OPERATIONS MANAGEMENT AND STRATEGIC MANAGEMENT

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IMPORTANT

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Operations Management

Chapter 1: Operations Management- Introduction

Day to day activities

All activities

Raw material → Finished product or service → customers

- Plan → Kya (Goal), Kaise?
- Organise → Resources
- Staff → Personal
- Direct → Implementation
- Control → Everything as per plan

To achieve the organisation's goal

1) What is Operations Management ?

Operations Management

Encompasses (includes) management of

All organisational activities that

- Acquire the raw material (input)
- Process or convert into a consumable product
- As required to meet the needs of the end customer

	Input →	Conversion through Process →	Finished Product or Service
	Chips, motherboard, battery, camera etc..	Assemble and mount them, test performance, quality check, maintenance.	Fully assembled smartphone, ready for packing & distribution to consumer
NETFLIX	Dealing with movie makers	Arranging for live or recorded version transmission	Accessible content library, smooth streaming experience
	Curriculum (content, structure), support material	Teaching session and activities, student engagement	Enhanced knowledge skill, evaluation and feedback
	Paper, ink	Book, content, creation and printing	Final printed books provided to students

Conversion through Process → Goods:

Physical transformation of raw material into Finished goods

Service

Delivery of service itself, leading to the desired outcome or impact on recipient

2) Why Operations Management? Or

What is the Need/Objective of Operations Management?

Organisations → Operations → Manage? → Goal

Meet the needs of the end consumer

Customer service | Resource utilisation

Customer service

- First objective, Meaning: Service for the satisfaction of customer wants
- Key objective of operations management
- OM must provide something to a specification which can satisfy the customers in terms of cost and timing.
- Thus, primary objective of operations management can be satisfied by providing the –

Right Thing at the Right Price at the Right Time

- They are the principal source of customer satisfaction and must, therefore, be the principal dimension of customer service objective for operations manager

Specification → Features → what we get

→ Characteristics → what we expect

→ Functionalities → what product can do/operation operations it performs

Principal customer wants → Specification | Cost | Timing

3) "Three aspects of customer service, specification, cost and timing are described in a little more details for four functions" in this context, summarise the principal customer wants.

Principal Function	Principal customer wants: Primary Consideration	Principal customer wants: Other Consideration
Manufacture	Goods of a given, requested or acceptable specification	Cost: purchase price or cost of obtaining goods Timing: delivery delay from order or request to receipt of goods
Transport	Movement of a given, requested or acceptable specification	Cost: cost of movement, Timing: (i) duration or time to move (ii) wait, or delay from requesting to its commencement
Supply	Goods of a given, requested or acceptable specification	Cost: that is purchase price or cost obtaining goods Timing: delivery delay from order or request to supply, to receipt of goods
Service	Treatment of a given, requested or acceptable specification	Cost: cost of treatment Timing: (i) Duration or timing required for treatment (ii) wait, or delay from requesting to its commencement

Resource Utilisation

- Another major objective
- Utilise resources for the satisfaction of customer wants effectively
- Customer service must be provided with the achievement of effective operations through efficient use of resources
- Inefficient use of resources or inadequate customer service leads to commercial failure of an operating system
- OM concerned essentially with Utilisation of Resources

↓ Obtaining maximum effect from resources.

↓ Minimising their loss, under utilisation or waste

- The extent of utilisation of resources potential might be expressed in terms of Proportion of:

Available time used/occupied,	Space Utilisation	Level of activity (actual)
Available Time	Space Availability	Maximum Possible Activity

Utilisation Rates

Each measure indicates the extent to which the potential or capacity of such resources is utilised.

Operations Management

Achievement of both

Satisfactory customer service Satisfactory resource utilisation

- Improvement in one → deterioration in other
- Often both cannot be maximised
- Hence, a satisfactory performance must be achieved on both objectives
- All activities of OM must be tackled with these two objectives in mind
- Many problems will be faced by operations manager because of conflict
- Hence, operations manager must attempt to balance these objectives

Twin objectives of Operations Management

The customer service objective.	The resource utilisation objective.
To provide agreed/adequate levels of customer service (and hence customer satisfaction)	To achieve adequate levels of resource utilisation (or productivity)

4) **Enumerate what are the Activities which are listed under the production and Operations Management functions.**

Or

What is the scope of operations management?

Operations Management concerns with

Conversion of inputs into outputs, using physical resources

So as to provide the desired utilities to the customer

While meeting other organisational objectives of

Effectiveness	Efficiency	Adoptability
Overall success of the organisation in achieving its strategic goals	Optimising, resources and processes	Capability to respond to changes in external environment

It distinguishes itself from other functions, such as personal, marketing, finance, etc.

by its primary concern for

`conversion of input into output by using physical resources'.

Activities under Production and Operation Management Functions / Scope of operation management

1. Product design.
2. Process design.
3. Location of facilities.
4. Plant layout and material handling.
5. Production planning and control.
6. Quality control.
7. Material management.
8. Maintenance management.

5) List down various major decision areas under production and operations management

Major Decision areas under operation management,

1. Product selection (what to produce?)
2. Facility Location Selection (Where to produce?)
3. Demand Forecasting (how much to produce?)
4. Process selection & Layout decision (how to produce?)
5. Capacity planning (Do we have the necessary resources and capabilities to meet the demand forecast?)
6. Aggregate Planning, Master production schedule (When to Produce?)
7. Materials Requirement Planning (MRP)/Manufacturing Resource Planning (MRP II)/ Distribution Resource Planning (DRP) / Enterprise Resource Planning (ERP)
8. Inventory Management (Do we have materials to Produce?)
9. Supplier Selection/Sourcing (From where to purchase Materials?)
10. Process Management
    (How can we optimize our production processes to enhance efficiency and reduce waste?)
11. Quality Management (Are we producing Right things?)
12. Maintenance (Are our machines able to provide desired results?)
13. Warehousing /Transportation (How to reach the products to the customers?)
14. Reverse Logistics (organisation is practicing sustainability)

In Addition, an operations manager is also responsible for working capital management, skill-management etc.

6) "Today's production system is characterised by at least four features". In this context, enumerate in detail, what are the said features.

Characteristics of Modern Operations Functions

The production management of today presents certain characteristics which make it look totally different from what it was during the past. Specifically, today's production system is characterised by at least four features.

1. Manufacturing as Competitive Advantage

Past	Today's Scenario: Contrasting
Production like any other function When demand was high and production capacities were inadequate	Plants have excess capacities, competition is mounting and firms look and gain competitive advantage to survive and succeed.
Concern somehow muster all inputs and use them to produce goods which would be grabbed by market.	production system offers vast scope to gain competitive edge and firms intend to exploit the potential.

Techniques which the companies are employing to gain competitive advantage.

- Total Quality Management (TQM): Enhancing quality through continuous improvement.
- Time-Based Competition: Faster operations to gain market advantage.
- Business Process Re-engineering (BPRE): Rethinking processes for efficiency and effectiveness.
- Just-in-Time (JIT): Minimizing waste with timely inventory management.
- Focused Factory: Specialized production for optimal efficiency.
- Flexible Manufacturing Systems (FMS): Adaptable systems for diverse manufacturing needs.
- Computer Integrated Manufacturing (CIM): Integration of technology for efficient production.
- The Virtual Corporation: Networked organization maximizing flexibility and efficiency.

2. Services Orientation

- Service sector is gaining greater relevance these days.
- The production system, therefore, needs to be organised keeping in mind the peculiar requirements of the service component.
- The entire manufacturing needs to be geared to serve

(i) intangible and perishable nature of the services,

(ii) constant interaction with clients or customers,

(iii) small volumes of production to serve local markets, and

(iv) need to locate facilities to serve local markets.

There is increased presence of professionals on the production, instead of technicians and engineers.

3. Disappearance of Smokestacks

– Protective labour legislation: Laws safeguarding workers' rights and safety.

– Environmental movement: Advocacy for conservation and sustainable practices.

– Gradual emergence of knowledge based organisations: focuses on human capital and intellectual resources have brought total transformation in the production system.

- Today's factories are aesthetically designed and built, environment friendly - in fact, they are homes away from homes. Going to factory everyday is no more excruciating experience, it is like holidaying at a scenic spot.

4. Small has Become Beautiful

E.F. Schumacher in his famous book Small is Beautiful, opposed giant organisations and increased specialisation. He advocated, instead, intermediate technology based on smaller working units, community ownership, and regional workplaces utilising local labour and resources. For him, small was beautiful.

Businessmen, all over the world, did not believe in Schumacher's philosophy. Inspired by economies of scale, industrialists went In for huge organisations and mass production systems.

Modern Operations Management is characterized by the following :

(a) Technological development

(b) Shorter product life cycle

(c) Changing needs and preferences of the customers

(d) Disruptions (market and product) and pressure for innovation

(e) Globalization

(f) Requirement for supreme service at an affordable price

(g) Pressure for optimization of operational cost

Aspect	Production Management	Operations Management
Focus	Production management is more used for a system where tangible goods are produced.	Operations management is more frequently used where various inputs are transformed into intangible services. But can be used for both tangible goods and intangible services
Scope	Primarily Manufacturing Enterprises	Operations management will cover such service organisations as banks, airlines, utilities, pollution control agencies, super bazaars, educational institutions, libraries, consultancy firms and police departments, in addition, of course, to manufacturing enterprises.
Historical Evolution	Precedes Operations Management in the historical growth of the subject.	Operations management is the term that is used nowadays.

7) "Recent trends in Production and Operation Management related to global competition and the impact it has on manufacturing firms." In this context, state in brief the recent trends in production and operations management.

Recent trends in production and operations management relate to global competition and the impact it has on manufacturing firms. Some of the recent trends are :

1. Global Market Place : Firms expand operations globally for economic advantage, intensifying competition worldwide.

2. Production/Operations Strategy : More and more firms are Recognizing the significance of production strategies and aligning it with overall business strategies.

3. Total Quality Management (TQM) : Adopted by many firms to achieve customer satisfaction by a never-ending quest for improving the quality of goods and services.

4. Flexibility/ Agile manufacturing: The ability to adapt quickly to Changes:
   - in volume of demand,
   - in the product mix demanded, and
   - in product design or in delivery schedules,
   - has become a major competitive strategy and a competitive advantage to the firms

5. Time Reduction : Reduction of manufacturing cycle time and speed to market for a new product provide competitive edge to a firm over other firms

6. Technology : Advances in technology have Advances have brought new products, processes, and materials. Automation and computerization transformed operations. Integrating new tech boosts competitiveness and quality.

7. Worker Involvement : The recent trend is to assign responsibility for decision making and problem solving to the lower levels in the organisation. This is known as employee involvement and empowerment. Examples: quality circles and use of work teams or quality improvement teams.

8. Re-engineering : Drastic measures or break-through improvements to improve the performance of a firm. It involves the concept of clean-slate approach or starting from scratch in redesigning the business processes.

9. Environmental Issues : Production managers prioritize pollution control and waste disposal. Focus on reducing waste, recycling, and using eco-friendly materials for packaging.

10. Corporate Downsizing (or Right Sizing) : Forced on firms to shed their obesity. Its necessary due to competition, lowering productivity, need for improved profit and for higher dividend payment to shareholders.

11. Supply-Chain Management : Management of supply-chain, from suppliers to final customers reduces the cost of transportation, warehousing and distribution throughout the supply chain.

12. Lean Production : Use minimal amounts of resources to produce a high volume of high quality goods with some variety. These systems use flexible manufacturing systems and multi-skilled workforce to have advantages of both mass production and job production (or craft production).

Chapter 2: Operations Planning

This Chapter Includes

2.1 Demand Forecasting

2.2 Capacity Planning

2.3 Facility Location and Layout

2.4 Resource Aggregate Planning

2.5 Material Requirements Planning

2.6 Manufacturing Resource Planning

2.7 Economic Batch Quantity

Demand Forecasting

Demand:

Requirement and desire of consumers to purchase products and services and

Willingness and abilities to pay for availing the same.

Industrial purpose products	Consumers specific products
like machines	like confectionaries.

Forecasting:

Process of making prediction about future happenings and/or requirements based on available information and/ evidences.

Demand Forecasting:

Technique for estimation of probable demand of product or in future.

Why do we need to forecast the demand?

From a holistic perspective any organisation is described in terms of its supply chain/ value chain which gets into existence from the moment demand is created and/or gets generated.

In other word, it is the demand that decides the existence of any business.

With the available demand forecasting the organisations perform

- production/ service planning,
- take inventory decisions,
- decide on facility selection and process design, and select appropriate technology,
- plan for fund requirement and
- manpower planning.

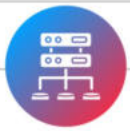
Hence, a reasonably accurate forecasting of demand can make a company while absence of the same lead to breaking of organisations.

Source of Information (used for forecasting)

Primary Source: Collected directly by your organization. Eg: Point of Sales data, Customer survey, Field report

Secondary Source: Collected by other organizations or institutions Eg: Market/ Industry Report, Experts' views.

Where the data can be:



Structured Data: Organized and formatted data that follows a predefined schema

Eg: Conducting a customer survey with multiple-choice questions and rating scales,

downloading weather data with daily temperature, humidity, and precipitation levels.

Unstructured Data: Data that has no predefined format

Eg: social media mentions of your brand to understand customer sentiment, Recording customer interviews

Steps in Forecasting

(a) Determine the objective of forecast: What for you are making forecast? Is it for predicting the demand? Is it to know the consumer's preferences? Is it to study the trend? You have to spell out clearly the use of forecast.

(b) Select the period over which the forecast will be made? Long-term forecast or medium-term forecast or short-term forecast? What are your information needs over that period?

(c) Select the method you want to use for making the forecast. Depends on the period selected for the forecast and the information or data available on hand.

(d) Gather information to be used in the forecast. The data may be collected by:

(i) Primary source: This data we will get from the records of the firm itself.

(ii) Secondary source: This is available from outside means, published data, magazines, educational institutions etc.

(e) Make the forecast: Using the data collected in the selected method of forecasting, the forecast is made.

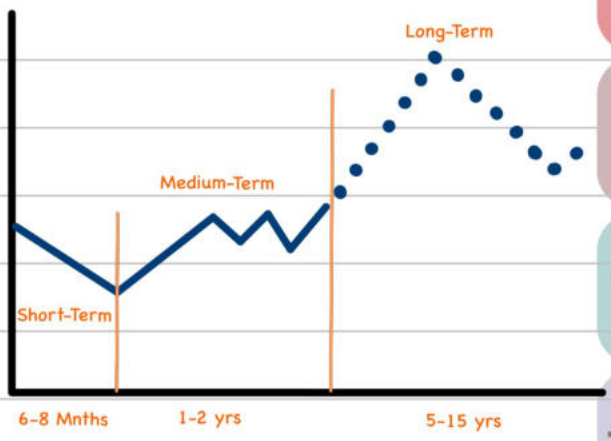
Forecasting Period

- Short range forecasting
  - Inventory requirements
  - Transport facilities
  - Working capital
  - Required overtime
  - Workload
- Medium range forecasting
  - Expenses- Budgetary control
  - Dividend policy
  - Maintenance expense
  - Capacity adjustment plans
- Long range forecasting
  - Research & development
  - Future development
  - Expected cash flow
  - Material/manpower requirement

Forecasting Methods (How to forecast demand?) There are two types of approaches such as

~ Qualitative

~ Quantitative



Forecasting / Sales Forecasting Methods

Qualitative Methods

Survey of buyer's intention (User expectation method)

- actual user contacted directly
- asked about intention to buy in future
- Direct method of forecasting
- thinking behind buying intention
- suitable for short-term forecasting
- appropriate when users are numbered, new product is to be introduced

Collective opinion (Sales force composite method)

- views of salesman, branch/area/sales manager from diff segment of market is considered

Estimates of individual salesman → For total estimated sales → Further Examination → Successive executive → Considering factors

Consolidated

Final emergence of forecasting ← Considering factors:

- changes in product design
- advertisement and selling price
- Competition etc.

Market test method

- Seller sells his product in part of market and makes assessment for full market
- appropriate when
  - product is new
  - estimates not available
  - Buyers do not prepare purchase plans

Group executive judgement (executive judgement method)

Combining, Averaging, Evaluating — Opinions of top executives

Expert's opinion

Opinion from specialist outside the organisation

Statistical or Quantitative Method

Causal/Regression Analysis

The causal model (helps to understand the casual/theoretical relationship between variables), is expressed as Dt = f(F1, F2...Fn)

Where, Dt = Demand for period t

F1, F2, F3...Fn are the factors responsible.

For, example, suppose we want to forecast the demand (sales) for period t

F1 = Sales budget

F2 = Price

F3 = Promotional Budget

F4 = Technology etc.

Now, a regression model will be used to form a mathematical equation to Estimates the relationships between variables, aiming to predict future values based on historical data.

Demand = 1000 + 5*F1 - 2*F2 + 0.1*F3 + 150*F4

Time Series Analysis

For any time series data, there are four components

- Trend(T)
- Seasonality(S)
- Cyclical Variation
- Irregular(I) or Random Variation

Time series models are of two kinds of forms

- Additive yt = T+S+C+I
- Multiplicative yt = TSCI

Finding the Trend:

1..Linear Trend: yt = a + bt (a and b are coefficients), Sales increasing steadily

2. Parabolic Trend: yt = a + bt + ct^2 (intrinsically linear in coefficients), Sales initially growing slowly, then accelerating, like seasonal product trends.

3. Exponential Trend: yt = ab^t (convertible to a log-linear model), Sales doubling or tripling

Finding Seasonality

I. Moving average

II. Weighted moving average

III. Simple exponential smoothing

IV. Double exponential smoothing

V. Hot-winter model

Question 1:

With the help of following of following data, project the trend of sales for the next 7 years:

Year	2005	2006	2007	2008	2009	2010
Sales (In Lakhs Rs.)	90	95	100	110	125	140

(8 marks)

Question 2:

The following table gives the age of cars of SKODA and its Annual Maintenance cost.

Age of cars in years (X)	2	4	6	8
Maintenance cost (in thousand of Rs.) (Y)	10	20	25	30

Required:

(a) **Fit a** Linear Regression of Y on X

(b) **Estimate**: (i) Maintenance Cost for Age of Cars of 10 years

(ii) Age of car in years for Maintenance cost of Rs. 50000

(7 marks)

Question 3:

AS an Analyst of POXN Ltd., you are interested in studying whether some relationship does exist between the expenditure on Advertising and the Annual Sales. Accordingly the data of expenditure on Advertising and Sales are collected for past six years as follows:

Years	2017	2018	2019	2020	2021	2022
Expenditure on Advertising (X) (₹ in Crore)	1	2	4	3	10	4
Annual Sales (Y) (₹ in Crore)	18	23	32	28	38	29

Required:

(i) Fit a Linear Regression of Y on X.

(ii) Predict the annual sales when expenditure on Advertising is Rs. 5 Crore.

(iii) Estimate the expenditure on Advertising for annual sales of Rs. 42 Crore.

(8 marks)

Question 4:

Actual Demand for last 10 weeks are given in the following table:

WEEK	1	2	3	4	5	6	7	8	9	10
Demand	70	130	90	140	140	120	170	160	120	160

Compute moving average forecasts for the three and four week period.

Capacity Planning

- Capacity refers to the maximum load an operating unit can handle.
- The operating unit might be a plant, a department, a machine, a store or a worker.
- Capacity of a plant is the maximum rate of output (goods or services) the plant can produce.
- The production capacity = volume of output per period of time (i.e., hour, day, week, month, quarter etc.)
- Capacity indicates the ability of a firm to meet market demand – both current and future.
- The effective management of capacity is the most important responsibility of production and operations management.
- The objective of capacity management i.e., planning and control of capacity, is to match the level of operations to the level of demand.
- Capacity planning is to be carried out keeping in mind future growth and expansion plans, market trends, sales forecasting, etc.

Capacity planning is concerned with finding answers to the basic questions regarding capacity such as:

(i) What kind of capacity is needed?

(ii) How much capacity is needed?

(iii) When this capacity is needed?

Capacity planning is required for the following:

~ Sufficient capacity is required to meet the customers demand in time,

~ Capacity affects the cost efficiency of operations,

~ Capacity affects the scheduling system,

~ Capacity creation requires an investment,

Capacity planning is the first step when an organisation decides to produce more or new products.

Forms of capacity planning:

Based on time-horizon/ Types

i) Long-term capacity planning: which are concerned with investments in new facilities and equipments. These plans cover time horizon of more than two years, and

ii) Short-term capacity planning: which takes into account work-force size, overtime budgets, inventories etc.

Based on amount of resources employed

i) Finite capacity planning: A plan that considers the limited resources available and aims to optimize their use. and

ii) Infinite capacity planning: A theoretical plan that assumes unlimited resources, which is not realistic

In real-world scenarios.

Measurement:

Single product → Units produced / Period of time

When firms are producing different types of product → Money value (Production value) Of units produced / Period of time

Capacity Planning Decisions

Capacity planning involves activities such as:

(i) Assessing the capacity of existing facilities.

(ii) Forecasting the long-range future capacity needs.

(iii) Identifying and analysing sources of capacity for future needs.

(iv) Evaluating the alternative sources of capacity based on financial, technological and economical considerations.

(v) Selecting a capacity alternative most suited to achieve strategic mission of the firm.

Effective Capacity can be determined by giving due consideration to the following factors:

- Facilities – design, location, layout and environment.
- Product – Product design and product-mix.
- Process – Quantity and quality capabilities of the process to be followed.
- Human factors – Job content, Job design, motivation, compensation, training and experience of labour, learning rates and absenteeism and labour turn over.
- Operational factors – Scheduling, materials management, quality assurance, maintenance policies, and equipment break-downs.
- External factors – Product standards, safety regulations, union attitudes, pollution control standards.

Factors affecting determination of plant capacity

(i) Capital investment required,

(ii) Changes in product design, process design, market conditions and product life cycles,

(iii) Flexibility for capacity additions,

(iv) Level of automation desired,

(v) Market demand for the product,

(vi) Product obsolescence and technology obsolescence and

(vii) Type of technology selected.

Factors Affecting Capacity Planning:

Two kinds of factors affecting capacity planning are:

(i) Controllable Factors: amount of labour employed, facilities installed, machines, tooling, shifts of work per day, days worked per week, overtime work, subcontracting, preventive maintenance and number of production set ups.

(ii) Less Controllable Factors: absenteeism, labour performance, machine break-downs, material shortages, scrap and rework, strike, lock-out, fire accidents, natural calamities (flood, earthquake etc.)

Factors influencing Effective Capacity:

- Forecasts of demand: Predicting how much demand there will be for a product or service. Demand can change based on factors like the product's popularity and how long it stays in demand. does accuracy influences effective capacity

- Plant and labour efficiency: How well the machines and workers in a plant or facility can do their jobs. Machines may break down or be slow, and workers may work at different speeds, affecting how much can be produced.

- Subcontracting: Sometimes, parts of a job are given to outside vendors instead of being done in-house. This helps meet demand but requires careful decision-making about cost and quality.

- Multiple shift operation: Running the plant for more than one shift per day can increase how much can be produced. However, there may be more mistakes or rejects, especially during late shifts.

- Management policy: Decisions made by management, like how many shifts to run, which departments work when, and when to replace machines, all affect how much the plant can produce.

Factors favouring over capacity and under capacity

The forecasted demand will be either higher or lower than the actual demand. This gives rise to either over capacity or under capacity.

Factors favoring overcapacity:

- Low fixed costs for capacity.
- Inability to subcontract due to secrecy or quality requirements.
- Long time required to add capacity.
- Importance of meeting delivery dates and retaining customers.
- Economic threshold below which plant operation is uneconomical.

Factors favoring undercapacity:

- High fixed costs for capacity.
- Lack of impact from product shortages.
- Rapid technological changes leading to equipment obsolescence.
- Prohibitively high costs to create capacity.

Capacity Requirement Planning

Capacity requirement planning (CRP) is a technique which determines what equipment and labour/personnel capacities are required to meet the production objectives (i.e., volume of products) as per the master production schedule and material requirement planning (MRP-I).

Capacity Requirement Planning Strategies:

Level Capacity Plan:

- Operates at uniform production levels.
- Finished goods inventories fluctuate based on demand.
- Based on "produce-to-stock and sell" approach.

Matching Capacity with Demand Plan:

- Production capacity adjusted to match demand.
- Material flows and machine capacity change to align with demand.
- Advantages: Lower finished goods inventory and back-ordering costs.
- Disadvantages: Higher labor and material costs due to frequent workforce changes.

Optimum Plant Capacity: Plant capacity has a great influence on cost of production with increasing volume of production, economies of scale arises which results in reduction in average cost per unit produced.For a given production facility, there is an optimum volume of output per year that results in the least average unit cost.

This level of output is called the "best operating level" of the plant.

Reasons for declining cost as output increases

- Fixed cost spread over More units
- Plant construction costs are less,
- Reduced cost of purchase material (qty discount)
- Cost advantage in mass production process (economies of scale)
- Decline will be only upto certain volume of production.
- After that, cost will remain ever increasing which results in 'Diseconomies of scale'

Methods of balancing the capacity

- Adding new machine to the bottlenecks Centre
- Sub contract excess capacity workload of bottleneck centre
- Change the product mix by manipulating the sales which leads to load of all work centre almost uniformly

Question 1:

A firm has four work centres, A, B, C and D, in series with individual capacities in units per day shown in the figure below:

(i) Identify the bottleneck centre.

(ii) Determine the system capacity.

(iii) Determine the system efficiency.

(9 marks)

Question 2:

A department works on 8 hours shift, 250 days a year and has the usage data of a machine, as given below:

Product	Annual demand (units)	Processing time (standard time in hours)
X	300	4.0
Y	400	6.0
Z	500	3.0

Determine the number of machines required.

Question 3:

A steel plant has a design capacity of 50,000 tons of steel per day, effective capacity of 40,000 tons of steel per day and an actual output of 36,000 tons of steel per day. Compute the efficiency of the plant and its utilisation.

Question 4:

A manager has to decide about the number of machines to be purchased. He has three options i.e., purchasing one, or two or three machines. The data are given below.

Number of Machines	Annual Fixed Cost	Corresponding range of output
One	₹ 12,000	0 to 300
Two	₹ 15,000	301 to 600
Three	₹ 21,000	601 to 900

Variable cost is Rs. 20 per unit and revenue is Rs. 50 per unit

(a) Determine the break-even point for each range

(b) If projected demand is between 600 and 650 units how many machines should the manager purchase?

Facility Location

Facility: Any type of set-up that an organisation requires to run its operations and produce required products and/or delivers intended services to the customers.

Location: Place or region where the above-mentioned facility may be established.

Therefore, the decision of facility location = Where to establish the set-up?

Need for an appropriate facility location

Organizations require appropriate facility locations:

(i) When they Start new ventures or expand existing ones.

(ii) To Address challenges like resource scarcity, lease expiration, socio-cultural, legal, political issues, prompting relocations.

A good facility location:

- Balances cost reduction and service maximization.
- Provides cost benefits, proximity to market and sources, and easy transportation.
- Is a strategic decision that organisation takes.

Factors influencing location selection:

- Sourcing: Raw materials, resources, internet connectivity, supplier proximity.
- Markets: Market proximity, wide coverage, customer connectivity, time-to-market.
- Cost: Transportation, lease, taxes, hidden expenses.
- Socio-cultural, Political: Community support, language familiarity, safety, regulations.
- Environmental concerns.
- Skilled labor availability.
- Competitive pressure.

Steps followed to make a correct location choice:

1. Decide on the criteria for evaluating location alternatives

2. Identify important factors

3. Develop location alternatives

4. Evaluate the alternatives

1. Make a decision and select the location

Popular approaches for facility location selection:

(i) Factor Rating Method

(ii) Centre of Gravity Technique

(iii) Transportation Model

(iv) Optimization and Heuristic Models: approximate solutions by using rules of thumb, intuition, or experience to guide decision-making

Question 1:

Suppose, an E-Commerce company wants to open a Central order fulfilment centre in Kolkata South in West Bengal. The possible locations are say L1, L2, and L3. The company forms a group of experts. The team identifies 4 factors such as F1, F2, F3, and F4 to evaluate L1 to L3. Which is the best location based on the factor rating method?

Location Factor	Rating		
	L1	L2	L3
F1	10	9	7
F2	7	3	10
F3	7	5	10
F4	6	8	5

Location Factor	Experts Rating			
	E1	E2	E3	E4
F1	4	3	4	7
F2	5	5	5	10
F3	3	5	4	10
F4	2	2	2	5

Question 2:

Suppose, XYZ Ltd wants to open a retail shop in Kolkata, West Bengal. It first selects the 4 locations such as L1, L2, L3 and L4. The coordinates of the locations (i.e., latitudes and longitudes) and volume of customers (i.e., average number of customers in a day in '000) are given in the following table

Location	Volume	Coordinates	
		X	Y
L1	200	30	100
L2	100	90	120

L3	100	130	130
L4	200	60	40

Find out the best location for centre of gravity (COG) method

Facility Layout

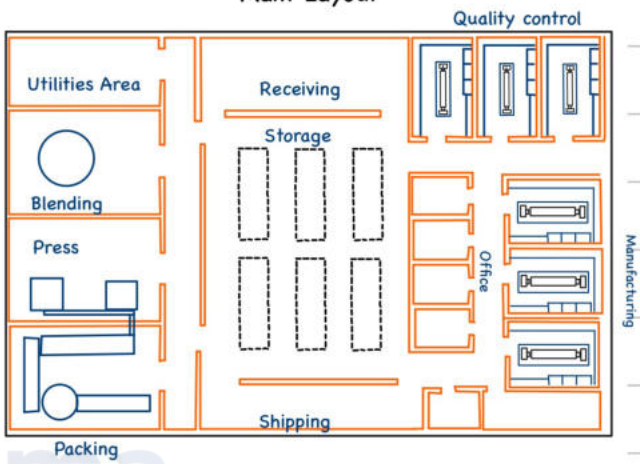
Facility Layout (Plant Layout)

It means planning for location of all

- -Machines
- - Equipments
- - Utilities
- - Workstations
- - Customer service areas,etc.

And also. Planning for the patterns of flow of material and people around, into and within the buildings.

Plant Layout



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

Can be anything that consumes space

Questions to be addressed.

- How much space and capacity each Centre needs?
- How should each Centres space be configured?
- what's centres should the layout include?
- Where should each Centre be located? → Dimensions for location of centre. → Absolute location / Relative location

Plant Layout – Principles

Principle of

- Minimum travel
- Usage
- Sequence
- Compactness
- Safety and satisfaction
- Flexibility
- Minimum investment

Why?

New Layout

- Long run efficiency
- Strategic implications as it establish an organisation's competitive priorities
- Provides strategic advantage that supports differentiation, low-cost, fast response or flexibility
- Well designed layout provides an economic layout

Redesign of layout

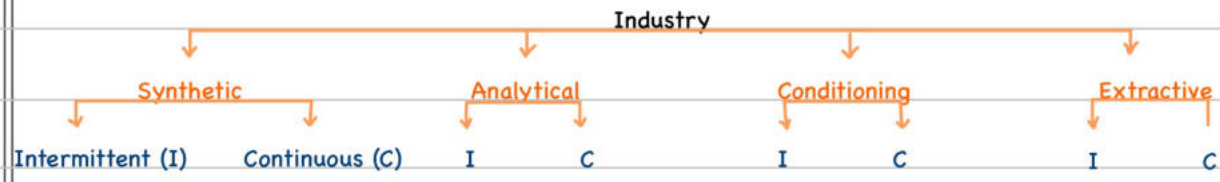
- Accidents, health hazards and low safety
- Changes in processes, method or equipment
- Environmental or legal changes
- Change and product or service design
- Inefficient operations (high-cost, bottleneck operations)
- Introduction of new product or service

Good plant layout

- Efficient utilisation of labour
- Higher flexibility
- higher utilisation of space
- Improved employee morale
- Improved flow of material, information & people
- Reduced bottlenecks Centres
- Reduced Health hazards
- Improves productivity
- Facilitate better coordination
- Utilise available space effectively & efficiently

Layout

- Avoidance of bottleneck
- Avoidance of unnecessary and costly changes
- Better production control
- Better supervision
- Economies in handling
- Effective use of available resources
- Improved employee morale
- Improved quality control
- Improved utilisation of labour
- Minimisation of production delay
- Minimum equipment investment



1. Industry Classification:

- Synthetic Industry: Creates products from raw materials through complex chemical processes. Examples include chemicals, pharmaceuticals, plastics, and synthetic materials.
- Analytical Industry: Analyzes and tests materials and substances, encompassing laboratories, testing facilities, and quality control operations.
- Conditioning Industry: Modifies the physical properties of materials through processes like heat treatment, cooling, drying, etc.
- Extraction Industry: Removes materials or substances from natural sources, including mining, oil extraction, and forestry.

2. Production Type:

- Intermittent Production: Produces different products in small batches or on-demand with frequent changes and shorter production runs.
- Continuous Production: Produces identical or very similar products in high volume without interruptions or frequent changeovers, running continuously.

Factors influencing layout choices

Primarily the layout is influenced by the relationship among the materials, machinery and men. others:

- Location
- Machinery & Equipment
- Managerial policies
- Materials
- Product
- Workers

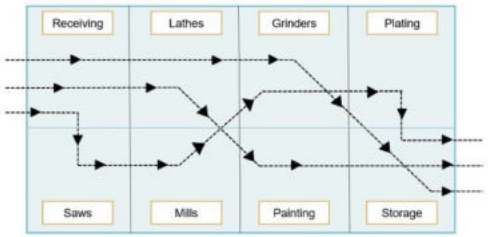
Types of Layout

Process Layout (Functional Layout)

- For job lot manufacture or batch production layout
- Involves grouping together of similar machines in one department
- Machines in each department attend to any product that is taken to them.
- These machines are, therefore, called general-purpose machines.

Principles to be followed while grouping machines according to process type

- Convenience for inspection.
- Convenience for supervision.
- Distance between departments to be short
- Departments to be located according to the principle of sequence of operation.



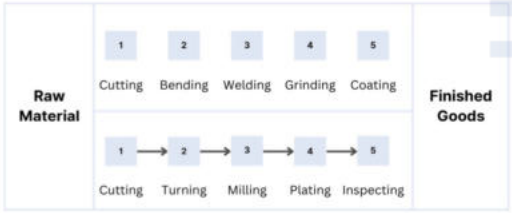
Product Layout

(Straight-line Layout/ Layout for serialised manufacturing)

- Material is fed into first machine and finished product comes out of the lost machine
- If there are more than one line of production, there are as many lines of machines.
- The emphasis is here, therefore, is on special purpose machines.

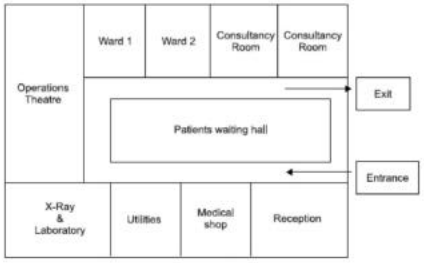
Principles to be followed by grouping machines according to product line

- All the machine tools or equipment's must be placed at the point demanded by the sequence of operations
- All the operations, should be included in the line
- Materials may be fed where they are required for assembly but not necessarily all at one point
- There should be no point where one line crosses another line



Service Layout

- Service facility layout exist normally to bring together customers and services.
- It should provide for easy entrance to this facilities, well designed walkways and parking areas
- types of service facility layout
  - Those that are almost totally designed around a customer receiving and service function (such as banks)
  - Those that are designed around the technologies, processing of physical materials and production efficiency (such as hospitals)

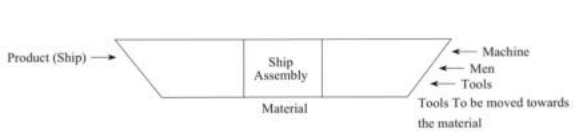


Fixed Position Layout

(Static Layout)

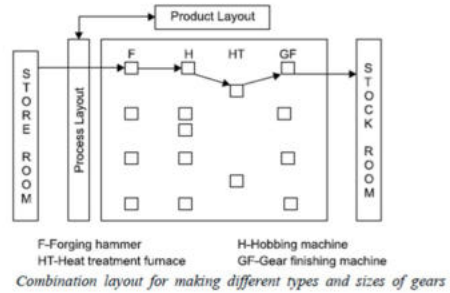
- Involves movement of men and machines to the product, which remains static.
- The The movement of men and machines to the product is advisable because,

Cost of moving men and machine < Cost of moving a product which is very bulky



Mixed Layout or Combined Layout

A combination of the product and process layouts, with an emphasis on either.



Combination layout for making different types and sizes of gears

Question 1:

The present layout is shown in the figure. The manager of the department is intending to interchange the departments C and F in the present layout. The handling frequencies between the departments is given. All the departments are of the same size and configuration. The material handling cost per unit length travel between departments is the same. What will be the effect of interchange of departments C and F in the layout?

A	C	E
B	D	F

From/To	A	B	C	D	E	F
A	-	0	90	160	50	0
B	-	-	70	0	100	130
C	-	-	-	20	0	0
D	-	-	-	-	180	10
E	-	-	-	-	-	40
F	-	-	-	-	-	-

Question 2:

A defence contractor is evaluating its machine shops current process layout. The figure below shows the current layout and the table shows the trip matrix for the facility. Health and safety regulations require departments E and F to remain at their current positions.

E	B	F
A	C	D

Current Layout

From/To	A	B	C	D	E	F
A	-	8	3		9	5
B	-	-		3		
C	-	-	-		8	9

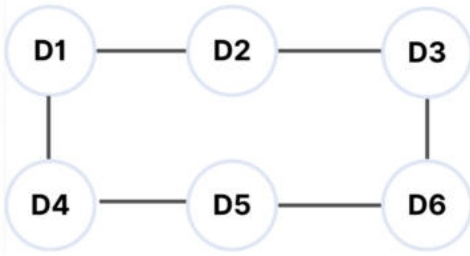
D	-	-	-	-		3
E	-	-	-	-	-	3
F	-	-	-	-	-	-

Can layout be improved? Also evaluate using load distance (ld) score.

Question 3:

Suppose a hospital has 6 major departments namely D1, D2, D3, D4, D5 and D6. The initial layout of the hospital is given below.

Initial Layout



The average traffic movement to and fro each department is given in the following table.

Table – Average traffic flow (Direct)

From/To	D1	D2	D3	D4	D5	D6
D1	-	10	20	0	5	6
D2	8	-	6	10	0	2
D3	10	6	-	20	7	8
D4	0	25	5	-	10	3
D5	15	10	1	20	-	6
D6	0	6	0	3	4	-

The hospital wants to find out an optimum layout.

Resource Aggregate Planning

Aggregate Planning:

- Intermediate-term planning (3 months to one year).
- Determines quantity and timing of output.
- Assumes fixed physical facilities.
- Variations in demand met through labor and inventory adjustments.
- Seeks best combination to minimize costs.
- Specifies demand in aggregate quantities, irrespective of product mix.

Production Planning Categories:

(i) Long Range Planning: Strategic decisions, e.g., facility purchase, new products.

(ii) Short Term Planning: Daily operations, scheduling, inventory.

(iii) Intermediate (Aggregate) Planning: Balances long and short term, focuses on capacity and demand over moderate timeframes (e.g., one year).

- Involves formulating general capacity strategies to meet demand economically.
- Operationalized through master schedules, guiding manufacturing schedules.
- Close relationship with facility planning and scheduling.

Guidelines for Capacity Planning:

Policy: Establish corporate policy for controllable variables.

Forecast: Use reliable forecasts for planning.

Units: Plan capacity in appropriate units.

Workforce: Maintain a stable workforce.

Inventory: Exercise control over inventory.

Flexibility: Maintain adaptability.

Demand: Respond to demand systematically.

Evaluation: Regularly assess planning effectiveness.

Fixed Facilities: Identify essential fixed facilities.

Aggregate Planning Strategies:

- Vary Workforce Size: Adjust labor force to match demand changes.
- Vary Work Hours: Maintain stable workforce; use idle time or overtime.
- Vary Inventory Levels: Manage demand fluctuations with inventory.
- Subcontract: Outsource to meet increased demand using external capacities.

Properties of Aggregate Planning:

(i) Standardized Output Measurement: Express output and sales in overall units (e.g., vehicles per year, liters of paint).

(ii) Reliable Forecast: Acceptable forecast for a reasonable planning period (e.g., one year).

(iii) Cost Identification: Identify and fix relevant costs associated with facilities.

(iv) Alternatives Availability: Options to meet organizational objectives.

(v) Optimal Decision Making: Construct models for optimal or near-optimal decisions across planning periods.

(vi) Fixed Facilities: Consider fixed facilities to achieve objectives.

Question 1:

ABC. Co. has developed a forecast for the group of items that has the following demand pattern

Quarter	Demand	Cumulative Demand
1	270	270
2	220	490
3	470	960
4	670	1630
5	450	2080
6	270	2350
7	200	2550
8	370	2920

The firm estimates that it costs ₹ 150 per unit to increase production rate ₹ 200 per unit to decrease the production rate, ₹ 50 per unit per quarter to carry the items in inventory and ₹ 100 per unit if subcontracted. Compare the costs of the pure strategies.

Question 2:

A firm has developed the following forecast (units) for an item which has a demand influence by seasonal factors.

Month	Forecasted Demand	Production Days
Jan	220	22
Feb	90	18
Mar	210	21
Apr	396	22
May	616	22
Jun	700	20
Jul	378	21
Aug	220	22

Sep	200	20
Oct	115	23
Nov	95	19
Dec	260	20

(a) Prepare a chart showing the daily demand requirements.

(b) Determine the production rate required to meet average demand.

(c) Determine the monthly inventory balance required to follow a plan with: 1. Constant workforce 2. No idle time or overtime 3. No Backorder 4. No use of Subcontractor 5. No capacity adjustment

(d) The firm has determined that to follow a plan of meeting demand by varying the size of the workforce strategy

It resulted in hiring and lay-off cast estimated at ₹ 12000. If the unit cost is ₹ 100 each to produce, carrying cost per year is 20% of the average inventory value and storage cost (based upon maximum inventory) is ₹ 0.90 per unit. Which plan results in the lower cost, varying inventory or varying employment? [Where Plan 1 indicates varying inventory and Plan 2 indicates varying Employment]

(e) Suppose the firm wishes to investigate two other plans (alternatives). A third plan is to produce at a rate of 10 units per day and sub-contract the additional requirements at a delivered cost of ₹ 107 per unit.

Any accumulated inventory is carried forward at a 20% carrying cost (No extra Storage cost). The Fourth Plan is to produce at a steady rate of 10 units per day and use overtime to meet the additional requirement at a premium of ₹ 10 per unit. Accumulated inventory is again carried forward at a 20% cost.

(f) Compare 4 plans given in Question (d) and (e) and comment which plan gives the minimum cost.

MRP I and MRP II

MRP/MRP-1 (Material Requirement Planning)

MRP-2 (Manufacturing Resource Planning)

MRP-I is integrated with material and time requirement.

Beyond this, MRP-II has been coined to close the loop, by integrating, financial, accounting, personnel, engineering and marketing information along with the basic production planning and control activities of basic MRP systems.

MRP	MRP-II
Stands for material requirements planning	Stands for manufacturing resource planning
Plan the needs for materials	Plan the needs for resources
It comprises only the manufacturing area	It includes the entire organisation
It is an open system	Close loop manufacturing resource planning
It responds to what , how much and when to acquire materials	It response to the same as MRP one, and also how much and when it will be produced, and what are the available resources
Improves the materials and production scheduling	Improves Productivity

Material Requirement Planning (MRP)

- MRP is a system for calculating materials and components needed to manufacture a product.

- MRP Is a technique of working backward from the scheduled quantity to determine:

- what components are needed?
- how many are needed?
- when they are needed?
- When they should be ordered?

Functions of MRP:

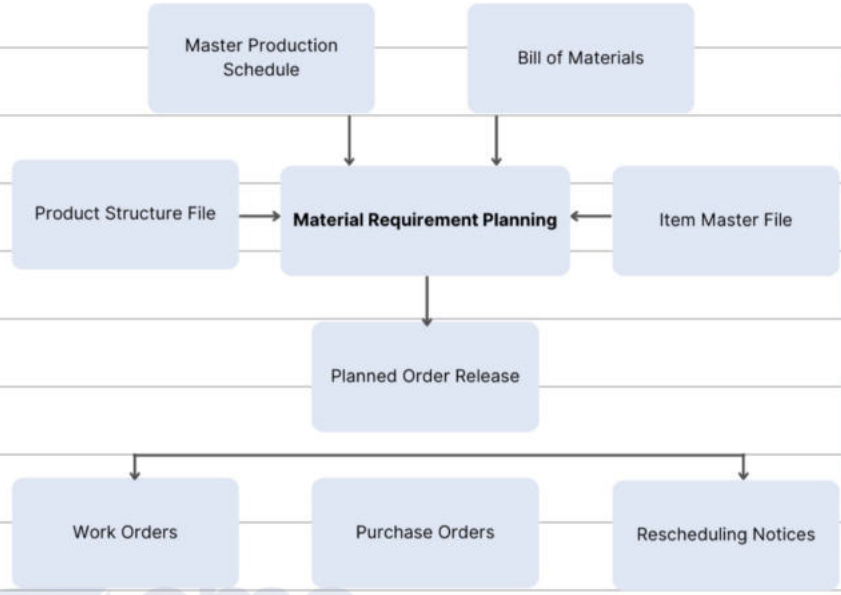
Order planning and control

Priority planning and control

Basis for planning capacity requirements and business plans.

Objectives

- Inventory reduction
- Reduction in the manufacturing and delivery lead times
- Realistic delivery commitments
- Increase the efficiency



Advantages

- Reduced inventory
- Reduced idle time
- Reduced set up time
- Ability to prize more competitively
- Better customer service
- Better response to market demand

Disadvantages of MRP:

- Lack of top management commitment.
- MRP perceived as standalone system, not part of total system.
- Integration with just-in-time production challenging.
- Requires high degree of accuracy and operational changes.
- Rigidity in scheduling, difficult to deviate if needed.

Manufacturing Resource Planning (MRP-II)

It has been developed to address the planning and controlling of a manufacturing process and all of its related support functions

It is a management process for taking the business plan and breaking down into specific, detail task that people evaluate, agree upon and held accountable for.

MRP-II comprises of a variety of processes is linked together

- Business planning
- Production planning
- Master production schedule
- Material requirement planning
- Execution support systems for capacity and material

Bill of Material
Order Date:
Receipt Date:

Item	Qty	Rate
X	10	20
Y	20	50
Z	40	100

Manufacturing Resource Planning (MRP-II)

Material Requirements Planning → Closed Loop MRP → Manufacturing Resource Planning

With a feedback feature that enables dynamic adjustments during the process.

Economic Batch Quantity

The optimum lot size which is known as economic lot size or Economic Order Quantity or economic batch quantity or economic manufacturing quantity is that quantity of output produced in one batch, which is most economical to produce, i.e., which results in lowest average cost of production.

Determination of Economic Lot Size for Manufacturing:

The factors to be considered in arriving at the economic lot size are:

(i) Usage rate: The rate of production of parts should match with the rate of usage of these parts in the assembly line.

(ii) Manufacturing cost: Higher the lot size, lower will be the cost per unit produced because of distribution of set up costs for setting up production or machines and preparing paper work (production orders). But the carrying cost (handling and storing costs) will increase with increase in lot size.

(iii) Cost of deterioration and obsolescence: Higher the lot size, higher will be the possibility of loss due to deterioration (items deteriorating after shelf life) or obsolescence (due to change in technology or change in product design).

If S is the set up cost per set up also known as Ordering Cost,

'C' is the inventory carrying cost per unit and

A is the annual demand for the item in units, then,

Economic Batch Quantity (EBQ) or Economic Order Quantity (EOQ) or Economic Lot Size (ELS) or Economic Manufacturing Quantity (EMQ)

$$= \sqrt{\frac{2AS}{C}} = \sqrt{\frac{2*\text{Annual Demand(units)}*\text{ Setup Cost per setup}}{\text{Inventory carrying cost per unit p.a.}}}$$

Setup Cost = Inventory Carrying Cost

Setup cost per setup(S) * Annual Demand (in units)(A). = Inventory Carrying Cost/unit p.a. (C) * Order/Batch Qty.

Order/Batch Quantity. 2

Order/Batch Quantity = $\sqrt{\frac{2AS}{C}}$

Safety Stock:

An additional inventory that is carried to reduce the risk of running out of inventory (a stock-out) during lead time.

Conditions for Safety Stock Requirement:

- Variations in Demand Rate,
- Variable lead time.

$SS = Z\sigma_{dLT}$

SS → Safety Stock

Z → Standard Normal Variate

σ_{dLT} → Standard Deviation of Lead Time demand

dLT → Demand during Lead Time

Amount of Safety stock depends upon three important factors:

1. The Average Demand Rate & Average Lead time.
2. Demand & lead-time variability.
3. The desired service level.

Different formulas for ROP (Re-Order Point) calculation

For constant demand (d) and lead time (LT): $ROP = d \times LT$

For variable demand rate: $ROP = \bar{d}LT + Z\sigma_d\sqrt{LT}$

$\bar{d}$ → Avg. demand Rate

σ_d → Standard Deviation of Demand

Fixed Time Interval Models

Orders are placed at fixed time intervals.

Periodic check of inventory level.

Order size vary cycle to cycle. Unlike in EOQ approach where orders size generally remain fixed while length of cycle varies.

Generally, used for perishable items where a new order is required after a fixed period of time.

Units to order formula

Order size in the fixed interval model is determined by the following computation:

Units to order = expected demand during the protection interval + safety stock - units on hand reorder

$$= \bar{d}(OI + LT) + Z\sigma_d\sqrt{(OI+LT)} - A$$

- $\bar{d}$: Avg. demand rate
- OI : Order Interval
- LT : Lead Time
- Z : Standard Normal Variate
- σ_d : Standard Deviation of Demand
- A : Units on hand at Reorder Level

Question 1:

Monthly demand for a component is 1000 units. Setting-up cost per batch is ₹120. Cost of manufacture per unit is ₹ 20. Rate of interest may be considered at 10% p.a. Calculate the EBQ.

Question 2:

The monthly requirement of raw material for a company is 3000 units. The carrying cost is estimated to be 20% of the purchase price per unit, in addition to ₹ 2 per unit. The purchase price of raw material is ₹ 20 per unit. The ordering cost is ₹ 25 per order.

(i) You are required to find EOQ.

(ii) What is the total cost when the company gets a concession of 5% on the purchase price if it orders 3000 units or more but less than 6000 units per month.

(iii) What happens when the company gets a concession of 10% on the purchase price when it orders 6,000 units or more?

(iv) Which of the above three ways of orders the company should adopt?

Question 3:

M/s. Tubes Ltd. are the manufacturers of picture tubes of T.V. The following are the details of their operation during 2001:

Average monthly market demand	2,000 tubes
Ordering cost	₹ 100 per order
Inventory carrying cost	20% per annum
Cost of tubes	₹ 500 per tube
Normal usage	100 tubes per week
Minimum usage	50 tubes per week
Maximum usage	200 tubes per week
Lead time to supply	6 – 8 weeks

Compute from the above:

(1) Economic order quantity. If the supplier is willing to supply quarterly 1,500 units at a discount of 5%, is it worth accepting?

(2) Maximum level of stock.

(3) Minimum level of stock.

(4) Re-order level of stock.

Question 4:

M/s Kobo Bearings Ltd., is committed to supply 24,000 bearings per annum to M/s Deluxe Fans on a steady daily basis. It is estimated that it costs 10 paisa as inventory holding cost per bearing per month and that the setup cost per run of bearing manufacture is ₹ 324.

(a) What is the optimum run size for bearing manufacture?

(b) What should be the interval between the consecutive optimum runs?

(c) Find out the minimum inventory holding cost.

Question 5:

A company planning to manufacture a household cooking range has to decide on the location of the plant. Three locations are being considered viz., Patna, Ranchi, and Dhanbad. The fixed costs of the three locations are estimated to be ₹30 lakh, ₹50 lakh, and ₹25 lakh per annum respectively. The variable costs are ₹300, ₹200 and ₹350 per unit respectively.
The expected sales price of the cooking range is ₹700 per unit Find out:
(i) The range of annual production/sales volume for which each location is most suitable and
(ii) Which one of the three locations is the best location at a production/sales volume of 18,000 units?

Question 6:

Find the economic order quantity and the reorder point, given
Annual demand (D) = 1000 units
Average daily demand (d) = 1000/365
Ordering Cost (S) = ₹ 5 per order
Holding cost(H) = ₹ 1.25 per unit per year. Lead time (L) = 5 days
Cost per unit (C) = ₹ 12.50
What quantity should be ordered?

Question 7:

Consider an economic order quantity case where annual demand D=1000 units, economic order quantity Q= 200 units , the desired probability of not stocking out P=0.95 , the standard deviation of demand during lead time 6L =25 units and lead time = L=15 days. Determine the reorder point. Assume the demand is over a 250 week day year.

Question 8:

Daily demand for a certain product is normally distributed with a mean of 60 and standard deviation of 7. The source of supply is reliable and maintains a constant lead time of six days. The cost of placing the order is ₹ 10 and annual holding costs are ₹ 0.50 per unit. There are no stock out costs, and unfilled orders are filled as soon as the order arrives. Assume sales occur over the entire 365 days of the year. Find the order quantity and reorder point to satisfy a 95 percent probability of not stocking out during the lead time.

Question 9:

Fixed -Time period Model with safety stock
Daily demand for a product is 10 units with a standard deviation of 3 units. The review period is 30 days, and lead time is 14 days. Management has set a policy of satisfying 98% of demand from items in stock. At the beginning of this review period, there are 150 units in inventory.

Question 10:

Average Inventory calculation – Fixed order quantity model

Suppose the following item is being managed using a fixed order quantity model with safety stock

Annual Demand (D) = 1000 units

Order quantity (Q) = 300 units

Safety stock (SS) = 40 units

What are the average inventory level and inventory turn for the item?

Question 11:

Average Inventory calculation – Fixed Time period model

Consider the following item that is being managed using a fixed time period model with safety stock

Weekly demand (d) = 50 units

Review cycle (T) = 3 weeks

Safety stock (SS) = 30 units

What are the average inventory level and inventory turn for the item?

Question 12:

Price Break Problem

Consider the following case, where

D = 10000 units (annual demand)

S = ₹ 20 to place order

I = 20 percent of cost (annual carrying cost, storage, interest, obsolescence, etc)

C = Cost per unit (according to the order size: order of 0 to 499 units, ₹ 5.00 per unit; 500 to 999 units, ₹ 4.50 per unit; 1000 and up, ₹ 3.90 per unit)

What quantity should be ordered?

Question 13:

A company currently has 200 units of a product on hand that it orders every two weeks when the salesperson visits the premises. Demand for the product averages 20 units per day with a standard deviation of 5 units. Lead time for the product to arrive is seven days. Management has a goal of 95 percent probability of not stocking out for this product. The salesperson is due to come in late this afternoon when 180 units are left in stock (assuming that 20 are sold today). How many units should be ordered?

Question 14:

A product is priced to sell at ₹100 per unit, and its cost is constant at ₹70 per unit. Each unsold unit has a salvage value of ₹20. Demand is expected to range between 35 and 40 units for the period. 35 definitely can be sold and no units over 40 will be sold. The demand probabilities and the associated cumulative probability distribution (P) for this situation follow.

How many units should be ordered?

No. of Units Demanded	Probability of this Demand	Cumulative Probability
35	0.10	0.10
36	0.15	0.25
37	0.25	0.50
38	0.25	0.75
39	0.15	0.90
40	0.10	1.00

Chapter 3: Designing of Operational System and Control

Content:

3.1 Product Design

3.2 Process Design and Selection

3.3 Product Life Cycle

3.4 Process Planning and Selection

3.5 Design Thinking

Product Design

Product design is a collection of

interdependent directional activities

that are planned and executed in a structured and planned way

to develop the value propositions

to be offered to the end customers for fulfilling their needs.

Basic objectives of product design:

- Meet end customer needs, provide value.
- Minimize cost, lead time (design to market).
- Maximize resource utilization.

Importance of Product Design:

- Establishes detailed product characteristics based on market demand and competition.
- Provides technical requirements for technology and processes.
- Guides production system design and operations strategy.
- Enables competitiveness, fosters customer relationships, and influences employment indirectly.
- Attributes include user-friendliness, features, aesthetics, reliability, durability, innovativeness, and appropriateness.

What Product Design Does:

(i) Translates customer requirements into technical specifications.

(ii) Extends product life cycle through differentiation.

(iii) Develops new products.

(iv) Formulates quality goals.

(v) Optimizes costs.

(vi) Builds and tests prototypes.

(vii) Documents design specifications.

Factors Affecting Product Design:

(a) Understanding customer needs, including unstated ones.

(b) User-friendliness across demographics.

(c) Balancing form, function, and cost.

(d) Quality of raw materials.

(e) Process and layout design.

(f) Quality of design tools and machines.

(g) Process capability and maturity.

(h) Availability of skilled resources.

(i) Impact on existing products.

(j) Product presentation, like packaging.

Characteristics of Good Product Design:

(a) Meets customer needs, provides value.

(b) Reliable and worthy of investment.

(c) Optimum cost for affordability.

(d) Short design to market lead time.

(e) Attractive aesthetics for immediate appeal.

(f) Compatible, user-friendly, with after-sales support.

(g) Easy maintenance and reproducibility.

(h) Balances standardization and customization.

(i) Detailed specifications.

(j) Safe, error-proof, environmentally friendly.

Process Design and Selection

Process Design encompasses all the activities that are performed to produce the final products as per the specifications in line with the requirements of the customers.

Process Design Factors:

(a) Product characteristics.

(b) Variety: Customization vs. standardization.

(c) Volume: Production amount and lot size.

(d) Human resource involvement: Automatic, semi-automatic, or manual.

(e) Resource requirements: Machines, human capital, space, energy, raw materials.

(f) Expenditure: Operating costs, fixed, and overhead.

(g) In-house vs. Outsource production decisions.

Process choice determines whether resources are organised around products or processes in order to implement the flow strategy. It depends on the volumes and degree of customisation to be provided.

Major Process Decision

Job Shop Process

Low-volume of high variety goods Or services

Processing is intermittent, each job requires somewhat different processing requirements

It is characterised by high customisation, high flexibility of equipment and skilled labour and low volume

Examples: Paint shops, printing shops, tailoring shops

Batch Process

Moderate volume of goods and services at moderate variety

In batch processing Volumes are higher because same or similar products and services are repeatedly provided

Differs from job shop processes in terms of volume and variety

Example Of products include, and, ice cream, soft drinks, books and magazines

Repetitive Process

Higher volume of more standardised goods or services

This type of processes characterised by slight flexibility of equipment (As products are standardised) and generally low labour skills

Repetitive process is also referred as line process as it include production lines and assembly lines in mass production

Product produced includes: automobiles, home appliances television sets, computers, toys.

Continuous Process

Very Highly standardised product is desired in higher volumes

These systems have almost no variety In output and hence there is no need for equipment flexibility

It is the extreme end of high-volume, standardised production with rigid line flows the process often is capital intensive and operate round-the-clock to maximise equipment utilisation and to avoid expensive shut downs and shut ups

Products made in continuous process system include petroleum products, steel, sugar, flour, paper, cement, fertilisers.

Project Process

High degree of job customisation

There is a large scope for each project and need for substantial resource to complete the project

Projects tend to be complex, take a long time and consist of large number of complex activities. Equipment flexibility and labour skills can range from low to high depending on the type of projects

Examples of projects or building a shop Centre, a Dam, a bridge, construction of a factory, hospital.

Product Life Cycle

Product Life Cycle (PLC) encompasses the various phases or cycles that a product undergoes throughout its usable life, akin to the lifecycle of organizations and individuals.

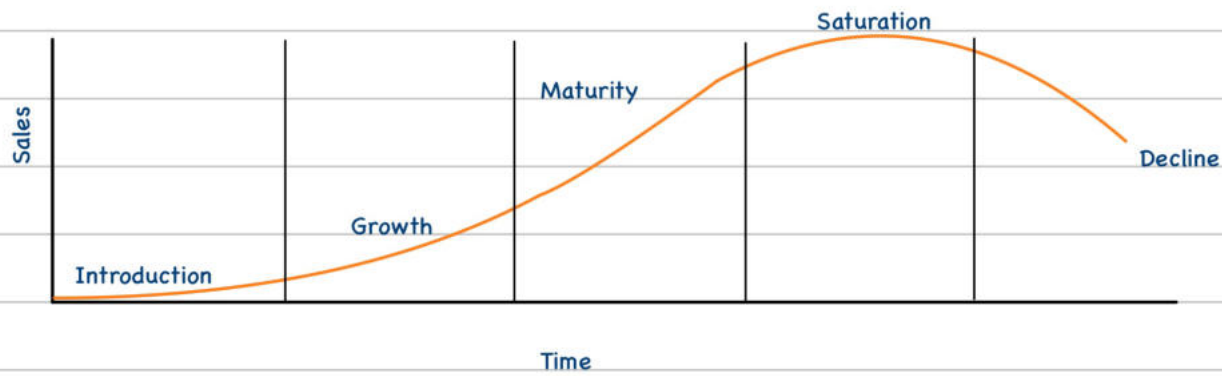
Introduction Phase: Product is launched, sales are low, promotional expenses are high, pricing may involve discounts to attract customers.

Growth Phase: Characterized by rapid revenue growth and market expansion. Sales aim to cover fixed costs and reduce overheads. Promotional strategies focus on customer retention and acquisition to capitalize on growth opportunities

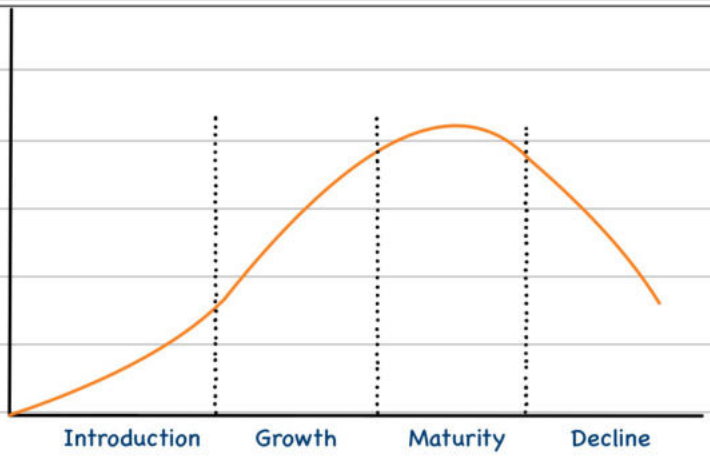
Maturity Phase: Market saturation occurs. Focus shifts from fast growth to maintaining stability. Organizations introduce product variety and differentiation to explore niche markets. Aggressive promotional and pricing strategies are employed. Profit margins tend to decrease compared to earlier phases.

Decline Phase: Sales decline, profit margins narrow. Organizations consider discontinuing the product and focus on cost reduction. Revival plans may include product differentiation and promotional strategies to boost sales.

Saturation Stage: This is when the market is filled up with a product, and sales either stop growing or start to decline because most potential customers already have it or don't want it.



Product Life Cycle for FMCG product



Product Life Cycle for High-Tech Product

High-tech products don't experience saturation like FMCG products due to continuous innovation and updates, offering ongoing value to consumers. Unlike FMCGs, high-tech products have longer lifecycles and evolving features, preventing them from reaching a saturation stage.

Process Planning and Selection

Process planning refers to all decisions regarding facility selection, layout planning, design of work systems and defining operating procedures, capacity planning, arrangement of equipment and resources, human resource planning etc which are necessary to facilitate the smooth execution of the activities to produce the intended products as required by the customers.

Process planning depends on variety and volume of outputs of the products, degree of equipment flexibility and flow of activities.

Process Strategy

A process strategy is a decision taken by the organization vis-à-vis selection of the processes for converting the input (i.e., resources) into output (i.e., finished products and services as required by the customers) in line with the product specifications.

It considers factors like efficiency, resource availability, flexibility, cost, quality, and lead time

Key premises include:

(a) Trade-off between Make (in-house conversion,fully or partial) or Buy (outsourcing, fully or partial)

(b) Level of capital intensity, balancing automation and manual operations.

(c) Flexibility in processes, including machine positioning and skills needed for layout decisions.

The facilities are designed while having three focus areas:

Process Focus:

- Common in job shops with low volume, high variety products.
- Organized around specific processes like welding or painting.
- Offers high product flexibility but incurs high variable costs and low facility utilization.

Repetitive Focus:

- Uses modules for product assembly, falling between product and process focus.
- Examples include assembly lines for automobiles and household appliances.
- Less flexible than process-focused facilities.

Product Focus:

- Organized around specific products with high volume and low variety.
- Examples include steel, glass, paper, and pharmaceuticals.
- Requires standardization and effective quality control, with high fixed costs but low variable costs.

Process layout selection aims to efficiently arrange equipment, materials, and workstations to:

(a) Facilitate production

(b) Minimize unnecessary movements

(c) Optimize material handling

(d) Organize workstations effectively

(e) Identify and remove bottlenecks

(f) Utilize space effectively.

The PV-LF Matrix is a useful tool for analysing the similarities and differences among the seven production systems. The PV-LF Matrix has four dimensions:

(a) Number of products produced

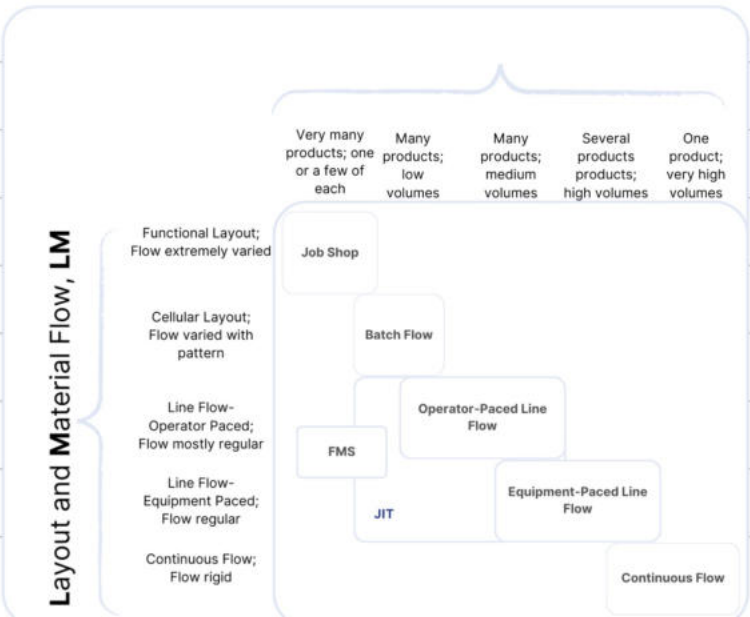
(b) Production volume of each product

(c) Layout or arrangement of equipment and processes used to manufacture the products

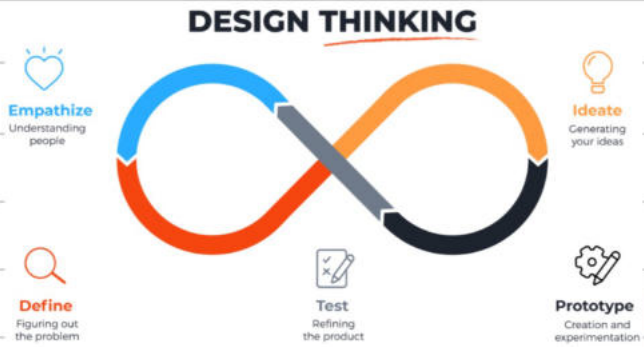
(d) Flow of material through the equipment and processes

A typical PV-LF diagram is given below

FMS (Flexible Manufacturing System) :



Design Thinking



What is Design Thinking?

Design thinking is a non-linear, iterative process that

- seeks to understand users needs,
- challenge assumptions,
- redefine problems and
- create innovative solutions to prototype and test.

Most useful to tackle problems that are ill-defined or unknown.

The Five Stages of Design Thinking [Hasso Plattner Institute of Design at Stanford (aka the d.school)]

Note: These stages are not always sequential, and teams often run them in parallel, out of order and repeat them in an iterative fashion.

Stage 1: Empathize—Research Your Users Needs

This stage involves gaining a deep understanding of users' needs, motivations, and challenges through research and observation. It requires empathy to set aside personal assumptions and truly understand users' perspectives.

Stage 2: Define—State Your Users' Needs and Problems

In this stage, the insights gathered from the Empathize stage are synthesized to define the core problems or opportunities. Problem statements are created to articulate the specific challenges that need to be addressed.

Stage 3: Ideate—Challenge Assumptions and Create Ideas

Ideation involves generating a wide range of creative solutions to the defined problems. The solid background of knowledge from the first two phases means you can start to "think outside the box". Teams brainstorm ideas, challenge assumptions, and explore alternative perspectives to encourage innovative thinking.

Stage 4: Prototype—Start to Create Solutions

Prototyping is the process of creating tangible representations of potential solutions. These prototypes can range from simple sketches to more elaborate mock-ups or models. The goal is to quickly and iteratively test ideas and gather feedback.

Stage 5: Test—Try Your Solutions Out

Evaluators rigorously test the prototypes. Although this is the final phase, design thinking is iterative: Teams often use the results to redefine one or more further problems. So, you can return to previous stages to make further iterations, alterations and refinements – to find or rule out alternative solutions.

Chapter 4: Application of Operation Research -

Production Planning and Control

This Module Includes

4.1 Introduction

4.2 Production Planning and Control

4.3 Control Measures – Time & Motion Study, Method Study, Work Study

4.4 Optimum Allocation of Resources - LPP

4.5 Transportation

4.6 Job Evaluation, Job Allocation - Assignment

4.7 Scheduling and Queuing Models

4.8 Simulation and Line Balancing

4.9 Lean Operations

4.10 JIT

Introduction

Operations Research (OR) uses math and data to help organizations solve tough problems and make smarter decisions for better efficiency.

Steps in solving a problem through Operations Research:

- Formulation: Define the problem, including input, output, objectives, and constraints.
- Modelling: Develop mathematical models to represent relationships and constraints.
- Solution: Apply scientific methods to solve the model, ensuring it meets objectives and constraints.
- Validation: Verify the model's reliability under given conditions.
- Feedback and Control: Adjust solutions based on changing variables to maintain effectiveness.
- Implementation: Coordinate with field staff to implement solutions, providing guidance and addressing limitations.

Applications/Scope of operations research

- National Planning: Including five-year plans, budgeting, and forecasting.
- Defense Operations: For technology development, cost optimization, and strategic planning.
- Industrial Management: Covering plant location, finance planning, inventory control, and personnel management.
- R&D and Engineering: In technology evaluation, project management, and systems evaluation.
- Business Management: In decision-making under uncertainty, strategy formation, and market research.
- Agriculture and Irrigation: For project management, optimal resource distribution, and infrastructure planning.
- Education and Training: Including school planning, resource allocation, and examination center location.
- Public Works: For time and cost control, project estimation, and tender evaluation.
- Transportation and Communication: In optimizing routes, capacity planning, and demand forecasting.
- Home Management: Covering budgeting, expense control, investment planning, and insurance optimization.

Methodology in Operations Research involves three main methods:

- Analytical Method: Relies on mathematical modeling and classical mathematical techniques like calculus and matrices. Example applications include Economic Order Quantity (EOQ) and linear programming for product mix optimization.
- Trial and Error Method: Used when analytical methods fail to yield solutions. It involves developing algorithms and iteratively modifying initial solutions until an optimal solution is reached. This method is deterministic and commonly applied in linear programming.
- Simulation Method: Utilizes statistical principles, sampling, and probability to solve problems where data is insufficient or situations are uncertain. It involves creating samples to represent real situations using devices like random tables or computers. Examples include Monte Carlo simulation for queuing problems and aircraft flight performance analysis. This method deals with stochastic models.

Nature and Characteristics of Operations Research

Problem Existence: OR addresses existing problems.

Problem Solving Intention: Aimed at solving problems.

System Approach: Applies system concepts and analysis.

Scientific Methodology: Utilizes research methods.

Multi-disciplinary Team: Involves specialists with a common goal.

Management Involvement: OR is facilitated by management.

Decision Support: Assists management in decision-making.

Recommending Solutions: OR offers recommendations.

Multiple Solutions: Often multiple solutions exist.

Optimal Solutions: Solutions aim to be optimal.

Appropriate Solutions: Solutions are appropriate for the problem.

Objective and Constraint Alignment: Solutions meet objectives within constraints.

Quantifiable Solutions: Solutions are expressed quantitatively.

Practical and Result-oriented: Solutions are practical and result-oriented.

Functions of Operations Research (OR) encompass:

- Scientific Decision-making: OR provides a scientific basis for decision-making, enhancing objectivity.
- Simplification of Complex Problems: OR techniques simplify complex problems for better understanding and resolution.
- Trade-off Analysis: OR identifies trade-offs between conflicting objectives to find optimal solutions, like in Economic Order Quantity (EOQ) calculations.
- System Integration: OR integrates subsystems to achieve goal congruence and optimization of the entire system.
- Resource Optimization: OR aids in conserving and optimizing scarce resources, such as through value engineering.
- Time Minimization: OR minimizes time through techniques like PERT, queuing theory, and transportation algorithms.
- Cost Minimization: OR reduces costs through methods like linear programming, CPM, and EOQ.
- Profit Maximization: OR contributes to profit maximization through techniques like LP, PERT/CPM, and decision trees.
- Alternative Selection: OR assists in selecting the best alternative among multiple options using techniques like game theory and decision trees.
- Specific Problem Solutions: OR provides solutions to specific problems such as line balancing, workstation design, and capacity decisions.

Limitations of Operations Research (OR) techniques include:

(a) Information Gap: OR relies heavily on mathematical manipulation, which may create a gap between OR specialists and management, leading to a lack of understanding and acceptance.

(b) Quantification Bias: OR techniques focus on quantifiable factors, often ignoring qualitative aspects like goodwill and attitudes.

(c) Finite Variables: OR typically deals with a finite number of variables, overlooking the multitude of factors influencing real-world situations.

(d) Limited Constraints: OR is constrained by the number of constraints it can handle, which may not fully capture the complexity of real-world problems.

(e) Single Objective Function: OR typically addresses problems with a single objective function, neglecting the presence of multiple objectives and sub-optimization.

Production Planning and Control

Production: Making goods or providing services.

Planning: Organizing and setting objectives.

Control: Monitoring and adjusting to meet goals.

The primary concern of production planning and control is the delivery of products to customers or to inventory stocks according to some predetermined schedule.

All the activities in the manufacturing or production cycle must be planned, coordinated, organised, and controlled to achieve this objective.

Plannings

Long-term	Medium-term.	Short-term
(7-10 yrs or more)	(2-5 year period).	(Several months to a year)
Plant construction	Capital equipment budgeting	Inventory goals
Location	Plant layout and capacity.	Utilisation of labour force,
Product line		material, physical facilities
Design and development		

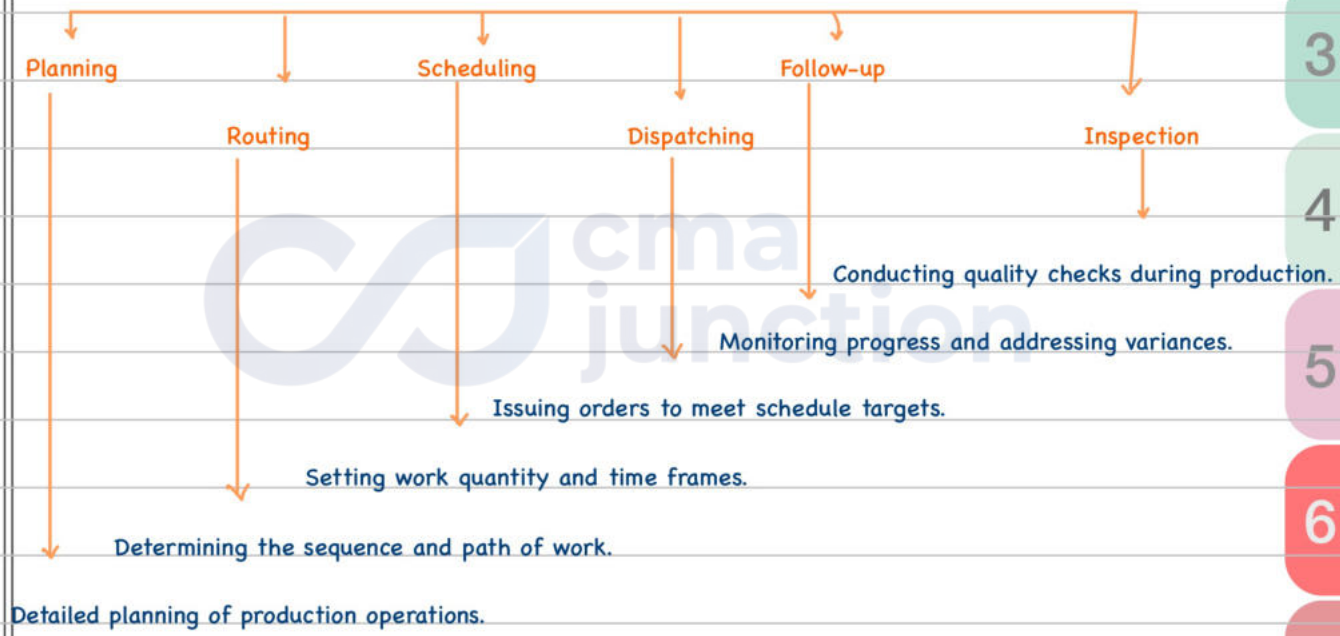
Production Planning and Control

Control is possible only when everything is planned

Why PPC?

- contributes to the profit of the enterprise
- keeps the customer satisfied through meeting of delivery schedules
- optimum utilisation of raw materials labourers and machines
- Control of work in process

Functions of Production Planning and Control



Basic types of production control include:

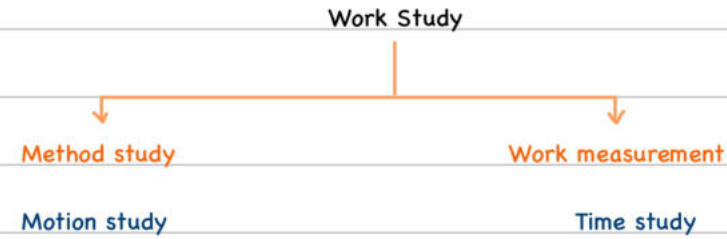
- Block Control: Used in industries like textiles and printing to keep processes separated.
- Flow Control: Common in continuous production systems like chemicals and petroleum.
- Load Control: Applied where bottleneck machines exist in manufacturing processes.
- Order Control: Employed in intermittent production systems, handling individual orders.
- Special Project Control: Needed for projects like construction, where close monitoring is essential.
- Batch Control: Found in food processing, managing manufacturing in discrete batches for consistency and quality

Production planning and control in continuous-production systems involves ensuring a constant flow of raw materials and finished products. This includes maintaining a steady supply of materials and sustaining a consistent production rate to meet demand.

In intermittent production systems, production planning revolves around using general-purpose machines and process layouts. Materials handling involves varied path equipment like hand trucks. Skilled labor is necessary due to the diverse range of products manufactured in small quantities.

Control Measures – Time & Motion Study, Method Study, Work Study

Work study is the investigation, by means of a consistent system of the work done in an organization in order to attain the best utilisation of resources i.e. Materials, Machines, Men and Money.



METHOD STUDY	WORK MEASUREMENT
SELECT the work to be studied.	SELECT the work to be studied.
RECORD all the relevant facts about the present method.	RECORD all the relevant data relating to the circumstances.
DEVELOP the most practical, economic and effective method in the circumstances.	MEASURE the quality of work involved in each element.
EXAMINE the facts critically and using the techniques best suited for the purpose.	EXAMINE the recorded data and the detailed breakdown critically.
EVALUATE different alternatives to developing a new improved method.	COMPILE the standard time for the operation
DEFINE INSTALL MAINTAIN (The new method)	DEFINE precisely the series of activities and methods of operation.

BASIS	TIME STUDY	MOTION STUDY
Meaning	Time study is one of the techniques of scientific management which involves observation and recording of the time taken in performing a particular task.	Motion study involves the observation of the movement of men, machines, materials and supplies, to find out the wasteful actions and eliminate them.
Involves	Tracking of the time consumed in carrying each part of the operation.	Ascertainment of total movements of workers while performing a task.
Purpose	To identify the standard time required to perform a task.	To reduce wastage of time and energy in unnecessary movements.
Tools used	Stopwatch	Surveillance Camera
Focuses on	Increase in productivity of labour.	Minimization of movement of workers.
Objective	To determine a fair day's work.	To find out the best method of doing a job.

Operation analysis is the study of the entire process to determine whether operations can be eliminated, combined or the sequence changed.

Job Evaluation

Job standardisation consists in determining the one best way of performing a job under the means at command of recording the exact method along with the time for each element of operation and establishing means to maintain the standard conditions.

Job analysis is the determination of essential factors in a specific kind of work and of the qualifications of a worker necessary for its performance.

Job Evaluation:

Job evaluation is the ranking grading, and weighing of essential work characteristics of all jobs in order to find out or rate the worth of jobs.

Job evaluation aims at fairness and consistency so far as all wages and salaries are concerned within an organisation and when systematic and impartial, it stimulates, confidence of the employees. There are three steps for evaluations of all jobs :-

(i) Preparation of preliminary description of each existing job.

(ii) Analysing each job to arrive at final job descriptions and specifications.

(iii) Analysing each job according to its approved description in order to determine its worth or value.

Job Evaluation.

Systems of job evaluation

- Ranking or grading method

  titles of all jobs are written on cards and the grading is done by several competent judges.

- Factor Comparison Method

  It ranks each job with respect to each factor

- Point Rating Method: There are three methods of analytical evaluation of a job. They are:

  a) Straight point method.

  Equal weight for each characteristics

  b) Weighted point method.

  Different points assigned to different characteristic

  c) Valuation of jobs directly in money method, not specifying any maximum weight.

  After selecting the job characteristics, 10 key jobs whose rates are believed to be correct, taken and the present wage rate of these jobs are distributed to the job characteristics by each analyst.

Factors affecting job valuation

- Qualifications required of the worker,
- Job difficulties,
- Job responsibilities,
- Working conditions.

Linear Programming Problem

Linear Programming is an optimization technique. It is "a technique for specifying how to use limited resources or capacities of a business to obtain a particular objective, such as least cost, highest margin or least time, when those resources have alternate uses".

The situation which require a search for "best" values of the variables, subject to certain constraints, are amenable to programming analysis.

Linear Programming

Objective Function

Describes the primary purpose of the formulation

to maximize some return (for example, profit) or to minimize some cost (for example, production cost or investment cost).

Constraint Set

System of equalities and/or inequalities which describes the restrictions (conditions or constraints) under which optimisation is to be accomplished.

Limitations of Linear Programming

- Limited application
- Certain assumptions
- Fractional valued answer
- Multiple goals
- No effect of time and uncertainty

Solution, Feasible Solutions, Optimal Solution

Maximise $Z = 3x_1 + 2x_2$ ——— (1)

Subject to, $x_1 - x_2 \geq 0$ ——— (2)

$-3x_1 + x_2 \geq 3$ ——— (3)

$x_1, x_2 \geq 0$ ——— non negativity constraint

Any value of X1, X2 with satisfies equation (2) and (3), is known as Solution.

Any value of X1, X2 with satisfies equation (2) and (3) + non-negativity, constant is known as Feasible Solution.

Any value of X1, X2 with satisfies equation (1), (2) and (3) + non-negativity, constant is known as Optimal Solution.

Slack Variable, Basic Variable, Surplus Variable and Artificial Variable,

Consider the following constraints:

$3x1 + 5X2 + 7X3 \leq 64$ can be written as, $3X1 + 5X2 + 7X3 = 64$ and $3x1 + 5X2 + 7X3 < 64$

$2X1 + 7X2 + 9X3 \leq 30$

In order to make the above inequalities, having " $\leq$." Sign to equations "=", we will be adding a non-negative quantities to each of the constraints.

Those non-negative quantities are called " Slack Variable"

The constraints will be, $3x1 + 5X2 + 7X3 + 1.S1 + 0.S2 = 64$

$2X1 + 7X2 + 9X3 + 0.S1 + 1.S2 = 30$

The variables and coefficient of slacks are in the form of,

$$\begin{bmatrix} 0 & 1 \\ 1 & 0 \end{bmatrix}$$

Hence, S1, S2 are basic variables.

Consider the following constraints:

$3x1 + 5X2 + 7X3 \geq 64$

$2X1 + 7X2 + 9X3 \geq 30$

In order to make the above inequalities, having " $\geq$" Sign to equations "=", we will be subtracting a non-negative variables to each of the constraints.

Those non -negative quantities are called "Surplus Variables".

The constraints will be:

$3x1 + 5X2 + 7X3 - 1.S1 + 0.S2 = 64$ ——— (1)

$2X1 + 7X2 + 9X3 + 0.S1 + 1.S2 = 30$ ——— (2)

We may note that equation (1) and (2), we do not have any basic variable (since an identity metrics is not formed). Just to have a basic variable in each of them a new variable called " Artificial variable" will be introduced in each of such constraint with a positive unit coefficient.

The revised equation will be,

$3x1 + 5X2 + 7X3 - 1.S1 + 0.S2 + 1.A1 + 0.A2 = 64$

$2X1 + 7X2 + 9X3 + 0.S1 + 1.S2 + 0.A1 + 1.A2 = 30$

Unrestricted Variable

Any variable xi, which takes either positive, negative or zero value

Maximise $Z = 3x1 + 2x2$ ——— (1)

Subject to, $x1 - x2 \geq 0$ ——— (2)

$-3x1 + x2 \geq 3$ ——— (3)

$x1 \geq 0$ ——— non negativity constraint

As x2 undefined, so it can be either positive, negative or zero. Thus, X2 is unrestricted variable.

If X2 is unrestricted variable, we consider, X2 = X3 minus X4, where X3, X4 ≥ 0

Question 1:

A Chemical Company produces two compounds A and B. The following table gives the units of ingredients C and D per kg of compounds A and B as well as minimum requirements of C and D and costs/kg of A and B. Write drawn the problem mathematically for minimisation of cost.

Ingredients	Table Compound		Minimum Requirement
	A	B	
C	1	2	80
D	3	1	75
Cost per Kg.	4	6	

Question 2:

A pension fund manager is considering investing in two shares A and B. It is estimated that:

(i) Share A will earn a dividend of 12% per annum and share B 4% per annum.

(ii) Growth in the market value in one year of share A will be 10 paise per ₹ 1 invested and in B 40 paise per ₹ 1 invested.

He requires investing the minimum total sum which will give:

Dividend income of at least ₹ 600 per annum and growth in one year of at least ₹ 1,000 on the initial investment.

You are required to:

State the mathematical formulation of the problem which will facilitate computation of the minimum sum to be invested to meet the manager's objective.

Question 3:

A Bank is in the process of formulating its loan policy. Involving a maximum of ₹ 600 Million. Table below gives the relevant types of loans. Bad debts are not recoverable and produce no interest. To meet competition from other Banks the following policy guidelines have been set. At least 40% of the funds must be allocated to the agricultural and commercial loans. Funds allocated to housing must be at least 50% of all loans given to personal, car, Housing. The overall bad debts on all loans may not exceed 0.06.

Formulate a linear program Model to determine optimal loan allocations.

Type of Loan	Interest Rate%	Bad Debts (Probability)
Personal	17	0.10
Car	14	0.07
Housing	11	0.05

Agricultural	10	0.08
Commercial	13	0.06

Question 4:

A city hospital has the following minimal daily requirement for nurses:

Period	Clock time (24 hour day)	Minimum Number of Nurses Required
1	6 a.m. - 10 a.m	2
2	10 a.m. - 2 p.m.	7
3	2 p.m. - 6 p.m.	75
4	6 p.m. - 10 p.m.	8
5	10 p.m. - 2 a.m.	20
6	2 a.m. - 6 a.m.	6

Nurses report to the hospital at the beginning of each period and work for 8 consecutive hours. The hospital wants to determine the minimal number of nurses to be employed so that there will be a sufficient number of nurses available for each period.
Formulate this as a Linear Programming question by setting up appropriate constraints and objective function.

Question 5:

One unit of product A contributes ₹ 7 and requires 3 units of raw material and 2 hours of labour. One unit of product B contributes ₹ 5 and requires one unit of raw material and one hour of labour. Availability of raw material at present is 48 units and hence there are 40 hours of labour.
i. Formulate it as a linear programming problem.
ii. Write its dual.

Question 6:

A Company produces the products P, Q and R from three raw materials A, B and C. One unit of product P requires 2 units ofAand 3 units of B.Aunit of product Q requires 2 units of B and 5 units of C and one unit of product R requires 3 units of A, 2 unit of B and 4 units of C. The Company has 8 units of material A, 10 units of B and 15 units of C available to it. Profits/unit of products P, Q and R are Rs.3, Rs.5 and Rs.4 respectively.
(a) Formulate the problem mathematically,
(b) Write the Dual problem.

Question 7:

What is the slope of the objective function Max Z = 15X + 45Y?

Question 8:

An electronic goods manufacturer has distributors who will accept shipments of either transistor radios or electronic calculators to stock for Christmas inventory Whereas the radios contribute ₹ 10 per unit and the calculator ₹ 15 per unit to profits, both products use some of the same components. Each radio requires diodes and resistors, while each calculator requires 10 diodes and 2 resistors. The radio takes 12.0 minutes and the calculatorstake 9.6 minutes of time on the company's electronic testing machine, and the production manager estimates that 160 hours of test time is available. The firm has 8,000 diodes and 3,000 resistors in inventory.

What product mix should be selected to obtain the highest profit?

Question 9:

The simplex calculator company makes a profit of ₹ 5 on each model X and ₹ 20 on each model Y. Each calculator requires the following time (in minutes) on the cleaning and testing machines.

	X Requirements	Y Requirements	Time Available
Cleaning	2	6	10
Testing	6	3	12

(a) State the objective function and constraints.

(b) Arrange the equations in a simplex format.

Question 10: The initial matrix of a maximisation linear programming problem is as shown where the decision variables are designated A, B, etc.

C →	4	8	6	0	0	0	
↓							
Variables in solution							RHS
	5	9	0	1	0	0	36
	0	8	5	0	1	0	24
	2	0	5	0	0	1	7
	0	0	0	0	0	0	
	4	8	6	0	0	0	0

(a) State the original constraint equations.

(b) How many decision variables are there?

(c) State the objective function.

Question 11:

Solve the following problem by Simplex Method:

Product/Machine	Per unit Resource Matrix			Profit per unit in Rs.
	M1	M2	M3	
P1	4	3	2	20
P2	4	4	1	12
P3	4	3	1	08
Maximum Capacity of the Matrix	1200	900	400	

Question 12:

Solve the following LPP, using simplex method:

Minimize $Z = 2X_1 - 3X_2 + 6X_3$

Subject to:

$3X_1 - X_2 + 2X_3 \leq 7$

$2X_1 + 4X_2 \geq -12$

$-4X_1 + 3X_2 + 8X_3 \leq 10$

$X_1, X_2, X_3 \geq 0$

Transportation Problem

Transportation model deals with the transportation of a product manufactured at different plants or factories to a number of different warehouses (supply origins) (demand destinations).

Typically arise in situations involving physical movement

Why?

To satisfy the destination requirements within the plants capacity constraints at the minimum transportation cost.

Feasible Solution:

A set of non-negative cell allocations of the given Cost Matrix whose elements are xij, i=1, 2, ..., m; j = 1, 2, ..., n that satisfies the total Demand and Supply requirement is called a feasible solution to the transportation problem.

Basic Feasible Solution:

An initial feasible solution with an allocation of (m + n − 1) number of cells of the matrix whose elements are, xij, i=1, 2, ..., m; j = 1, 2, ..., n (m = No. of rows, n = No. of columns) is called a basic feasible solution.

Optimum Solution:

A feasible solution (not necessarily basic) is said to be optimum if it minimises the total transportation cost.

Balanced or Unbalanced Transportation Problems:

A transportation problem can be balanced or unbalanced. It is said to be balanced if the total demand of all the warehouses equals the amount produced in all the factories.

Where the number of rows and columns (or Supply and demand) are not equal, it is called unbalanced transportation problem

Balanced

	1	2	3	Supply
A	2	3	4	10
B	5	7	9	30
C	10	2	5	60
Demand	20	30	50	100

Unbalanced

	1	2	3	Supply
A	2	3	4	10
B	5	7	9	30
C	10	2	5	60
Demand	20	25	45	90/100

Balanced

	1	2	3	4	Supply
A	2	3	4	0	10
B	5	7	9	0	30
C	10	2	5	0	60
Demand	20	25	45	10	100

Loops in Transportation Table:

In a transportation table, an ordered set of four or more cells is said to form a loop if any two adjacent cells in the ordered set lie either in the same row or in the same column. Moreover every loop has an even number of cells. It may be noted that a feasible solution to a T.P is basic if and only if the corresponding cells in the transportation table do not contain a loop.

Degeneracy of a Transportation Problem:

When the quantities are allocated to cost cells within the matrix and if such allocations are less than m + n -1 allocations (where 'm' stands for no. of rows and 'n' stands for no. of columns), such a situation is said to be Degeneracy of a Transportation Problem.

Methods for obtaining Basic Feasible Solution

- The north-west corner rule
- Least cost method.
  - Minimum row cost method;
  - Minimum column cost methods;
  - Minimum cost matrix method;
- Vogel's approximation method

Question 1:

A company has three factories O1, O2,O3 whose daily production of a material are respectively 7,9,18 units. It has four warehouses D1, D2, D3, D4 whose capacities of storage are respectively 5,8,7,14 units, so that all units of productions can be stored there.

The cost (in rupees) per unit materials of transporting the materials from O1 to the four warehouses are respectively 19,30,50,10.

The cost from O2 to the warehouses are respectively 70,30,40,60.

The cost from O3 to the warehouses are respectively 40,8,70,20.

Find a basic feasible solution (allocations) and the corresponding total cost, by the method of north-west corner rule.

Question 2:

Solve Question 21 by the

a) minimum row cost method.

b) minimum column cost method.

c) minimum cost matrix methods.

d) Vogel approximation or unity penalty method.

Question 3:

The cost conscious company requires for the next month 300, 260 and 180 tonnes of stone chips for its three constructions C1, C2 and C3 respectively. Stone chips are produced by the company at three mineral fields taken on short lease by the company. All the available boulders must be crushed into chips. Any excess chips over the demands at sites C1, C2 and C3 will be sold ex-fields. The fields are M1, M2 and M3 which will yield 250, 320 and 280 tons of stone chips respectively.

Transportation costs from mineral fields to construction sites vary according to distances, which are given below in monetary units (MU).

	To	C1	C2	C3
From	M1	8	7	6
	M2	5	4	9
	M3	7	5	5

(i) Determine the optimal economic transportation plan for the company and the overall transportation cost in MU.

(ii) What are the quantities to be sold from M1, M2 and M3 respectively?

Question 4:

Ladies fashion shop wishes to purchase the following quantity of summer dresses:

Dress Size	I	II	III	IV
Quantity	100	200	450	150

Three manufacturers are willing to supply dresses. The quantities given below are the maximum that they are able to supply of any given combination of orders for dresses:

Manufacturers	A	B	C
Total Quantity	150	450	250

The shop expects the profit per dress to vary with the manufacturer as given below: Size

	I	II	III	IV
A	₹2.5	₹4.0	₹5.0	₹2.0
B	₹3.0	₹3.5	₹5.5	₹1.5
C	₹2.0	₹4.5	₹4.5	₹2.5

Required:

(a) Use the transportation technique to solve the problem of how the orders should be placed with the manufacturers by the fashion shop in order to maximise profit.

(b) Explain how you know there is no further improvement possible.

Question 5:

The products of three plants F1, F2 and F3 are to be transported to 5 warehouses W1, W2, W3, W4 and W5. The capacities of plants, demand of warehouses and the cost of transportation from one plant to various warehouses are indicated in the following table:

	W1	W2	W3	W4	W5	Plant Capacity
F1	74	56	54	62	68	400
F2	58	64	62	58	54	500
F3	66	70	52	60	60	600
Warehouse Demand	200	280	240	360	320	1500/1400

(a) Find out a distribution plan of products from plants to the warehouses at a minimum cost. What is the minimum cost?

(b) Is there any surplus capacity of the plants? If so, in which plant should we associate that surplus capacity?

(c) Is there any alternate solution for the optimum solution achieved in

Job Allocation - Assignment

Assignment is a specialized linear programming problem commonly encountered in various scenarios such as assigning workers to machines, clerks to checkout counters, or salesmen to sales areas. The objective is to minimize total costs by optimally assigning tasks to individuals based on their varying abilities and associated costs.

There are four methods of solving an assignment problem and they are:

1. Complete Enumeration Method (Trial amd Error)
2. Simplex Method
3. Transportation Method and
4. Hungarian Method

Hungarian Methods: Steps:

Step 1: Row Operation: Find the smallest cost element in each row and subtract it from all other elements in that row to create a reduced cost table.

Step 2: Column Operation: In the reduced cost table, find the smallest element in each column and subtract it from all other elements in that column.

Step 3: Optimality: Draw the minimum number of lines (horizontal and vertical) to cover all zero elements. If the number of lines equals the number of rows/columns, the solution is optimal. If not, proceed to step 4.

Step 4: Improved Matrix: Adjust the matrix by subtracting the smallest uncovered cost element from all uncovered elements and adding it to the intersection of any two lines. Repeat steps 3 and 4 until an optimal solution is reached.

Step 5: Assignments: Make job assignments based on zero elements in the matrix. Assign jobs corresponding to rows or persons corresponding to columns with only one zero. Cross out assigned zeros and repeat until all assignments are made. If no single zero remains in a row or column, make arbitrary assignments.

Question 1:

Six men are available for different jobs. From past records the time in hours taken by different persons for different jobs are given below.

	Jobs						
		1	**2**	**3**	**4**	**5**	**6**
MEN	1	2	9	2	7	9	1
	2	6	8	7	6	14	1
	3	4	6	5	3	8	1
	4	4	2	7	3	10	1
	5	5	3	9	5	12	1
	6	9	8	12	13	9	1

Find out an allocation of men to different jobs which will lead to minimum operation time.

Question 2:

A captain of a cricket team has to allot five middle batting positions to five batsmen. The average runs scored by each batsman at these positions are as follows:

	Batting Position					
		III	IV	V	VI	VII
Batsmen	A	2	9	2	7	9
	2	6	8	7	6	14
	3	4	6	5	3	8
	4	4	2	7	3	10
	5	5	3	9	5	12
	6	9	8	12	13	9

Make the assignment so that the expected total average runs scored by these batsmen are maximum.

Question 3:

Average time taken by an operator on a specific machine is tabulated below. The management is considering replacing one of the old machines by a new one and the estimated time for operation by each operator on the new machine is also indicated.

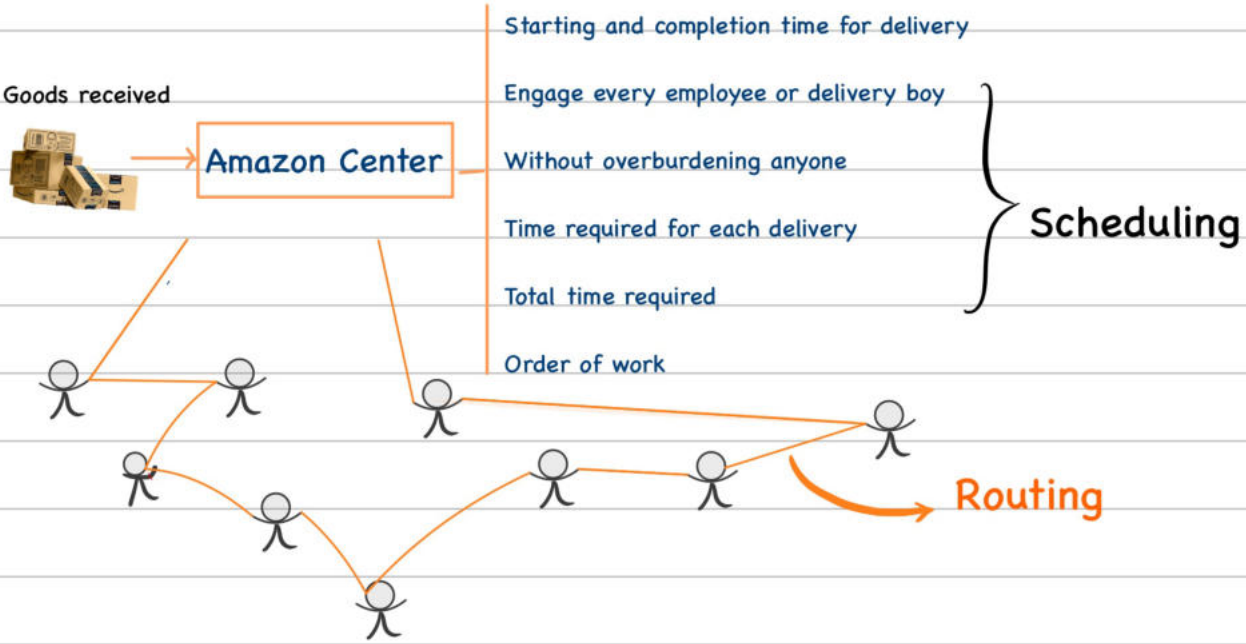
Operator	Machines						
	M1	M2	M3	M4	M5	M6	New
01	2	3	2	1	4	5	6
02	4	4	6	3	2	5	1
03	6	10	8	4	7	6	1
04	8	7	6	5	3	9	4
05	7	3	4	5	4	3	12
06	5	5	6	7	8	1	6

(a) Find out an allocation of operators to the old machines to achieve a minimum operation time.

(b) Reset the problem with the new machine and find out the allocation of the operators to each machine and comment on whether it is advantageous to replace an old machine to achieve a reduction in operating time only.

(c) How will the operators be reallocated to the machines after replacement?

Scheduling



Scheduling is the process of arranging, controlling and optimising work and workloads in a production process or manufacturing process.

Scheduling → Determination of time required → to perform each operation
→ to perform the entire series as routed.

Scheduling technique determines

Starting time — Completion time

each operation, of the total manufacturing process

so that the man and machines can be utilised to the maximum.

Routing means determination of the route to be followed by each part or component being transformed from input/Raw material into final product.

Relationship between Routing and Scheduling

'Routing' and 'Scheduling' are interconnected and either of these activities cannot be undertaken independently. It is very difficult to prepare schedules without determining the routing of sequence of operations.

Routing is a prerequisite for scheduling. Unless route or sequence of operations, tools, equipment and plants and the persons by when operations are to be performed, are established, the time taken by each operation, the idle time of men and machine and total time for the whole process cannot be ascertained in a convincing manner.

Conversely, scheduling is equally important for routing. It is quite difficult to route an item efficiently through a plant without consulting previously-designed schedules.

Thus, routing and scheduling are inter-related, inter-connected and inter-dependent activities of production planning and control.

Factors affecting scheduling

- Routing
- The method of production
- Quantity of production
- Transportation of Raw material
- Production capacity

Principles of scheduling

The principle of optimum task size

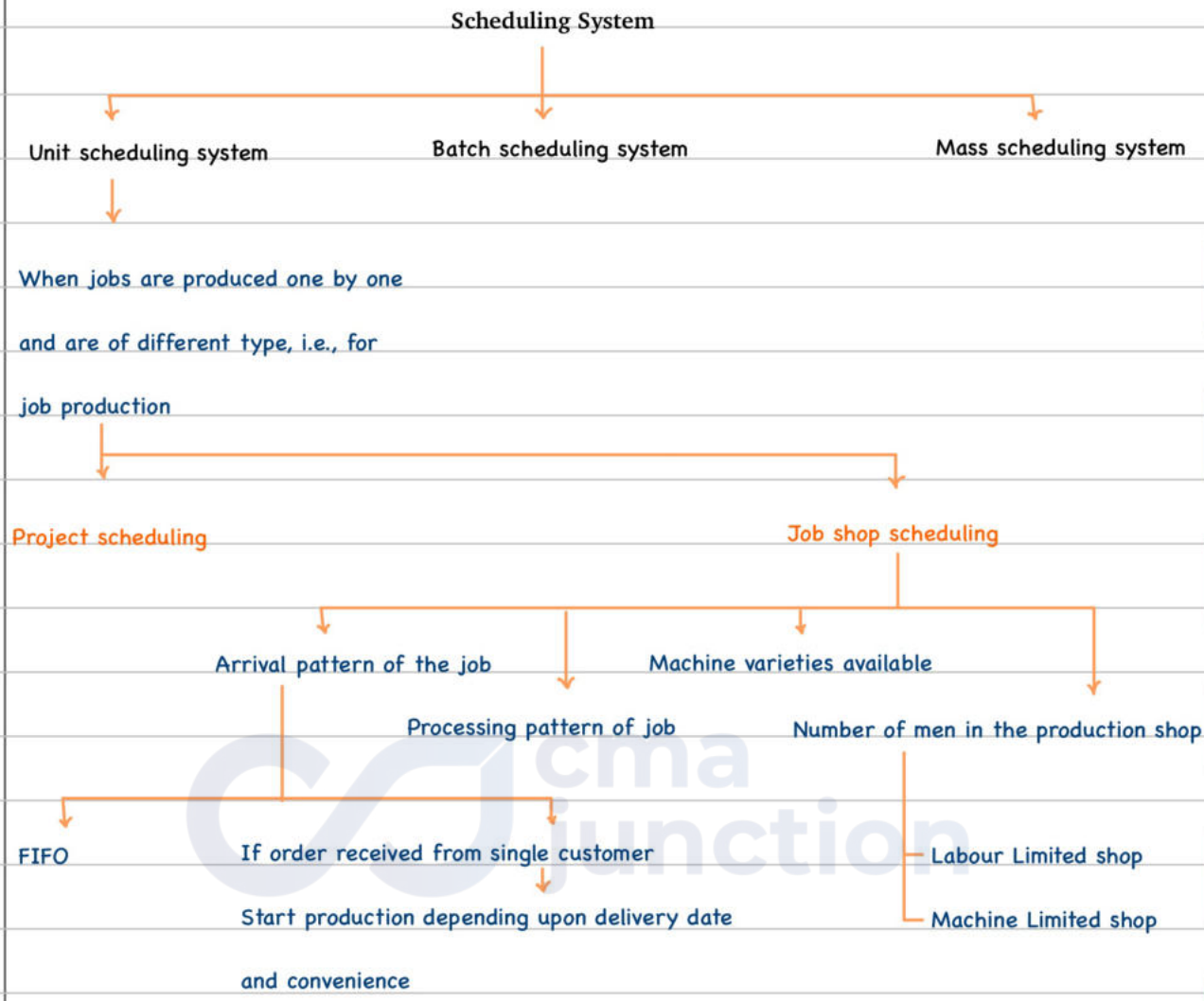
All tasks are relatively small and of similar size.

The principle of the optimum operation sequence

The work centers are normally used in the same sequence

The principle of the optimum Production plan

It distributes an equal workload across all facilities.



Sequencing rules for single facility

- First in first out (FIFO)/First in first served (FIFS)
- Shortest processing time (SPT)
- Maximum due date (MDD)
- Last come first served (LCFS)/Last in first out (LIFO)
- Static slack for remaining operation (SSRO) — (Time till due date - Remaining Processing Time) / Number of remaining operations
- Dynamic slack for remaining operation (DSRO) — (Time till due date - Expected time of Remaining Operations) / Number of remaining operations

Question 1:

The processing times (tj) in hrs for the five jobs of a single machine scheduling is given. Find the optimal sequence which will minimise the mean flow time and find the mean flow time.

Determine the sequence which will minimise the weighted mean flow time and also find the mean flow time

Job (j)	1	2	3	4	5
Processing time (tj) hrs	30	8	10	28	16
Weight (Wj)	1	2	1	2	3

Question 2:

Table shows the time remaining (number of days until the due date) and the work remaining (number of day's still required to finish the work) for 5 jobs which were assigned the letters A to E as they arrived at the shop.

Sequence these jobs by priority rules viz., (a) FCFS, (b) EDD, (c) LS, (d) SPT, (e) LPT, (f) least slack rule, (g) critical ratio rule.

Job	No. of days until due date	No. of days of work remaining
A	8	7
B	3	4
C	7	5
D	9	2
E	6	6

Question 3:

In a factory, there are six jobs to perform, each of which should go through two machines A and B, in the order AB. The processing timings (in hours) for the jobs are given here.

You are required to determine the sequence for performing the jobs that would minimise the total elapsed time, T.

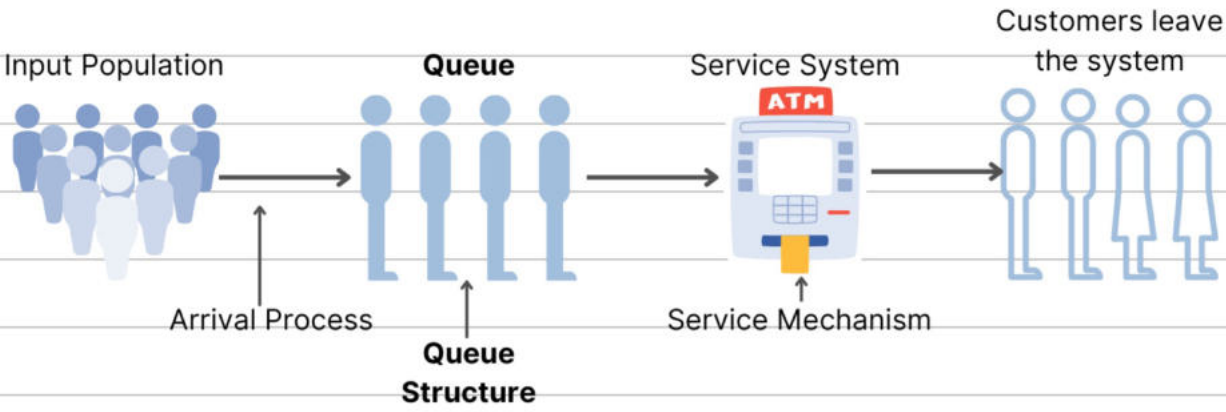
What is the value of T?

Job	Machine A	Machine B
1	7	3
2	4	8

3	2	6
4	5	6
5	9	4
6	8	1

Queuing Models

General Structure of Queuing System



Behaviour or Attitude

- Patient
- Impatient
  - Jockeying → Customer switching to other queue which are moving fast.
  - Balking. → Customers, upon their arrival, not join the queue for some reason
  - Reneging → Customer stands in the queue for sometime and then leave the system because it is working too slowly

Assumptions

- Storage capacity to be infinite
- No balking, jockeying and reneging
- First come first served

Characteristics of waiting line

Population source

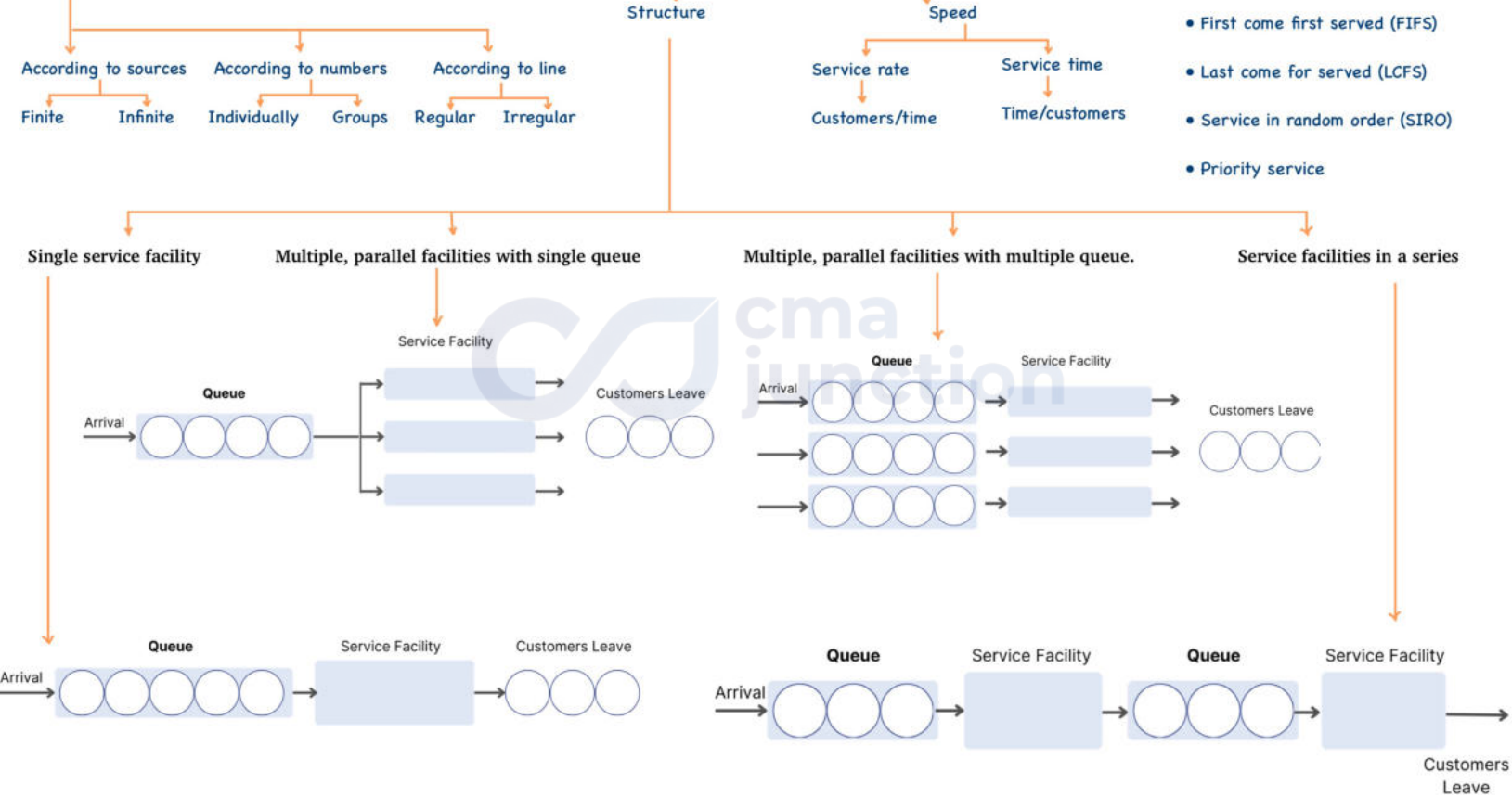
Number of servers (channel)

Arrivals and service pattern

Queue discipline

Characteristics of queue system

- Queue Length
- System length
- Waiting time in the queue
- Total time in the system
- Server idle time



Measures of waiting-line performance

1. The average number of customers waiting, either in line or in the system.

2. The average time customers wait, either in line or in the system.

3. System utilization, which refers to the percentage of capacity utilized.

4. The implied cost of a given level of capacity and its related waiting line.

5. The probability that an arrival will have to wait for service.

Queuing Models: Infinite-source

1. Single server, exponential service time.

2. Single server, constant service time.

3. Multiple servers, exponential service time.

4. Multiple priority service, exponential service time.

Infinite Source Symbol

Symbol	Represents
λ	Customer arrival rate
μ	Service rate per server
Lq	The average number of customers waiting for service
Ls	The average number of customers in the system (waiting and/or being served)
r	The average number of customers being served
ρ	The system utilization
Wq	The average time customers wait in line
Ws	The average time customer's spend in the system (waiting in line and service time)
1/μ	Service time
Po	The probability of zero units in the system
Pn	The probability of n units in the system
M	The number of servers (channels)
Lmax	The maximum expected number waiting in line

Formulas for basic single-server model

Performance Measure	Equation
Average number in line/queue	$L_q = \frac{\lambda^2}{\mu(\mu-\lambda)}$
Probability of zero units in the system	$P_o = 1 - (\frac{\lambda}{\mu})$
Probability of n units in the system	$P_n = P_o(\frac{\lambda}{\mu})^n$
Probability of less than n units in the system	$P_{<n} = 1 - (\frac{\lambda}{\mu})^n$

Customers	Line	+	Service	=	System
Average number waiting	$L_q = \frac{\lambda^2}{\mu(\mu-\lambda)}$	+	λ/u	=	$L_S = \frac{\lambda}{\mu-\lambda}$
* Multiply	1/λ				1/λ
= Average time waiting	$W_q = \frac{\lambda}{\mu(\mu-\lambda)}$	+	1/u	=	$W_S = \frac{1}{(\mu-\lambda)}$

Question 1:

Customers arrive at a bakery at an average rate of 16 per hour on weekday mornings. The arrival can be described by a Poisson distribution with a mean of 16. Each clerk can serve a customer in an average of three minutes; This time can be described by an exponential distribution with a mean of 3.0 minutes.

a. What are the arrival and service rates?

b. Compute the average number of customers being served at any time.

c. Suppose it has been determined that the average number of customers waiting in line is 3.2. Compute the average number of customers in the system (i.e., waiting in line or being served), the average time customers wait in line, and the average time in the system.

d. Determine the system utilisation for M = 1, 2, and 3 servers.

Question 2:

An airline is planning to open a satellite ticket desk in a new shopping plaza, staffed by one ticket agent. It is estimated that requests for tickets and information will average 15 per hour, and requests will have a Poisson distribution. Service time is assumed to be exponentially distributed. Previous experience with similar satellite operations suggests that mean service time should average about three minutes per request.

Determine each of the following:

a. System utilisation.

b. Percentage of time the server (agent) will be idle.

c. The expected number of customers waiting to be served.

d. The average time customers will spend in the system.

The probability of zero customers in the system and the probability of four customers in the system.

Question 3:

A departmental store has one cashier. During the rush hours, customers arrive at a rate of 20 per hour. The average number of customers that can be handled by the cashier is 24 per hour.

Assume the conditions for use of the single – channel queuing model.

Find out the average time a customer spends in the system.

Question 4:

As a tool service centre the arrival rate is two per hour and the service potential is three per hour. Simple queue conditions exist. The hourly wage paid to the attendant at the service centre is ₹1.50 per hour and the hourly cost of a machinist away from his work is ₹ 4. Calculate:

(i) The average number of machinists being served or waiting to be served at any given time.

(ii) The average time a machinist spends waiting for service.

(iii) The total cost of operating the system for an eight – hour day.

(iv) The cost of the system if there were two attendants working together as a team, each paid ₹ 1.50 per hour and each able to service on average 2 per hour.

Question 5:

Workers come to the tool store room to enquire about special tools (required by them) for accomplishing a particular project assigned to them. The average time between two arrivals is 60 seconds and the arrivals are assumed to be in Poisson distribution.

The average service time (of the tool room attendant) is 40 seconds.

Determine:

(i) average queue length,

(ii) average length of non-empty queues,

(iii) average number of workers in the system including the worker being attended

(iv) mean waiting time of an arrival,

(v) average waiting time of an arrival who waits.

Question 6:

Wanda's Car Wash & dry is an automatic, five-minute operation with a single bay. On a typical Saturday morning, cars arrive at a mean rate of eight per hour, with arrivals tending to follow a Poisson distribution.

Find

a. The average number of cars in line.

b. The average time cars spend in line and service.

Question 7:

Customers arrive at a booking office window being manned by a single individual at a rate of 25 per hour. The time required to serve a customer has exponential distribution with a mean of 120 seconds. Find the average waiting time of a customer.

Question 8:

Trucks arrive at a factory for collecting finished goods for transportation to distant markets. As and when they come they are required to join a waiting line and are served on a first come, first served basis. Trucks arrive at the rate of 10 per hour whereas the loading rate is 15 per hour. It is also given that arrivals are Poisson and loading is exponentially distributed.

Transporters have complained that their trucks have to wait for nearly 12 hours at the plant.

Examine whether the complaint is justified.

Also determine the probability that the loaders are idle in the above problem.

Question 9:

In a Tool Crib manned by a single Assistant, operators arrive at the tool crib at the rate of 10 per hour. Each operator needs 3 minutes on an average to be served.

Find out the loss of production due to waiting for an operator in a shift of 8 hours if the rate of production is 100 units per shift.

Question 10:

A repairman is to be hired by a company to repair machines that break down at an average rate of 3/hour. Breakdown occurs randomly (Poisson distribution) over time. Non-productive time on any machine is considered to cost the company ₹20 per hour.

The management has narrowed down the choice to 2 repairmen; one 'slow but cheap' and other 'fast but expensive'. The 'slow but cheap' repairman has a rate of ₹5 per hour and he will service breakdown machines at an average rate of 4/hour. The 'fast but expensive' repairman has a rate of ₹7 per hour and he will service breakdown machines at an average rate of 6/hour.

Which repairman should the company hire?
Assume exponential repair time for both repairmen.

Simulation

To simulate means to imitate. In general, simulation involves developing a model of real phenomenon and then performing experiments on the model evolved.

It is to be noted that simulation is a descriptive and not optimising technique. In simulation, a given system is copied and variables and constant associated with it are manipulated in that artificial environment to examine the behaviour of the system

Simulation consists of four phases:

1. Definition of the problem and statement of objectives.
2. Construction of an appropriate model
3. Experimentation with the model constructed.
4. Evaluation of the results of simulation.

Monte Carlo simulation

Although simulation can be of many types, our discussion will focus on the Probabilistic simulation using the Monte Carlo method, also called computer simulation

Question 1:

TANEESA, a car rental agency has collected the following parameters on the dem for five-seater vehicles over the past 50 days.

Daily Demand	5	6	7	8	10
No. Of Days	4	10	16	14	6

The agency has only 7 cars currently. [Given: Random numbers: 15, 48, 71, 56, 90]

Required:

1. Using the random numbers stated supra, develop 5 days of demand for the car rental agency.
2. Calculate the average numbers of cars rented per day for the 5 days.
3. Assess how many rentals will be lost over the 5 days.

Question 2:

After observing heavy congestion of customers over a period of time in a petrol station, Mr. Petro has decided to set up a petrol pump facility on his own in a nearby site. He has compiled statistics relating to the potential customer arrival pattern and service pattern as given below. He has also decided to evaluate the operations by using the simulation technique.

Arrivals		**Services**	
Inter-arrival time (minutes)	**Probability**	**Service time (minutes)**	**Probability**
2	0.22	4	0.28
4	0.30	6	0.40
6	0.24	8	0.22
8	0.14	10	0.10
10	0.10		

Assume:

(i) The clock starts at 8:00 hours

(ii) Only one pump is set up.

(iii) The following 12 Random Numbers are to be used to depict the customer arrival pattern:

78, 26, 94, 08, 46, 63, 18, 35, 59, 12, 97 and 82.

(iv) The following 12 Random Numbers are to be used to depict the service pattern:

44, 21, 73, 96, 63, 35, 57, 31, 84, 24, 05, 37

You are required to find out the

(i) probability of the pump being idle, and

(ii) Average time spent by a customer waiting in queue.

Question 3:

A retailer deals in a perishable commodity. The daily demand and supply are variables. The data for the past 500 days show the following demand and supply:

Availability (Kg.)	Supply (No. of Days)	Demand (Kg.)	Demand (No. of Days)
10	40	10	50
20	50	20	110
30	190	30	200
40	150	40	100
50	70	50	40

The retailer buys the commodity at ₹ 20 per kg. and sells at ₹ 30 per kg. Any commodity remains at the end of the day has no sales value. Moreover the loss on unsatisfied demand is ₹ 8 per Kg.

Given the following pair of random numbers, simulate 6 days sales, demand and profit:
(31, 18) (63, 84) (15, 79) (07, 32) (43, 75) (81, 27).
The first random number in the pair is that of supply and the second random number is for demand.

Question 4:

How simulated times can be used to gain a knowledge of the interface of two assembly activitiesIn an aircraft assembly operation, activities A precedes activity B, and inventory may accumulate between the two activities. With the use of random numbers, a simulated sample of performance times yielded the values shown (minutes) in the accompanying table.

A → B →

Activity A		Activity B	
Random Number	Time (min)	Random Number	Time
07	0.3	63	0.5
90	0.8	44	0.4
02	0.2	30	0.4
50	0.5	98	0.9

76	0.6	30	0.4
47	0.5	72	0.6
13	0.3	58	0.5
06	0.3	96	0.9
79	0.7	37	0.4

(a) Simulated the assembly of six parts, showing idle time inactivity B, waiting time of each part, and number of parts waiting. Note: omit the first random number of A so that activity B begins at time zero.

(b) What was the average length of the waiting line ahead of B (in number of units)?

(c) What was the average output per hour of the assembly line?

Question 5:

Empirical data collected on the time required to weld a transformer bracket were recorded to the nearest ¼ minute, as shown in the accompanying table.

Weld Time (min)	Number of Observation
< 0.25	0
0.25 < 0.75	24
0.75 < 1.25	42
1.25 < 1.75	72
1.75 < 2.25	38
2.25 < 2.75	14
2.25 < 3.25	10

(a) Formulate a cumulative distribution in percentage terms.

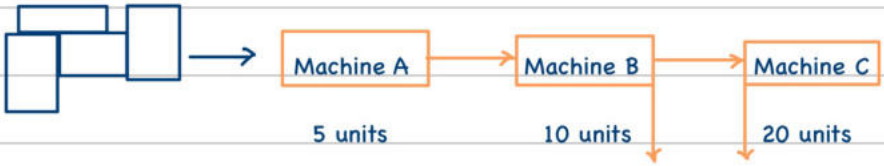
(b) Graphs the frequency and cumulative distributions.

(c) A simulation is to be conducted using random numbers. What simulated weld times (to the nearest .25 minute) would result from the random numbers 25, 90, and 59?

(d) What proportion of the time exceeds 2.0 minutes?

Line Balancing

Line balancing is arranging a production line so that there is an even flow of production from one work station to the next, i.e. so that there are no delays at any work station that will leave the next work station with idle time.



Will remain idle (B - 50%, C-75%)

Unbalanced line

For balancing it

line is to have 4 machines of type A, 2 of type B with every machine of type C

OR

give some other task to machines B and C so so that they do not remain idle.

Line Balancing Procedure

Steps :

- Calculate the cycle time and determine the theoretical minimum number of workstations

$$N = \frac{\Sigma t}{CT} = \frac{\text{Sum of all task time}}{\text{Cycle time}}$$

$$\text{Cycle time (CT)} = \frac{\text{Available time}}{\text{Output required}}$$

- Compute the actual number of workstation (N) required by rounding up the theoretical number of workstations to the next higher integer value.

• Assign the tasks to the workstations beginning with station 1. Tasks are assigned to work stations moving from left to right through the precedence diagram.

• Before assigning each task to a workstation, use the following criteria to determine which tasks are eligibly to be assigned to a workstation

(a) All preceding tasks in the sequence have been assigned already.

(b) The task time ≤ the time remaining at the workstation.

If no tasks are eligible to be assigned to a particular workstation, move to the next workstation.

• After each task assignment, determine the time remaining at the current work station by subtracting the sum of times for tasks already assigned to the work station from the cycle time.

• When there is a tie between two tasks (parallel tasks) to be assigned, use one- of these rules :

(a) Assign the, task with the longest task time

(b) Assign the task with greatest number of followers.

If there is still a tie, choose one task arbitrarily,

• Continue assignment of tasks until all tasks have been assigned to workstations.

• Calculate the idle time (or balance delay), percent idle time and efficiency of balancing the line.

Balancing Efficiency :

An efficient line balancing will minimize the amount of idle time. The balance efficiency can be calculated as:

(i) EffB = $\frac{\text{Output of task time.}}{\text{Input by workstation times}} = \frac{\Sigma t}{CT*N}$

Where, Σt = Sum of the actual worker times or task times to complete one unit CT = Cycle time ;

N = No. workers or work stations

(ii) EffB = $\frac{\text{Theoretical minimum number of workers}}{\text{Actual number of workers}}$

Question:

Time available for production = 100 minutes

Total number of output required = 20 units

Total time in performing the task for production of one unit = 20 minutes

1) Find out the theoretical minimum number of workstations and cycle time

2) If actual number of workstations is a) 5

b) 2.

Find out the balancing efficiency.

Lean Operations

No matter what type of business you run, cutting costs and operating more efficiently should be a top priority.

It's called lean operations

Lean operations is a business strategy driven by the principle of doing more with less. It is a minimalist approach to running a business and improving day-to-day operations.

Lean operation has its roots in the Toyota Automobile Co., of Japan, where waste was to be avoided at all costs:

- In time — By repairing faulty products.
- Of Investment — In keeping High Inventories
- Of having Idle Workers

The elements of lean production are:

- to consider the organisation in terms of supply chain
- Have everyone in the organisation conscious about their work
- Continuous quality improvement
- operation by product or cellular manufacturing rather than functional or process layout
- To operate the facility in just-in-time mode

Cellular Manufacturing is a lean approach where equipment and workstations are arranged for efficient material flow, minimizing waste and delays.

Just-in-Time

Just-in-time manufacturing (JIT manufacturing) is a production model in which items are created to meet demand, not created in surplus or in advance of need.

Why? Specifically to provide the right quality level at the right place.

(i) Produce only the products (goods or services) that customers want.

(ii) Produce products only as quickly as customers want to use them.

(iii) Produce products with perfect quality.

(iv) Produce in the minimum possible lead times.

(v) Produce products with features that customers want and no others.

(vi) Produce with no waste of labour, materials or equipment, designate a purpose for every movement to leave zero idle inventory.

(vii) Produce with methods that reinforce the occupational development of workers.

Overview of JIT manufacturing

- Inventory reduction
- Quality improvement
- Lead time reduction
- Vendor control or performance improvement
- Continuous improvement
- Total preventive maintenance
- Strategy Gain

Chapter 5: Productivity and Quality Management

This Module Includes

5.1 Measurement Techniques of Productivity Index

5.2 Five Key Aspects of Productivity

5.3 TQM Basic Tools and Certification

5.4 ISO Standard Basics

Measurement Techniques of Productivity Index

Productivity implies development of an attitude of mind and a constant urge to find better, cheaper, quicker, easier and safe ways of doing a job, which could be either manufacturing an article or providing a service.

Productivity is the quality or state of being productive. It is some relationship of outputs to inputs. It is a concept that guides the management of a production system, and measures its success. It is the quality that indicates how well labour, capital, materials and energy are utilised.

The productivity is a measure of how much input is required to achieve a given output.

Symbolically:

P = O/I where

P = Productivity;

O = Output,

I = Input.

Productivity Index is a method to track productivity

Why Productivity?

1. To beat the competition — Productivity ↑ → Can only beat the competition
2. Guide to Management
   - a) Strategic — Firm A. ⟷ Firm B
   - b) Tactical — Unit X. ⟷ Unit Y
   - c) Planning — Eg., Most beneficial input
   - d) Administration — Individual Productivity Indices
3. An Indicator of Progress
4. Maximum utilisation of Scarce Resources
5. Key to National Prosperity — Productivity ↑ – General Public ☺ → cheaper rate → Market Expansion
   - Wage of worker Improves.
   - Industrialist will get larger profit
   - Nation's Prosperity
6. Prosperity to Labour
7. Other Uses
   - a) Expansion and modernisation
   - b) Improves goodwill

Productivity Measurement Criteria

(i) Change in output per unit of input e.g., change in output per worker

(ii) Change in input per unit of output e.g., change in man-hour or workers' per unit of output

BASIS FOR COMPARISON	PRODUCTION	PRODUCTIVITY
Meaning	Production is a function of an organisation which is associated with the conversion of range of inputs into desired output.	Productivity is a measure of how efficiently resources are combined and utilised in the firm, for achieving the desired outcome.
What is it?	Process	Measure
Represents	Numbers of units actually produced.	Ratio of output to input
Expression	Absolute terms	Relative terms
Determines	Value of output	Efficiency of factors of production

Factors affecting industrial productivity

1. Technological Development
   - (a) The Size of the Plant
   - (b) Research and Development
   - (c) Plant and Job Layout
   - (d) Machine and Equipment Design
   - (e) Production Processes
   - (f) Power, Raw Materials etc
   - (g) Scientific Management Techniques
2. Individual Factors → Knowledge, skills and attitude
3. Organisation Factors → Steps taken by organisation towards maintaining better industrial relations
4. Work Environment → Proper work environment and physical condition
5. Other factors
   - (a) Natural Factors
   - (b) Managerial Factors
   - (c) Government Policy

Indices of Productivity

(A) Man-hour output

Productivity =

Units of output / Total man-hours.

(B) Productivity Ratio.

Productivity =

Net Profit / Capital employed.

(C) Use of Financial Ratios

Productivity =

Added Value / Labour Costs

Productivity =

Added Value / Conversion Cost

(D) Other Useful Measures

(i) Manpower Productivity =

$$\frac{\text{Value of output of goods or services.}}{\text{No. of workers or man hours used.}}$$

(ii) Materials Productivity =

$$\frac{\text{Value of output of goods or services}}{\text{Units (or cost) of materials used}}$$

(iii) Capital Productivity =

$$\frac{\text{Value of output of goods or service}}{\text{Capital assets employed}}$$

(iv) Energy Productivity =

$$\frac{\text{Value of output of goods or services}}{\text{Units (or cost) of energy used}}$$

(E) A combined measure of productivity

$$\frac{\text{Value of output of goods or services}}{\{\text{Value-of (labour+capital+materials+ others-inputs)}\}}$$

Tools of productivity or how to increase productivity

1. Human Aspects

- Workers participation in decision-making
- Improving communication services
- Improving mutual trust and cooperation
- Better planning of work, democracy, improve human relations, trainings

2. Supply of Inputs

- Improvement in nature and quality of Raw material
- Introduction of more and more machines and equipment
- Fuller utilisation of manpower and efficiency

3. Technological Aspects

- Work, time and motion studies
- Implementing various simplification, specialisation and standardisation programmes
- Applying control techniques
- Improving layout

Five Key Aspects of Productivity

Material Productivity

Employee Productivity

Management in Productivity

Factors Impacting Productivity

Productivity Improvement Techniques

Employee Productivity:

- Definition: Amount of work an employee completes in a specific time.
- Measured through: Goals achieved, quality of work, amount of work completed
- Ways to increase: Improve workplace conditions, offer flexible schedules, set clear expectations, encourage self-care, optimise meetings, coach on priorities, teach time management, boost morale

Material Productivity:

- Definition: Efficiency of using materials in production.
- Calculated as: Material output (Net sales) / Material input.
- Material productivity ratio: Reflects output received per unit of material input.
- Improvement: Ratio above 100 indicates higher productivity than base year.

Role of Management in Productivity:

- Management is the catalyst for production factors (land, labor, capital).
- Competence and attitude of managers affect productivity.
- Efficient management is essential for optimal resource utilization.
- Managers' leadership impacts job performance and results.

Factors Impacting Productivity:

- Technological: Product design, plant layout, size, location, raw material supply, maintenance, handling, research.
- Natural: Physical, geographical, geological, climatic conditions.
- Social: Cultural, traditions, customs, norms, societal influences.
- Political: Law and order, government stability, policies.
- Economic: Market size, banking, credit facilities, transport, communication.

Productivity Improvement Techniques:

- Develop productivity measures.
- Analyse critical operations.
- Implement methods for improvement.
- Set reasonable improvement goals.
- Show management support.
- Measure and publicize improvements.
- Managerial techniques: Time management, breaks, self-imposed deadlines, avoiding multitasking, efficient meetings, proactive approach.

Note: These aspects collectively contribute to enhancing productivity within an organization and optimizing resource utilization.

Key Techniques for Managers to Improve Productivity:

- Time your Time: Time Management, Schedule tasks effectively.
- Initiate Regular Breaks: Include short breaks for better focus.
- Self-Imposed Deadlines: Set deadlines for tasks.
- Quit the habit of Multitasking: Focus on one task at a time.
- Encourage the 2-Minute Rule: Handle tasks that take 2 minutes or less immediately.
- Avoid unnecessary meetings: Minimize Meetings
- Use the Unexpected 'Bonus' Time: Use unexpected free time for small tasks.
- Be Proactive and Not Reactive : Initiate tasks rather than reacting.

Question 1:

Calculate the standard production per shift of 8 hours duration, with the following data: Observed time per unit = 5 minutes, Rating Factor -120%, Total allowances = 30% of normal time.

Question 2:

Find the standard production for an 8 hr shift. If allowance = 25% of normal time, Observer time per unit is 7 min and the rating factor is 110%.

Question 3:

Study in the Packaging Department of a Soft Drinks Manufacturing unit revealed the following facts for a worker Basant Rao Patil.

Cycle No. Activity Element	1	2	3	4	Performance Rating
(A) Get empty car- toon	0.15 min	0.25 min	—-	0.17 min	90%
(B) Place 30 bottles in the cartoon	1.56 min	*	1.80 min	1.75 min	105%
(C) Close the car- toon & set aside	0.20 min	†	0.10 min	0.15 min	95%
(D) Smoking	—	0.50 min	—-	—	—-

* Bottles slipped out of hands and broke

† Empty cartoon not set aside and used for packaging in the next cycle.

Calculate the standard production by Basant Rao in a shift of 8 hours when the units standard rules allow 10% as Allowance Factor.

Question 4:

Following results are recorded in a study of work sampling carried for 100 hours in a Machine Shop.

1. Total no. of observations recorded — 2500
2. No. of observations in which no working activity is noticed — 400
3. Ratio of Manual to Machine elements — 2 : 1
4. Average Rating Factor — 115%
5. No. of articles produced during the study period — 6000

As per the policy of the company, rest and personal allowances are taken as 12% of Normal Time.

Calculate Standard Time to produce an article.

Given that the shop produces 42000 articles per month of 25 working days by 5 workers working for a shift of 8 hours per day. Consider absenteeism to be 7%.

Compute Efficiency of utilisation of Labour and Productive Efficiency of Labour.

Question 5:

In a particular plant there are 10 workers manufacturing a single product and the output per month consisting of 25 days of that particular product is 200. How much is the monthly productivity?

Question 6:

There are two industries A and B manufacturing hose couplings. The standard time per piece is 15 minutes. The output of two small scale industries is 30 and 20 respectively per shift of 8 hours. Find the productivity of each per shift of 8 hours. What is the expected production of each per week consisting of 6 days?

Question 7:

The following data is available for a manufacturing unit :

No. of operators	15
Daily working hours	8
No. of days per month	25
Std. production per month	300 units
Std. Labour hours per unit	8

The following information was obtained for November 2015:

Man days lost due to absenteeism	30
Unit produced	240
Idle Time	276 man hours

Find the following:—

(a) Percent absenteeism

(b) Efficiency of utilisation of labour

(c) Productive efficiency of labour

(d) Overall productivity of labour in terms of units produced per man per month.

Question 8:

An incentive scheme allows proportionate production bonus beyond 100% performance level. Calculate the amount of (i) Incentive bonus and (ii) Total payment received by an operator on a particular day during which the following particulars apply:

Operation	:	Assembling pocket transistor radio set
Work Content	:	30 Standard minutes per assembled set
Attended Time	:	8 Hours
Time spent on unmeasured work	:	2 Hours
Numbers of sets assembled during the day	:	15
Wage rate	:	₹ 4 per hour

(iii) What is the net labour productivity achieved by the operator during the day?

Question 9:

The following data is available for a machine in a manufacturing unit:

Hours worked per day	8
Working days per month	25
Number of operators	1
Standard minutes per unit of production	
Machine time	22
Operator time	8
Total time per unit	**30**

(i) If plant is operated at 75% efficiency, and the operator is working at 100% efficiency, what is the output per month?

(ii) If machine productivity is increased by 10% over the existing level, what will be the output per month?

(iii) If operator efficiency is reduced by 20% over the existing level, what will be the output per month?

Total Quality Management

A philosophy that involves everyone in an organisation in a continual effort to improve quality and achieve customer satisfaction.

Basic Concepts in TQM

1. Top management commitment and support.
2. Focus on both internal and external customers.
3. Employee involvement and empowerment.
4. Continuous improvement (KAIZEN)
5. Partnership with suppliers
6. Establishing performance measures for processes.

Essentials of TQM Focus

Three Philosophies of TQM

- Continuous Improvement
- Employee Involvement
- Customer Satisfaction

ISO Standards

Quality Certification: ISO [International Organisation for Standardisation] certification.

Most well known

- ISO 9000 Quality Management

  concerns what an organization does to ensure that its products/services are suitable to customers expectations

- ISO 14,000

  concerns minimization of harmful effects to the environment caused by its operations

Both ISO 9000 and ISO 14000 are related to an organization processes rather than its products and services and they stress continual improvement.

The latest version of ISO 9000 forms the basis of eight quality management principles.

- Leadership
- Process approach.
- Customer focus
- People involvement
- Continual improvement
- Factual approach to decision making
- A system approach to management
- Mutually beneficial supplier relationships

Question:

You are working as a Production Manager in a manufacturing unit. The executive management of this company has decided to go for the ISO certification for this unit. For this purpose, you are appointed as a Management Representative to ensure successful implementation of ISO certification. Now answer the following:

(i) What are all those broad activities that you have to consider for such responsibility?

(ii) What are the five standards associated with ISO 9000 series, that you have tothoroughly refer to, for finding out the best fitment for your unit?

(iii) In which scenarios, ISO certification is a must, and is particularly helpful?

(iv) When is it reviewed? (12 marks)

Answer:

(i) ISO (International Organisation for Standardisation) certification is an elaborate and expensive process.

You need to document how workers of your unit perform every function that affects quality and install mechanisms to ensure that, they follow on expected lines.

ISO 9000 certification entails a complex analysis of management systems and procedures. Rather than judging the quality of a particular product, ISO 9000 evaluates the management of the entire manufacturing process, from purchasing, to design, to training. You must fill out a report and then be certified by a team of independent auditors.

With certification comes registration in an ISO directory, that your firm (seeking suppliers) can refer to, for a list of certified companies. They are generally given preference over unregistered companies.

ii) Quality System:

9001 Model for Quality Assurance in Design, Production, Installation and Servicing.

(To be used when conformance to specified requirements is to be assured by the supplier during several stages that may include design/development, production, installation and servicing).

9002 Model for Quality Assurance in Production and Installation.

(To be used when conformance to specified requirements is to be assured by the supplier during production and installation).

9003 Model for Quality Assurance in Final Inspection Test.

(To be used when conformance to specified requirements is to be assured by the supplier solely at final inspection and test).

Guidelines for Use:

9000 Quality Management and Quality Assurance Standards

- Guidelines for Selection and Use.

9004 Quality Management and Quality System Elements

- Guidelines

(iii) ISO certification is a must for doing business with any member of the EU.

In addition to the benefits of accessing the EU, ISO 9000 certification and registration is particularly helpful for companies that do not currently have a quality management system, as it provides guidelines for establishing the system and making it effective.

(iv) ISO standards are reviewed every 5 years and revised, if needed. This helps ensure they remain useful tools for market place.

Chapter 6: Project Management,

Monitoring and Control

Project management is the discipline of organising and managing resources in such a way that the project is completed within defined scope, quality, time and cost constraints.

This Module Includes

6.1 Project Planning

6.2 Project Life Cycle

6.3 Gantt Charts

6.4 PERT and CPM

6.5 Basics of MS Project

Project Planning

Project Planning

Temporary

One time endeavour

Undertaken to create a unique product or service

Planning-Goals or objectives

Project team – from various department

Defining project – identify –

controllable variables uncontrollable variables

Project Boundaries

Performance criteria – evaluate – on the basis of time, cost and resource

Project Planning

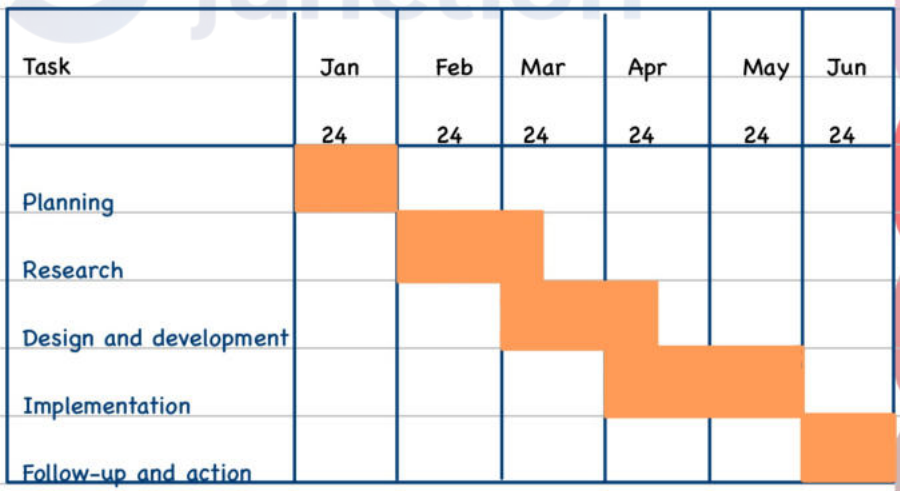
Part of Project Management

which relates to the use of schedules such as Gantt charts to plan and subsequently report progress within the project environment.

Project planning involves

- Defining Objectives
- Explaining the Scope
- Scheduling Tasks
- Generating Progress Reports

Project Planning Tools



Gantt Chart

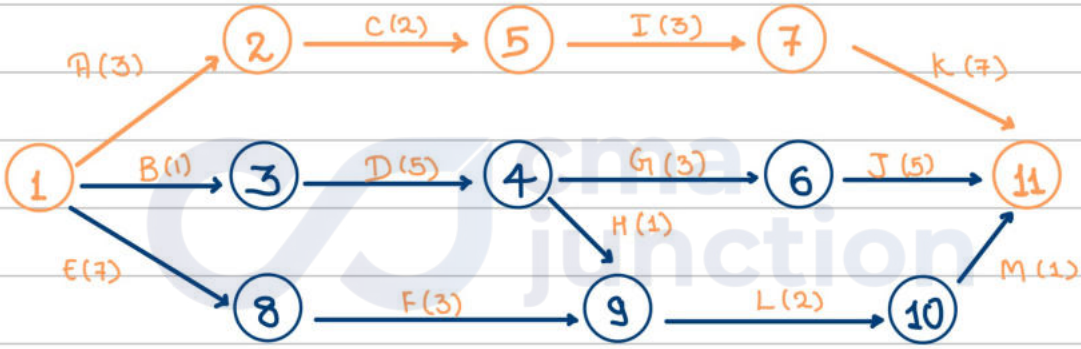
- Gantt Charts are an industry standard that helps in tracking both time and interdependencies between tasks
- Gantt charts are an essential tool to show different phases, jobs, and resources involved in project management

Critical Path Method (CPM)

- Critical Path Method is a crucial tool for determining the progress of the project to ensure that the project is on schedule
- CPM helps in determining the essential or critical path by finding out the longest stretch of dependent tasks

PERT Chart

- The Project Evaluation and Review Techniques (PERT) helps in analyzing the tasks to complete the project and the time required to complete those tasks
- PERT simplifies the planning and scheduling of large and complex projects

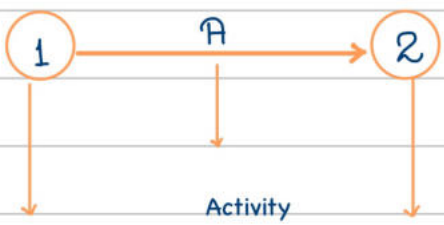


Network Diagram

1. A 'Network Diagram', will always have activities and events. Activities will be presented by arrows and events will be presented by circles.

2. Events will be denoted by number, while activities will be denoted by alphabets.

3.



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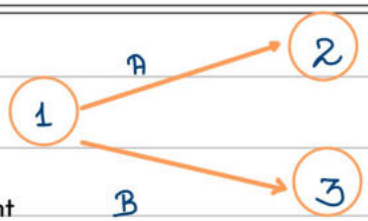
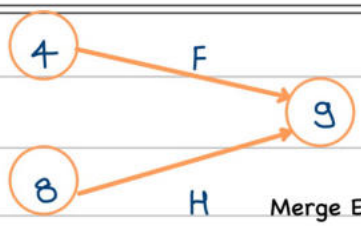


Burst Event



Merge Event

5. Network diagram will always flow left to right.

6. Network diagram will always have only one starting point and competition point.

7. Always try that arrows do not cross each other but if it is unavoidable then it can be done.

8. Arrows should be drawn only for activities no unnecessary arrows to be drawn.

9. A network must not have dangling.

10. A network diagram must not have a loop.

11. Dummy Activity

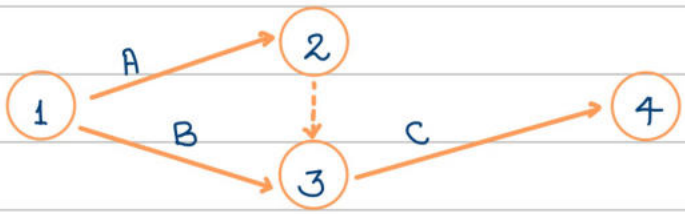
a) It is not an activity. It is used only for maintaining logical flow of network.

b) It is always denoted by dotted line.

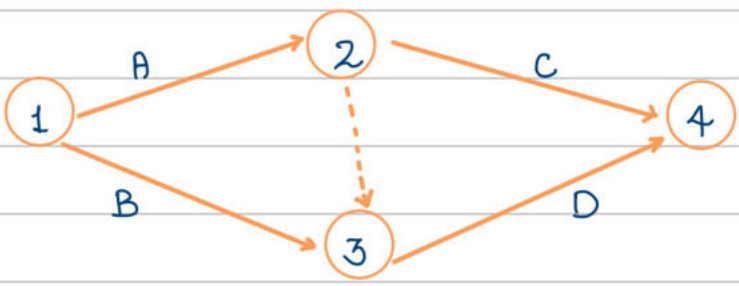
c) Dummy activity will not consume any time or cost.

d) Dummy activity will be taken only in two cases:

I) When starting and completion point of two activities are same.



II) If any activity is individual predecessor and joint predecessor then we have to use dummy activity.



PERT (Project Evaluation & Review Technique)	CPM (Critical Path Method)
1. It is a technique for planning, scheduling & controlling of projects whose activities are subject to uncertainty in the performance time. Hence it is a probabilistic model.	1. It is a technique for planning, scheduling & controlling of projects whose activities are not subjected to any uncertainty and the performance times are fixed. Hence it is a deterministic model.
2. It is an Event oriented system	2. It is an Activity oriented system
3. Basically does not differentiate critical and non- critical activities.	3. Differentiates clearly the critical activities from the other activities.
4. Used in projects where resources (men, materials, money) are always available when required.	4. Used in projects where overall costs are of primary importance. Therefore better utilised resources.
5. Suitable for Research and Development projects where times cannot be predicted.	5. Suitable for civil constructions.
6. Focused on time	6. Focused on time-cost trade off
7. More suitable for new projects	7. More suited for repetitive projects

	Gantt Chart	Critical Path
Description	A timeline view of a project that tracks individual project tasks, dependencies, resources, and remaining work	A sequence of scheduled tasks that determines the duration of a project
Visual Component	A timeline plotting project tasks against time on an x and y axis	A diagram of linked tasks that you must complete from start to finish
Purposes	Provides a visual overview of how a project is progressing and shows the dependent tasks and resources that you need for each task	Calculates project duration based on estimated task durations and helps reduce timelines and cut project costs
Uses	Project management	Project management, project scheduling, and time estimating

Question 1:

Project with the following data is to be implemented. Draw the network and find the critical path.

Activity	Predecessor	Duration (days)	Cost (Rs./Day)
A	-	2	50
B	-	4	50
C	A	1	40
D	B	2	100
E	A,B	3	100
F	E	2	60

1. What is the minimum duration of the project?
2. Draw a Gantt chart for early start schedule.
3. Determine the peak requirement of money and the day on which it occurs in the above schedule.

Question 2:

Given the following information develop a network:

Activity	Immediate Predecessor
A	-
B	-
C	A
D	A
E	C,B

Question 3:

Develop a network based on the following information

Activity	Immediate Predecessor
A	-
B	A
C	A
D	B
E	B,C
F	E
G	D,F

H	G

Question 4:

A project consists of seven activities. Activities P, Q, R run simultaneously. The relationships among the various activities is as follows:

Activity	Immediate Successor
P	S
Q	T
R	U

Activity "V is the last operation of the project and it is also an immediate successor to S, T and U. Draw the network of the project.

Question 5:

XYZ Auto-manufacturing company has to prepare a design of its latest model of motorcycle. The various activities to be performed to prepare design are as follows:

Activity	Description of activity	Preceding activity
A	Prepare drawing	–
B	Carry out cost analysis	A
C	Carry out financial analysis	A
D	Manufacture tools	C
E	Prepare bill of material	B, C
F	Receive material	D,E
G	Order sub-accessories	E
H	Receive sub-accessories	G
I	Manufacture components	F
J	Final assembly	I,H
K	Testing and shipment	J

Prepare an appropriate network diagram.

Question 6:

Draw the network for the following activities and find critical path and total duration of project.

Activity	Duration (months)

1-2	2.5
2-3	2.5
2-4	1.5
3-4	1.0
3-5	1.0
4-5	2.0
5-6	3.0
6-7	1.5
5-7	1.5

Question 7:

The following activities must be accomplished in order to complete a construction project:

Activity	A	B	C	D	E	F	G	H	I	J
Time	3	8	4	2	1	7	5	6	8	9
Predecessors	-	-	AB	B	A	C	EF	DF	GH	I

~ Construct a network diagram for this project. Find the CP and the duration of the project.

~ Assume that you are the project manager of the project mentioned above. The project has progressed for 10 weeks and the status is follows:

Activities completed: A, B, E. Other activities have not started as yet.

~ If no managerial action is taken at all when will the project get completed?

~ What action might you take to get the project back to a schedule that can be completed by the end of week 42?

Question 8:

Given is the following information regarding a project:

Activity	A	B	C	D	E	F	G	H	I	J	K	L
Dependence	-	-	-	AB	B	B	FC	B	EH	EH	CDFJ	K
Duration	3	4	2	5	1	3	6	4	4	2	1	5

Draw the Network Diagram and identify the Critical Path and Project Duration.

Question 9:

From the information given in previous question find:

(a) EST, EFT, LST, LFT.

(b) Total float of each activity.

(c) Free Float of each activity.

(d) Independent Float of each activity.

Question 10:

A project with normal duration and cost along with crash duration and cost for each activity is given below:

Activity	Normal time (Hrs.)	Normal cost (₹)	Crash time (Hrs.)	Crash cost (₹)
1-2	5	200	4	300
2-3	5	30	5	30
2-4	9	320	7	480
2-5	12	620	10	710
3-5	6	150	5	200
4-5	0	0	0	0
5-6	8	220	6	310
6-7	6	300	5	370

Overhead cost is Rs. 50 per hour.

Required:

Draw a network diagram and identify the critical path.

Find out the optimum duration with associated cost.

Question 11:

The following table gives data on normal time & cost and crash time & cost for a project.

Activity	Normal		Crash	
	Time (days)	Cost (₹)	Time (days)	Cost (₹)
1-2	6	600	4	1,000
1-3	4	600	2	2,000
2-4	5	500	3	1,500
2-5	3	450	1	650
3-4	6	900	4	2,000
4-6	8	800	4	3,000
5-6	4	400	2	1,000
6-7	3	450	2	800

The indirect cost per day is Rs. 100.

(i) Draw the network and identify the critical path.

(ii) What are the normal project duration and associated cost?

(iii) Crash the relevant activities systematically and determine the optimum project completion time and cost.

Question 12:

For the given data find the expected duration of the project and variance of the project.

Activity	Optimistic time (to)	Most likely Time (tm)	Pessimistic time (tp)
1-2	6	9	12
1-5	4	7	8
2-3	14	17	20
2-4	7	10	13
2-5	3	5	9
3-7	13	18	25
4-6	10	14	16
4-7	12	15	18
5-6	9	11	12
6-7	17	20	25

Question 13:

A marketing organisation is planning a questionnaire survey on behalf of their client to assess the market potential of instant foods. The following activities are involved in this project:

Task		Duration(days)		
	Precedence	Optimistic	Most(likely)	Pessimistic
A. Design questionnaire		2	3	4
B.Sample design		6	10	20
C.Testing of questionnaire and refinements		2	4	6
D.Recruiting interviewers	B	2	3	10
E. Training of interviewers	D,A	1	1	1
F.Allocation of interviewers to territories	B	4	5	6
G.Conducting interviews	C,E,F	5	12	25
H.Evaluation of results	G	6	10	20

(a) Find the expected duration and variance of each task.

(b) Draw an arrow diagram (network) of the project.

(c) Calculate EST, EFT, LST, LFT & TF

(d) Identify the critical path.

(e) Find the critical path duration of the project.

(f) What percentage of the project will be complete in 44 days?

(g) Find the no of day by which approximately 100% of the project will be completed

Basics of Microsoft Project

Microsoft Project is a project management software program developed and sold by Microsoft, designed to assist a project manager in developing a schedule, assigning resources to tasks, tracking progress, managing the budget, and analysing workloads.

Project creates budgets based on assignment work and resource rates. As resources are assigned to tasks and assignment work estimated, the program calculates the cost, equal to the work times the rate, which rolls up to the task level and then to any summary task, and finally to the project level.

Each resource can have its own calendar, which defines what days and shifts a resource is available. Microsoft Project is not suitable for solving problems of available materials (resources) constrained production. Additional software is necessary to manage a complex facility that produces physical goods.

Project management involves more than just using software like MS Project. While MS Project helps with scheduling, it's essential for project managers to understand the difference between a schedule and a plan. A plan encompasses all aspects of a project, including strategy, scope, cost, time, resources, quality, and risk.

Project managers need to answer specific questions during the planning process:

- What tasks are required to deliver project objectives and in what sequence?
- What are the time constraints and deadlines for tasks and the project overall?
- What resources (human, machinery, materials) are needed for each task?
- What are the estimated costs for each task?
- What risks are associated with the project schedule?

While MS Project can help create schedules, it cannot generate a comprehensive project plan. Understanding project management methodology is crucial for effective planning and execution.

Scheduling involves using logic and math to sequence tasks efficiently, considering resource and cost constraints. The schedule lists milestones, tasks, and deliverables with start and finish dates, linked with resources, budgets, and dependencies. It's a part of the overall project plan.

Microsoft Project offers more than scheduling; it handles task dependencies, constraints, resource conflicts, and cost/schedule performance. Marketing it as a "Plan Creator" reflects its comprehensive functionality beyond basic scheduling.

MS Project can help you -

~ Visualize your project plan in standard defined formats.

~ Schedule tasks and resources consistently and effectively.

~ Track information about the work, duration, and resource requirements for your project.

~ Generate reports to share in progress meetings

Chapter 7: Economics of Maintenance and Spares Management

This Module Includes

7.1 Breakdown Maintenance

7.2 Preventive Maintenance

7.3 Routine Maintenance

7.4 Replacement of Machine

7.5 Spare Parts Management

Maintenance

सुधारना

Any function aimed at bringing back or restoring an item to its original or acceptable condition or to keep it & retain its health as well as workability.

बनाए रखना

Objectives of Maintenance:

(i) To keep all the production facilities and other allied facilities such as building and premises, power supply system, etc in an optimum working condition,

(ii) To ensure specified accuracy to products and time schedule of delivery to customers,

(iii) To keep the down time of the machine at minimum, so that the production program is not disturbed,

(iv) To keep the production cycle with in the stipulated range,

(v) To modify the machine tools to meet the augmented need for production,

(vi) To improve productivity of existing machine tools and to avoid sinking of additional capital,

(vii) To keep the maintenance cost at a minimum as far as possible, there by keeping the factory Overheads at minimum,

(viii) To extend the useful life of plant and machinery, without sacrificing the level of performance.

Maintenance Problem: Minimise the overall cost of maintenance without sacrificing the objectives.

There are two alternatives before management.

repair a machine or equipment only when it breaks down.

This will save expense of inspection and replacement of a part before its lifetime ends.

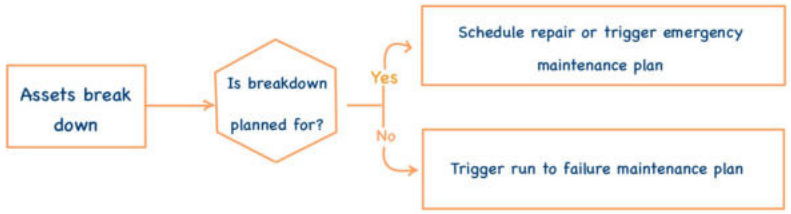
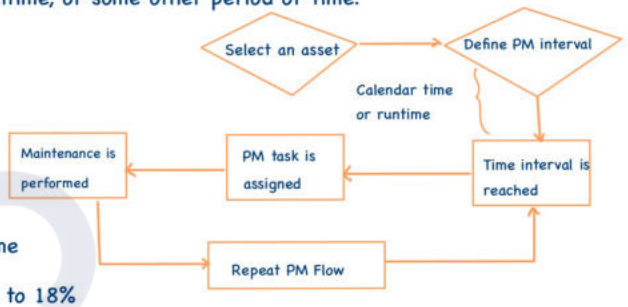
BREAK DOWN MAINTENANCE

replace the equipment before the expiry of its working life

involve cost of periodic shutdown for check up and repairs.

PREVENTIVE MAINTENANCE (PM).

ROUTINE MAINTENANCE

	BREAK DOWN MAINTENANCE	PREVENTIVE MAINTENANCE (PM)	ROUTINE MAINTENANCE
Definition	BM is work that is only performed when a piece of equipment breaks down or has a downtime event	PM is work that is scheduled based on calendar time, asset runtime, or some other period of time.	Routine maintenance is simple, small-scale activities (usually requiring only minimal skills or training) associated with regular (daily, weekly, monthly, etc.) and general upkeep of a building, equipment, machine, plant, or system against normal wear and tear. It is the work which can be carried out while the facility is in service.
Work flow			
Trigger	Downtime event	Time	
Cost savings	Dependent on equipment and breakdown maintenance plan	12 to 18%	
Resources needed	* Maintenance software for downtime triggers * Necessary replacement equipment	* Maintenance software for scheduling * Maintenance scheduler * Preventive maintenance checklist	
Pros	* Lowers overall cost of non-critical manufacturing equipment * Minimises preventive maintenance cost on non-essential equipments	* Extend lifetime of asset * Reduced break down and down time * Fewer large scale repairs * Less standby or reserve equipment or spares	
Cons	• Can't be used for many types of equipment, especially safety equipments. • Requires careful planning and execution to work effectively	* Can be expensive to keep up for a long period * Labour intensive due to constant maintenance task	
Use Case	An organisation wants to lower the cost of constantly replacing a variety of light bulbs in a facility. Instead of replacing them at designated intervals, the organisation decides to adapt a breakdown maintenance plan, only replacing light bulbs when they were completely burned out. This saves time and reduces the overall cost of buying light bulbs as a necessary amount of spares is lower.	An organisation wants to decrease unplanned downtime in emergency maintenance but does not have a large maintenance budget. As a solution, They implement a PM program for select assets. Work orders are scheduled for inspections, lubrication, filter replacement and parts replacement based on recommendations from OEMs	

Preventive vs Routine

Preventative maintenance takes longer time than routine maintenance and there will also be a cost difference

Standby Equipment → During equipment breakdown or breakdown maintenance

→ Kept to reduce loss due to break down of a key machine

→ How many standby machines to be kept & for how long?

↓

Cost benefit analysis to be made

Cost involved in standby machines	Benefit
→ Interest	→ Protection against complete shut down or shut down of operations
→ Depreciation	
→ Space	
→ Periodical checking and servicing	→ Avoids loss of production

Requirements for full benefits of effective maintenance

(i) Good Supervision and administration of maintenance department,

(ii) Good and clear instructions to be given to maintenance crew regarding the repair, (iii) Proper control of work in coordination with production department,

(iv) Good training should be given to the maintenance personnel,

(v) Good scheduled maintenance program should be chalked out,

(vi) Proper maintenance record keeping is a must,

(vii) There should be adequate stock of spare parts, particularly insurance spares

Three rules for proper control of maintenance work

- → Maintenance request
- → Maintenance stores
- → Records of maintenance work done

Spare Parts Management

In manufacturing plants that own a huge number of equipment, supervising the spare parts correctly and in a timely manner is a difficult task.

Database management system Should do following to keep track

(a) keep record of the spare parts required for a particular type of maintenance;

(b) keep record of the spare parts received and used in the past;

(c) schedule forthcoming major maintenance services;

(d) keep record of spare parts vendors;

(e) forecast future demand for fast moving spare parts based on past consumptions; etc.

Usually, spare parts are categorized into two main groups

- fast moving spares: those that are usualy required
- slow moving parts: those that are hardly ever required.

Regular spares

The spare parts required regularly & in substantial number. Both reliabilty & per unit cost of these items are less.

Insurance spares

An insurance spare is a spare part that you hold in your spare parts inventory, that you would not expect to use in the, normal life of the plant and equipment but if not available when needed it would result in significant losses.

Capital spares

Capital spares are spare parts which, although acknowledged to have a long life or a small chance of failure, would cause a long shutdown of equipment because it would take along time to get a replacement for them.

Rotable spares

Rotable items are generally thought of as items of plant or assets that periodically are changed out for repair or overall.

$$P(X \le x) = \sum_{r=0}^{x} \lambda^{r} \frac{e^{-\lambda}}{r!}$$

λ=		0.1	0.2	0.3	0.4	0.5	0.6	0.7	0.8	0.9	1.0	1.2	1.4	1.6	1.8
x=	0	0.9048	0.8187	0.7408	0.6703	0.6065	0.5488	0.4966	0.4493	0.4066	0.3679	0.3012	0.2466	0.2019	0.1653
	1	0.9953	0.9825	0.9631	0.9384	0.9098	0.8781	0.8442	0.8088	0.7725	0.7358	0.6626	0.5918	0.5249	0.4628
	2	0.9998	0.9989	0.9964	0.9921	0.9856	0.9769	0.9659	0.9526	0.9371	0.9197	0.8795	0.8335	0.7834	0.7306
	3	1.0000	0.9999	0.9997	0.9992	0.9982	0.9966	0.9942	0.9909	0.9865	0.9810	0.9662	0.9463	0.9212	0.8913
	4	1.0000	1.0000	1.0000	0.9999	0.9998	0.9996	0.9992	0.9986	0.9977	0.9963	0.9923	0.9857	0.9763	0.9636
	5	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	0.9999	0.9998	0.9997	0.9994	0.9985	0.9968	0.9940	0.9896
	6	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	0.9999	0.9997	0.9994	0.9987	0.9974
	7	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	0.9999	0.9997	0.9994
	8	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	0.9999
	9	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000
λ=		2.0	2.2	2.4	2.6	2.8	3.0	3.2	3.4	3.6	3.8	4.0	4.5	5.0	5.5
x=	0	0.1353	0.1108	0.0907	0.0743	0.0608	0.0498	0.0408	0.0334	0.0273	0.0224	0.0183	0.0111	0.0067	0.0041
	1	0.4060	0.3546	0.3084	0.2674	0.2311	0.1991	0.1712	0.1468	0.1257	0.1074	0.0916	0.0611	0.0404	0.0266
	2	0.6767	0.6227	0.5697	0.5184	0.4695	0.4232	0.3799	0.3397	0.3027	0.2689	0.2381	0.1736	0.1247	0.0884
	3	0.8571	0.8194	0.7787	0.7360	0.6919	0.6472	0.6025	0.5584	0.5152	0.4735	0.4335	0.3423	0.2650	0.2017
	4	0.9473	0.9275	0.9041	0.8774	0.8477	0.8153	0.7806	0.7442	0.7064	0.6678	0.6288	0.5321	0.4405	0.3575
	5	0.9834	0.9751	0.9643	0.9510	0.9349	0.9161	0.8946	0.8705	0.8441	0.8156	0.7851	0.7029	0.6160	0.5289
	6	0.9955	0.9925	0.9884	0.9828	0.9756	0.9665	0.9554	0.9421	0.9267	0.9091	0.8893	0.8311	0.7622	0.6860
	7	0.9989	0.9980	0.9967	0.9947	0.9919	0.9881	0.9832	0.9769	0.9692	0.9599	0.9489	0.9134	0.8666	0.8095
	8	0.9998	0.9995	0.9991	0.9985	0.9976	0.9962	0.9943	0.9917	0.9883	0.9840	0.9786	0.9597	0.9319	0.8944
	9	1.0000	0.9999	0.9998	0.9996	0.9993	0.9989	0.9982	0.9973	0.9960	0.9942	0.9919	0.9829	0.9682	0.9462
	10	1.0000	1.0000	1.0000	0.9999	0.9998	0.9997	0.9995	0.9992	0.9987	0.9981	0.9972	0.9933	0.9863	0.9747
	11	1.0000	1.0000	1.0000	1.0000	1.0000	0.9999	0.9999	0.9998	0.9996	0.9994	0.9991	0.9976	0.9945	0.9890
	12	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	0.9999	0.9999	0.9998	0.9997	0.9992	0.9980	0.9955
	13	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	0.9999	0.9997	0.9993	0.9983
	14	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	0.9999	0.9998	0.9994
	15	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	0.9999	0.9998
	16	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	0.9999
	17	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000

Question 1:

Public transport system is experiencing the following number of breakdowns for months over the past 2 years in their new fleet of vehicles:

Number of breakdowns	0	1	2	3	4
Number of months this occurred	2	8	10	3	1

Each breakdown costs the firm an average of ₹2,800. For a cost of ₹1,500 per month, preventive maintenance can be carried out to limit the breakdowns to an average of one per month. Which policy is suitable for the firm?

Question 2:

No. of breakdown	Frequency in days
0	40
1	150
2	70
3	30
4	10
	300

The firm estimates that each breakdown costs ₹ 650 and is considering adopting a preventive maintenance program which would cost ₹ 200 per day and limit the number of breakdown to an average of one per day. What are the expected annual savings from the preventive maintenance program?

Question 3:

M/s XYZ Pvt. Ltd has 50 identical machines in its facilities. The company has the recorded figure for cost of preventive maintenance (Cp) and cost of breakdown maintenance (Cb) as ₹ 20 and ₹ 100 respectively. The company wants to reduce the breakdown occurrence while minimising Cp. Given is the data on breakdown occurrence.

Probabilities of machine breakdown, by month:

Months after servicing that breakdown occurs (i)	Probability that breakdown will occur (Pi)	i.P i
1	0.10	0.10
2	0.05	0.10
3	0.05	0.15

4	0.10	0.40
5	0.15	0.75
6	0.15	0.90
7	0.20	1.40
8	0.20	1.60
Total	1.00	5.40

Question 4:

Maharashtra Trucking Company (MTC) has a fleet of 50 trucks. The past data on the breakdown of the trucks show the following probability distribution (for a new truck as well as for one which has been repaired after a breakdown).

Months after Maintenance	Probability of Breakdown
1	0.10
2	0.20
3	0.30
4	0.40

Each breakdown costs ₹ 3,000 on an average; which includes cost of time lost and cost of materials and manpower.

The manager of MTC knows the importance of preventive maintenance. He estimates the costs of the preventive maintenance to be ₹ 500 per such preventive action. What should be the appropriate maintenance policy in terms of the mix of preventive and breakdown maintenance

Question 5:

A firm is using a machine whose purchase price is ₹ 15,000. The installation charges amount to ₹ 3,500 and the machine has a scrap value of only ₹ 1,500 because the firm has a monopoly of this type of work. The maintenance cost in various years is given in the following table:

Year	1	2	3	4	5	6	7	8	9
Maintenance Cost (₹)	260	760	1100	1600	2200	3000	4900	4100	6100

The firm wants to determine after how many years should the machine be replaced based on economic considerations, assuming that the machine replacement can be done only at the year end.

Question 6:

A large computer installation contains 2,000 components of identical nature which are subject to failure as per probability distribution that follows:

Month End:	1	2	3	4	5
% Failure to date:	10	25	50	80	100

Components which fail have to be replaced for efficient functioning of the system. If they are replaced as and when failures occur, the cost of replacement per unit is ₹ 3. Alternatively, if all components are replaced in one lot at periodical intervals and individually replace only such failures as occur between group replacement, the cost of component replacement is ₹ 1.

(a) Assess which policy of replacement would be economical.

(b) If group replacement is economical at current costs, then assess at what cost of individual replacement would group replacement be uneconomical.

(c) How high can the cost per unit in-group replacement be to make a preference for individual replacement policy?

Question 7:

An electric company which generates and distributes electricity conducted a study on the life of poles. The repatriate life data are given in the following table:

Life data of electric poles

Year after installation:	1	2	3	4	5	6	7	8	9	10
Percentage poles failing:	1	2	3	5	7	12	20	30	16	4

~ If the company now instals 5,000 poles and follows a policy of replacing poles only when they fail, how many poles are expected to be replaced each year during the next ten years?

To simplify the computation assume that failures occur and replacements are made only at the end of a year.

~ If the cost of replacing individually is ₹ 160 per pole and if we have a common group replacement policy it costs ₹ 80 per pole, find out the optimal period for group replacement.

Question 8:

Compute the requirement of spares for breakdown maintenance for an item that exhibits a Poissonian behaviour for failure rates with a mean breakdown rate of five items per month. If the lead time for procuring these spares is one month and a service level of 90 per cent is to be used, what buffer stock of these items should be maintained? (A fixed reorder quantity system of inventory is being used).

Question 9:

The main shaft of an equipment has a very high reliability of 0.990. The equipment comes from Russia and has a high downtime cost associated with the failure of this shaft. This is estimated at ₹ 2 crore as the costs of sales lost and other relevant costs. However, this spare is quoted at ₹ 10 lakh at present. Should the shaft spare be procured along with the equipment and kept or not?

Question 10:

Indian Electronics, manufactures TV sets and carries out the picture tube testing for 2000 hours. A sample of 100 tubes was put through this quality test during which two tubes failed. If the average usage of TV by the customer is 4 hours/day and if 10,000 TV sets were sold, then in one year how many tubes were expected to fail and what is the mean time between failures for these tubes?

Question 11:

Product A has a Mean Time Between Failures (MTBF) of 30 hours and has a Mean Time To Repairs (MTTR) of 5 hours. Product B has a MTBF of 40 hours and has a MTTR of 2 hours.

(i) Which product has the higher reliability?

(ii) Which product has greater maintainability?

(iii) Which product has greater availability?

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Chapter 8:

Strategic Management - Introduction

Question 1: What is Strategy?

Answer:

The term strategy is derived from the Greek word strategia, meaning "generalship".

Has its origins from the classic, The Art of War, written by Sun Tzu in 500 BC.

- Strategy is a set of goal-directed actions a firm takes
- to gain and sustain superior performance relative to competitors.

  To achieve superior performance, companies compete for resources.
- The sole objective of a strategy is to provide competitive advantage.
- It provides the basic framework through which the organisation will achieve its mission and objectives.

Strategy may be defined as the direction and scope of an organisation over the long term, which achieves advantage for the organisation through the configuration of resources within a changing environment and to fulfill stakeholder expectations.

A strategy is good when it enables a firm to achieve superior performance. It consist of three key elements that work together:

1. Diagnosis of the competitive challenge:
2. Guiding policy to Address the challenge:
3. Set of coherent actions to implement a firms guiding policy

Question 2: What are the characteristics of Strategy or strategic decisions?

Answer:

- Concerned with the long term direction of an organization.
- Aim to achieve an advantage for the organization over its competition.
- Concerned with scope of the organization's activities.
- Involves matching resources and activities to the environment in which it operates
- Involves stretching the organization's resources and competences to create new opportunities or to capitalise on it.
- Strategies may require major resource changes.
- Likely to affect operational decisions
- Strategy is affected not only by environmental factors and resource availability but also by the values and expectations of those who have power in and around the organisation.

Question 3: What are the Consequences of strategic decision?

Answer:

- Likely to be complex in nature
- Demand an integrated approach
- Very often involve change in organisation
- Made in situations of uncertainty
- Change relationships and networks outside the organisation

Corporate Strategy:

Concerned with overall purpose and scope of the organization and

How value will be added different parts (business units) and product lines of the

organisation.

(Enhance performance and profitability)

Fit within the three main categories: Stability, Growth and Retrenchment

- Decisions:
  - Diversification (entering new markets)
  - Vertical integration (controlling parts of the supply chain)
  - Acquisitions and new ventures
  - Resource allocation between business units
  - Divestments (selling off business units)

Functional Strategy (Operational Level Strategy):

- Focus: Effective execution of corporate and business strategies.
- Goal: Developing competences to achieve a competitive advantage.
- Decisions:
  - Resource allocation and optimization within departments (marketing, finance, operations)
  - Process improvement initiatives
  - People development and training
- Examples: Implementing a lean manufacturing system to improve efficiency (operations strategy), Developing targeted marketing campaigns to reach specific customer segments (marketing strategy).

Business Strategy:

- Focus: Competing successfully in specific markets.
- Goal: Strengthening competitive position of products or services.

Two Main Categories:

- Competitive strategies (e.g., cost leadership, differentiation)
- Cooperative strategies (e.g., partnerships, joint ventures)

Question 5: Differentiate between Red ocean and Blue ocean strategy.

Answer:

Basis	Red Oceans	Blue Oceans
Definition	Red oceans represent existing industries with established competitors.	Blue oceans represent markets or industries that haven't been explored yet.
Market Space	Boundaries are defined, and competition is fierce.	Uncharted territory with no direct competition.
Focus	Companies fight for a larger share of existing demand	Companies create new demand by offering innovative products or services.
Competition	Cutthroat, with companies trying to outperform rivals through cost leadership or differentiation.	Irrelevant, as companies create a new category of offerings.
Growth	Limited, as the market space becomes saturated.	Potentially high, as companies can capture significant new markets.
Demand	Exploit existing demand	Create and capture new demand
Value-Cost Trade-off	Make trade-offs	Break the trade-off
Examples	Automobile industry, smartphone industry.	Uber (Ride-Hailing App), Netflix (Streaming Service)

Question 6: What is Strategic Management ?

Answer: Strategic management refers to the process of making high-level decisions and taking actions that shape an organization's long-term direction and performance.

Strategic management replaced "corporate planning" for a reason. Here's why:

- Corporate planning focused on internal goals, like setting a long-term direction for the company.
- Strategic management takes things a step further. It acknowledges the competitive environment and aims to give the company an edge over its rivals.

Question 7: What do you understand by objectives of strategic management?

Answer: The objectives of strategic management may be listed as under:

- Identifying opportunities and adapt resources to exploit the opportunities created.
- To create opportunities by stretching the resources and competences of the organisation and capitalise them.
- Enhance understanding of managers for key relationships among actions, external environment, and performance
- To help an organisation enjoy competitive advantage.
- Improve competitive position through resource deployment & acquisition, & by adapting to environmental changes.
- Stay responsive to the needs of key stakeholders
- Identify critical success factors and meet customer needs.
- Focus on building blocks of competitive advantage and continuous improvement.
- Embrace change to remain competitive and survive.
- To develop a creative and innovative attitude and to think strategically.

Question 8: What are the four basic elements of strategic management?

Answer: I. Environmental scanning

Monitoring, evaluating and disseminating of information from the external and internal environments to key people within the organisation.

Purpose: Identify the strategic factors that will shape the future of organisation.

Environmental Scanning Techniques:

Formal Techniques:

Single variable extrapolation (projecting future sales based on historical trends)

Theoretical limit envelopes (analyzing the limitations of existing technologies)

Dynamic modes (simulating different scenarios based on environmental changes)

Mapping (creating visual representations of the competitive landscape)

Multivariate interaction analysis (statistically analyzing the relationships between multiple factors)

Informal Techniques:

- Unstructured expert opinion (seeking insights from experienced individuals)
- Structured expert opinion (conducting surveys or interviews with experts)
- Structured inexpert opinion (gathering feedback from employees)
- Unstructured inexpert speculation (considering potential future trends based on general observations)

II. Strategy Formulation

Development of long range plans for the effective management of environmental opportunities and threats, in the light of corporate strengths and weaknesses (SWOT).

It includes defining the Mission, Setting objectives, Developing strategies, Setting policy guidelines

III. Strategy Implementation

It is the process by which strategies and policies are put into practise though the development of

Programs: Breaking Down the Strategy into Actionable Steps

Budgets: Allocating Resources for Effective Execution and

Procedures: outline the specific steps and methods for carrying out program activities.

This includes day to day decisions in resource allocation and is typically conducted by the middle and lower level managers with review by the top management.

It involves taking actions at the Functional, Business and Corporate levels to execute a strategic plan.

Implementation involves executing actions such as quality improvement programs, redesigning products, adjusting positioning, market segmentation, pursuing mergers and acquisitions, and downsizing the company.

IV. Evaluation and control:

Organisational activities and performances are monitored.

The actual performances are compared to desired performances and corrective actions are taken to resolve problems. Helps to identify the weakness and gaps of the previously implemented strategic plan and thereby, stimulates the entire process to begin again.

Question 9: What is Competitive Advantage?

Answer: A company achieves competitive advantage when it provides buyers with superior value compared to rival sellers or offers the same value at a lower cost to the firm.

- A firm's competitive advantage is always relative, not absolute.
- To assess competitive advantage, we compare firm's performance to a benchmark that is, either the performance of other firms in the same industry or an industry average.
- The advantage is sustainable if it persists despite the best efforts of competitors to match or surpass
- If a firm underperforms its rivals or the industry average, it has a competitive disadvantage.
- Two or more firms that perform at the same level have competitive parity.

Question 10: Vision is a desired future state of an organisation. Explain.

Answer:

- A vision statement defines an organization's desired future state.
- It's a powerful tool that can:
  - → Focus Attention and Energy of employees to work towards a common goal
  - → Describe the Ideal Future of what the company aspires to become.

- Vision articulates a view of Realistic, Credible and Attractive Future of the organisation.
- Well conceived visions are Distinctive and Specific to a particular organisation: they avoid generic, feel good statements
- To be effective, visions need to be backed up by hard to reverse strategic commitments and tied to economic fundamentals.

Types of Vision Statements:

- Product-Oriented: These define the business in terms of the goods or services they provide.

To be the world's most intelligent smartphone" (Samsung Galaxy)

To create the most immersive and realistic virtual reality experience" (Meta)

To be the fastest and most fuel-efficient electric car on the market" (Tesla)

- Customer-Oriented: These focus on serving customer needs and offer more strategic flexibility.

Nike: "To bring innovation and inspiration to every athlete in the world."

Facebook: "To make the world more open and connected".

Walmart: "To be the best retailer in the hearts and minds of consumers and employees "

Question 11: What are the Benefits of having a vision? (5 marks)

Answer:

- Good visions are inspiring and exhilarating
- Vision represents a discontinuity, a step function and a jump ahead so that the company knows what it is to be.
- Good vision helps in the creation of a common identity and a shared sense of purpose
- Good visions are competitive, original and unique. The make sense in the market place as they are practical
- Good visions foster risk taking and experimentation.
- Good visions foster long term thinking
- Good visions represent integrity: they are truly genuine and can be used to the benefit of the people.
- The visions are customer-oriented.
- Internal stakeholders are invested in defining the vision.

Question 12: What is Mission Statement?

Answer:

A Mission statement defines an organization's present purpose and core business.

It answers the fundamental questions:

- Who are we?
- What do we do?
- Why are we here?

Key Characteristics of a Mission Statement:

- Unique Purpose: It distinguishes the company from its competitors by highlighting its unique value proposition.
- Focus: It defines the scope of the company's operations, specifying the products or services offered.
- Values: It may also reflect the company's values and philosophies about how it operates and treats stakeholders.
- Public Image: It communicates the organization's goals and values to external stakeholders.

Product-Oriented vs. Customer-Oriented Missions:

- Product-Oriented: These statements focus on the specific products or services offered by the company.

  e.g., "We manufacture high-quality electronics"

  Rolex: "To manufacture watches that support human achievement"

- Customer-Oriented: These statements focus on the customer needs that the company's products or services address.

  e.g., "We help people connect and share information easily"

  Uber: "To provide the fastest and most convenient way for people to get around their city."

Benefits of a Customer-Oriented Mission:

- Adaptability to changing customer needs.
- Identifying new opportunities.
- Future-proofing against market shifts.

Question 13: Explain the organisational culture and key layers of Organisational Culture.

Answer: Organizational culture is the foundation of how a company operates. It's the set of shared beliefs, values, and assumptions that define:

- How employees behave
- How business is conducted
- The overall work environment

Key Layers of Organizational Culture:

- Values: It guide how managers, employees conduct business and build the organization to achieve the mission. They form the bedrock of organizational culture, influencing how employees work toward goals. Clear, specific values are essential; vague terms like "service to the community" or "honoring equal employment opportunities" should be avoided.
  Eg: Encouraging creativity, new ideas, and continuous improvement.

- Beliefs: These are more specific convictions held by employees about the organization and its practices. They might not be explicitly stated but are evident in how people discuss issues. (e.g., belief in teamwork, skepticism towards risk-taking)

- Behaviors: This is the observable layer, reflecting how employees interact and perform their daily tasks. It encompasses work routines, management styles, and even informal customs. (e.g., collaborative work style, dress code, open communication)

- Taken-for-Granted Assumptions: These are the deepest and most ingrained aspects of the culture. They represent unconscious beliefs that shape the way people perceive and respond to situations.
  (e.g., assumption that hierarchy is respected, belief in long working hours)

Question 14: Explain Ethical Behaviour

Answer: Creating an ethical business environment is crucial for long-term success. Here's how companies can foster ethical behavior by building a strong ethical culture:

1. Articulate Clear Values:

Businesses must explicitly articulate values that place a strong emphasis on ethical behaviour.

Develop a code of ethics – a formal document outlining the company's ethical priorities. This document clearly states the company's commitment to ethical conduct.

2. Leadership by Example:

It is important that leaders in the business give life and meaning to those words by repeatedly emphasizing their importance and then acting on them.

This means using every relevant opportunity to stress the importance of business ethics and making sure that key business decisions not only make good economic sense but also are ethical.

3. Incentives and Rewards:

Building an organisation culture that places a high value on ethical behaviour requires incentive and reward systems, including promotional systems that reward people who engage in ethical behaviour and sanction those who do not.

4. Aligning Strategy with Ethics:

When ethical principles guide strategic decision-making, it builds trust with stakeholders and safeguards the company's reputation. Ethical core values act as "guardrails," ensuring the company stays on track while pursuing its mission and competitive advantage.

Question 15: Explain Goal. Differentiate between Goals and Objectives.

Answer:

Goals:

Well construed goals denote what an organisation hopes to accomplish in a future period of time.

They represent future state of outcome of effort put in now.

The set of goals that an organisation sets addresses a wide range of financial and non financial issues.

Goals are close-ended attributes which are precise and expressed in specific terms.

Feature	Goals	Objectives
Focus	Desired future state or outcome	Specific actions to achieve goals
Specificity	Broad and general	Concrete and measurable
Timeframe	Long-term (years)	Short-term (months, quarters)
Example	Increase market share	Launch a new marketing campaign
Purpose	Provide overall direction	Define actionable steps

Question 16: Explain objectives and its desirable characteristics in order to be effective

Answer:

Objectives are the foundation for an organization's functioning.

They translate the broad strategic vision into specific, achievable targets.

Objectives' Impact:

- Define the organization's relationship with its environment (customers, competitors).
- Help pursue the organization's vision and mission.
- Provide a framework for strategic decision-making
- Establish performance evaluation standards (tracking progress towards goals).

Characteristics: S.M.A.R.T. Objectives:

- Specific: Clearly define what needs to be achieved. Involves answering to specific set of questions
  - What the organisation wants to achieve?
  - Why is this objective important?
  - Who are being involved in the process?
  - When should the objective be accomplished?
  - What are the resources and constraints that needs to be identified?

  Specific objectives are motivating for managers.
- Measurable: Quantify the target whenever possible for clear evaluation (e.g., increase sales by 10% in Q1).

  This allows comparison with industry standards and tracks progress.
- Attainable: Set challenging but realistic goals that stretch the organization without being demoralizing.

  Objectives should incentivize improvement but remain achievable.
- Relevant: Align with the organization's overall vision and mission. Objectives shouldn't conflict with broader goals to ensure all efforts contribute to the desired future state.
- Time-Bound: Specify a timeframe for completion. Deadlines create a sense of urgency and motivate action, although not all objectives require strict deadlines.

Objectives should also be understandable

Question 17: Explain in brief the various important issues that need to be kept in mind while setting up objectives of an organization. (7 marks)

Answer:

Specificity: Objectives should be clear and specific, avoiding broad statements. Use terms like "corporate," (corporate level) "general,"(department level) or "specific"(Team or Individual level) to match the organizational level.

Multiplicity: Don't have too few or too many objectives. Aim for a balanced number that cover various areas without overwhelming everyone.

Periodicity: Set objectives for different timeframes (long-term, medium-term, short-term) and ensure they align with each other. Long-term goals are general, short-term are more specific.

Verifiability: Objectives should be measurable (quantitative) whenever possible. If not, use qualitative goals requiring expert judgment.

Reality: Ensure objectives are realistic and reflect what the organization truly aims to achieve, not just what they say they want.

Quality: A good objective provides clear direction and a way to measure success. It should be specific, measurable, achievable, relevant, and time-bound (SMART).

Question 18: Explain Personal Objectives.

Answer: Personal Objectives: Guiding Performance and Success

Personal objectives are job-specific goals set for each employee. They are important for several reasons:

- Clarity and Alignment: They communicate what's expected and what matters most.
- Performance Measurement: They track progress and measure individual and team performance.
- Guidance and Development: They help employees understand their roles and contribute to company goals.
- Increased Productivity: Clear objectives create a more productive work environment.

Setting Objectives:

- Frequency: Objectives are typically set quarterly, biannually, or annually.
- Collaboration: Managers and employees work together to define measurable targets.
- Types: Objectives can be activity-based (number of tasks completed) or outcome-based (achieving specific results).
- Review: Progress is regularly reviewed to ensure alignment and make adjustments if needed.

Overall, personal objectives are a key tool for improving individual and team performance, boosting productivity, and achieving organizational goals.

Question 19: Explain FAST.

Answer: FAST, a modern approach to goal setting that challenges the traditional SMART method.

Term	Definition	Advantages
F- Frequently Discussed	Goals should be frequently discussed in order to see the progress, allocate resources as and when needed, prioritise initiatives and provide feedback	- Gives guidance for important decisions. - Helps employees remain focused on the most important matters. - Links performance feedback to concrete goals - Evaluates the progress and helps in course corrections.
A- Ambitious	Goals should be challenging or ambitious but not impossible to achieve	- Motivates performance of individuals and teams towards goal. - Helps in minimising the risk of downplaying the achievements of the subordinates. - Focuses on innovative ways to achieve goals.
S- Specific	Goals should be translated into specific metrics so that there is clarity in achieving the goals.	- Clearly mentions what the employees are expected to deliver. - Helps in easy identification of deviations from the goals and offers quick course corrections. - Enhances performance of individuals and teams.
T- Transparent	Goals and their achievements should be made public for all employees to see.	- Use of peer pressure to perform on goals. - Clearly showcases the activities and contribution of the employees towards goal achievement - Helps employees understand the agenda of other employees and the teams. - Helps to identify the strategies that are redundant and are not aligned to the overall organisational goals.

Question 20: Explain Strategic Leadership. What are the key qualities of Leadership

Answer: Strategic leadership is about managing the strategy-making process to create a competitive advantage for the organization.

This translates to maximizing shareholder value through balanced profit growth and profitability.

Key Qualities of a Strategic Leader:

- Visionary: A strategic leader has a clear and compelling vision for the organization's future.
- Communicator: They can effectively communicate this vision to all levels of the organization, making it a part of the culture.
- Business Acumen: They can identify and articulate the business model that aligns with the vision and ensures its achievement.
- Commitment: Their actions and words demonstrate a strong commitment to the vision and business model.
- Information Network: They actively build strong networks (formal and informal) to stay informed about internal and external developments.
- Empowerment: They recognize and empower subordinates to make decisions, boosting motivation and reducing their own workload. However, critical decisions remain theirs.
- Consensus Builder: They strive to build consensus for their ideas through discussion and collaboration, rather than relying solely on authority.

Question 21: What are the components of psychological abilities that contribute to strong leadership?

Answer: Emotional Intelligence (EI): EI refers to a set of psychological abilities that contribute to strong leadership.

Components of Emotional Intelligence:

- Self-awareness: Understanding your own emotions, motivations, and their impact on others.
- Self-regulation: Managing your emotions and impulses to think before you act.
- Motivation: Having a strong drive and passion for your work, beyond just external rewards.
- Empathy: The ability to understand and share the feelings of others.
- Social skills: Building positive and productive relationships with others.

Benefits of High EI for Leaders:

- Confidence and Adaptability: Self-aware and self-regulated leaders tend to be more confident, cope better with uncertainty, and are more open to change.
- Trust and Respect: People respect leaders who demonstrate self-awareness and self-regulation.
- Effective Decision-Making: Self-aware leaders recognize their limitations and make considered decisions, leading to greater trust and confidence from subordinates.
- Motivation: A leader's passion for work can be contagious, motivating subordinates to strive for excellence.

Question 22: Explain Organizational Change Management (OCM).

Answer: Change is inevitable in businesses, driven by factors like:

- New technology
- Updated practices
- Restructuring
- Leadership shifts
- Strategic adjustments

Organizational Change Management (OCM) helps businesses adapt to these changes. It involves:

1 Preparing employees and stakeholders for upcoming changes.

2 Implementing the changes smoothly.

3 Helping everyone adjust to the new way of working.

There's no one-size-fits-all approach to OCM. Popular methods include:

McKinsey & Company's 7-S Framework: Style, Skills, Systems, Structure, Staff, Shared Values & Goals and Strategies

Kurt Lewin's Change Model: Unfreeze → Change → Refreeze

ADKAR Model: Awareness → Desire → Knowledge → Ability → Reinforcement

The Kubler-Ross Model: Shock → Anger → Bargaining → Depression → Acceptance

William Bridges' Transition Model: Ending → Neutral Zone → New Beginnings

Employee involvement is crucial for successful change management. Here's what's needed for success:

- Informed and prepared leadership
- Equipped HR team
- Employee buy-in throughout the process

By following these principles, organizations can navigate change effectively and achieve their goals.

Question 23: What are Performance Objectives?

Answer:

Goals set for employees to understand expectations and accountability.

Can be performance-based (quantity of work) or development-led (skills improvement).

Examples of Performance Objectives:

- Productivity: Amount of work completed in a specific timeframe. (e.g., number of clients served in banking)
- Quality and Efficiency: How well and how fast tasks are completed. (e.g., accurate and fast service delivery)
- Education and Self-Development: Employee-driven goals for skill development. (e.g., new skill training,)

Why are Performance Objectives Important?

- Provide direction and focus for employees.
- Improve employee productivity and quality of work.
- Promote continuous learning and development.

Alignment with Organizational Goals

- Crucial to maintain employee motivation.
- Helps employees see their contribution to the bigger picture.
- Prioritizes tasks and fosters collaboration within teams.

Question 24: Examine with examples, why do we need the Strategic Business Unit. MTP (7 marks)

Answer: Objectives translate an organization's vision and mission into specific and measurable targets.

Types of Objectives:

1 Financial Objectives: Focus on financial performance and profitability.

Examples: Increase revenue, improve profit margins, generate cash flow.

2 Strategic Objectives: Focus on strengthening market standing, competitive position and future prospects.

Examples: Gain market share, achieve cost advantages over competitors, develop superior technology.

There is a need to balance the financial objective with strategic objectives.

Attaining financial objectives include – adequate profitability and financial strength

It's a paramount importance as the organisation. Long-term health and ultimately survival will depend on it.

However, one cannot ignore the need for accomplishment of strategic objective as it signals whether the organisation competitive position is on the rise or not. And one can expect a strong financial performance if the competitive strength and market position is on the rise.

Most widely used method for combining the use of both strategic and financial objectives, tracking their achievement and giving management more complete in balance view of how well as organisation is performing is known as **balance scorecard.**

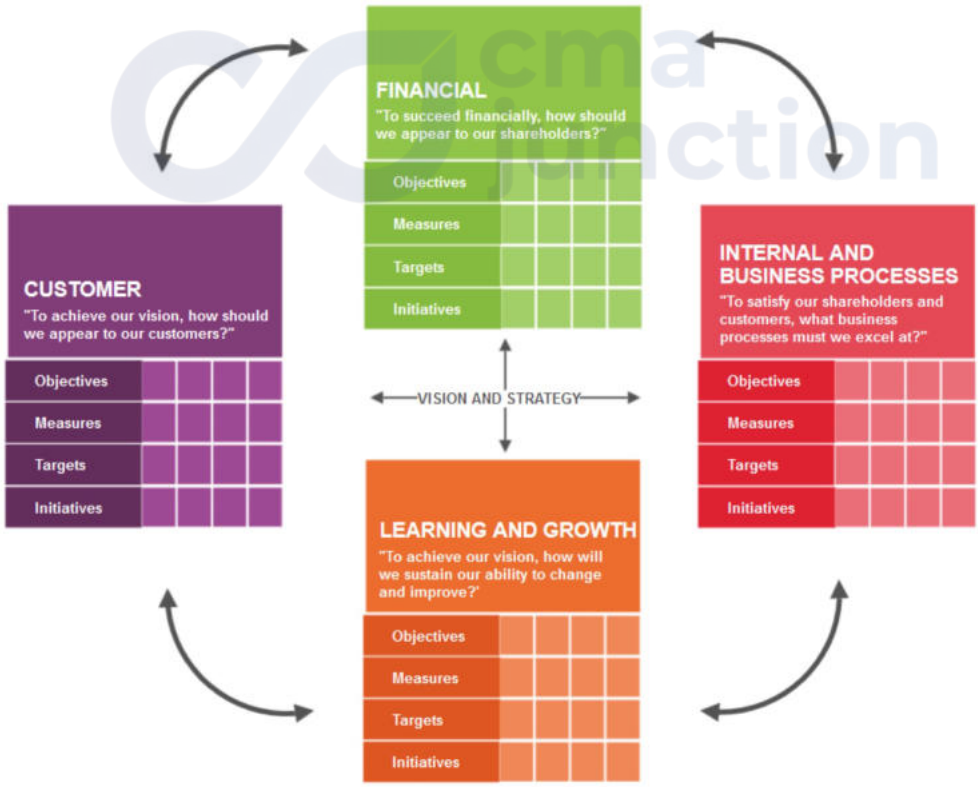
- Links financial goals to specific strategic goals derived from the business model.
- Provides employees with a clear understanding of how their work contributes to overall goals.

Development of the BSC:

- Created by Robert S. Kaplan and David Norton.
- Aims to move beyond a focus on short-term financial goals.
- Emphasizes measuring a wider range of non-financial performance indicators.

The Four Perspectives of the BSC:

- Financial Perspective: Measures financial outcomes arising from the organization's strategic intent. (e.g., revenue, profitability, cash flow).
- Customer Perspective: Measures customer satisfaction and loyalty (e.g., market share, customer satisfaction surveys).
- Internal Business Perspective: Measures the efficiency and effectiveness of internal processes (e.g., innovation, cycle time, quality).
- Learning and Growth Perspective: Measures the organization's ability to adapt to change and develop new skills (e.g., employee training, knowledge management).



Question 25: What are the steps involved in balance scorecard approach?.

Answer: The balanced score card is a top-down approach to performance management. It starts with the strategic intent and ends with operationally relevant targets.

Steps in the Balanced Scorecard Approach:

1 Establish Strategic Intent:

- Define the organization's vision and mission.
- Determine the overall desired future state.

2 Design the Balanced Scorecard:

- Identify specific measures for each BSC perspective:
  - Financial (e.g., revenue growth, profitability)
  - Customer (e.g., customer satisfaction, market share)
  - Internal Business Process (e.g., efficiency, quality)
  - Learning and Growth (e.g., employee skills, innovation)
- Formulate specific strategies to achieve the vision.

3 Strategy Mapping:

- Identify organizational activities linked to the formulated strategies.
- Show how activities in one perspective lead to success in another.
- Example: Improved employee training (Learning & Growth) leads to higher quality products (Internal Process), resulting in increased customer satisfaction (Customer Perspective) and ultimately driving revenue growth (Financial Perspective).

4 Establish Measures:

- Define specific and measurable metrics for each objective.
- Track progress towards achieving the desired outcomes.
- Examples: Customer satisfaction score, employee training completion rate, product defect rate.

Question 26: What is EVA - Driven Responsibility Accounting?

Answer:

Accounting Profit vs. Economic Profit:

Accounting Profit: Traditional profit measure, calculated as revenue minus explicit costs.

Economic Profit: A more rigorous measure that considers all costs, including:

- Explicit costs (e.g., materials, labor)
- Implicit costs (e.g., opportunity cost of capital)

Economic Profit as "Pure Profit"

- Accounting profit can be misleading because it doesn't account for the cost of capital.
- Economic profit represents the true surplus after all inputs, including capital, are compensated.

Why Economic Profit Matters:

- More Demanding Performance Measure: Forces managers to consider the cost of using capital.
- Better Resource Allocation: Helps allocate capital to businesses that generate the highest returns relative to their capital needs.
- EVA (Economic Value Added): A popular measure of economic profit.
  - Calculated as NOPAT (Net Operating Profit After Tax) minus Cost of Capital.

Advantages of Economic Profit:

1 Stricter Performance Discipline:

By factoring in the cost of capital, economic profit highlights companies that are truly generating a surplus after all costs are accounted for.Many seemingly profitable companies might see their profitability disappear when the cost of capital is considered.

2 Improved Capital Allocation:

Economic profit helps identify businesses within a firm that generate the highest returns relative to the capital they require.This can guide investment decisions and ensure capital is allocated to the most efficient and profitable areas.

Chapter 9:

Strategic Analysis and Strategic Planning

Strategic manager

↓

Manage the strategy making process

Environment Scanning	Formulation of strategy	Strategy implementation	Strategy, evaluation and control
- Analysing organisation's internal and external environment External environment analysis: PESTEL, Porter's five forces framework Internal Environment Analysis: VRIO, Value chain analysis, SWOT Analysis	- Stating the organisation's vision, mission, values, and major goals - Strategic planning - Portfolio Analysis - Critical success Factors		

Question 1: With reference to Business Environment, examine in detail (i) Various lavers and (ii) Characteristics Jun 23 (8 marks)

Answer:

Business environment refers to the sum total of all the conditions, events and influences in and around an organisation that affects it hence, a clear understanding of business environment is of crucial importance.

The very survival of an organisation depends on its external environment which presents both opportunities (e.g., new markets) and threats (e.g., new regulations).

Careful analysis allows managers to anticipate and potentially influence these changes.

Layers of the Business Environment:

The framework categorizes factors into distinct layers, moving from broad to specific:

1 Macro-Environment (Outermost Layer):

- Broadest and highest-level influences affecting most organizations.
- PESTEL framework helps analyze Political, Economic, Social, Technological, Environmental, and Legalfactors.
- PESTEL analysis provides data to identify key drivers of change and construct future scenarios.

2 Industry/Sector:

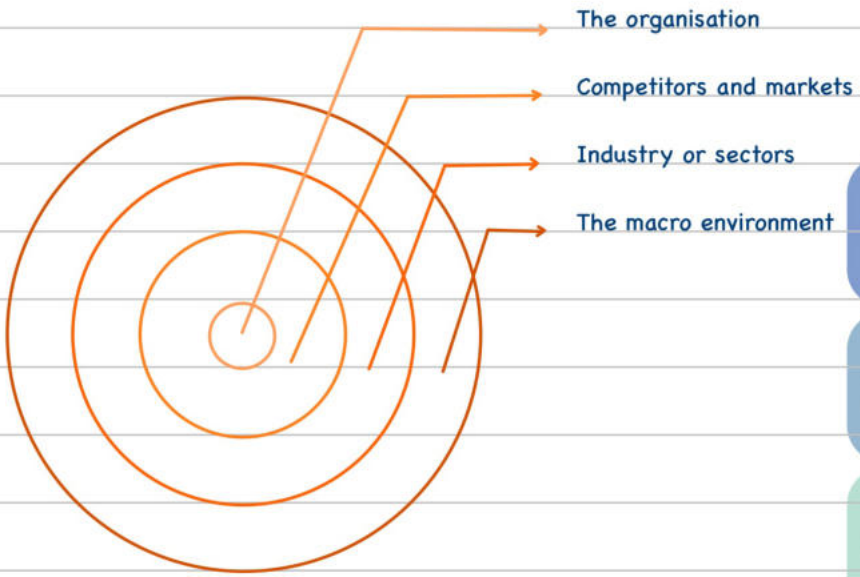
- Organisations producing similar products or services.
- Porter's Five Forces framework helps understand industry attractiveness and external threats.
- It analyzes factors like competition, bargaining power of buyers/suppliers, threat of new entrants, and threat of substitutes.

3 Competitors and Markets:

- The most immediate environment surrounding an organization.
- Strategic groups help identify close and distant competitors.
- Market segmentation and critical success factors help understand customer expectations and needs.

Internal factors specific to the organisation itself, influence its capabilities and operations.

Methods: VRIO, SWOT analysis, value chain analysis



Key Characteristics of business environment:

- Complexity: The business environment is a complex interplay of events, conditions, and influences from various sources, creating new effects that are difficult to fully comprehend at once.
- Dynamism: The environment is constantly changing due to numerous factors, shaping its character and form over time.
- Multi-faceted: Different observers perceive environmental changes differently, with opportunities seen by some and threats by others.
- Far-reaching Impact: The environment significantly affects an organization's growth and profitability, with changes impacting its survival and existence in multiple ways.

Question 2: Explain PESTEL Framework.

Answer:

PESTEL framework, a useful tool for analyzing the macro-environment that impacts businesses.

- PESTEL stands for Political, Economic, Social, Technological, Environmental, and Legal factors.
- Understanding these factors is crucial for managers to identify opportunities and threats.

Political Factors:

- Government policies and regulations can restrict or enable business operations.
- Political stability affects investor confidence and economic activity.

Economic Factors:

- Economic growth creates opportunities for expansion and profit.
- Economic decline increases competition and reduces consumer spending.
- Interest rates influence borrowing costs and investment decisions.
- Currency exchange rates impact the competitiveness of exports and imports.
- Inflation/Deflation:

- Inflation can destabilize the economy and make future planning difficult.

- Deflation can discourage spending and investment.

Social Factors:

- Demographics (age, gender, etc.) influence market needs and preferences.
- Cultural shifts can create new demands or challenges for businesses.

Technological Factors:

- Technological advancements (AI, internet, etc.) can revolutionize industries and create new opportunities.
- Businesses need to adapt to stay competitive.

Environmental Factors (green issues):

- Environmental concerns (pollution, waste) require businesses to adopt sustainable practices.
- Governments are increasingly implementing regulations to protect the environment.

Legal Factors:

- Laws and regulations (health & safety, mergers & acquisitions) impact business operations.
- Businesses need to comply with legal requirements.

Key Drivers for Change:

- Not all PESTEL factors have equal impact.
- Managers need to identify high-impact factors ("key drivers") that significantly affect their industry or sector.
- This helps them prioritize which factors need the most attention.

Question 3: Summarize the factors that determine the rivalry among established firms according to Porter's Five Forces Framework. MTP (7 marks)

Answer: Porter's Five Forces Framework

- Helps identify sources of competition in an industry.
- Used at the level of strategic business units (SBUs), not the whole organization, due to diversity in operations and markets.
- Not used solely for a snapshot; requires understanding of connections between competitive forces and structural drivers.
- Five forces are interdependent, not independent.
- Competitive behavior may aim to disrupt these forces, not just accommodate them.

I. Risk of Entry by Potential Competitors

Established companies aim to discourage potential competitors from entering the industry to safeguard their market share and profitability. High entry barriers, which increase potential competitors' costs, weaken this threat. Even in profitable industries, high entry barriers can discourage potential competitors.

1. Economies of Scale:

- Established companies with large production volumes enjoy lower costs per unit produced compared to new entrants starting small.
- This cost advantage gives them an edge in pricing and profitability.

2. Brand Loyalty:

When customers are loyal to established brands, they are less likely to switch to new entrants, making it harder for new companies to gain market share.

3. Absolute Cost Advantages:

- Established companies might have:
  - More efficient production processes due to experience or proprietary technology.
  - Control over crucial resources or raw materials.
  - Easier access to financing due to lower perceived risk.
  - These advantages allow them to keep their costs lower than potential entrants.

4. Customer Switching Costs:

If customers have to invest significant time, money, or effort to switch from established brands to new entrants (e.g., data transfer, retraining), they might be less likely to do so.

5. Government Regulations:

Strict government regulations can make it expensive and time-consuming for new companies to enter an industry, acting as a barrier to entry.

II. Rivalry Among Established Companies

Impact on Profits:

High Rivalry:

- Companies compete fiercely using price cuts, promotions, etc.
- This lowers profits due to lower prices and higher marketing costs.

Low Rivalry:

- Companies may have the power to raise prices or reduce non-price competition spending.
- This can lead to higher industry profits.

Four factors have a major impact on the intensity of rivalry among established companies within an industry: (1) industry competitive structure, (2) demand conditions, (3) cost conditions, and (4) the height of exit barriers in the industry.

1) Industry Competitive Structure

Fragmented Industry (Many Small Companies):

- Low barriers to entry lead to many competitors.
- Price wars erupt due to difficulty in differentiating products.
- Excess capacity and boom-and-bust cycles occur.
- Cost minimization is key for survival.

Consolidated Industry (Few Large Companies):

- Companies are interdependent and actions by one affect others.
- Price wars and competitive spirals can erupt.
- Companies may follow the price set by the dominant player.

2) Industry Demand

Growing Demand:

- More opportunity for companies to compete for new customers.

- Less rivalry as all companies can grow without taking market share from others.
- Often leads to high industry profits.

Declining Demand:

- Companies fight for shrinking market share and revenue.
- Increased rivalry as companies try to take customers from each other.
- Declining demand is a major threat that intensifies competition.

3) Cost Conditions: High fixed cost

- Companies need high sales volume to be profitable.
- They might cut prices or increase promotions to boost sales.
- If many companies do this in a slow-growing market, intense rivalry erupts.
- Weakest firms often start price cuts due to their struggle with fixed costs.

4) Exit Barriers

- Companies get stuck in declining industries due to difficulty leaving.
- This leads to excess capacity and intense price competition.

Reasons for High Exit Barriers:

- Specialized assets with no value outside the industry.
- High fixed costs associated with shutting down (e.g., severance pay).
- Emotional attachment to the industry.
- Dependence on a single industry for revenue.
- Bankruptcy regulations allowing unprofitable companies to stay afloat.

Consequences of High Exit Barriers:

- Unprofitable companies stay in the market, increasing competition.
- Excess capacity leads to price wars and lower profits for everyone.

III. The Bargaining Power of Buyers

Strong Buyers = Threat to Profits:

- Buyers can negotiate lower prices or demand higher quality/service.
- This squeezes profits out of the industry for companies.

Factors that Make Buyers Powerful:

- Many Choices: When there are many sellers, buyers can choose who to buy from. (e.g., Multiple clothing stores)
- Large Purchases: Buyers who buy a lot can leverage their volume for discounts. (e.g., Wholesalers)
- Important Customers: If a company relies on a few big buyers, those buyers have more power. (e.g., Supermarkets for food suppliers)
- Easy Switching: If buyers can easily switch to another company (low switching costs), they have more bargaining power. (e.g., Phone plans)
- Threat of Backward Integration: If buyers can become their own suppliers, it threatens the industry's pricing power. (e.g., Manufacturers making their own components)

IV. The Bargaining Power of Suppliers

Strong Suppliers = Threat to Profits:

- Suppliers can raise input prices or deliver lower quality products/service.
- This increases costs for companies in the industry, squeezing their profits.

Factors that Make Suppliers Powerful:

- Unique and Vital Inputs: When a product has few substitutes and is essential for the industry (e.g., semiconductors for electronics), suppliers have the upper hand.
- Independent of the Industry: If suppliers have a diverse customer base and the industry isn't a major client (e.g. oil suppliers to many industries), they have more power.
- High Switching Costs: If switching to a different supplier is expensive or time-consuming (e.g., specialized machinery), suppliers have more leverage.

- Threat of Forward Integration: If suppliers can become their own customers by entering the industry and making the final product (e.g., aluminum supplier starting a can factory), it threatens the industry's profits.
- Limited Buyer Power: If companies can't make their own key inputs (e.g., obtaining rare earth metals), suppliers have an advantage.

V. Substitute Products

Close Substitutes = Threat to Profits:

- Customers can switch to cheaper substitutes if prices in an industry get too high. (e.g., Switching from coffee
- This limits the ability of companies in the industry to raise prices and earn high profits.

Few Substitutes = Opportunity for Profits:

- If there are no good alternatives, companies have more pricing power.
- They can raise prices without customers easily switching, potentially increasing profits.

Complementors: A Sixth Force in Competitive Analysis

Andrew Grove, former CEO of Intel, proposed that Porter's Five Forces model overlooks an important factor influencing industry demand: Complementors.

- What are Complementors?

Companies that sell products that enhance the value of another industry's products when used together. Essentially, they "complement" each other.

- Example: PC industry (Main product), Software application companies (Complementors)

When high-quality software applications are readily available for PCs, it increases the overall value of PCs for customers. This can lead to: - Increased demand for PCs. - Higher profitability for the PC industry

Impact of Complementors:

- Stronger complementors can boost demand and profitability for the main industry.
- Companies might benefit by collaborating with or strategically influencing complementors.
- The power and competence of complementors become another factor to consider in industry analysis.

Question 4: What are critical success factors? What are the major sources of critical success factors?

Answer: Critical Success Factors (CSFs) are essential product features or areas where a company must excel to outperform the competition and satisfy customer needs.

What are CSFs?

- Features highly valued by customers.
- Areas where a company must excel to be successful.

Major Sources of CSFs (by Rockart):

- Industry Structure:
  - Specific factors relevant to the industry as a whole.
  - Example: Auto companies need strong service networks for customer satisfaction.
- Competitive Strategy, Industry Position, and Geographic Location:
  - CSFs based on a company's unique situation.
  - Example: India's large english speaking workforce is a CSF for BPO companies to compete globally.
- Environmental Factors:
  - CSFs influenced by broader business and economic conditions.
  - Example: Deregulation became a CSF for private telecom companies in India.
- Temporal Factors:
  - Short-term developments requiring immediate attention.
  - Example: Finding a new CEO might be a temporary CSF until leadership is stabilized.

Using CSFs in Strategy Development:

- CSFs can help narrow down strategic options.
- Analyze promising alternatives based on their relevance to CSFs.
- Forecast the outcome of different options considering CSFs.

By identifying and understanding CSFs, companies can focus their efforts on what truly matters for customer satisfaction and competitive advantage.

Question 5: Explain VRIO.

Answer:

The VRIO Framework Explained

The VRIO framework, developed by Jay Barney, is a strategic management tool used to analyze an organization's resources and capabilities to identify those that can create a sustainable competitive advantage. It evaluates resources based on four key characteristics:

VRIO Stands for:

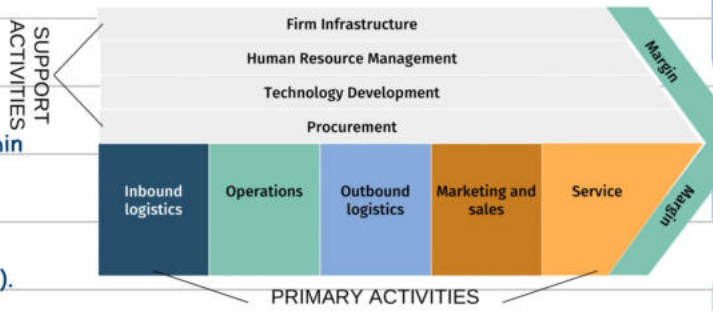
- V - Valuable: Do the resources and capabilities provide value to customers and create a competitive advantage?
  - Threshold competencies are necessary but don't provide an advantage (e.g., meeting basic safety standards).
  - Core competencies create a competitive advantage by offering superior value to customers.
- R - Rare: How rare are the resources and capabilities? Are they possessed by many competitors?
  - Rarity contributes to competitive advantage as it becomes harder for others to replicate.
- I - Inimitable: How easily can competitors imitate the resources and capabilities?
  - Barriers to imitation, such as complex processes, unique technologies, or strong brand recognition, can make them difficult to replicate.
- O - Organized: Is the organization structured to capture the value of its resources and capabilities?
  - A well-organized structure with effective processes and a culture that fosters innovation allows the organisation to leverage its resources effectively.

Sustainable Competitive Advantage:

A resource or capability that meets all four VRIO criteria is considered a source of sustainable competitive advantage.This means it's valuable, rare, difficult to imitate, and the organization is well-positioned to exploit its benefits.

Question 6: "The value chain describes the categories of activities within and around an organization which create a product or service". In this context, demonstrate the activities involved in the value chain of an organization. (7 marks)

Answer: Michael Porter's Value Chain framework, a valuable tool for analyzing the activities that create value for your customers.



What is the Value Chain?

- It describes the interconnected activities within an organization that transform inputs into customer-valued outputs (products or services).
- It helps identify how value is added at each stage.

Types of Activities:

1 Primary Activities (directly create value for the customer):

- Inbound Logistics: Receiving, storing, and distributing materials. (e.g., inventory control)
- Operations: Transforming inputs into the final product or service. (e.g., assembly, machining)
- Outbound Logistics: Delivering the product or service to the customer. (e.g., warehousing, distribution)
- Marketing and Sales: Promoting and selling the product or service. (e.g., advertising, customer service)
- Service: Activities that maintain or enhance the product's value. (e.g., installation, repairs)

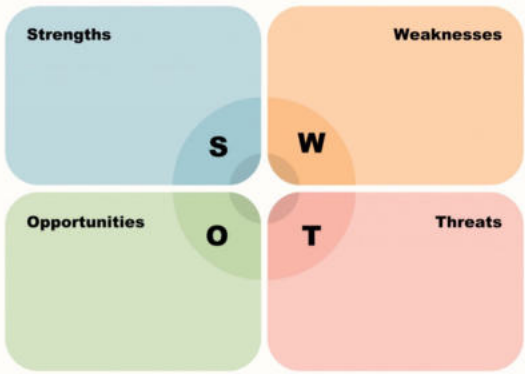
2 Support Activities (indirectly create value by supporting primary activities):

- Procurement: Acquiring resources needed for the primary activities. (e.g., purchasing raw materials)
- Technology Development: Developing & managing technologies to improve efficiency. (e.g., research & development)
- Human Resource Management: Recruiting, training, and motivating employees.
- Infrastructure: The organization's overall structure and systems (e.g., finance, accounting, quality control).

Adding Value:

- Value can be added at any stage in the value chain, both upstream (early) and downstream (later).
- The goal is to optimize the value chain to deliver the most value to the customer at the lowest cost.

Question 7: What is meant by SWOT analysis? (4 marks)



Answer: SWOTC Analysis

SWOT stands for Strengths, Weaknesses, Opportunities, and Threats or Challenges. It's a framework used to analyze an organization's strategic position.

Benefits:

- Simple and versatile: Easy to use and adaptable to various situations.
- Clarifies issues: Helps identify key factors impacting the organization.
- Develops strategic options: Provides a foundation for exploring future courses of action.

Steps:

1 Set objectives: Define the goals of the organization or unit.

2 Identify factors: Brainstorm strengths, weaknesses, opportunities, and threats.

3 Develop strategies:

- Strengths: Leverage strengths to capitalize on opportunities.
- Weaknesses: Minimize weaknesses to reduce threats.
- Opportunities: Exploit opportunities using strengths.
- Threats: Protect against threats by minimizing weaknesses.

Challenges:

- Clarity: Distinguishing opportunities from threats and vice versa can be difficult.
- Focus: SWOT can generate extensive lists, making it crucial to prioritize what's important.
- Oversimplification: Complex realities can be oversimplified in the SWOT framework.
- Passivity: SWOT can encourage a reactive approach instead of proactive strategy development.
- Misinterpretation: Strengths might be confused with opportunities, and weaknesses with threats.
- Limited Scope: SWOT doesn't replace in-depth analysis of core competencies, critical success factors, etc.

Key Takeaway:

SWOT analysis is a valuable tool for initial strategic analysis, but it's important to be aware of its limitations and use it in conjunction with other strategic frameworks for a more comprehensive understanding.

Threats (Challenges) in SWOT Analysis

Why They Matter:

Threats (or challenges) are arguably the most crucial aspect of SWOT analysis. They represent external factors that can hinder your business's success.

Examples of Threats:

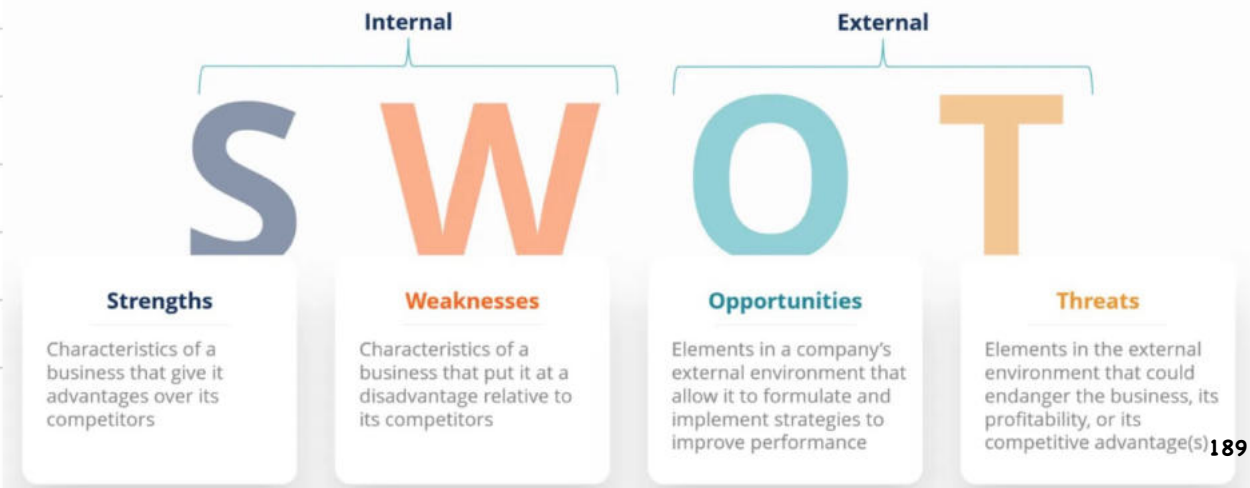
- Tightening regulations
- Shifting consumer demands
- New competitor products
- Changing technological landscape

Impact:

A well-defined plan based on strengths, weaknesses, and opportunities can be useless if you don't consider industry challenges.

Key Point:

Understanding threats helps you make informed decisions about your products and strategies.



Question 8: Explain Portfolio Analysis, its various objectives and advantages (7 marks)

Answer:

Portfolio analysis is a strategic tool used by multi-business corporations to manage their collection of businesses (portfolio) for optimal returns. It views the corporation as an investor managing a portfolio of assets, with each business unit being an investment.

Objectives:

- Analyze current business mix: Evaluate the performance and potential of each business unit.
- Make investment decisions: Allocate resources and decide on acquisitions or divestitures.
- Develop growth strategies: Identify opportunities for new businesses or existing ones.
- Strategic alliances: Assess how alliances contribute to corporate and business unit goals.

Popular Techniques:

- BCG Growth-Share Matrix: Classifies businesses based on market growth and relative market share (Stars, Cash Cows, Dogs, Question Marks).
- GE Business Screen: Evaluates businesses on market attractiveness and business unit strength.

Advantages

- Strategic focus: Encourages evaluation of individual businesses and setting specific goals.
- Data-driven decisions: Promotes using external data to supplement management judgment.
- Resource allocation: Raises awareness of cash flow needs for expansion.
- Clear communication: Visualization tools (matrices) simplify communication.

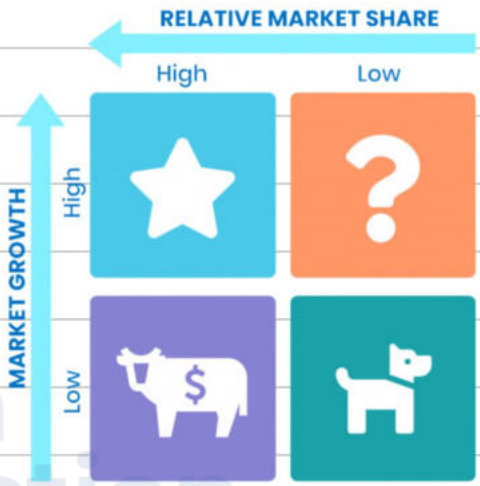
Limitations:

- Market segmentation: Defining product/market segments can be challenging.
- Standardization: Prescribed strategies might miss opportunities or be impractical.
- Subjectivity: Portfolio positions are often based on judgment, not pure science.
- Labeling bias: Terms like "cash cow" and "dog" can lead to self-fulfilling prophecies.
- Uncertainties: Industry attractiveness and product lifecycle stage might be unclear.
- Misuse: Following portfolio models blindly can harm profits if applied incorrectly.

Question 9: Explain the four sorts of business as given in the BCG Matrix. Identify the advantages and limitation of BCG Matrix. (7 marks)

Answer:

The BCG Growth-Share Matrix, developed by the Boston Consulting Group (BCG), is a popular tool for analyzing a corporation's business portfolio. It categorizes businesses based on their market growth rate and relative market share ("star," "cash cow," "question mark," "dog").



Market Growth vs. Market Share:

High Market Growth: Market is rapidly expanding.

High Market Share: Business unit has a large share of the market.

Low Market Growth: Market is stagnant or declining.

Low Market Share: Business unit has a small share of the market.

The Four Categories:

Stars: High growth, high share - require heavy investment to maintain growth but generate good profits.

Question Marks: High growth, low share - require investment to capture market share and become stars, but many fail.

Cash Cows: Low growth, high share - mature businesses generating healthy cash flow to fund other ventures.

Dogs: Low growth, low share - unprofitable and drain resources. BCG recommends divestment or closure.

Advantages:

- Visualizes Portfolio: Provides a clear picture of different business needs and potential.
- Financial Awareness: Warns against overemphasis on high-growth businesses with high investment demands.
- Lifecycle Awareness: Emphasizes that stars eventually decline.
- Discipline for Managers: Reminds business unit managers that surplus resources belong to the corporation.

Limitations:

- Definitional Issues: Defining "high" and "low" growth/share can be subjective.
- Capital Market Assumptions: Ignores the possibility of raising external capital.
- Motivation Problems: Labeling businesses as "cash cows" or "dogs" can demotivate managers.
- Self-Fulfilling Prophecies: Cash cows can decline faster if starved of investment.
- Oversimplified Divestment: Ignores potential ties between business units.

Overall:

The BCG matrix is a helpful tool for strategic portfolio analysis, but its limitations must be considered. It should be us

other frameworks and sound judgment.

Question 10: Analyze the steps in a formal strategic planning process? MTP (7 marks)

Answer:

The Five Steps of Strategic Planning

Strategic planning is a crucial process for organizations to define their direction and achieve long-term goals.

1. Define Mission and Goals:

- Mission Statement: Defines the organization's purpose, values, and desired future state (vision).
- Major Goals: Set ambitious but achievable targets to guide strategic direction.

2. Analyze External Environment:

- Industry Analysis: Identify opportunities and threats within your specific industry.
- National Environment: Consider factors like regulations and economic trends.
- Macro Environment: Analyze broader social, economic, and technological factors

3. Analyze Internal Environment:

- Strengths and Weaknesses: Evaluate your resources, capabilities, and competencies to identify internal strengths and weaknesses.
- SWOT Analysis: Compare internal strengths and weaknesses with external opportunities and threats. This helps refine your business model by aligning resources with environmental demands

4. Select Strategies:

- Build on Strengths: Leverage your strengths to capitalize on external opportunities.
- Correct Weaknesses: Address weaknesses to mitigate external threats.
- Competitive Advantage: Choose strategies that create a sustainable competitive advantage.
- Alignment: Ensure strategies are consistent with your mission and goals.

5. Implement Strategies:

- Putting Strategies into Action: Translate strategies into actionable plans at functional, business, and corporate levels.
- Organizational Alignment: Design the right structure, culture, and control systems to support strategy execution.
- Governance: Establish systems to ensure ethical and legal implementation.

The Feedback Loop:

Strategic planning is an ongoing process. Monitor execution to assess progress towards goals and competitive advantage. This feedback informs future strategy formulation and implementation, allowing for adjustments as needed.

Question 11: Explain Alternatives in Strategic Planning

Answer:

Alternatives to Traditional Strategic Planning

Traditional strategic planning often assumes a predictable future and a top-down approach. Here are some criticisms and alternative approaches:

Criticisms of Traditional Planning:

- Unpredictable Future: Real-world contingencies can disrupt even the best plans.
- Limited Role for Lower Management: Excludes valuable insights from those closest to operations.
- Overlooking Serendipity: Successful strategies can emerge from unexpected opportunities.

Alternative Approaches:

1. Scenario Planning:

- What-If Scenarios: Develop plans for various future possibilities (optimistic, pessimistic).
- Tracking Trends: Monitor indicators to assess the likelihood of each scenario.
- Benefits:
  - Improves understanding of a dynamic environment.
  - Encourages strategic thinking.
  - Generates diverse strategic options.

2. Decentralized Planning:

- Problem with Traditional Approach: "Ivory tower" planning by top management can be ineffective.
- Decentralised Approach: Involves managers at all levels.
- Benefits:
  - Leverages insights from those closest to daily operations.
  - Improves strategic plan's practicality.
  - Corporate-level managers act as facilitators, setting goals and providing resources.

3. Strategy Analysis and Choice:

This process involves generating, evaluating, and selecting feasible strategic alternatives based on:

- Vision, Mission, and Objectives
- Environmental Analysis (Opportunities & Threats)
- Internal Analysis (Strengths & Weaknesses)

Generating Strategic Alternatives:

- Factors Affecting Alternatives: Size, management style, industry characteristics.
- Methods for Generating Alternatives:
  - Brainstorming Sessions: Top management and key executives discuss various options.
  - Special Meetings: Executives meet off-site to explore alternative scenarios and actions.
  - Outside Consultants: Bring in objective and expert viewpoints.
  - Joint Meetings: Combine internal and external perspectives for a wider range of ideas.

Question 12: What are the effects of biases in strategic decisions? Explain the different types of biases.

Answer:

Bounded Rationality and Biases in Strategic Decisions

Our decision-making abilities are limited (bounded rationality) and can be influenced by mental shortcuts (heuristics) that sometimes lead to errors. Here's how these biases can affect strategic decision making:

Bounded Rationality:

- Human capabilities limit our ability to process information perfectly.
- We rely on simplified rules (heuristics) to navigate complex situations.

Cognitive Biases:

- These are systematic errors in thinking that can affect our decisions.

Types of Cognitive Bias

- Prior Hypothesis Bias: Sticking to preconceived beliefs despite evidence to the contrary.

  Example: A company might invest heavily in a project based on a faulty belief about market demand.
- Escalating Commitment: Throwing good money after bad by continuing to invest in failing projects.

  Example: A company might continue funding a failing marketing campaign due to sunk costs.
- Reasoning by Analogy: Making faulty decisions based on overly simplistic comparisons.

  Example: A company might launch a product based on the success of a similar but unrelated product.
- Representativeness Bias: Generalizing from small samples or anecdotes.

  Example: A company might invest in a new technology based on a single successful case study.
- Illusion of Control: Overestimating one's ability to influence events.

  Example: A CEO might make overly risky investments due to overconfidence in their own judgment.

Consequences of Biases:

- These biases can lead to poor strategic decisions with negative consequences for businesses.

Question 13: What are the Techniques to Improve Strategic Decision Making?

Answer:

- Devil's Advocacy:

  - Requires a plan and a critical analysis of that plan.
  - A designated "devil's advocate" identifies potential weaknesses and challenges.
  - Benefits: Raises awareness of potential problems before implementation.

- Dialectic Inquiry:

  - More complex than devil's advocacy.
  - Involves creating a plan (thesis) and a counter-plan (antithesis).
  - Advocates debate both plans, exposing flaws and assumptions.
  - Outcome: A more comprehensive "synthesis" plan emerges from the debate.
  - Benefits: Encourages critical thinking and reveals hidden issues.

- Outside View:

  - Requires identifying similar past strategic initiatives.
  - Analyze success or failure of those past initiatives.
  - Evaluate the current project against the historical context.
  - Benefits: Provides insights from past experiences.

Groupthink:

- Concept by Irving Janis: A psychological phenomenon in group decision-making.
  - Group prioritizes cohesion over critical thinking.
  - Members suppress dissenting views to maintain harmony.
  - Decisions based on emotions and justifications rather than objective analysis.
- Consequences: Poor strategic decisions with negative outcomes.

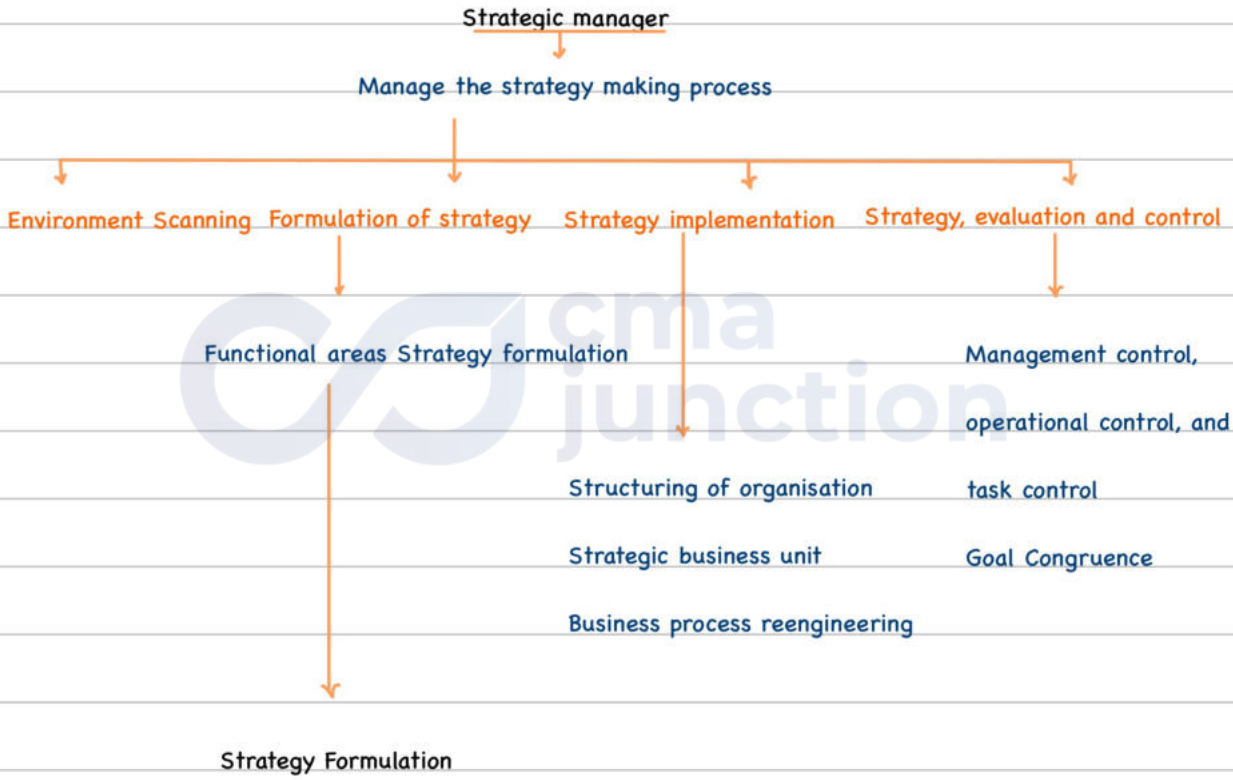
How Techniques Mitigate Groupthink:

- Devil's advocacy and dialectic inquiry directly challenge groupthink by introducing opposing viewpoints.
- The outside view encourages looking beyond the immediate group and considering past experiences.

By employing these techniques, organizations can foster a more critical and objective decision-making environment, reducing the risk of groupthink and leading to better strategic choices.

Chapter 10:

Formulation and Implementation of Strategy



Strategy Formulation

The possession of resources (including people) does not guarantee strategic success. Strategic capability is concerned with how these resources are deployed, managed and controlled to create competences in those activities and business processes needed to run the business.

The formulation of strategy with respect to the functional areas namely production, supply chain, marketing and human resource.

Question 1: What is Goal Congruence and Agency Theory.

Answer:

Goal Congruence:

Alignment of goals between different groups within an organization (e.g., employees, managers, shareholders).

Importance: Increased profitability and overall success.

Challenges: - Employees have personal goals besides organizational ones.

- Information asymmetry between management and shareholders.

Agency Theory:

Analyzes conflicts arising when one party (principal) delegates decision-making to another (agent).

In organizations, managers are agents acting on behalf of shareholders (principals).

Potential issues: - Managers may not always act in the shareholders' best interests.

- Moral hazard: Managers take excessive risks or shirk responsibilities.

- Adverse selection: Shareholders lack complete information about managers' capabilities.

Achieving Goal Congruence and Mitigating Agency Problems:

- Incentivize Alignment: Profit-sharing bonuses, Stock options, Performance-based compensation
- Monitoring and Controls: Management audits, Additional reporting requirements, Ethical codes of conduct

Aspects of Goal Congruence:

- Communication and Understanding:
  - Clear communication of goals through formal (budgets) and informal channels (meetings).
  - Ensure goals are well-understood to avoid misinterpretations.
- Direction and Motivation:
  - Performance management systems that define expectations and goals.
  - Understanding strategic objectives and value drivers.
  - Addressing employee motivation through recognition, challenging work, and responsibility.

- Incentives:

  - Linking rewards and compensation to desired behaviors and performance.

- Connection:

  - Aligning incentives with performance measures and goals.

  - Encouraging employees to focus on what matters most for the organization.

By implementing these strategies, organizations can create a more unified environment where individual goals and organizational objectives work in harmony, leading to greater success.

Challenges and Considerations:

- Creative Accounting: Incentive structures might encourage manipulating financial statements.
- Overly Complex Systems: Too many goals or metrics can overwhelm employees.

Question 2: Explain Key Result Areas (KRAs), Key Performance Areas (KPAs) and Key Performance Indicators (KPIs)

Answer: Imagine a company's KPA is "Increase Customer Satisfaction" (broad area).

- KRA: "Improve customer service response time" (specific area within customer satisfaction).
- KPI: "Reduce average call wait time by 2 minutes within 3 months" (measurable outcome for the KRA).

Key Points:

- KPAs encompass a broad range of performance.
- KRAs define specific areas of focus within a KPA.
- KPIs provide measurable ways to track progress towards achieving a KRA

I. Key Result Areas (KRAs):

Definition: KRAs are a concise list of critical goals that define success for an individual, department, or organization. They represent the most important 20% of activities that will deliver 80% of the value.

Purpose: KRAs provide clarity and direction, ensuring everyone focuses on what truly matters for achieving the organization's objectives.

Characteristics of Effective KRAs:

- SMART: Specific, Measurable, Achievable, Relevant, and Time-bound.
- Limited Number: Typically 3-5 KRAs to maintain focus.
- Alignment: Aligned with the organization's strategic goals.
- Written and Agreed Upon: Clearly documented and reviewed by relevant parties.

Common Challenges in Developing KRAs:

- Lack of Clarity: Unclear expectations about the employee's role and focus areas.
- Distractions: Focusing on daily tasks with limited value to the organization's success.
- Top-Down Imposition: Supervisors dictating KRAs without employee input, leading to disengagement.

Best Practices for Developing KRAs:

- Collaborative Effort: Involve employees in setting KRAs to ensure buy-in and ownership.
- Alignment: Ensure KRAs are aligned with the organization's strategic goals.
- Measurable: Define success through measurable metrics whenever possible.

II. Key Performance Areas (KPAs):

Definition: KPAs are broader categories that define areas of responsibility. They encompass a wider range of activities than KRAs, but without a direct focus on results or measurement.

Examples: Improving safety, customer satisfaction, resource efficiency, etc.

Importance: KPAs ensure all crucial areas of responsibility are addressed within the organization.

Important KPAs:

- Financials: Revenue, costs, profits, and trends.
- Customer Satisfaction: Complaints, returns, satisfaction surveys.
- Market Perception: Brand image, customer views.
- Productivity: Goal achievement, efficiency in daily tasks.

III. Key Performance Indicators (KPIs):

Definition: KPIs are specific metrics used to measure progress towards achieving KRAs. They translate the general goals outlined in KRAs into measurable terms.

Examples: Sales figures, customer satisfaction ratings, product return rates, etc.

Role: KPIs help track performance and identify areas needing improvement.

By effectively utilizing KRAs, KPAs, and KPIs, organizations can establish clear direction, track progress, and achieve their desired outcomes.

Question 3: Explain Strategic Control

Answer: -

Strategic Control is a system of tools and processes used by managers to monitor and evaluate the effectiveness of an organization's strategies and structures.

- It goes beyond just measuring current performance. It assesses whether the chosen strategies are actually leading to the desired outcomes aligned with the business model

Why is Strategic Control Important?

- Ensures strategies are working as planned: Tracks progress towards achieving the organization's goals and objectives.
- Identifies areas for improvement: Helps identify weaknesses or gaps in the current approach.
- Promotes adaptation: Provides insights to adjust strategies or structures if needed to stay competitive and successful.
- Motivates employees: Strategic control can be used to create incentive programs that keep employees focused on important problems and solutions for long-term success.

Benefits of Effective Strategic Control:

Superior Efficiency, Enhanced Quality, Increased Innovation, Improved Customer Responsiveness:

Role of Control in achieving efficiency, quality, innovation, and responsiveness to customers.

1) Control and Efficiency: Control systems help managers measure inputs (resources) used to produce outputs (goods/services).This allows them to identify areas for improvement and optimize production.
2) Control and Quality: By tracking customer complaints and product returns, control systems provide feedback on product quality, enabling managers to focus on building better products.
3) Control and Innovation: Strategic control can foster innovation by creating a culture that empowers employees and encourages experimentation. However, designing control systems that balance risk-taking with accountability is crucial.
4) Control and Customer Responsiveness: Monitoring employee interactions with customers helps assess their performance and identify areas for improvement through training or better procedures. Knowing they are being monitored can incentivize employees to provide better customer service.

Strategic control systems exist at four levels:

Corporate, Divisional, Functional, Individual

Key Points:

- Controls at each level should be aligned to avoid conflicts.
- Lower-level controls should be built upon the foundation set by higher-level controls.

Question 4: What are the types of strategic control?

Answer: Focus on the big picture, ensuring the organization's overall strategy is effective.

1) Premise Control: Regularly checks if the assumptions your strategy is based on (e.g., environmental factors, industry factors) are still valid. If not, the strategy might need adjustments.

2) Strategic Surveillance: Continuously monitors your internal and external environment (news, competitors, etc.) to identify potential threats or opportunities that could impact your strategy.

3) Special Alert Control: Deals with sudden, unexpected events (e.g., major regulation changes) that require immediate action. Contingency plans and crisis teams can help navigate these situations.

4) Implementation Control: Tracks how well your strategy is being executed. It assesses if your plans, programs, and policies are actually leading you towards your goals. This might involve monitoring key projects and milestones,and using operational controls like budgets and schedules.

Question 5: Strategic control aims to achieve high performance by:

Answer:

1) Setting Ambitious Goals: Motivating employees and managers to strive for excellence through challenging targets.

2) Management by Objectives:

- Employees participate in setting their own goals, increasing ownership.
- Managers intervene only when necessary (manage by exception).

3) Performance-Based Rewards:

- Linking pay to performance creates a strong incentive for high achievement.
- Managers can accurately assess individual contributions.

In summary, strategic control uses a functional structure combined with ambitious goals, management by objectives, and performance-based rewards to drive employee and management excellence.

Question 6: Explain approaches to strategic control.

Answer: There are two main approaches to strategic control:

1 Traditional Approach (Sequential):

- Follows a step-by-step process:
  a) Formulate strategies and set goals.
  b) Implement strategies.
  c) Measure performance against goals.
  d) Take corrective actions if needed.
- Relies on feedback after measuring performance to adjust the strategy.
- Limitations:
  a) Time-consuming (often tied to annual planning cycles).
  b) Not proactive enough for a dynamic environment.
  c) Ignores the need for continuous evaluation during implementation.

2 Contemporary Approach (Adaptive):

- Emphasizes continuous monitoring and adaptation.
- Key question: Do strategies still fit the current environment?
- Requires managers to:
  a) Continuously scan internal and external environments.
  b) Regularly challenge and update the assumptions underlying the strategy.
- May involve changes in strategic direction.
- More suitable for today's dynamic business landscape.

In short: Traditional control is good for operational tasks, but contemporary control is essential for strategic planning due to its focus on continuous adaptation.

Question 7: What are the Types of General Control System?

Answer: Focus on monitoring and regulating specific aspects of an organization's operations.

1) Personal control: It involves influencing someone's behavior in person to achieve company goals. This can be done through:

- Direct supervision: Managers checking on employees and addressing any issues.
- Peer pressure: Team members influencing each other's behavior to ensure everyone contributes.

This approach helps identify problems early, fosters learning, and reduces the chance of employees slacking off.

2) Output Control:

Focuses on achieving specific goals: Managers set performance targets for divisions, departments, and individual employees. These goals can relate to efficiency, quality, innovation, and customer responsiveness.

- Linked to incentives: Often, a company's reward system is tied to goal achievement, motivating employees at all levels.
- Cascading Goals: Goals are set at different levels:
  - Corporate Level: Overall company expectations for efficiency, quality, etc.
  - Divisional Level: Goals for each division aligned with corporate goals.
  - Functional Level: Goals set by divisional managers for departments to contribute to divisional goals.
  - Individual Level: Specific goals assigned to employees to help their department achieve its goals.

Benefits:

- Tracks progress towards strategic goals.
- Identifies strengths and weaknesses.
- Provides clear benchmarks for evaluation.

Drawbacks:

- Inappropriate targets can cause conflict between divisions if they prioritize divisional goals over corporate goals.
- Pressure to meet targets might lead to manipulating data to make divisions look better.

3) Behavior control relies on established rules, procedures, and standards to guide actions and decision-making across the organization. It focuses on how tasks are done, not the specific goals themselves. This ensures:

- Predictability: Consistent actions and outcomes if employees follow the rules.
- Accuracy: Reduced errors by following established procedures.

Examples of behavior control include:

- Operating budgets: Setting spending limits for departments.
- Standardization: Using uniform processes for tasks (e.g., manufacturing procedures).
- Documented rules and procedures: Clear guidelines for employees to follow.

Question 8: Task Control

Answer: Task control is all about ensuring tasks are completed efficiently and effectively.

- Focus: It emphasizes control over how tasks are done and the performance achieved.

Examples: Making a list, prioritising, setting deadlines, scheduling, breaking down big task

- Benefits:

  - Increased Efficiency: You can get more done in less time.
  - Reduced Interdependence: Tasks become less reliant on each other, avoiding delays.
  - Improved Stress Management: Knowing you control your workload reduces stress.

- Drawback of Low Task Control: Employees lacking control over their tasks can become stressed due to:

  - Uncertainties about how and when to do tasks.
  - Inability to influence the pace of their work.

Question 9: Operational Control

Answer: Operational control ensures activities are performed according to company standards. Here's a breakdown of the four-step process:

1) Setting Standards:

a) Quantitative: Measurable targets in areas like production, cost, revenue (e.g., production quotas, budgets).

b) Qualitative: Address human factors that can impact performance (e.g., employee morale, customer satisfaction).

2) Measuring Performance: Actual performance is assessed against predetermined standards.

Challenges: Difficulty measuring some activities (e.g., managerial performance).

Timing: Measurements should be taken at crucial points to avoid delays.

Frequency: Depending on the activity, measurements can be daily, weekly, monthly, or annually

3) Identifying Deviations:

Analyze the difference between actual performance and set standards.

Three scenarios: - Match: Ideal, but uncommon.

- Exceed: Investigate the measurement system's validity if unusual.

- Fall Short: Requires investigation to pinpoint the cause of the underperformance.

- Analyze variances (differences) to identify root causes:

  - Internal vs. external factors?, Random or expected deviations?, Temporary or permanent issues?

4) Taking Corrective Action:

Address shortfalls in performance.

Three main options:

- Checking Performance: Identify and address underlying issues that hinder performance (e.g., resource allocation, leadership styles). This might involve changes in strategy, systems, or employee training.

- Checking Standards: Review if standards are unreasonably high or low.

- Reformulating Strategies: In rare cases, a complete overhaul of strategies, plans, and objectives might be required. This involves revisiting the strategic planning process.

Question 10: Key principles for designing an effective control system:

Answer:

- Minimize information: Only gather the essential data to avoid overwhelming everyone.
- Reasonable frequency: Avoid overly frequent or rapid reporting, which can be frustrating.
- Acceptability and Meaning: Employee buy-in, Track what matters
- Adaptability and Timeliness: Controls need to adapt to changing circumstances

  Enable corrective actions before problems escalate.
- Balance and Focus: Long-term and short-term view:

  Focus on deviations from set standards rather than constant monitoring.
- Motivation over Punishment: Reward success, Avoid punishment for failure
- Culture plays a role: A culture aligned with the company's strategy can reduce the need for extensive formal controls.

Question 11: Explain Business Process Reengineering (BPR):

Answer: Business Process Reengineering (BPR) is 'the fundamental rethinking and radical redesign of business processes to achieve dramatic improvements in critical contemporary measures of performance such as cost, quality, service, and speed'. It's not a structural change itself, but a program to implement a turnaround strategy.

Why BPR? Three Main Drivers:

Turnaround Situations: Companies in deep trouble, facing high product failure rates or customer complaints, can use BPR to achieve dramatic improvements and regain profitability.

Future-Proofing: Anticipating future challenges due to internal or external environmental changes can prompt BPR to prepare the organization for those shifts.

Competitive Advantage: BPR can help organizations to be in better position than they are currently in and gain a significant edge over competitors.

BPR vs. Automation:

- Traditional approaches might simply automate existing processes with information technology.
- BPR challenges that mindset, asking "If we were starting fresh, how would we design this process?"

Hammer & Champy's (1993) BPR Principles:

- Combining several jobs into one.
- Allowing workers to make decisions.
- Performing the steps of a process in a natural order.
- Recognition that processes have multiple versions and designing processes to take account of different situations.
- Performing processes where it makes the most sense, e.g., if the accounting department needs pencils
- Reducing checks and controls to the point where they make economic sense.
- Minimizing reconciliation.
- Appointing a case manager to provide a single point of contact at the interface between processes.

- Reconciling centralization with decentralization in process design – e.g., via a shared database, decentralized decisions can be made while permitting overall coordination simply through information sharing.

Concerns and Challenges of BPR:

1. Process Complexity: Understanding existing processes before redesigning them is crucial, and this can be more complex than initially thought.
2. Organizational Silos: Many processes involve intricate interactions across departments, requiring a holistic view that can be challenging to achieve.
3. Institutional Knowledge Loss: Radical change can risk losing valuable tacit knowledge embedded in existing processes.

Conclusion

BPR can be a powerful tool for organizational transformation, but careful planning, consideration of potential drawbacks, and a focus on understanding existing systems are essential for successful implementation.

Question 12: Difference between strategy formulation and strategy implementation.

Answer:

Strategy Formulation	Strategy Implementation
It involves positioning forces before the action	It involves managing forces during the action.
The focus is on effectiveness.	The focus is on efficiency.
It is primarily an intellectual process.	It is primarily an operational process.
It requires good intuitive and analytical skills.	It requires motivation and leadership skills.
Requires coordination among few individuals	Requires coordination among many individuals.

Question 13: Explain Organisational Structures.

Answer: Formal structures (organization charts) define roles, responsibilities, and communication patterns within a company.

They reveal:

- Communication Flow: Reporting lines influence who talks to whom. People tend to communicate less across hierarchies or departments.
- Skill Importance: The kind of structural position at the top suggest the kind of skills required. Top positions with functional titles (marketing, production) indicate the value placed on specialized skills over general business experience.

Five Basic Structural Types:

1 Functional: Emphasizes functional expertise (e.g., marketing, finance).

2 Multidivisional: Groups by business unit (e.g., product lines, geographic regions).

Hybrid Structures (Blend Dimensions):

3 Matrix: Combines functional and product/geographic structures.

4 Transnational: Combines global geographic structure with functional or product focus.

5 Project: Temporary structures for specific projects, often cross-functional.

Choosing the Right Structure:

- There's no one-size-fits-all solution.
- The optimal structure depends on the organization's unique challenges.

I. Functional Structure:

What it is: A structure based on core functions (e.g., production, marketing, finance). Often used in smaller or less diverse companies.

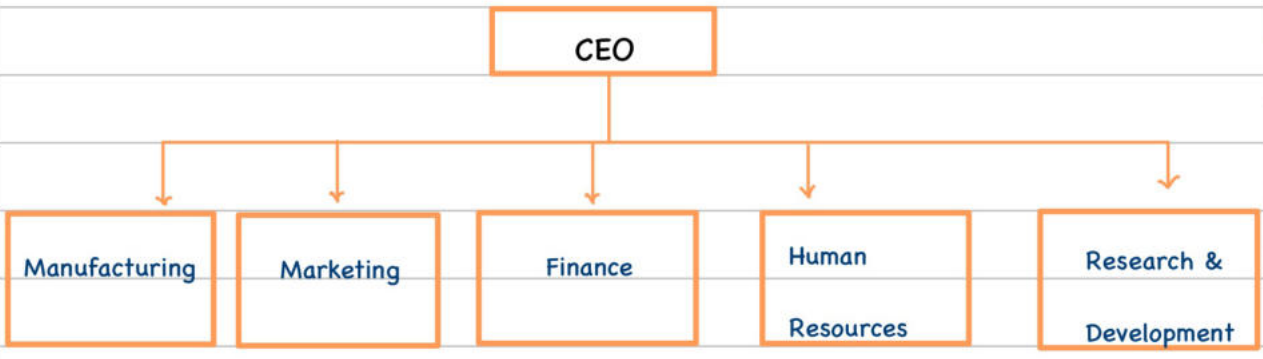
Advantages:

- Strong Operational Control: Senior managers have direct oversight and can make centralized decisions.
- Clear Roles & Accountability: Functional departments define clear roles and responsibilities.
- Expertise Concentration: Functional departments foster deep knowledge within specialized areas.

Disadvantages:

- Limited Strategic View: Senior managers may get bogged down in operational details and miss the bigger picture.
- Information Silos: Functional departments can become isolated, hindering communication and collaboration.
- Inflexibility for Growth: Struggles to adapt to product diversity or geographic expansion.
- Top Management Overload: Functional conflicts may burden upper management.
- Standardization Challenges: Maintaining consistent standards across functions can be difficult.

Ideal for: Smaller companies with limited product lines or those within a multidivisional structure (as sub-departments).



II. Multidivisional Structure

What it is: A structure based on separate divisions (product, service, or geographic). Used for companies with diverse offerings.

Advantages:

- Flexibility: Adapts to changing market needs by adding, closing, or merging divisions.
- Performance Monitoring: Divisions operate as independent units, allowing for easier performance control.
- Empowered Divisional Managers: Encourages ownership and strategic thinking among division leaders.
- Specialization: Divisions can develop deep expertise in specific markets or products.
- Strategic Training Ground: Managing a whole division prepares future leaders for broader roles.
- Reduced Functional Conflict: Clear accountability within divisions minimizes cross-functional conflicts.

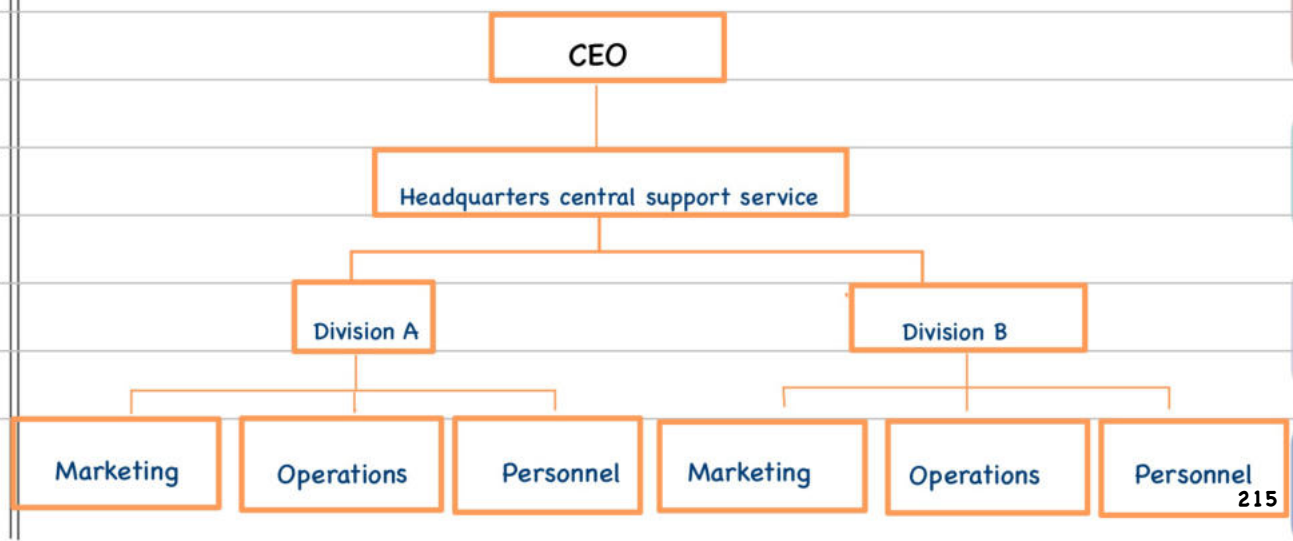
Disadvantages:

- Duplication and Cost: Independent divisions may duplicate functions, increasing overall costs.
- Limited Collaboration: Divisions can become isolated, hindering knowledge sharing and cooperation.
- Excessive Autonomy: Highly autonomous divisions may become like separate businesses, weakening central control.
- Quality and Image Inconsistency: Standards and brand image may vary across divisions.
- Short-Term Focus: Divisions may prioritize short-term gains over long-term organizational goals.

Subdivisions:

Large multidivisional structures may have sub-divisions within main divisions to manage complexity. This reduces the number of units directly reporting to the center and allows for addressing conflicting demands.

Ideal for: Large, diverse companies with multiple product lines or geographic markets.



III. The Matrix Structure:

What it is: A hybrid structure combining multiple dimensions (e.g., product & geographic, functional & divisional).

Advantages:

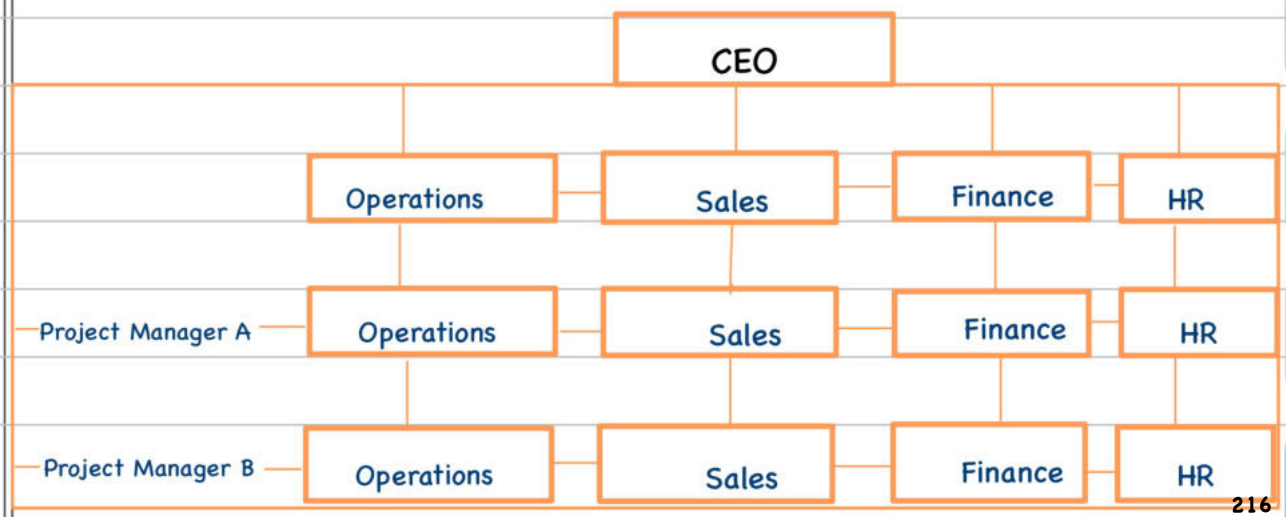
- Knowledge Integration: Breaks down silos, allowing expertise to flow across different areas.
- Flexibility and Innovation: Adapts to changing environments and fosters creativity.
- Global Coordination: Balances local and global needs (e.g., local marketing with global product development).
- Efficient Resource Utilization: Optimizes resource allocation across teams.
- Broader Responsibilities: Provides professionals with diverse experience.

Disadvantages:

- Decision-Making Delays: Consensus-based decision making can be slow due to negotiation between managers.
- Dual Reporting Conflicts: Employees may face conflicting priorities from multiple managers.
- Control Challenges: Complex structure can be difficult to manage effectively.
- Overreliance on Teamwork: Excessive focus on group processes can hinder individual accountability.
- Timely Decision Risks: Decision-making delays can impact responsiveness.

Key to Success: Strong leadership that fosters collaboration and manages ambiguity within the matrix.

Ideal for: Organizations requiring flexibility, knowledge sharing, and efficient resource use across diverse areas.



IV. The Transnational Structure: Balancing Global and Local

What it is: A structure balancing global coordination with local responsiveness, aiming for the best of both worlds (multi-domestic and global strategies).

Key Features:

- Combines local autonomy with centralized coordination (like a matrix, but with a focus on internationalization).
- Fixed responsibilities within cross-cutting dimensions.

How it Works:

- Independent National Units: Local subsidiaries act independently but contribute ideas and capabilities to the entire corporation (e.g., Unilever's global hair-care innovation center in France).
- Global Economies of Scale: National units specialize for the whole corporation or large regions (e.g., Unilever's European food manufacturing consolidation).
- Network Management: The corporate center establishes roles, relationships, and systems for effective network operation (e.g., Unilever's international manager forums).

Success Factors:

- Clarity of Roles and Boundaries: Clear definitions of responsibilities for different managers (global business, country/area, functional, and corporate).
- Global Competences: Developing expertise valuable across the entire organization.
- Local Responsiveness: Adapting to local market needs.
- Organizational Learning: Encouraging knowledge sharing and innovation across the network.

Managerial Responsibilities:

- Global Business Managers: Drive global competitiveness, strategize product-market approaches, manage resources, and coordinate transnational transactions.
- Country/Area Managers: Serve as local market sensors and build unique competences (e.g., R&D or manufacturing excellence) to contribute to the whole company.

- Functional Managers: Ensure global innovation and learning by identifying and disseminating best practices across the organization.
- Corporate Managers: Provide leadership, talent management, and facilitate collaboration across all levels.

Disadvantages:

- Demanding Management: Requires managers to work beyond their immediate roles for the transnational good.
- Complexity and Control Challenges: Similar to matrix structures, with potential for diffused responsibility and control issues.

Ideal for: Companies operating globally who need both global efficiency and local market adaptation.

V. Project-Based Structures: Flexibility for Temporary Endeavors

What it is: A structure where temporary teams are formed to complete specific projects, then disbanded.

Suitable for:
- Large, complex projects (e.g., construction, IT systems, movies).
- Time-bound events (e.g., conferences, sporting events, consulting engagements).

Advantages:

- High Flexibility: Teams can be assembled and disbanded as needed to adapt to changing demands.
- Clear Accountability: Project teams have defined goals and timelines, fostering ownership.
- Knowledge Sharing: Cross-functional teams promote knowledge exchange across departments.
- International Collaboration: Project timelines can be conducive to temporary global teamwork.

Disadvantages:

- Uncoordinated Proliferation: Without strong oversight, organizations may have too many uncoordinated projects.
- Knowledge Loss: Disbanding teams can hinder long-term knowledge accumulation in specific areas.

Growing Importance: Project-based structures offer vital flexibility in a fast-paced world, allowing for rapid redeployment and integration of skills.

Complementary Use:

Many organizations use project teams alongside their main structure to address specific strategic needs or challenges.

Question 14: How to choose a right structure for the organisation?

Answer:

Choosing the Right Structure: Aligning with Strategy and Challenges

The Perfect Fit:
- Organizations rarely adopt pure structural forms.
- The best structure is a tailor-made solution that blends different types to address specific challenges.

Goold & Campbell's Nine Tests: Fit Tests (Ensuring Alignment with Core Objectives):

1. Market-Advantage Test: Does the structure support the market strategy? (e.g., coordinating production steps for better market advantage).
2. Parenting Advantage Test: Does the structure fit the corporate center's role? (e.g., centralizing marketing or research for synergy management).
3. People Test: Does the organization have the necessary people to operate the chosen structure? (e.g., transitioning from functional to multidivisional requires managers skilled in decentralized business units).
4. Feasibility Test: Does the structure comply with legal and stakeholder constraints? (e.g., investment banks separating research and deal-making departments).

Good Design Tests (General Principles):

5. Specialized Cultures Test: Does the structure nurture specialist expertise by keeping specialists together?
6. Difficult Links Test: Does the structure create unnecessary strain on critical connections within the organization? (e.g., highly decentralized units and a central R&D department might struggle to collaborate effectively).
7. Redundant Hierarchy Test: Does the structure have unnecessary management layers that hinder efficiency? (e.g.,delayering to reduce management overhead).
8. Accountability Test: Does the structure have clear lines of accountability to ensure manager control and commitment? (e.g., matrix structures with dual reporting can be unclear).
9. Flexibility Test: Can the structure adapt to future changes? (e.g., broad divisional domains allow managers to pursue emerging opportunities).

Question 15: Explain SBU.

Answer:

Strategic Business Units (SBUs): Building Blocks for Strategy

An SBU is a distinct part of an organization that caters to a specific external market for goods or services, separate from other SBUs within the same organization.

Importance of SBUs: Identifying SBUs helps develop targeted business-level strategies, which may differ for each unit based on its market.

Challenges of SBU Identification:

- Market Segmentation: Balancing the need for market differentiation with the risk of creating too many SBUs (unmanageable complexity).
- Corporate Strategy Complexity: Too many SBUs can make developing a cohesive corporate-level strategy difficult.
- Structure vs. Strategy: SBUs are defined for strategic purposes, but an organization's structure might not always reflect these divisions.

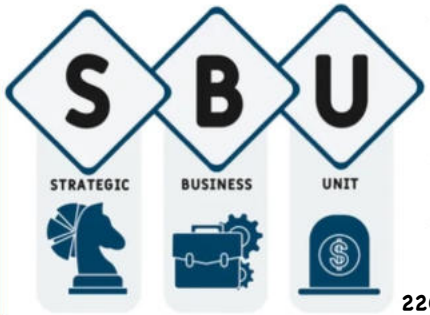
Criteria for Identifying SBUs:

- Market-Based Criteria: Same customer types, Similar distribution channels, Common competitors, Localized vs. standardized product/service offerings, Different sales channels for the same customer group (e.g., retail vs. online)
- Capabilities-Based Criteria: Similar strategic capabilities required

Example:

A food manufacturer would likely consider branded goods a different SBU from private label (retail "own-brand") goods, even if they sell to the same customers through the same channels. This is because the strategic capabilities required for each product line differ significantly.

Note:: All SBUs are divisions, but not all divisions qualify as SBUs. SBUs represent a more specific type of division with a high degree of strategic focus, autonomy, and accountability.



Question 16: Explain Production Strategy.

Answer: Production strategy is the roadmap for transforming raw materials into finished products in the most efficient and effective way possible. It's not just about having fancy equipment; it's about optimizing how you use all your resources(workforce, materials, equipment, space) to achieve your production goals.

Key Decisions in Production Strategy

Production System Design: How your production process will function? This includes capacity, location, layout, product design, work systems, automation, and how much you make yourself (vertical integration).

Technology Choice: Selecting the right level of technology for efficiency.

Product Lifecycle Impact: An effective production strategy considers the different stages of a product's life cycle (introduction, growth, maturity,decline) and adapts accordingly. like Introduction requires Job shop might work well, While Maturity often requires high volume production assembly line might work well.

Examples/Types of Production Strategies

- Mass Production: Efficient for high-volume standardized goods (e.g., traditional car manufacturing).
- Continuous Improvement: Focuses on ongoing process improvement and employee empowerment (e.g., Toyota Production System).
- Modular Manufacturing: Pre-assembled components delivered just-in-time for final assembly (e.g., some automakers).
- Customization: Tailoring products/services to individual customer needs (e.g., Club Mahindra's Zest vacations).

Considerations: Resource scarcity and environmental regulations are important factors.

Choosing the right production strategy is essential for achieving your business goals.

Question 17: Explain Supply Chain Strategy.

Answer: - Task of managing the flow of inputs, components and finished goods within a company's production process

- Aims to minimize inventory costs and maximize efficiency.

Why it's important?

- Reduced costs: By optimizing processes and minimizing waste, companies can save money throughout the supply chain.
- Improved customer satisfaction: Faster delivery times & responsiveness to changing needs lead to happier customers.
- Increased agility: A well-designed strategy allows companies to adapt to market changes and disruptions more easily.
- Enhanced profitability: By streamlining operations and reducing costs, companies can improve their bottom line.

JIT Strategy: significantly improves the companies supply chain and material management:

- Order materials only when needed for production
- Reduces storage and holding costs.
- Example: Wal-Mart wins by getting deliveries more often (daily or twice a week) compared to competitors (every 2 weeks). This means they keep less stuff in stock, saving money on storage and freeing up cash. Lower costs let them offer better prices,giving them an edge over the competition.

Benefits of JIT:

- Lower inventory holding costs.
- Increased inventory turnover.
- Reduced need for working capital.

Limitations of JIT:

- No buffer stock for unexpected disruptions
- Less flexibility to handle sudden demand increases.

Overcoming JIT Limitations: Multiple Suppliers: Reduces dependence on a single source.

Question 18: Explain Marketing Strategy.

Answer: Marketing strategy is the overall game plan for promoting and selling your products or services to your target audience. It outlines how you'll reach your ideal customers, convince them of the value you offer, and ultimately drive sales and achieve your business goals.

Marketing's impact on cost:

- Customer Loyalty: Keeping happy customers is cheaper than acquiring new ones. Happy customers lead to higher sales and the cost of acquiring a customer is spread out over more sales, leading to lower unit costs and higher profits. Losing customers means losing those benefits.
- Experience Curve: Aggressive marketing (pricing, promotions) can boost sales volume, moving the company faster down the experience curve. This means lower production costs per unit due to higher sales.

Marketing's role in keeping costs low:

- Track customer defection (churn) rates percentage of a company's customers who defect every year to competitors and reasons.
- Develop strategies to address those reasons and keep customers loyal.
- Use marketing tactics (pricing, promotions) to increase sales volume.

Benefits of loyal customers:

- Lower costs per customer
- Higher profit per customer
- Free advertising through referrals

Key takeaway: Marketing plays a crucial role in reducing costs by focusing on customer satisfaction and sales growth.

Question 19: Explain Human Resource Strategy

Answer: Human Resource Strategy

Employee Productivity Matters:

- A company's success heavily relies on how productive its employees are.
- Productive employees across different departments (manufacturing, sales, R&D) directly contribute to:
  - Lower costs (goods sold, sales expenses, R&D expenses)
  - Increased revenue
  - Improved return on investment (ROI)

HR's Challenge:

The Human Resource (HR) department plays a crucial role in devising strategies to increase employee productivity. Among its choices are using certain hiring strategies, training employees, organizing the workforce into self-managing teams, and linking pay to performance.

I. Hiring Strategy:

Successful companies prioritize hiring people with positive attitude and teamwork. They believe this leads to:

- Hard work: Positive employees are more likely to be dedicated and put in effort.
- Strong customer interactions: Good teamwork fosters better communication and collaboration, resulting in a positive customer experience and loyalty.

Alignment is Key:

A company's hiring strategy should be aligned with its:

- Internal culture: Hire people who fit the established company culture for a smooth integration.
- Strategic priorities: Recruit individuals whose skills and attributes directly support the company's strategic goals.

II. Employee Training

Employees are valuable resources in the production process. Highly skilled employees offer advantages:

- Faster and more accurate work
- Adaptability to complex tasks

Benefits of Training:

- Improved skills
- Increased efficiency

Overall, a well-defined hiring strategy and commitment to employee training are crucial for building a productive workforce and achieving a company's strategic objectives.

III. Self-Managing Teams: Potential and Challenges

What are they?

- Groups of 5-15 employees who handle entire tasks or products.
- Members are cross-trained and rotate jobs, creating a flexible workforce.
- They make decisions on hiring, training, work, and rewards.

Benefits:

- Increased productivity (reportedly up to 30% or more).
- Improved product quality.
- Cost savings from reduced hierarchy and eliminated supervisor roles.
- Increased employee motivation due to empowerment and autonomy.
- Improved teamwork through team-based performance bonuses.

Challenges:

- Training is crucial for team members to handle new responsibilities.
- Rushing implementation can lead to dysfunctional teams.
- May not be effective without compatible technology (e.g., flexible manufacturing).

IV. Pay for Performance:

- Linking pay to performance can boost productivity.
- Effective systems define what performance is rewarded and how.
- Team-based bonuses incentivize cooperation and teamwork.

Question 20: Explain People Dimension of Strategy

Answer: The People Dimension of Strategy:

- People's knowledge and experience are key to successful strategies.
- People-related issues are a central concern for managers, not just HR.
- Fostering a success-oriented work environment is crucial.
- Formal HR structures should support, not hinder, chosen strategies.

There are three possible related issues about the people dimension of strategy namely,

People as a resource,

People and behaviour and

The need to organise people.

I. People as a Resource: Managing for Strategic Success

Human Resources: A Unique Challenge

- Human resources are essential for any organization, but managing them is different from managing other resources.
- There are two main categories of HR issues: "harder" (traditional) and "softer" (behavioral).

HR Practices Supporting Strategies: Harder Issues:

- HR Audits: Assess HR needs to support strategies and identify core competencies for future planning.

- Goal Setting and Performance Management:

- Traditional: Line managers set individual/team goals within a central framework, linking them to strategy.

- 360° Appraisals: Assess performance from multiple perspectives (managers, colleagues, even external stakeholders) for a more holistic view.

- Reward Systems: Aligned with teamwork, not just individual incentives (e.g., sales commissions).
- Recruitment and Retention: Hiring qualified people and keeping them happy.
- Training and Development: Shift from formal programs to coaching and mentoring for self-development.

II. People and Behavior: The "Softer" Side of HR

Employees are not like other resources. They influence strategy through:

- Competence: Their skills and knowledge.

- Collective Behavior: The organization's culture.

The "Soft" Side of HR: All About People and Their Behavior

- Culture: This refers to the overall vibe and way things are done at a company. It's like the unwritten rules and how people typically act. A good culture makes employees feel happy and motivated.
- Change Management: When a company needs to do things differently, HR helps manage this change. They might explain the reasons for the change and help employees adjust.
- Leadership: HR helps managers become better leaders by teaching them how to motivate and inspire their teams.It's not just about giving orders, but also about building relationships and trust.
- Teamwork: HR encourages employees to work together effectively. This might involve team-building activities or creating a work environment where collaboration is valued.

The hard side ensures the company has the right resources, while the soft side helps those resources work together effectively.

III. Organizing People for Competitive Advantage

A well-organized workforce is crucial for an organization's competitive edge, especially in today's dynamic environment. Here's how to approach organizing people:

Three Key Areas:

- HR Function: The role and structure of the HR department.
- Line Managers: Responsibilities of managers in people management.
- Structure and Processes: Formal organizational structure and associated processes.

1) The HR Function: Rethinking the Role:

- Clarity of Purpose: If an HR function exists, its roles and responsibilities need to be clear and aligned with strategic goals.
- Four Potential Roles:
  - Service Provider: Provides support to line managers (e.g., recruitment, training).
  - Regulator: Sets HR policies and frameworks (e.g., pay, promotions).
  - Strategic Advisor: Guides line managers on HR strategy and best practices.
  - Change Agent: Drives organizational change and development.

Choosing the Right HR Model:

- The most effective HR model depends on the organization's context:
  - Employee Types: Skill levels, experience, and needs of the workforce.
  - Strategic Direction: The organization's overall goals and direction.
  - Organizational Structure: Centralized, decentralized, or a hybrid model.

Challenges and Considerations:

Balancing different roles can be difficult for HR professionals.

For example, regulating and advising managers might create conflict.

2) Line Managers: Empowering People Management

The trend of involving line managers directly in people management has advantages:

- Increased Ownership: Managers take greater responsibility for HR issues.
- Strategic Alignment: People management aligns better with business strategies.

Challenges and Concerns:

- Managerial Competence: Can line managers effectively handle complex HR tasks? Inadequate training could lead to subpar performance.
- Short-Term Pressures: Meeting immediate targets may overshadow strategic people management. Downsizing and restructuring might leave managers overloaded.
- Union and Association Resistance: Centralized HR may be easier for unions and professional associations to manage and advocate for members
- Managerial Incentives: Lack of recognition or reward for taking on additional HR tasks may disincentivize managers.

The Importance of Line Managers:

Despite the challenges, line managers have a crucial impact on employee performance and behavior.

- Include line managers in HR strategy development to ensure buy-in and successful implementation.
- Provide training and support to equip them with the necessary HR skills.

3) Structures and Processes: Aligning with Strategy

The Challenge of Alignment:

- Traditional organizational HR structures and processes may hinder strategic success.
- As strategies evolve, HR structures and relationships need to adapt to support them.

Two Key Considerations:

- Internal vs. External Resources:
  - Internal: Utilize existing structures and processes for HR functions (recruitment, training, etc.).

- External: Outsource HR activities to specialists who offer wider best-practice knowledge, but may lack familiarity with the organization's specific needs.

Balancing the Benefits:

Internal:

- Advantages: Deeper understanding of the organization's culture and needs.
- Disadvantages: May lack access to the latest best practices and expertise.

External:

- Advantages: Broader knowledge and access to best practices.
- Disadvantages: May not fully grasp the organization's unique context.

Choosing the Right Approach:

- The optimal approach depends on the organization's specific needs and resources.
- Consider factors like:
  - Complexity of HR needs
  - Availability of internal expertise
  - Cost-effectiveness

HR vs People dimension of strategy

HR Strategy: Focuses on managing the workforce (hiring, training, culture) to achieve business goals.

People Dimension of Strategy: Looks at the entire organization, ensuring everyone works together to achieve those goals (leadership, culture, skills). It's about how all the people in the organization contribute to the strategy.

Chapter 10:

Digital Strategy

Digital Technologies and Strategies

The digital age has brought about significant changes in how we live and work.

Digital Technologies:

- Electronic tools, devices, and systems that use digital data (0s and 1s).
- Examples: online games, multimedia, social media, mobile phones.
- The invention of the transistor in 1947 is a major milestone.

Digital Revolution:

- The shift from mechanical/analog to digital technologies (late 1950s-1970s).
- Led to the Information Age with increased use of computers and digital record-keeping.
- Impacts include:

  Job creation, Medical advancements (personalized medicine), Increased manufacturing output (automation)

Digital Strategy vs. Digital Transformation:

- Digital Strategy/ Digital Media Strategy:

  - A plan to maximize business benefits using digital tools and data.
  - Focuses on technology to create capabilities for a digital business.
  - Short-term, action-oriented with measurable goals.
  - Requires collaboration across departments (marketing, IT, etc.).

- Digital Transformation:

  - The broader process of changing an organization using digital technologies.
  - Involves changes in: Customer experience, Operational processes, Business models
  - Requires cultural changes across the organization.
  - Long-term vision with focus on disruption and competitive advantage.

Developing a Digital Strategy:

1. Identify areas for improvement: - Where is your value chain vulnerable?

- How can digital technology strengthen your business?

2. Consider these 5 questions: - Does digital technology impact your target customers?

- Can digital technology improve your value proposition?

- Should you enter new businesses due to digital changes?

- How can digital technology differentiate you from competitors?

- How can digital technology enhance your capabilities?

3. Develop a clear strategy: - Align technology with business objectives.

- Avoid wasting resources on irrelevant technologies.

Digital Transformation in Industry 4.0:

- Most large businesses are undergoing digital transformation.
- This includes: Automation of processes, Integration of technologies like AI and IoT

  Development of innovative digital solutions
- Two types of disruptive solutions are emerging:

a) Destruptive: Meaning Destructively (causing damage or harm) Disruptive (causing a disturbance or interruption to normal way things are done) Solution.

These have either destroyed certain conventional for manufacturing, marketing, and supply chain operations or replaced traditional products by combining many functional capabilities in one device. For example, robotic process automation has brought in a new era of man-machine collaboration and smart phones have almost killed traditional/amateur cameras and torches.

b) Bizruptive solutions are unique strategy driven innovations for P2P, B2C and B2B networking, as well as time and cost-efficient processes for service deliveries with safety, speed and quality.

The Interplay Between Business Strategy and Digital Technologies

How businesses leverage digital technologies to gain a competitive edge and create value.

Goals of Digital Transformation:

- Outmaneuver competitors: Achieve a strategic competitive advantage.
- Sustainable growth: Achieve long-term prosperity.

Creating "Blue Ocean" Markets:

- Trans-created solutions: Develop new products/models that address customer needs.
- First-mover advantage: Be the first to exploit a new market opportunity.

"Innovention":

- Combining innovation, invention, and strategic planning.
- Focuses on value creation, including: Time savings, Quality improvements, Environmental sustainability Risk reduction

Four Categories of Digital Business Strategies

1) Scope: Defining the boundaries of digital initiatives.

2) Scale: Expanding the reach and impact of digital solutions.

3) Agility: Adapting quickly to changing digital landscapes.

4) sources of Value Creation: Identifying how digital technologies create value.

Bottom-Up vs. Top-Down Strategizing:

- Bottom-up: Lower-level organizational units develop initial strategies.
- Top-down: Senior leadership aligns strategies and sets direction.

The PDP Loop (Problem-Data-Product):

1 Identify customer needs: Understand emerging problems and latent demands.

2 Data collection and analysis: Utilize data from business operations (e.g., banking transactions).

3 AI/ML/Big Data Analytics: Process and gain insights from the data.

4 New business design: Develop innovative solutions based on the insights.

5 Implementation and revenue generation: Deliver solutions to customers and generate value.

Key Takeaway: The interplay between strategy and digital technology is an ongoing process. Businesses can identify opportunities, develop solutions, and create value by continuously analyzing data and adapting their strategies.

Question 1: What are the Key Elements of a Digital Strategy:

Answer:

-  Leadership: Appoint a strong leader (CEO, Chief Digital Officer) with influence to drive digital initiatives across the organization.
-  Attack vs. Defend:Identify digital threats and opportunities to guide your approach (attack new markets or defend existing ones).
-  Measured Approach: Evaluate new technologies for their fit with your current business strategy before rushing into implementation.
- 

Future-Proofing: Build a foundation for digital business that can adapt to changing technologies and customer expectations.

Question 2: Explain Digital Transformation

Answer:

Digital Transformation: A Journey, Not a Destination

Digital transformation (DT) as a crucial step for organizational survival and growth in the modern world. It emphasizes a continuous journey rather than a one-time fix.

Key Elements of Digital Transformation:

- 4Ds: Discover, Design, Deliver, De-risk
- 2Ps: People and Process
- 1T: Tools

Measures for Orchestrated Planning and Execution:

- Integration of Digital Technologies: Enhance business operations, stakeholder relationships, and experiences.
- Challenge the Status Quo: Rethink policies and standard operating procedures for digital transformation.
- Training and Reskilling: Equip human capital with the skills to leverage digital tools.
- Digital Experimentation: Test new technologies to assess their suitability and potential benefits.
- Creative Destruction: Embrace new digital practices while phasing out outdated processes.
- Innovation Environment: Foster innovation by providing a supportive environment for the DT team.
- Data Security and Privacy: Ensure data privacy, cybersecurity, and information safety.
- Embrace Learning: Encourage experimentation and avoid penalizing mistakes.
- Resource Commitment: Allocate necessary funds and resources for the DT team.

Five Essential Elements of Digital Transformation:

1. Stakeholder Relationship & Experience: Improve interactions and satisfaction of stakeholders.
2. Operational Agility: Adapt processes quickly to changing demands.
3. Culture & Leadership: Foster a culture that embraces digital transformation with strong leadership.
4. Workforce Enablement: Equip employees with the skills and knowledge to succeed in a digital environment.
5. Integration of Digital Technologies: Leverage digital tools to drive revival, growth, and prosperity.

Diffusion of Digitization and Digitalization:

- Digitization: Convert analog data into digital format (e.g., scanning physical documents).
- Digitalization: Use digital technologies to transform business models and processes.
- Data Analysis: Leverage data to gain insights and make strategic decisions.

The Importance of Innovation:

- Exploratory Analysis: Identify unmet needs and societal problems.
- Groundbreaking Solutions: Develop cost-effective solutions for win-win outcomes.
- Disruption Potential: Be prepared for potential disruptions caused by innovation.

In Conclusion:

Digital transformation requires continuous efforts, including digitization, digitalization, and innovation. Businesses must adapt and leverage digital technologies to stay competitive, create value, and thrive in the ever-evolving digital landscape.

Question 3: Compare and contrast the two terms: Digitization and Digitalization. (4 marks)

Answer: While both digitization and digitalization involve technology, they represent distinct stages in a business's digital transformation journey. Here's a breakdown:

Digitization:

- Focus: Converting analog information (documents, processes) into digital formats.
- Process: Essentially scanning and encoding data.
- Outcome: Creates a digital record of previously physical information.
- Example: Scanning paper documents into PDFs or storing music on MP3 players.

Digitalization:

- Focus: Leveraging digital technologies to improve business processes and models.
- Process: Utilizes digitized data to automate tasks, create new offerings, and enhance efficiency.
- Outcome: Transforms how a business operates and creates value.
- Example: E-commerce platform replacing a brick-and-mortar store, or using data analytics to optimize marketing campaigns.

Key Differences:

Scope: Digitization deals with data conversion, while digitalization focuses on broader business transformation.

Impact: Digitization offers accessibility, while digitalization aims for innovation and improved efficiency.

Analogy: Think of digitization as taking a physical book and scanning it into a PDF (readable format).Digitalization is then taking that digital book and creating an interactive e-reader app with features like search and annotation (new functionalities).

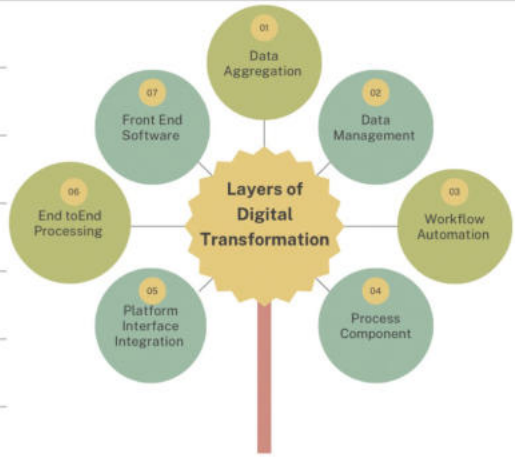
In essence, digitization is the foundation for digitalization. It provides the digital building blocks that can be used to create new processes, services, and business models.

Question 4: Explain the layers of Digital Transformation

Answer: Layers of Digital Transformation:

- Data Aggregation: Gather relevant data from various sources, converting analog data to digital format for easy access.
- Data Management: Organize and categorize the collected data for further analysis.
- Workflow Automation: Apply algorithms to automate business processes using the data.
- Process Component: Implement the automation using the data and algorithms.
- Platform Integration: Connect the new digital system with existing core systems for smooth operation.
- End-to-End Processing: Ensure error-free transformation throughout the entire process.
- Front-End Software: Integrate with user devices for seamless access to services.

These steps should be reviewed regularly (at least annually) to adapt to changing business environments.



Question 5: Explain Big Data

Answer:

Big Data:

Big data refers to massive and complex datasets that traditional data tools struggle to handle.

What is Big Data?

- Extremely large and ever-growing datasets.
- Too complex for traditional data management tools.
- Examples: stock exchanges, social media, jet engine data.

Types of Big Data:

- Structured: Organized data with a fixed format (e.g., databases).
- Unstructured: Data with no predefined format (e.g., emails, social media posts).
- Semi-structured: A combination of structured and unstructured data (e.g., XML files).

Characteristics of Big Data (4Vs):

- Volume: The immense size of the data is crucial for its value.
- Variety: The diverse nature of data, including structured, unstructured, and semi-structured formats.
- Velocity: The high speed at which data is generated and processed.
- Variability: The inconsistency of data, which can pose challenges for handling and managing it.

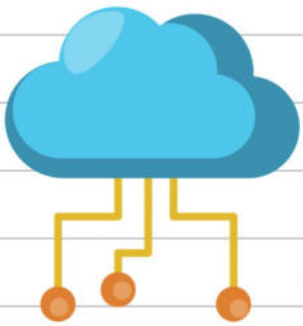
Benefits of Big Data Processing:

- Smarter Decisions: Businesses can leverage external data sources for better decision-making.
- Improved Customer Service
- Early Risk Identification
- Enhanced Operational Efficiency

By understanding the characteristics and benefits of big data, businesses can leverage its power to gain valuable insights, make informed decisions, and achieve better outcomes.

Question 6: "Inspite of the fact that cloud computing has huge benefits yet, it has its own causes of concern". Examine the demerits of cloud computing. MTP + Dec 23 (7 marks)

Describe the merits and demerits of Cloud Computing? MTP (7 marks)



Answer:

Cloud Computing: Benefits and Challenges

Cloud computing offers a flexible and scalable way to access computing resources over the internet.

What is Cloud Computing?

- Delivering hosted services over the internet.
- Three main categories:

- Infrastructure as a Service (IaaS): Virtual servers, storage, APIs.

- Platform as a Service (PaaS): Development tools hosted on cloud infrastructure.

- Software as a Service (SaaS): Software applications delivered over the internet.

Public vs. Private Cloud:

- Public Cloud: Open to anyone with internet access.
- Private Cloud: Proprietary network or data center for a limited user group.

Examples of Cloud Computing:

Google Docs, Microsoft 365, Email services, Google Calendar, Skype, WhatsApp, Zoom, etc.

Benefits of Cloud Computing:

- Cost Management: Reduces capital expenses on hardware and IT staff.
- Data and Workload Mobility: Access data from anywhere with an internet connection.
- Business Continuity and Disaster Recovery (BCDR): Ensures data accessibility and faster recovery in emergencies.

Challenges of Cloud Computing:

- Cloud Security: Concerns about data breaches and unauthorized access.
- Cost Unpredictability: Difficulty in predicting final costs due to variable usage.
- Lack of Capability and Expertise: Need for skilled personnel to manage cloud deployments.
- IT Governance: Difficulty in controlling provisioning and management of cloud infrastructure.
- Compliance with Industry Laws: Challenges in managing compliance when using a third-party cloud provider.
- Management of Multiple Clouds: Increased complexity when managing workloads across different cloud platforms.
- Cloud Performance: Potential disruptions due to network or provider outages.
- Building a Private Cloud: High resource requirements for building and managing private clouds.
- Cloud Migration: Complications and potential delays during data and application migration.
- Vendor Lock-In: Difficulty and costs associated with switching between cloud providers.

In Conclusion:

Cloud computing offers significant benefits but also comes with challenges. Businesses need to carefully consider these factors when deciding whether and how to leverage cloud computing for their specific needs.

Question 7: Explain Artificial Intelligence.

Answer:

Artificial Intelligence (AI)

AI is rapidly transforming many aspects of our world. Here's a breakdown of the key concepts:

What is AI? Intelligence exhibited by machines, mimicking human cognitive functions.

Levels of AI:

Narrow AI (Current State): Most common type, excels at specific tasks (e.g., weather forecasting, self-driving cars).

General AI (Future): Hypothetical machines with human-level intelligence across all domains.

Super AI (Theoretical): Machines surpassing human intelligence in all aspects.

Machine Learning (ML):

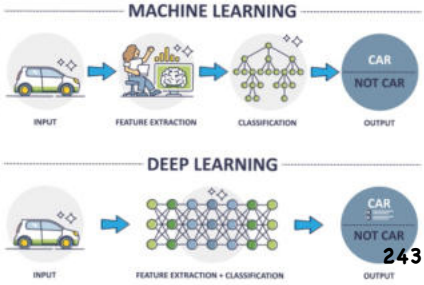
- A core component of AI where machines learn from data.
- ML algorithms are trained on data to improve performance on a specific task.
- Often used interchangeably with AI, especially in business contexts.

Deep Learning:

- A powerful subfield of AI using artificial neural networks with many layers.
- Deep learning has achieved breakthrough results in various AI applications.

Benefits of AI:

- Data Analysis: Analyze vast amounts of complex data (e.g., video, audio).
- Quality Control: Detect and analyze product defects more efficiently.
- Process Optimization: Continuously learn and improve manufacturing processes.



The Future of AI:

- Problem Solving: AI as a tool for tackling societal challenges.
- Cybersecurity: AI can help combat cybercrime.
- Digital Transformation: Businesses are adopting AI for a competitive edge (often with IoT and Blockchain).

Conclusion

- AI is still evolving, with the ultimate capabilities of General and Super AI yet to be determined.
- The responsible development and use of AI are crucial considerations.

Question 8: Write a short note on Fintech

Answer:

FinTech: Making Finance Faster, Easier, and More Accessible

FinTech (financial technology) uses technology to revolutionize how we manage money. Here's the gist:

- What is it? Software, apps, and other tech tools that improve and automate financial services.
- Examples: Mobile banking, payment apps (Venmo, CashApp), investment platforms (Groww, Upstox), cryptocurrencies (Bitcoin, Ethereum).
- Benefits: Makes finance more accessible, affordable, and secure. Uses AI, big data, and blockchain for enhanced security.

In short, FinTech is changing the way we bank, invest, and pay.

Question 9: What is Block Chain. Important components of Block Chain and its benefits.

Answer:

Blockchain: A Shared Ledger for Secure Transactions

Blockchain technology is revolutionizing how information is shared and transactions are conducted. Here's a breakdown of its key features and benefits:

What is Blockchain?

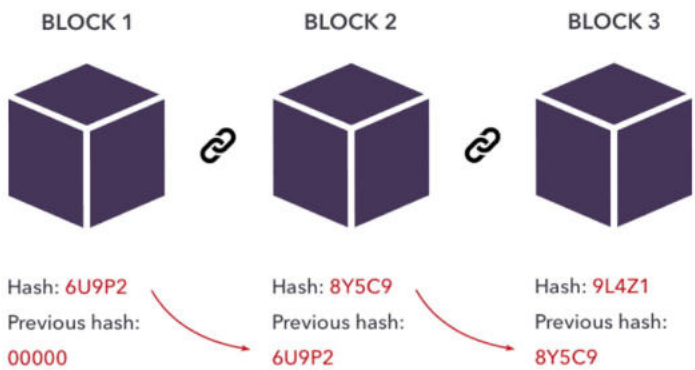
- A shared, tamper-proof ledger for recording transactions and tracking assets.
- Assets can be tangible (physical objects) or intangible (intellectual property).
- Ideal for businesses that rely on accurate and secure information sharing.

Why is Blockchain Important?

- Trust and Transparency: Provides a secure and transparent way to share information within a permissioned network.
- Efficiency: Reduces reconciliation efforts and automates transactions with smart contracts.

Components of a Blockchain Network:

- Distributed Ledger Technology: All participants have access to the same immutable record of transactions, eliminating duplication.
- Immutable Records: Once recorded, transactions cannot be altered, ensuring data integrity.
- Smart Contracts: Self-executing contracts stored on the blockchain that automate agreements and transactions.



Benefits of Blockchain Networks:

- Increased Trust: Network membership restricts access to authorized participants, ensuring data accuracy and timeliness.
- Greater Security: Consensus mechanisms and immutability make tampering with data nearly impossible.
- Enhanced Efficiency: Eliminates reconciliation and streamlines transactions through automation with smart contracts.

In Conclusion:

Blockchain offers a secure and transparent way to manage data and conduct transactions. Its potential applications extend across various industries, fostering trust, security, and efficiency.

Question 10: Explain Robotic Process Automation and list the benefits of RP

Answer:

Robotic Process Automation (RPA)

RPA is a technology that automates repetitive computer tasks using software bots.

Key Points:

- What it is: Business process automation using software bots.
- What it does: Mimics human-computer interactions to perform tasks with high volume and speed.
- Not physical robots: Software tools, not mechanical devices.
- Best suited for: Repetitive, predictable tasks with clear rules.

Benefits of RPA:

- Reduced costs
- Decreased cycle times (faster completion of tasks)
- Flexibility and scalability (adapts to changing needs)
- Improved accuracy
- Improved employee morale (frees up humans for more complex work)
- Detailed data capture (provides better insights into processes)

The Future of Robotics:

- Humanoid Robots: Robots with human-like capabilities, such as piloting spacecraft.
- AI-powered Robots: Robots with artificial intelligence for tasks like security and surveillance.
- Collaborative Robots (Cobots): Robots designed to work alongside humans in shared workspaces.

In Conclusion:

RPA offers a way to automate tasks and improve efficiency. The future of robotics holds promise for even more advanced capabilities, with robots working alongside humans in various capacities.

Question 11: How digitalisation in sports affect fan engagement and performance?

Answer:

Digital Transformation in Sports:

Technology is revolutionizing the sports industry, impacting both fans and athletes. Here's a breakdown of the key trends:

Fan Engagement:

- Digital Media: Sports organizations are using digital platforms and partnerships with broadcasters to:
  - Offer fans a personalized experience across devices (mobile, web, etc.).
  - Create real-time marketing opportunities.
  - Broaden content reach through multi-channel distribution.
- Immersive Technologies:
  - Virtual Reality (VR) and Augmented Reality (AR) can create more exciting stadium experiences.
  - Personalized experiences can be tailored to individual fan preferences based on data analysis.

Performance Enhancement:

- Smart Equipment: Technology like "smart chips" embedded in cricket balls can:
  - Assist umpires in making accurate decisions.
  - Provide valuable data for player training and improvement.

In Conclusion:

Digital transformation offers numerous benefits for the sports industry. Fans are getting more engaging experiences, and athletes have access to advanced tools for training and performance optimization. This trend is likely to continue, with even more innovative applications of technology emerging in the future.

Question 12: What is in IOT and its components? Explain the enabling technologies of IOT.

Answer:

The Internet of Things (IoT): Connecting Everything

The Internet of Things (IoT) is a vast network of interconnected devices collecting and sharing data.

What is IoT?

- A system of connected devices, machines, objects, etc. with unique identifiers.
- These devices can transfer data over a network without human intervention.
- Examples: fitness trackers, smartwatches, self-driving cars, sensor-equipped machines.

Benefits of IoT:

- Increased Efficiency: Organizations can optimize operations and resource utilization.
- Enhanced Customer Service: Businesses can gain insights to personalize customer experiences.
- Improved Decision-Making: Data analysis from IoT devices can inform better business decisions.
- Increased Business Value: IoT can create new revenue streams and enhance existing offerings.

Components of an IoT Ecosystem:

- Smart Devices: Embedded systems with sensors, processors, and communication hardware.
- Data Collection and Sharing: Devices collect data and transmit it to gateways or edge devices.
- Data Analysis: Data can be analyzed locally or sent to the cloud for further processing.
- Device Interaction: Devices can communicate and act on information from each other.
- Human Interaction (Optional): People can interact with devices for setup, instructions, or data access.

Enabling Technologies of IoT:

- Low-cost Sensors: Affordable and reliable sensors make IoT implementation more feasible.
- Connectivity Protocols: Network protocols enable efficient data transfer between devices and the cloud.
- Cloud Computing Platforms: Cloud platforms provide scalable infrastructure for data storage and analysis.
- Machine Learning and Analytics: Advanced analytics unlock valuable insights from vast amounts of data.
- Conversational AI: Natural language processing allows for voice interaction with IoT devices.

Question 13: Explain various application areas of Internet of Things (IOT). MTP (7 marks) + Jun 23 (6 marks)

Answer: Examples of IoT Applications:

- Smart Lighting: Remote control, scheduling, brightness adjustment, and energy monitoring of lighting systems.
- Smart Parking: Real-time occupancy monitoring, car location identification, and optimized parking management.
- Medical Fridges: Remote temperature monitoring and control for sensitive medications and vaccines.

The Future of IoT:

As technology advances, the capabilities and applications of IoT will continue to evolve, transforming various aspects of our lives and industries.

Question 14: List down the types of digital marketing strategies.

Answer: The digital landscape offers a variety of marketing channels to reach your target audience. Here's a breakdown of the most common strategies:

1. Social Media Marketing:

- Platforms like Facebook, Instagram, LinkedIn, and Snapchat allow you to:
  - Run paid advertising campaigns targeting specific demographics.
  - Share organic content and engage with followers.
  - Build brand awareness and loyalty.

2. Influencer Marketing:

- Partner with industry experts or celebrities to:
  - Promote your brand to their established audience.
  - Leverage their credibility and reach.
  - Increase brand awareness and trust.

3. Email Marketing: (zomato)

- Send targeted emails to nurture leads and drive sales:
  - Segment your audience based on interests and behavior.
  - Offer personalized promotions and newsletters.
  - Stay connected and build customer relationships.

4. Content Marketing:

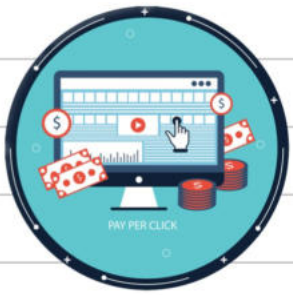
- Create valuable content (articles, videos, etc.) to educate and engage your audience:
  - Address different stages of the buyer's journey (awareness, consideration, decision).
  - Provide solutions to your target audience's needs.
  - Establish your brand as a thought leader.

5. Search Engine Optimization (SEO):

- Optimize your website and content to rank higher in search engine results pages (SERPs):
  - Improve user experience and website technical aspects.
  - Increase organic traffic from search engines.
  - Make your website more discoverable by potential customers.

6. Pay-per-Click (PPC) Advertising:

- Bid on keywords to display your ads on search engines and websites:
  - Pay each time someone clicks on your ad.
  - Drive targeted traffic to your website.
  - Generate leads and sales quickly.



7. Affiliate Marketing:

- Partner with affiliates who promote your products in exchange for a commission on sales:
  - Expand your reach through established affiliate networks.
  - Reduce marketing costs by outsourcing promotion.
  - Require careful monitoring to ensure brand reputation is maintained.

8. Mobile Marketing:

- Reach your audience on their smartphones and tablets through various channels:
  - Text messages, social media apps, push notifications, mobile apps.
  - Optimize your website and marketing efforts for mobile devices.
  - Crucial strategy as mobile shopping continues to grow.

By understanding these core digital marketing strategies, you can create a comprehensive plan to reach your target audience, achieve your marketing goals, and gain a competitive edge in the online world.