   Identify the critical path and time for the project to be completed

Q2:

You are required as the project manager to build a house. The activities and duration needed (in days) are as follow:

Activity	Description	Immediate Predecessor	Duration (Days)
A	Build foundation	-	6
B	Build walls, ceiling	A	9
C	Build roof	B	14
D	Do writing	B	7
E	Put in windows	B	6
F	Put in siding	E	6
G	Paint house	C,F	4

You are required to:

a)   Construct a complete project network

b)   Identify the critical path

c)   Calculate the time for the project to be completed

Q3:

What are the objectives of project management.

Q4:

Explain types of maintenance with example.

Q5:

Describe the importance of maintenance by giving four reasons.

TOPIC 8: EFFICIENCY AND QUALITY IMPROVEMENT CONCEPT

Course Learning Outcome: Describe clearly the concept of operation and quality management system. (CLO1)

Learning Outcome: Ascertain quality management concept & apply Total Quality Management. (TQM)

Quality is a wonderful tonic for improving operations. Managing quality helps build successful strategies of differentiation, low cost and response.
Quality can be defined as "*the ability of a product or service to meet customer needs*".
For example: defining customer quality expectation helps us in determining what to produce to meet that expectation. If this happen, it means we are producing efficiently (based on what customer needs and wants) and it means profit!

Quality based on categories:

- Product based – measured based on the characteristics or attributes of products
- User experience – refer to the extent to which goods or services give satisfaction to user.
- Production based – determined by how closely products meet the desired specifications and standards
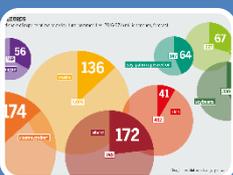
IMPORTANCE OF QUALITY
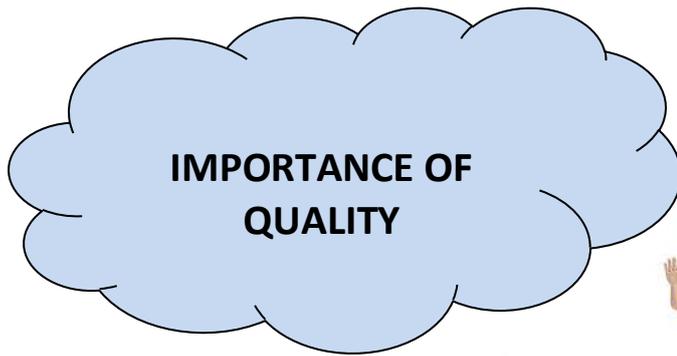
Will portray a good image of the company

Competitive advantage that can be used by companies to compete in the market

Will be able to dominate the market

Customers often value the price as well the quality of the products and services that they are paying for.
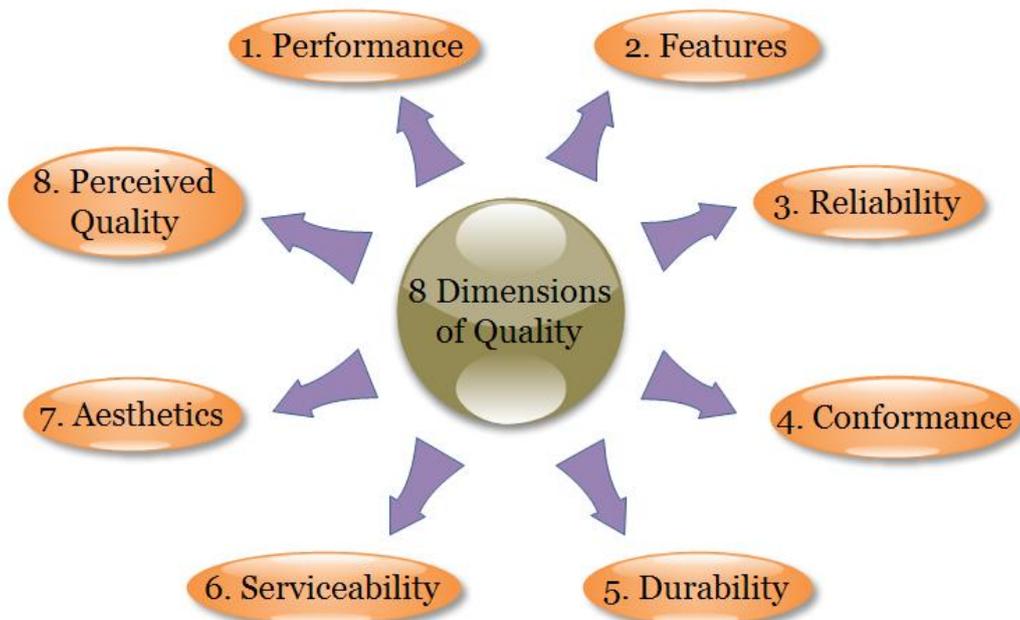
Will enhance reputation of companies

Will take legal action against the manufactures if poor quality product and pose harm to customers.

OBJECTIVES OF QUALITY MANAGEMENT:

1. **Ensure companies produce goods and services that meet standards or specification**
2. **Reduce the production costs that are linked to non-compliance of standards and specification.**
3. **Ensure the product and services are always well received by users.**
4. **Protect companies from lawsuits caused by producing goods that are harmful to the customers.**
5. **Provide assurance to the management and users that the products produced have been designed, manufactured and marketed in compliance with the required standards.**
6. **Achieve zero defects by producing high-quality products, starting from the beginning till the end of the process, instead of defecting products through inspections.**

QUALITY DIMENSIONS FOR GOOD & SERVICES

- 1. Performance
- 2. Features
- 3. Reliability
- 4. Conformance
- 5. Durability
- 6. Serviceability
- 7. Aesthetics
- 8. Perceived Quality

8 Dimensions of Quality
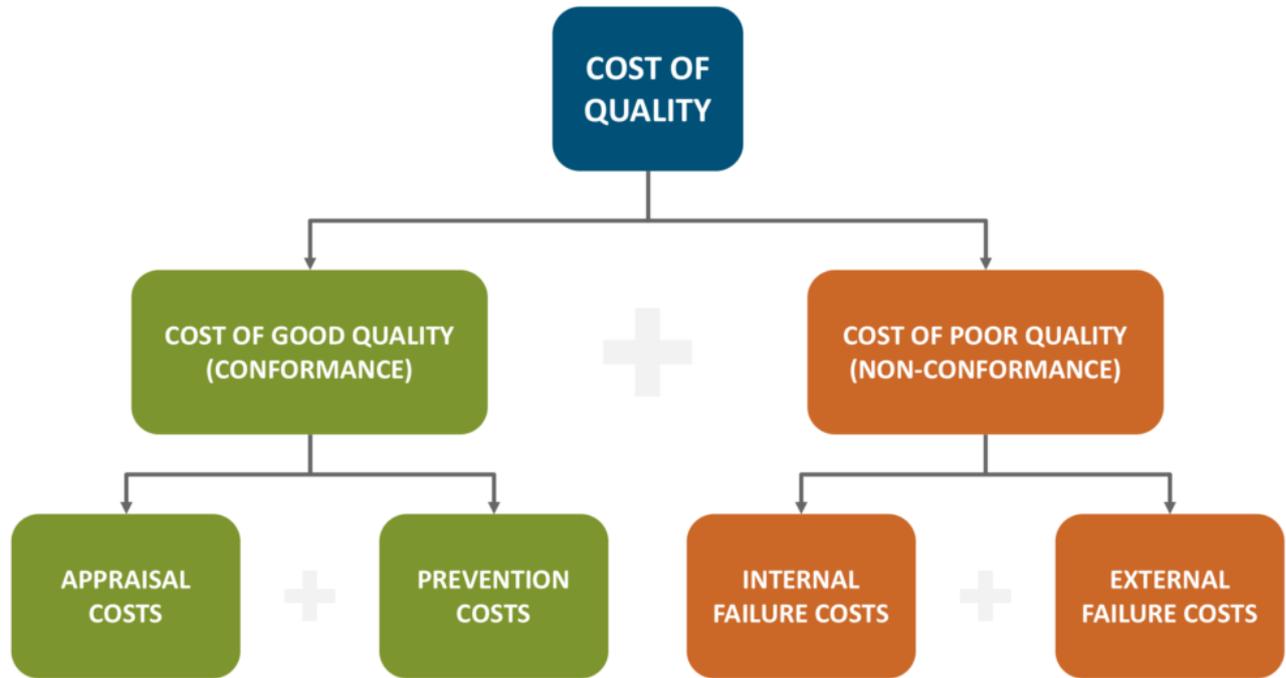
STAGES IN QUALITY CONTROL

- Product or process design stage.
  - Product design must be easy for manufacturing .
  - Materials selected must also be able to go through the production process.
  - machinery used should be of high quality .
  - The process for making the product must fit the product requirement.
  - For services , the designer must determine the level of customers involvement in the services process.

- Manufacturing Stage

  | inspection of raw materials received | inspection during the production process | inspection of the finished goods |

- After sale stage

  -Companies must ensure that their after-sales services to customers are of high quality and it will be easy for customers to claims.
  -Company must monitor the returned goods process and warranty claims, so that corrective action can be taken.

COST OF
QUALITY

COST OF GOOD QUALITY
(CONFORMANCE)

COST OF POOR QUALITY
(NON-CONFORMANCE)

APPRAISAL
COSTS

PREVENTION
COSTS

INTERNAL
FAILURE COSTS

EXTERNAL
FAILURE COSTS

Cost of Conformance

Prevention Costs
(Build a quality product)

- Training
- Document processes
- Equipment
- Time to do it right

Appraisal Costs
(Assess the quality)

- Testing
- Destructive testing loss
- Inspections

Money spent during the project
to avoid failures

Cost of Nonconformance

Internal Failure Costs
(Failures found by the project)

- Rework
- Scrap

External Failure Costs
(Failures found by the customer)

- Liabilities
- Warranty work
- Lost business

Money spent during and after
the project **because of failures**

TOTAL QUALITY MANAGEMENT

Total quality management is a management system for a customer focused organization that involves all employee in continual improvement of all aspects of the organization. TQM uses strategy, data, and effective communication to integrate the quality principles into the culture and activities of the organization. **TQM** can be described as "*management of entire organization so that it excels in all aspects of products and services that are important to the customer*".
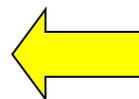
What is TQM?

Refers to managing the entire organizations so that it excels on all dimensions of product and services that are important from supplier to customer.
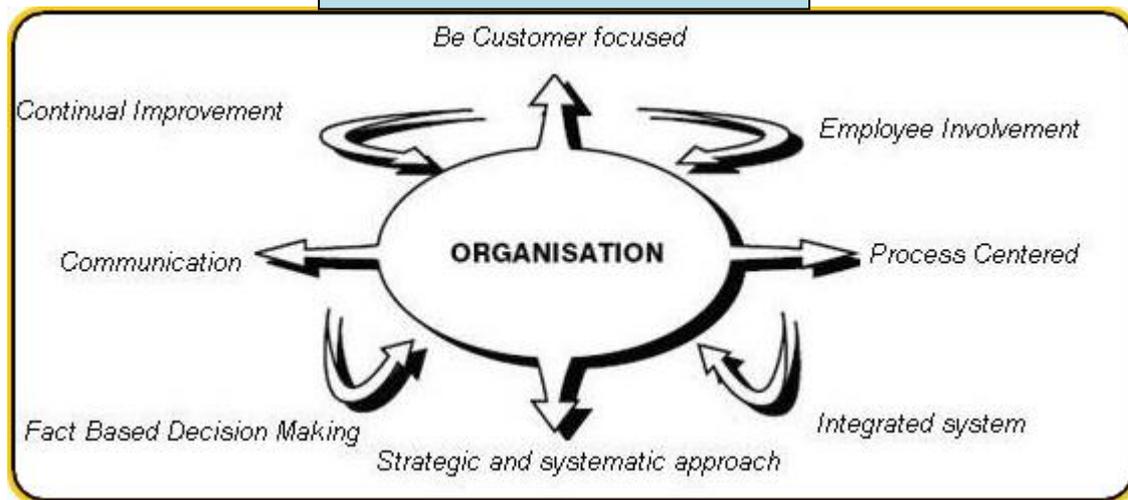
TOTAL : everyone is involved in

QUALITY : continuously improving service to customers

MANAGEMENT : with data and profound knowledge

TQM Concept

1-Be Customer focused: Whatever you do for quality improvement, remember that ONLY customers determine the level of quality. Whatever you do to foster quality improvement, training employees, integrating quality into processes management, **ONLY** customers determine whether your efforts were worthwhile.

2-Insure Total Employee Involvement: You must remove fear from work place, then empower employee you provide the proper environment.

3-Process Centered: Fundamental part of TQM is to focus on process thinking.

4-Integrated system: All employees must know the business mission and vision. An integrated business system may be modeled by MBNQA or ISO 9000

5- Strategic and systematic approach: Strategic plan must integrate quality as core component.

6- Continual Improvement: Using analytical, quality tools, and creative thinking to become more efficient and effective.

7- Fact Based Decision Making: Decision making must be ONLY on data, not personal or situational thinking.

**8- Communication:** Communication strategy, method and timeliness must be well defined.

OBSTACLES TO IMPLEMENTING OF TQM

1. Competitive markets
2. Bad attitudes / abdication of responsibility / management infallibility
3. Lack of leadership for quality
4. Deficiency of cultural dynamism
5. Inadequate resources for total quality management
6. Lack of customer focus
7. Lack of effective measurement of quality improvement
8. Poor planning
9. Lack of management commitment
10. Resistance of the workforce
11. Lack of proper training / inadequate Human Resources Development

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BENCHMARKING

</div>

- involves selecting a demonstrated standard of performance that represents the very best performance for a process or an activity
- process of identifying 'best practice' in relation to both product and the process by which those products are created and delivered.
- The objective of benchmarking is to understand and evaluate the current position of a business or organization in relation to best practice and to identify areas and means of performance improvement.

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THE STEPS OF DEVELOPING BENCHMARKING

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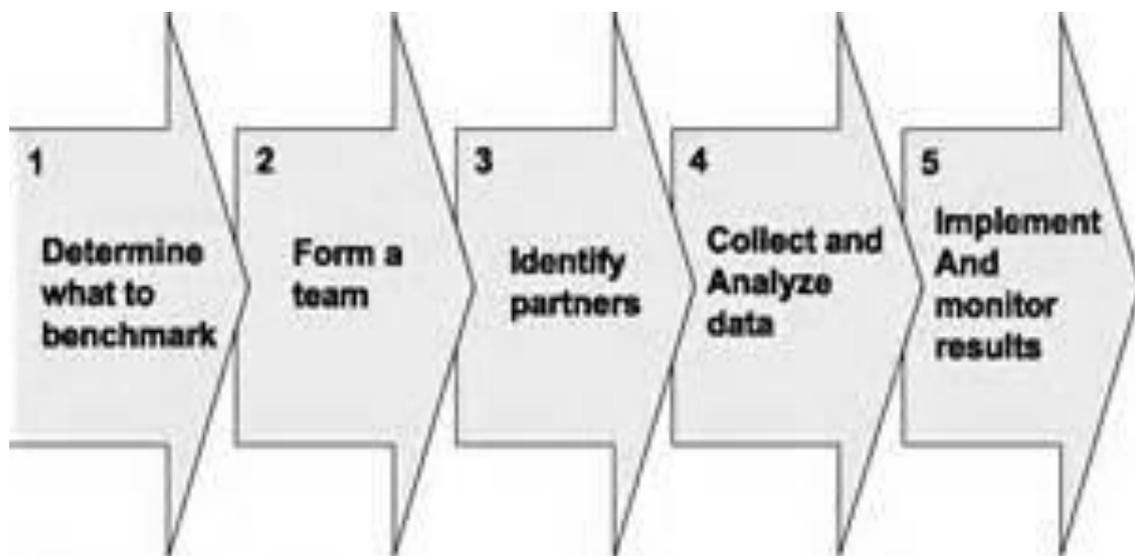
i. **Determine what to benchmark**
   o The plan should fit within the mosaic of the company – wide quality plan

ii. **Form a benchmark team**
   o A team represents the different perspectives, special skills, variety of business connections the individuals brings to the benchmarking process

iii. **Identify benchmark partners**

iv. **Collect & analyze benchmarking information**
   o Identify and analyze the gaps between best practice and your own business processes

v. **Take action to match or exceed the benchmark**
   o Develop strategies and action plans to close the gaps

i. **Internal Benchmarking**
   - The objective is to identify the internal performance standards of an organization
   - Usually practiced by large organizations with many divisions or business units in it.

ii. **Competitive benchmarking**
   - The objective is to compare with companies in the same markets which have similar competing products or services or work processes (direct competitors)
   - E.g. Kedai Runcit Pak Ali and Moonlight Sundry Shop both located in Kg. Likas (located in same area – same market and selling similar products – groceries)

iii. **Functional Benchmarking**
   - Benchmarking with other companies in the same industry who may have the same products or services but are not competitors in the same market
   - E.g. Kedai Runcit Pak Ali in Kg. Likas and Sunshine Sundry Shop in Sandakan (not in the same market)

iv. **Process Benchmarking**
   - Focuses on excellent work processes rather than on the business practices of a particular organization or industry
   - The most difficult and has potential of revealing the best of best practices.
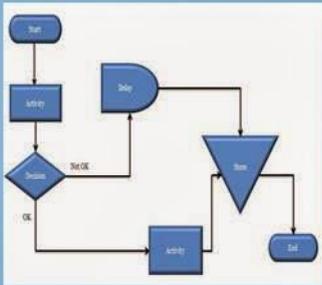
ADVANTAGES IN BENCHMARKING:

i. Better understanding of customer wants & expectations.
ii. Better economic planning of the purposes and the objectives of the company by centering on what can be done and what can't.
iii. Better increase of the productivity
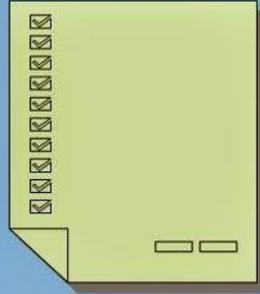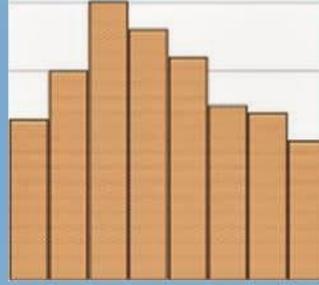iv. Company becomes more competent (competitive)
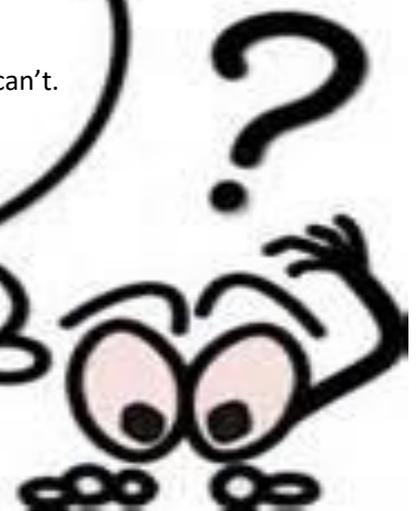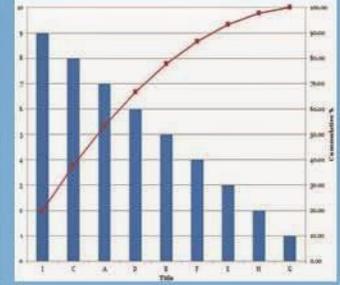
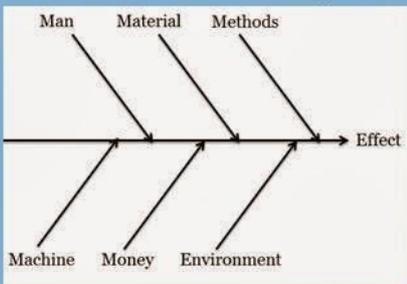7 Q C Tools

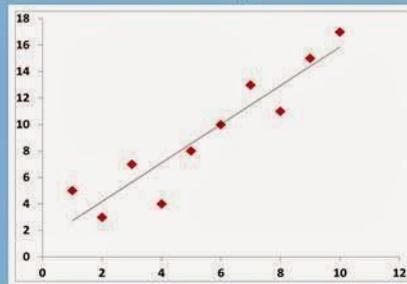Process Flow Diagram | Check Sheet | Histogram | Pareto Diagram

Cause and Effect Diagram | Scatter Diagram | Control Charts

QUALITY STANDARD

Quality Management system is a management technique used to communicate to employees what is required to produce the desired quality of products and services and to influence employee actions to complete tasks according to the quality specifications.

- Maintaining a minimum standard of quality (ensuring quality is preserved by organizations)

ISO 9000 (Quality Management)
- A set of quality standards developed by the International Organization for Standardization (ISO)
- ISO 9000 is the only quality standard with international recognition.
- ISO 9001:2008 sets out the criteria for a quality management system and is the only standard in the family that can be certified to (although this is not a requirement).
- It can be used by any organization, large or small, regardless of its field of activity.
- In fact ISO 9001:2008 is implemented by over one million companies and organizations in over 170 countries.
- ISO 9000:2005 – covers the basic concepts and language
- ISO 9004:2009 – focuses on how to make a quality management system more efficient and effective
- ISO 19011:2011 – sets out guidance on internal and external audits of quality management systems.

ISO 14000 (Environmental Management)
- A series of environmental management standards established by the International Organization for Standardization (ISO)
- Five core element: environmental management, auditing, performance evaluation, labeling and life cycle assessment.

ISO 31000 (Risk Management)
- ISO 31000:2009 *Risk management – Principles and guidelines*, provides principles, framework and a process for managing risk.
- It can be used by any organization regardless of its size, activity or sector.

ISO 26000 (Social Responsibility)
- ISO 26000 provides guidance on how businesses and organizations can operate in a socially responsible way.
- This means acting in an ethical and transparent way that contributes to the health and welfare of society.
- ISO 26000:2010 provides guidance rather than requirements, **so it cannot be certified to unlike some other well-known ISO standards.**

ISO 50001 (Energy Management)
- SO 50001:2011 – Energy Management System: Makes it easier for organizations to integrate energy management into their overall efforts to improve quality and environmental management.

ISO 4217 (Currency Codes)
- ISO 4217:2008 is to establish internationally recognized codes for the representation of currencies.
- Currencies can be represented in the code in two ways: a three-letter alphabetic code and a three-digit numeric code.
- E.g. RM, USD

1. MS ISO 9000 Series (MS ISO 9001:2008) - Quality Management (QMS)
2. MS ISO 14000 Series (MS ISO 14001:2004) - Environmental Management (EMS)
3. MS ISO/IEC 27000 Series - IT Security Management (ISMS)
   a. MS ISO/IEC 27001
   b. MS ISO/IEC 27002
4. MS ISO 31000 (MS ISO 31000: 2010) - Risk Management
5. MS ISO 50001 (MS ISO 50001:2011) - Energy Management

EXERCISES QUESTIONS:

Q1. Briefly explain the advantages of Just-In-Time (JIT) management in an organization.

Q2. Briefly explain the principles of TQM.

Q3. Identify the major concepts of TQM.

Q4. Identify the four costs of quality. Which one is hardest to evaluate? Explain.

Q5. What steps can be taken to develop benchmarks?

Knowing others is intelligence, knowing yourself is true wisdom.
(Lao Tse)

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