

Principles of Management for Engineers

Introduction



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Content

Unit I

[8]

Definition of management: Science or art, manager vs entrepreneur; Types of managers managerial roles and skills; Evolution of management- scientific, human relations, system and contingency approaches; Types of Business Organizations, sole proprietorship, partnership, company, public and private enterprises; Organization culture and environment; Current trends and issues in management.

Unit II

[8]

Nature and purpose of Planning: types of Planning, objectives, setting objectives, policies, Strategic Management, Planning Tools and Techniques, Decision making steps & processes. Nature and purpose of Organizing, formal and informal organization, organization structure, types, line and staff authority, departmentalization, delegation of authority, centralization and decentralization, job design, human resource management, HR planning, Recruitment selection, Training & Development, Performance Management, Career planning and Management.

Unit III

[8]

Organizational Behavior: Directing, individual and group behavior, motivation, motivation theories, motivational techniques, job satisfaction, job enrichment, leadership, types & theories of leadership, effective communication.

Unit IV

[8]

Controlling, system and process of controlling : Controlling, system and process of controlling, budgetary and non-budgetary control techniques, use of computers and IT in management control, productivity problems and management, control and performance, direct and preventive control, reporting.

Book List

Textbooks:

1. Robins S.P. and Couiter M., Management, Prentice Hall India, 10th ed., 2009.
2. Stoner JAF, Freeman RE and Gilbert DR, Management, 6th ed., Pearson Education, 2004.
3. Tripathy PC & Reddy PN, Principles of Management, Tata McGraw Hill, 1999

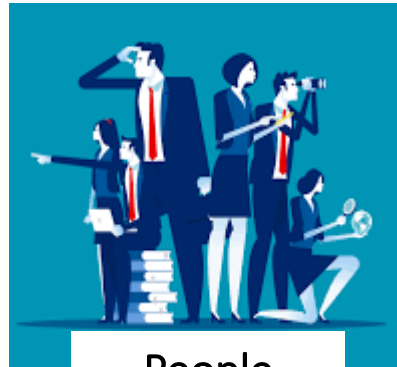
Introduction: Management

Organisation:

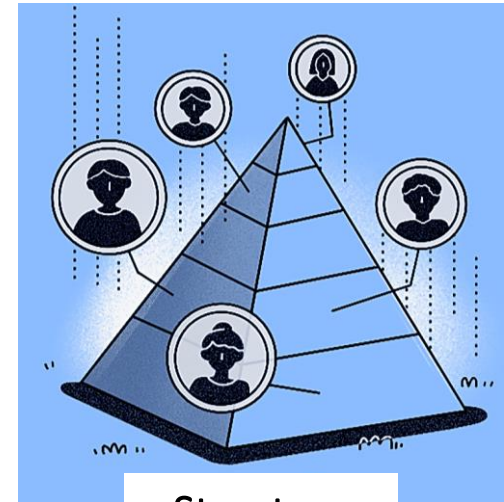
A systematic arrangement of people brought together to accomplish some specific purpose.



Goals



People



Structure

Introduction: Management

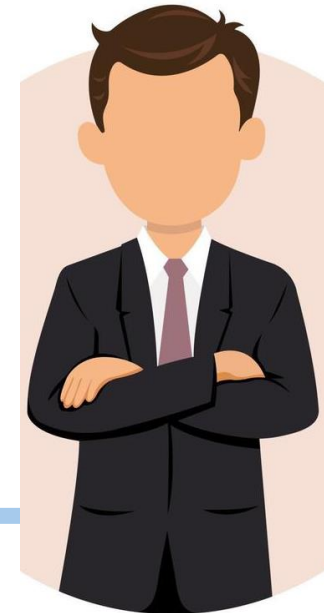
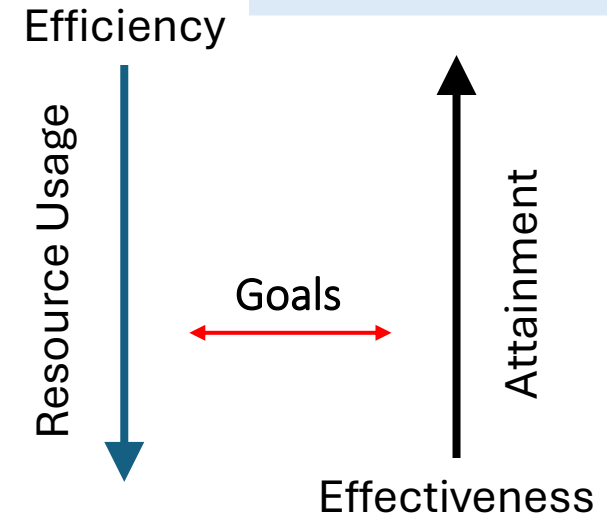
Management:

(Frederick Winslow Taylor):

Finding the one Best Way

Process of Designing and Maintaining Environment in which individuals, working together in groups, **efficiently** accomplish selected aims.

Management is What Managers Do



What is Engineering?

- A Profession.
- A systematic approach to solve the real – world problems by applying the existing (mathematics and natural science) and acquired experience based knowledge.



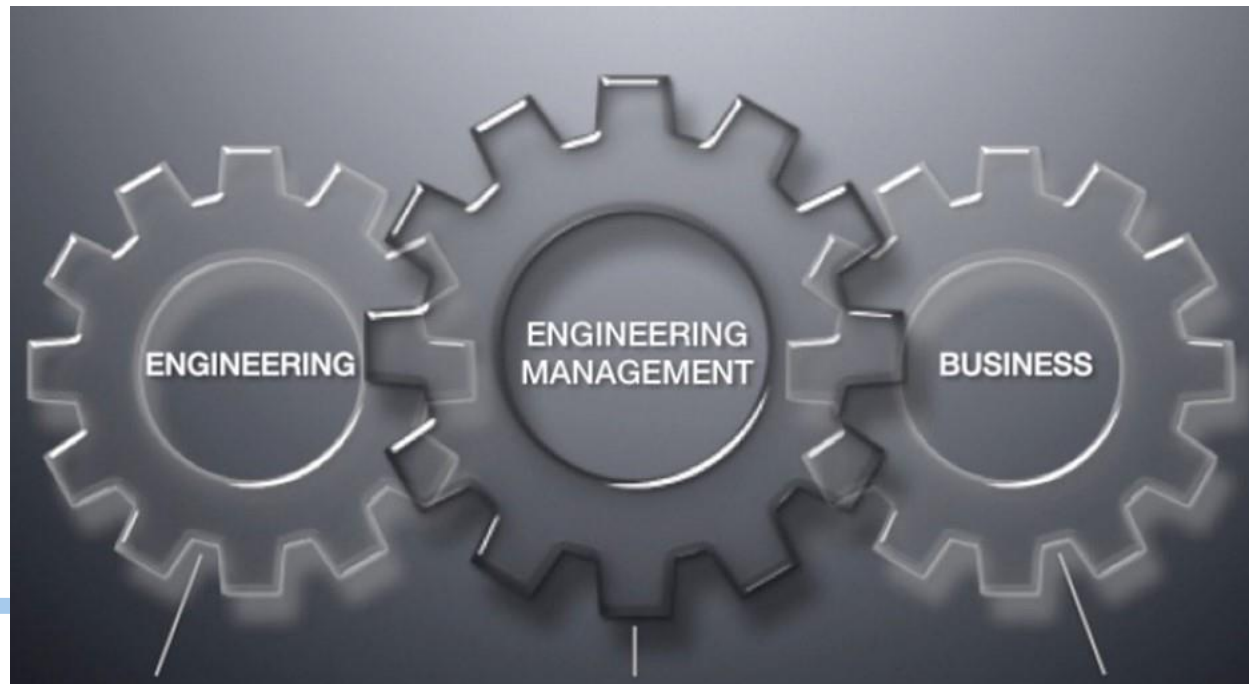
What is Management?

- A set of Activities.
- Activities (planning, decision making, organising, leading and control) to direct organisation resource (human, financial, physical and information) with the aim of achieving common goal in effective and efficient manner...Griffin.



What is Engineering Management?

- A bridge between engineering and management.
- It combines technical expertise of engineering with organisational activities (planning, leadership, etc.) to ensure technical solution are delivered on time, within budget and maintain quality and standard.



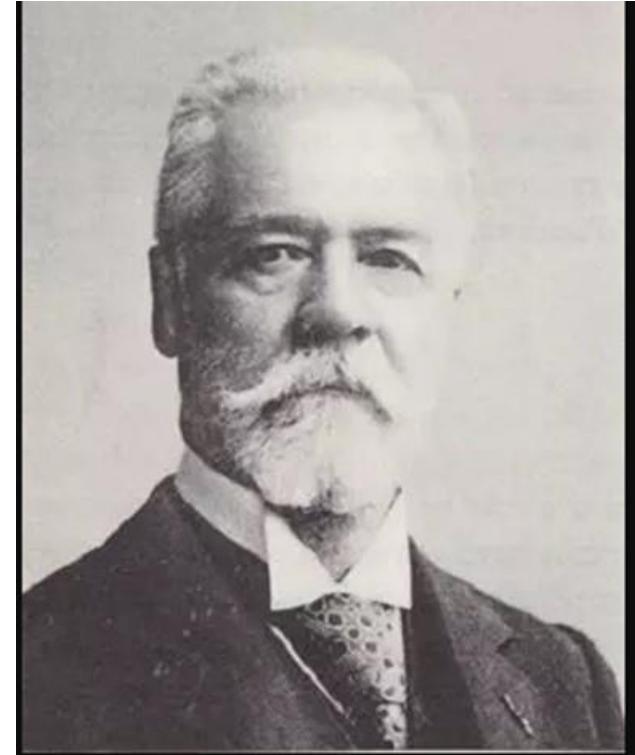
Engineer as Technical Contributor

- **Understand:** Objectives of the specified task.
- **Develop:** Action plan
- **Define:** Standards matrix
- **Select:** Methodology/ techniques
- **Implement**
- **Generate:** Results
- **Analysis:** Curated results
- **Report:** Impact and lessons



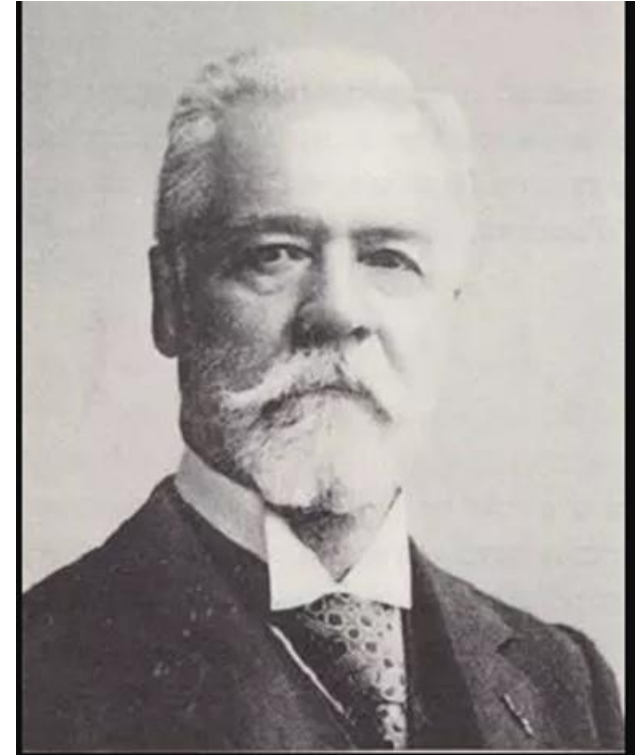
Henri Fayol (1841 – 1925)

- Father of Modern Management
- 6 primary functions of management:
 - Forecasting
 - Planning
 - Organising
 - Commanding _ Leading
 - Coordinating _ Leading
 - Controlling _ Feedback - Adjustment



Engineering Management Functions

- **Planning:** Forecasting, setting objectives, action planning, policies, procedure establishment
- **Organising:** Organizational structure, creating working relationship
- **Leading:** Deciding, communicating, motivating, selection and development
- **Controlling:** Setting performance standards, evaluation/ documenting/ correcting



Case Study 1

Tata Nano Project

- Automobile Engineering
- Cost Innovation
 - ~ 2008
 - ~ Rs. 1 Lakh



Case Study 1

Planning & Goal Setting – Set a strict target for cost, weight, and performance.

Value Engineering – Reduced material usage (thinner steel, single wiper, no power steering in base model).

Supplier Collaboration – Partnered with vendors to co-develop cost-efficient components.

Leadership & Vision – Ratan Tata personally reviewed progress and motivated engineers.

Crisis Management – Relocated plant from Singur to Sanand after political protests.

Quality Control Challenges – Some early units had safety issues (engine fires), impacting trust.

Case Study 2

Amul

- Food Processing
- Logistics Engineering

About 1946, Gujarat, White revolution



Case Study 2

Process Engineering – Introduced automated milk chilling, pasteurization, and UHT packaging.

Resource Organization – Established a three-tier cooperative structure (village societies → district unions → state federations).

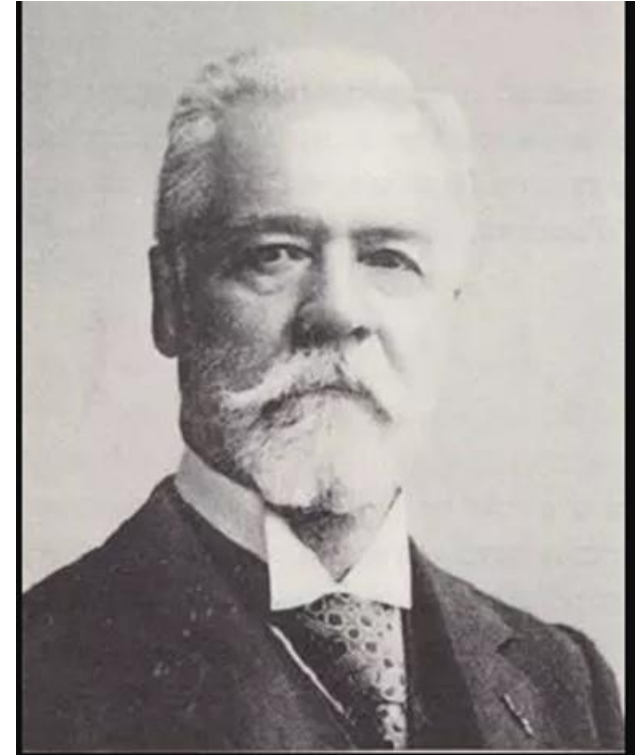
Quality Assurance – Implemented strict hygiene and bacterial load testing at every stage.

Sustainability – Developed biogas plants from dairy waste; wastewater recycling at plants.

Decision-Making – Adopted decentralized collection centers to minimize transportation costs.

Engineering Management Functions

- **Planning:** Forecasting, setting objectives, action planning, policies, procedure establishment
- **Organising:** Organizational structure, creating working relationship
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- **Objective** : Define the objective
- **Decision**
 - **What** is to be done?
 - **When** is to be done?
 - **How** it is to be done?
 - **Who** is to do it?



Organizing

- Gathering and allocating resources
- Coordination
- Define following
 - How authority is structured?
 - How communication flows?
 - How tasks are accomplished?



Directing and Controlling

- **Directing**

- Assign task and motivate subordinates to achieve the end goal

- **Controlling**

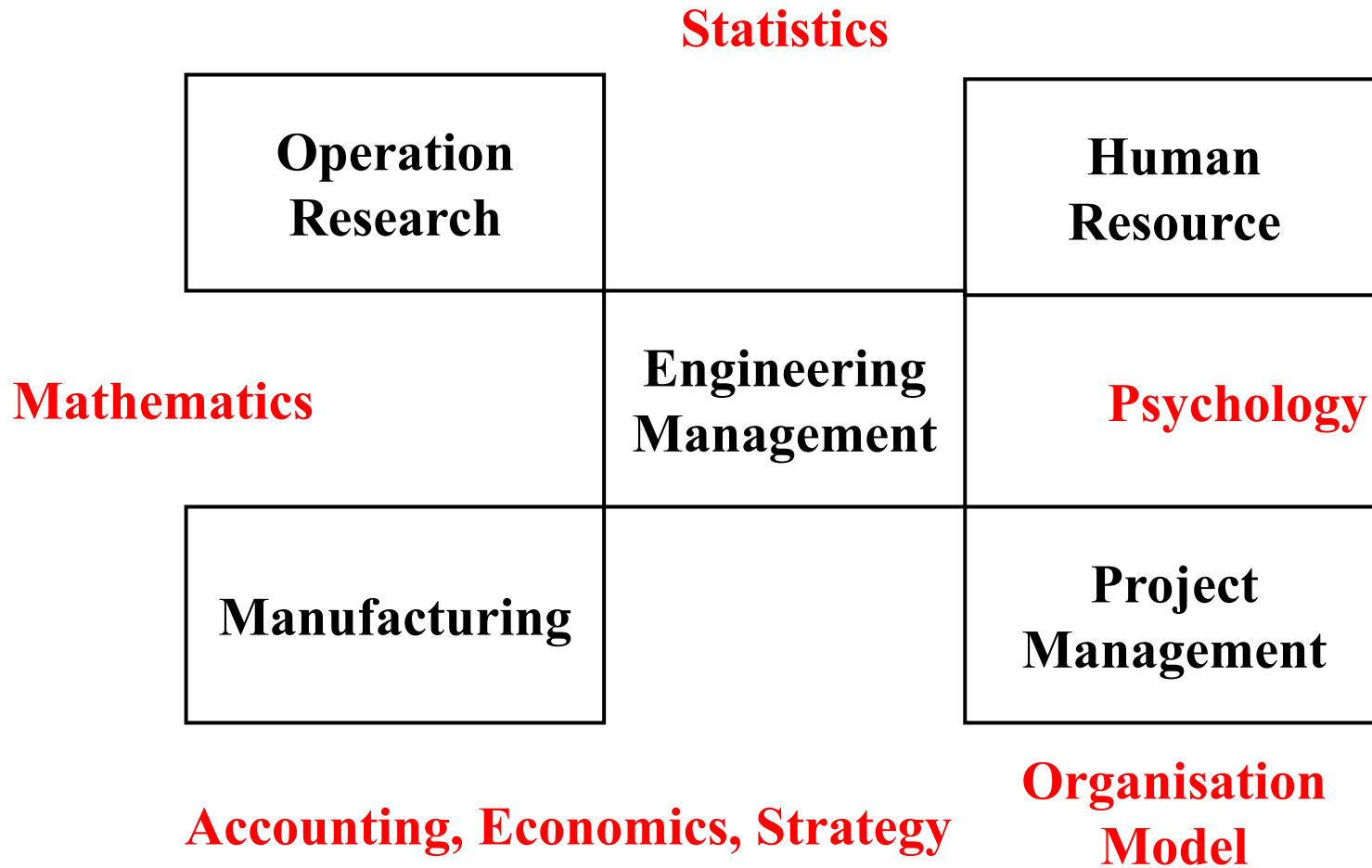
- Keep things on track
- Monitoring and adjustment



Managerial Levels and Skills

Focus by Level	Skills Needed	Interpretation
Top Management	Conceptual	Ability to solve long term problem, Vision
Middle Management	Human Relation	Ability work affectively, lead and assure harmonious interpersonal relations
Supervisory Management	Technical	Ability to use tools, apply specialised knowledge and manage process and technique

Engineering Management



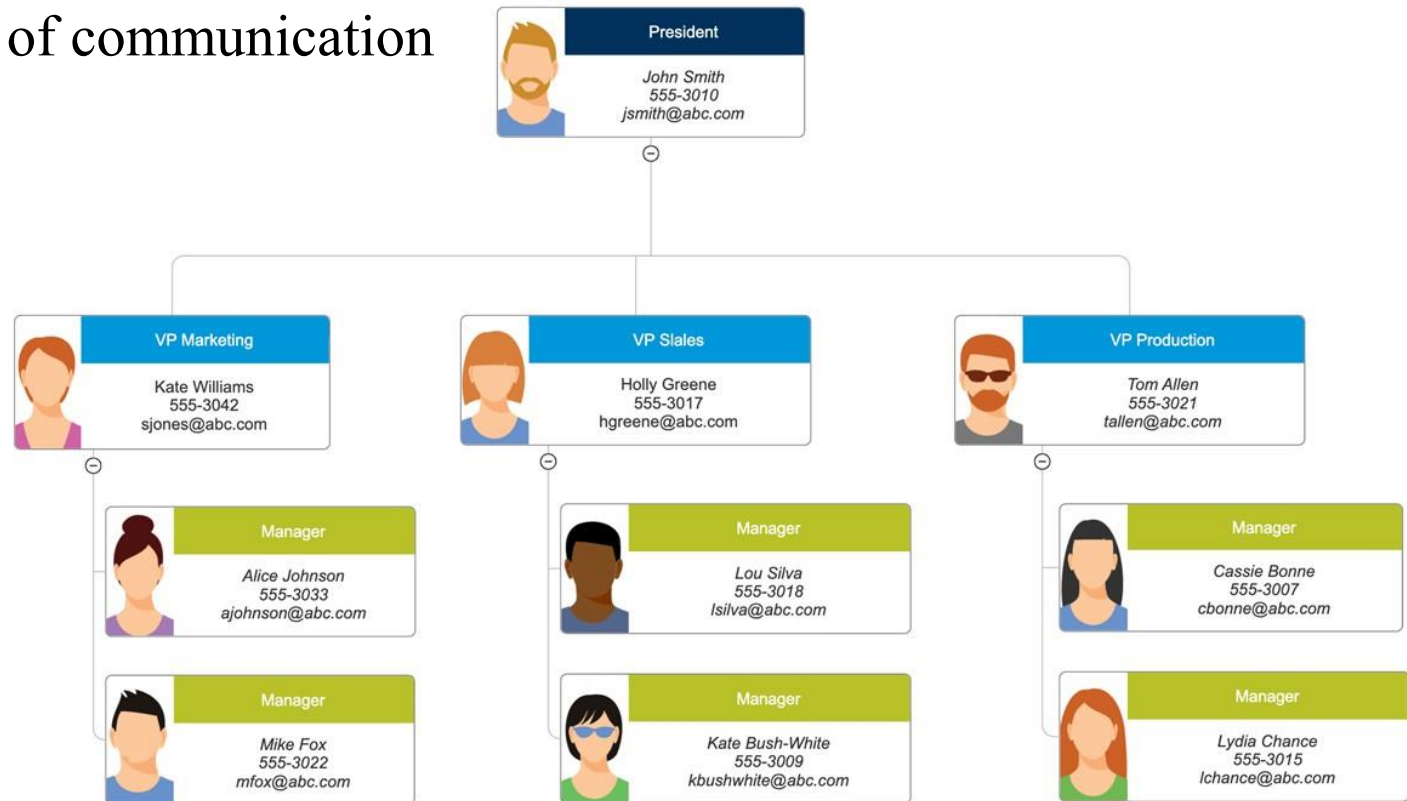
- **Organisation/ Organization**

- Collection of persons, materials, procedures, ideas or facts so managed and ordered that in each case the combination of parts makes a meaningful whole to achieve set objectives.
- **Job description:** Responsibility, authority
- Manager decide how to:
 - Divide the overall task into small jobs
 - Decide the bases by which to group the jobs
 - Size of group
 - Distribute authority

Organisational Model

- Organisational Chart

- Formal relationship between people in various positions
- Provide the supervisory level or can be called as hierarchy or channels of communication



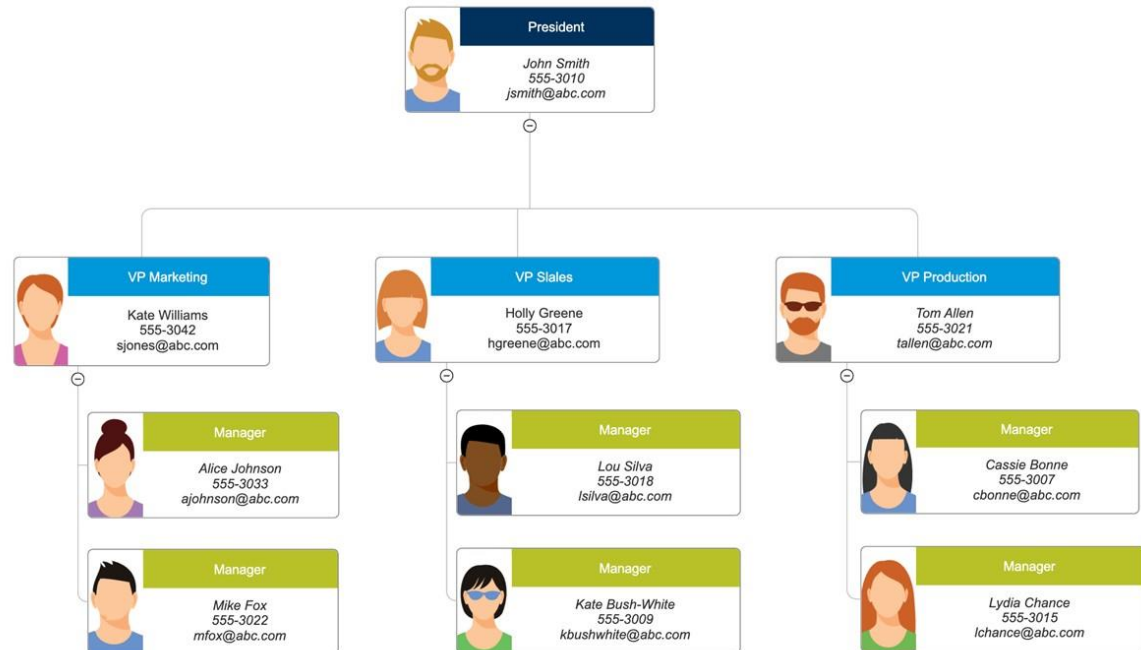
Organisational Model

- Organisational Structure

- Formal reporting relationship with number of levels in the hierarchy or channels of communication
- Grouping overall and inter departmental

- Ensure

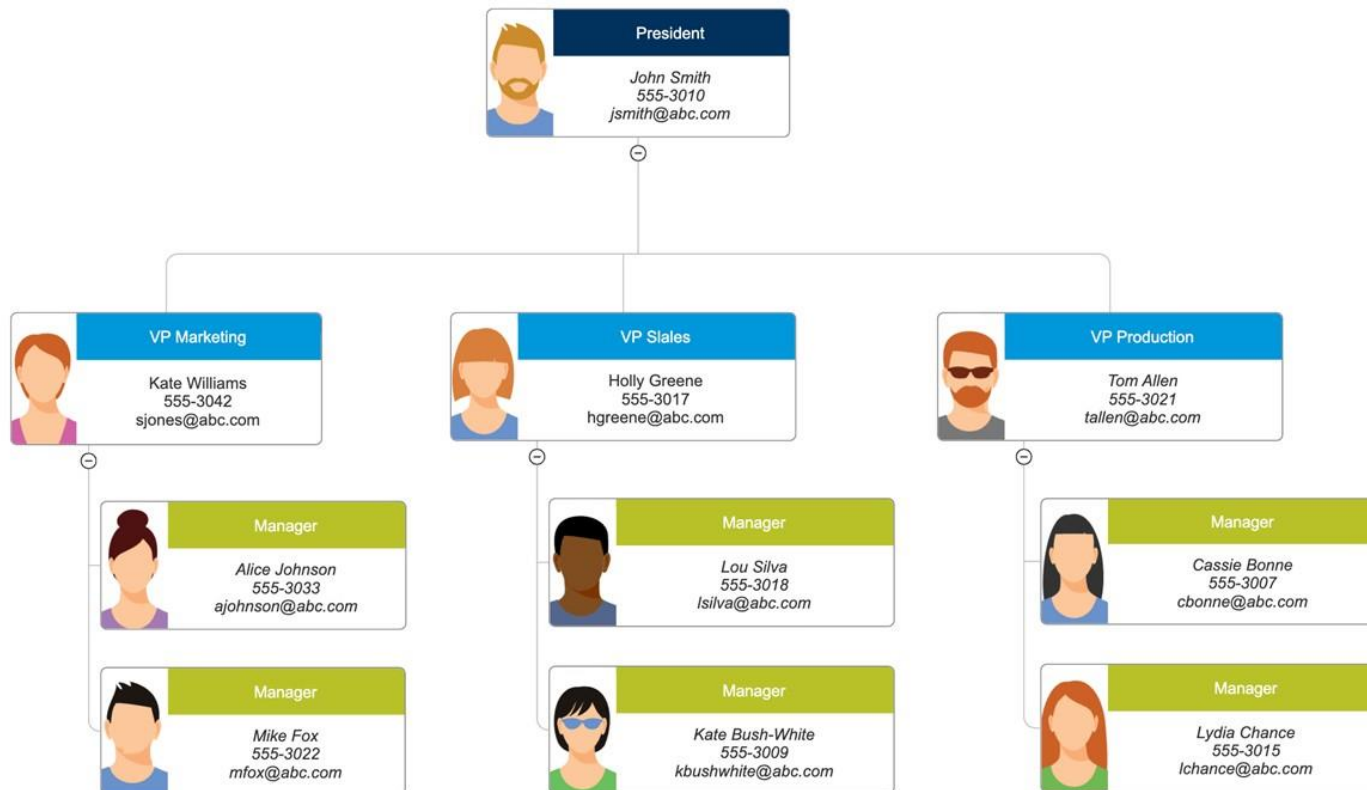
- Effective Communication
- Coordination
- Integration between departmental effort



Organisational Model

- Elements Organisational Structure

- Division of Labour
- Departmentalisation
- Span of Control
- Authority



- **Elements Organisational Structure**

- **Division of Labour**

- Dividing work into relatively small specialised tasks
 - Subdivision among the people
 - Types of division
 - **Personal specialities:** Accountants, engineers (software), scientists, etc.
 - Natural sequence of work: i.e. manufacturing plant fabrication and assembly (horizontal specialization)
 - Vertical plane: hierarchy of authority

Note: Coordination (means synchronising)

- **Elements Organisational Structure**

- **Departmentalization**

- Horizontal differentiation of organization departments.
 - Departments share a common supervisor, resource and jointly responsible for performance
 - The process of grouping activities
 - Can be grouped based on : Services, location, or by geographical area.

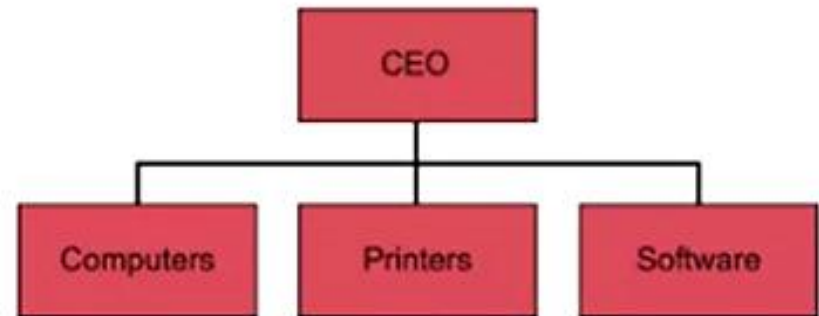
Organisational Model

- Elements Organisational Structure
 - **Departmentalization**

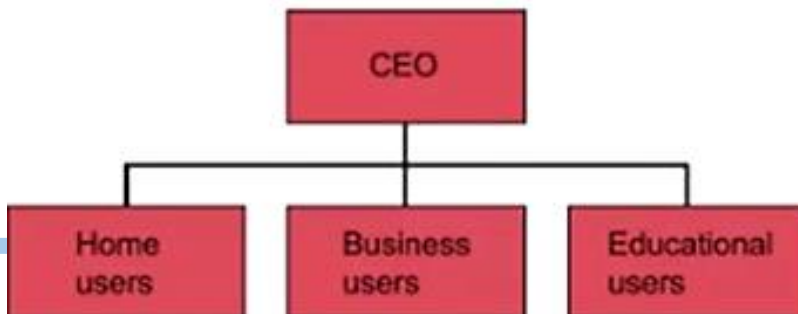
By Function



By Product



By Customer



By Location



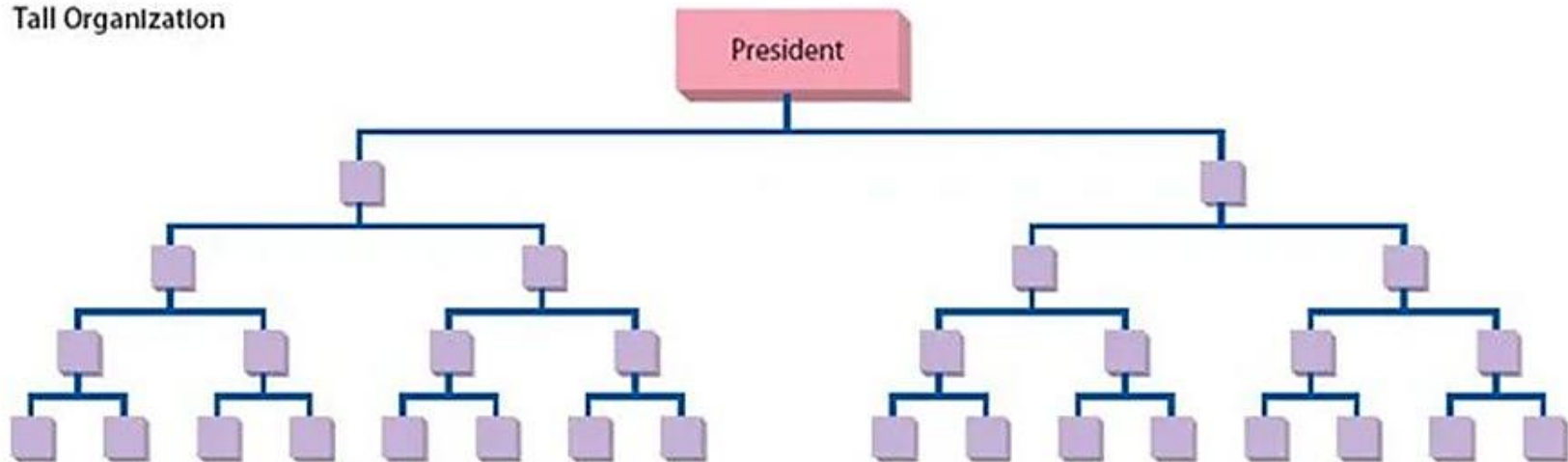
Organisational Model

- Elements Organisational Structure

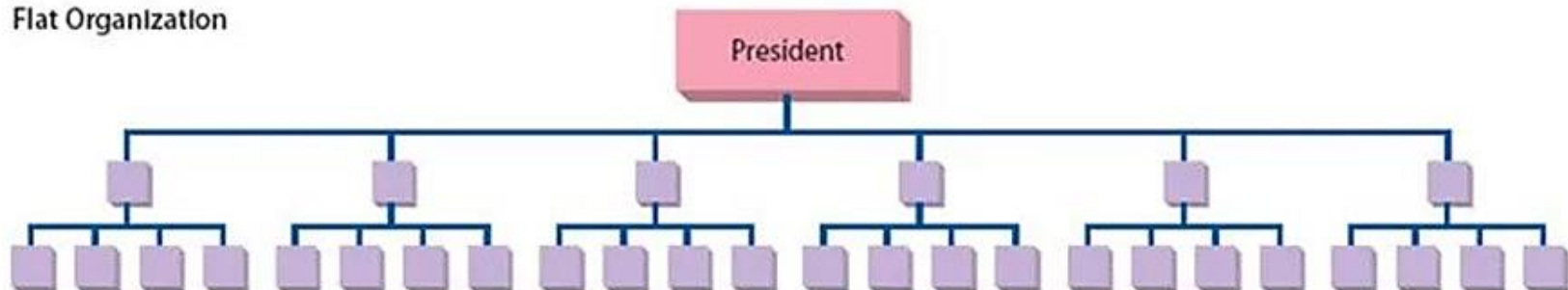
- **Span and Control**

- Numbers of individual who report to specific manager
- Number directly reporting to next level

Tall Organization



Flat Organization



- Elements Organisational Structure

- **Authority**

- Manager decide how much authority to each job and to job holder
- Types
 - **Line authority:** flows up and down of chain of command
 - **Staff authority:** Based on expertise that usually involves counselling and advising line manager
 - **Committee and team authority**

- **Centralisation and decentralisation**
 - Level at which most or the operating decisions will be made
 - Greater the decisions made lower down the management Hierarchy the greater the decentralisation
 - And visa versa ...



- **Advantages of decentralisation**
 - Quick action regarding specific problems
 - Local need fulfilled early
 - Increase flexibility of actions
 - Junior staff also be trained for management skills and in future grow

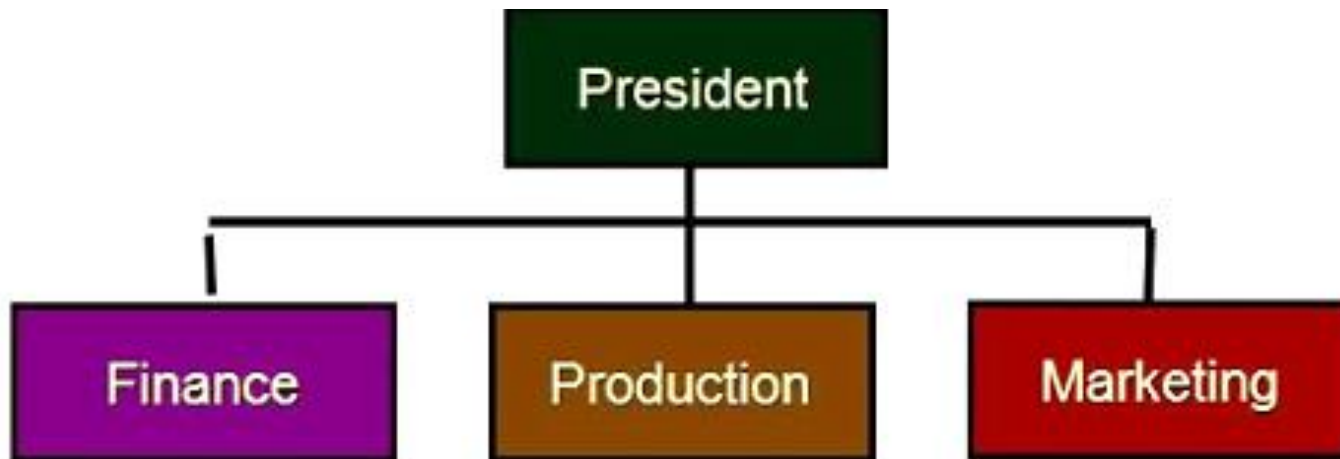


- **Advantages of centralisation**
 - Uniform policy
 - Better control on activities
 - Unity of command: All are responsible to one top management/ head



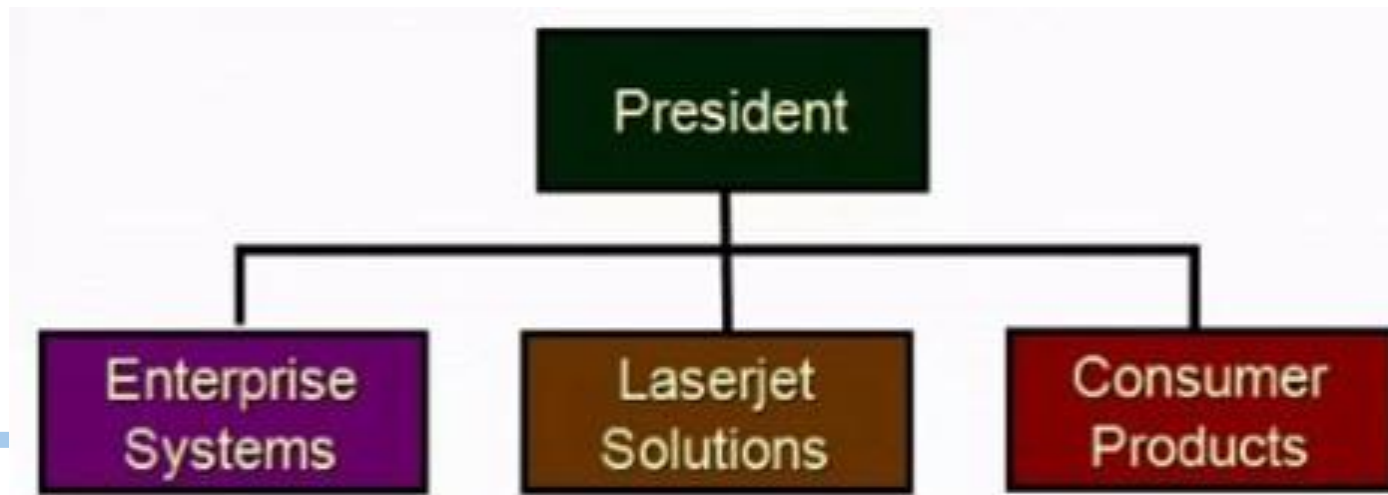
- Functional Organisation Structure

- Organise employee around skills or resources like marketing, production, etc.
- Create subordinate goals
- Promote specialisation
- -ve to organisational goal and subunits and low coordination



- **Divisional Organisation Structure**

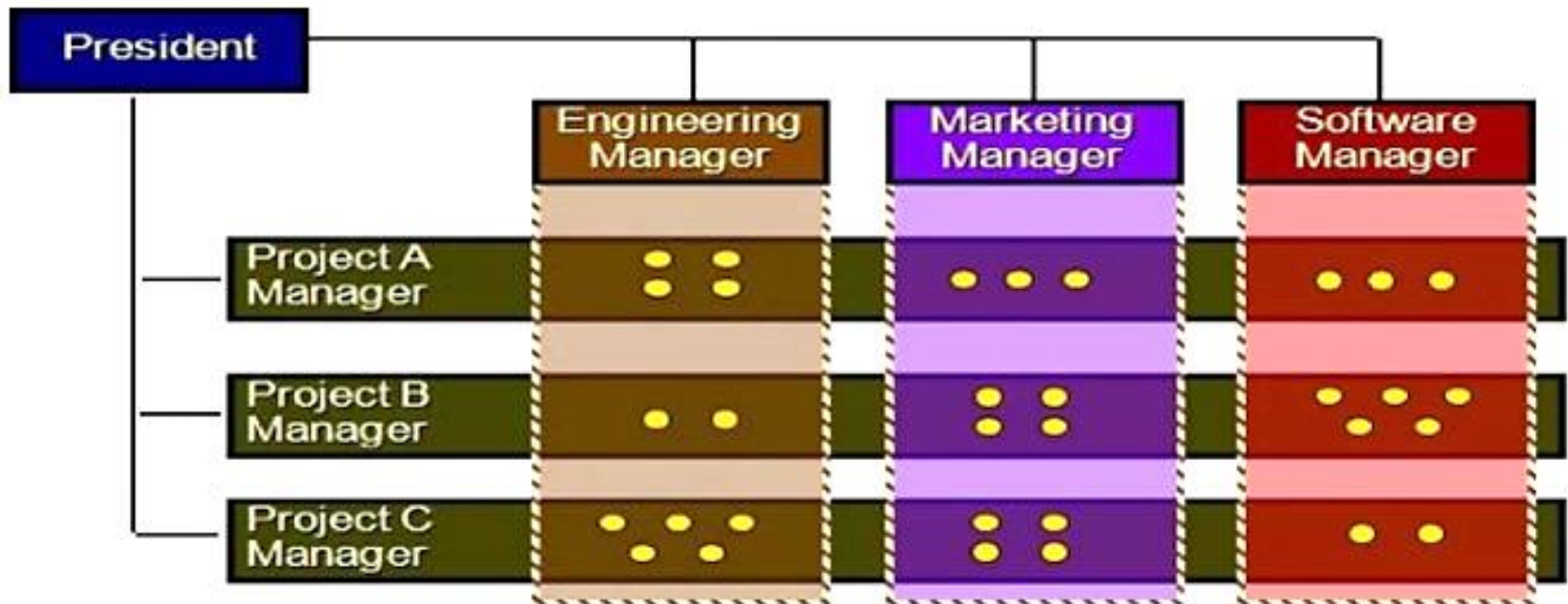
- Organise employee around outputs, clients, or geographical areas
- Better coordination in diverse markets
- Low specialisation



Organisational Model

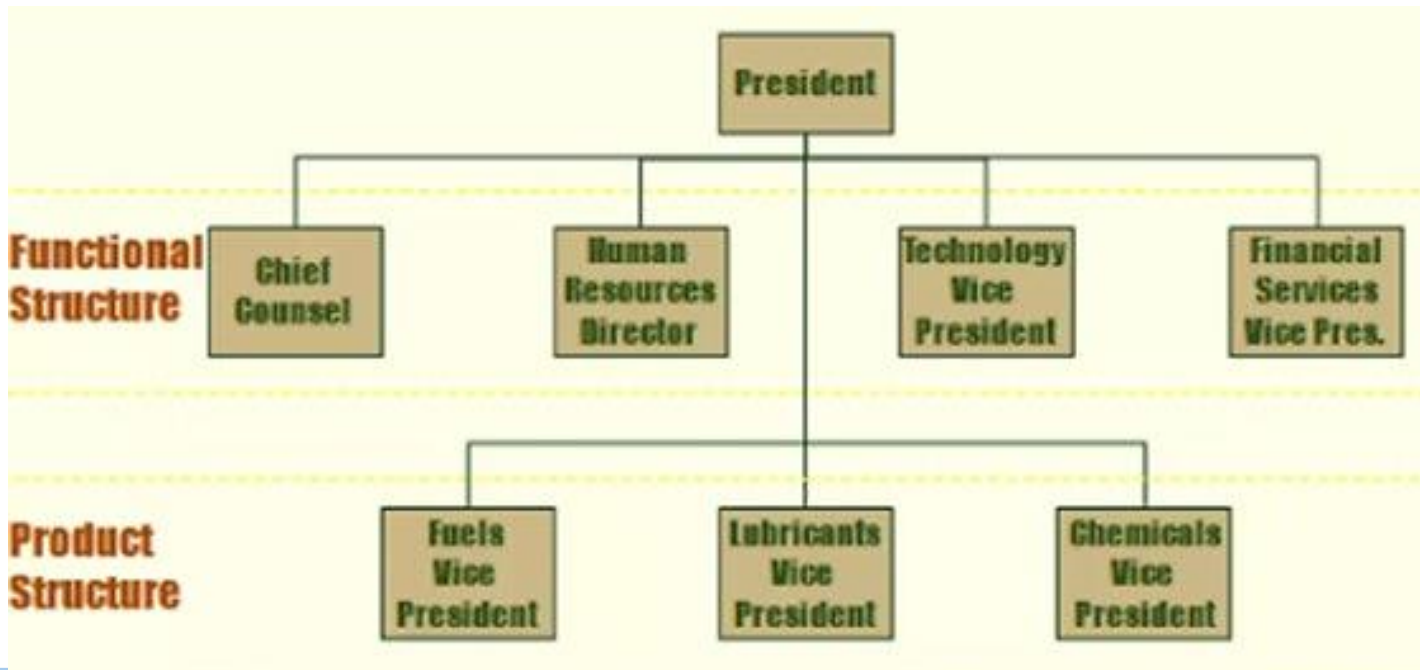
- Matrix Organisation Structure

- Employees are temporarily assigned to a specific project task
- In a permanent functional unit
- Maximise the strengths of functional and product based models



Organisational Model

- **Hybrid Organisation Structure**
 - Balance of power and effectiveness across functional, product, geographic, and client focused units.



- Organisation Culture

- System of shared values, assumptions, belief and norms that unite the members of an organisation.
- Reflect employees view about “the way things are done”
- Culture specify how employee feel and act. Hired and retained by company.



- **Human Resource**

- The science and practice that deals with the nature of the employment relationship and all of the decisions, actions and issues that relate to this relationship.
- The process of attracting, developing and maintaining a talented and energetic workforce to support organizational mission, objectives and strategies.
- It involves an organisation's acquisition, development and utilization of employee, well as the employee relationship to an organisation and its performance.

- **Human Resource**
 - Organise resource to achieve competitive advantage.
 - It includes:
 - Equal employment opportunity
 - Health and safety
 - Recruitment/ selection
 - Induction/ orientation
 - Training and professional development
 - Performance appraisal and management
 - Quality of work life

- **Principles of HRM**
 - Strategic integration
 - Organisational flexibility
 - Commitment
 - Quality
 - Work, worker, product and services

- **HRM Activities**
 - **Job analysis**
 - Define the job in term of tasks, responsibilities and identify abilities, skills, and qualifications needed to perform it.
 - **Human resource planning or employment planning**
 - Ensure right number of qualified or skilled people in the right jobs at right time.
 - **Employee recruitment**
 - Selection of the skilled and qualified candidate for a particular job. **(Employee selection: from available people)**

- **HRM Activities**

- **Performance appraisal**

- How well employee are doing their jobs, and plan for performance improvement.

- **Training and development**

- Help employees learn how to perform their jobs, improve their performance, and improve skills, etc.

- **Career planning and development**

- Identifying possible future growth option, self improvement of employee so that their skills can be utilised for overall development of the company.

- **HRM Activities**
 - **Employee motivation**
 - Keep employee motivated for work through, extra pay, leave and other benefits.

- **Human resource development**

- A set of systematic and planned activities designed by an organisation to provide its members with necessary skills to meet current and future job demands.

- **Tangible and Intangible assets**

- Tangible assets: Visible and Quantified, easily duplicated, depreciate with use: Plants, equipment, physical infrastructure etc.
- Intangible assets: invisible, difficult to quantify, develop over time, appreciate with use: skills, technological know-how, etc.

- **Firm capital**
 - Human capital
 - Knowledge, skills, abilities of individuals, etc.
 - Social capital
 - Relationships or networking, structural, cognitive, relational dimensions, etc.
 - Intellectual capital
 - Knowledge and knowing capability of social collectivises
 - Procedural and declarative etc.

- **Challenges for HR**
 - Competing in the global economy
 - New technologies
 - Need skilled and qualified worker
 - Cultural sensitivity
 - Team involvement
 - Problem solving
 - Communication skills

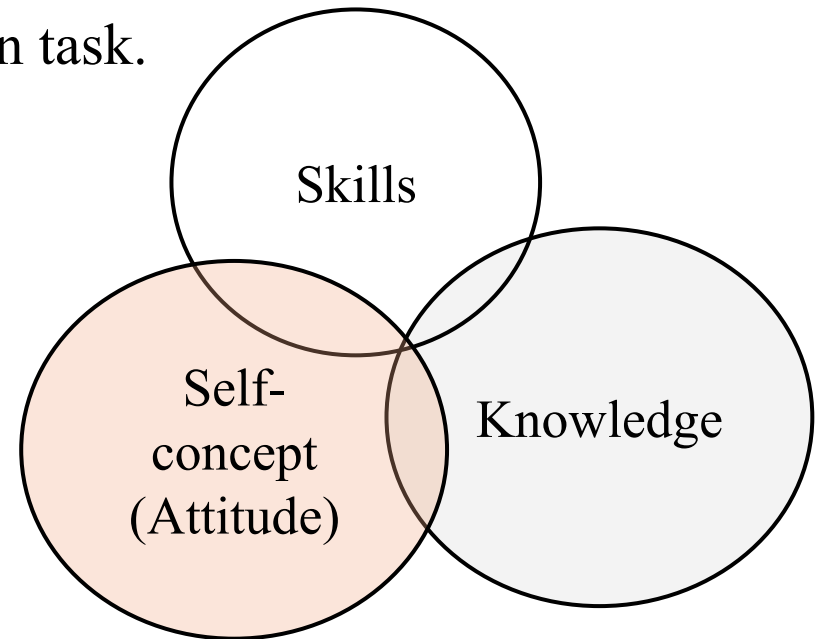
- **Challenges for HR**
 - Need for learning
 - Organisations change
 - Technological change
 - Product change
 - Process change
 - People ... must change!!

- **Reward and recognition system**
 - By valuating and recognizing people, motivation can be harnessed.
 - Reward → Monetary
 - Recognition → Feelings

- **Coaching and mentoring**
 - Mentoring:
 - Supporting in career transition
 - At need
 - Coaching:
 - It focused on innovation, change and specific skills
 - More structure learning process with specified aim...

- Competencies

- A collection of characteristics (i.e. skills, knowledge and self concept, behavior, motivation, etc.) that enables someone to successfully complete a given task.



- **Cost terminology**
 - **Cost:** Sacrificed resource to achieve a specific objective.
 - **Actual Cost:** Cost that occurred.
 - **Budgeted Cost:** Predicted cost.
 - **Cost Object:** Anything of interest for which a cost is desired.
 - **Direct Cost:** can be invested on parts, infrastructure.
 - **Indirect cost:** not tracked easily like rent, property taxes.
 - **Variable cost:** Change in total in proportion to change in the related level of activity or volume change.
 - **Fixed cost:** remain unchanged related to changes in related activity or volume.

- **Types of inventories**
 - **Direct materials:** Resources in stock and available for use.
 - **Work in progress or process:** products started but yet to be completed.
 - **Finished goods:** Product ready for sale.
 - Why keep inventories:
 - Stable production
 - To take price advantages
 - Prevent loss
 - Meet demand replenishment

- **Types of product costs**
 - **Direct materials:** Resources in stock and available for use.
 - **Direct labour**
 - **Indirect manufacturing:** treated as overhead costs to run day to day activities or production.

- Cost – volume – Profit Analysis

- Change in production/ sale volume influence cost and revenue
- Total cost = Fixed cost + Variable cost
- Selling price, variable cost per unit, and fixed costs

$$\text{Operating income} = \text{Revenues} - \text{Variable costs} - \text{Fixed costs}$$

$$\text{Operating income} = \left(\text{Selling price} \times \text{Quantity of output units sold} \right) - \left(\text{Variable cost per unit} \times \text{Quantity of output units sold} \right) - \text{Fixed costs}$$

$$\text{net income} = (\text{ operating income}) (1 - \text{Tax rate})$$

$$\text{Revenues} - \text{Variable costs} - \text{Fixed costs} = \frac{\text{net income}}{1 - \text{Tax rate}}$$

- **Contribution margin**

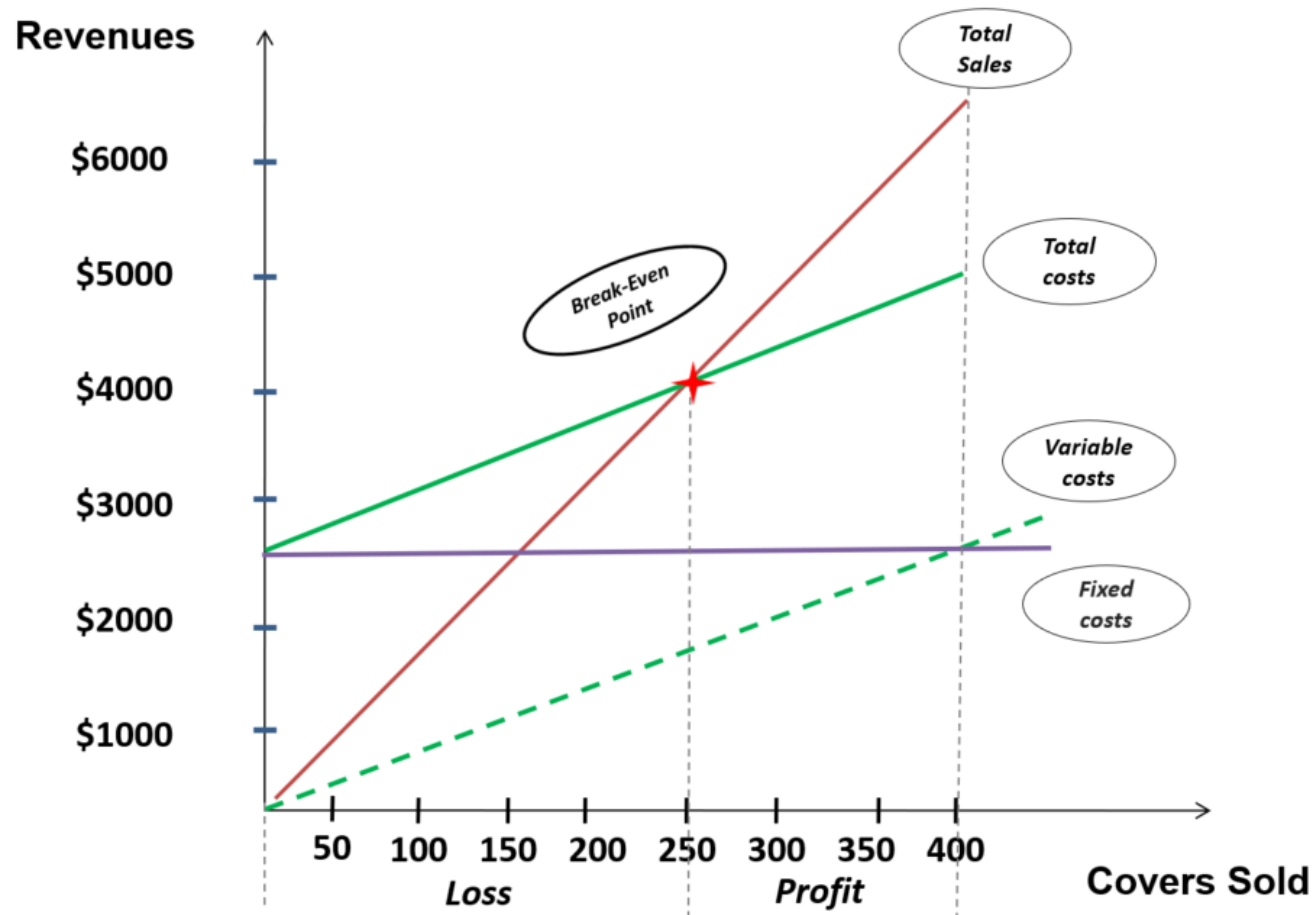
- Contribution margin equals sales less variable costs: $CM = S - VC$
- Contribution margin per unit equals units selling price less variable cost per unit
- Contribution margin ratio equals contribution margin per unit divides by selling price: $CMR = CM_u / SP$
- Horizontal penetration of CM income statement:
 - Operating Income (OI) = Sales – VC – FC
 - $OI = Q (CM_u) - FC$

- Breakeven Point

- At this point, a firm has no profit or loss at a given sales level
- $OI = Q (CM_u) - FC$
- If $OI = 0$
- Then $0 = Q (CM_u) - FC$
- $Q = FC / CM_u$

Cost Management

- Cost – volume – Profit Analysis



- **Cost – volume – Profit and Income Tax**
 - it is necessary to move back and forth between pre tax profit (OI) and after tax profit (NI)
 - After tax profit: $NI = OI \times (1 - \text{Tax rate})$
 - NI can be substituted into profit planning
 - $OI = NI / (1 - \text{Tax rate})$

- **Operating leverage**
 - it is the effect fixed cost have on changes in operating income as changes occurs in units sold
 - $OL = CM / OI$

- **Effects of sales – mix on CVP**

Weighted Average of CMu (multiple products)

=

$$\frac{\{(\text{Product 1 CMu} \times \text{Product 1 Q}) + (\text{Product 2 CMu} \times \text{Product 2 Q}) + \dots\}}{\text{Total units sold (Q) for all products}}$$

- Example

A company manufactures a single product.

Selling price per unit = ₹500

Variable cost per unit = ₹300

Total fixed costs per month = ₹12,00,000

Answer the following:

Contribution per unit and Contribution Margin (CM) ratio

Break-even point (BEP) in **units** and in **₹ sales**

Contribution and CM ratio

Contribution per unit = Selling price – Variable cost
= ₹500 – ₹300 = ₹200 per unit

Contribution Margin ratio (CM%) = Contribution ÷ Selling price
= ₹200 ÷ ₹500 = 0.40 = 40%

Break-even point (BEP)

(a) BEP in units

$$\begin{aligned}\text{BEP (units)} &= \text{Fixed costs} / \text{Contribution per unit} = ₹12,00,000 / ₹200 \\ &= \mathbf{6,000 \text{ units}}\end{aligned}$$

(b) BEP in ₹ sales

Two equivalent ways: **Way 1 (units × price):**

$$\begin{aligned}\text{BEP sales} &= 6,000 \text{ units} \times ₹500 \\ &= 6,000 \times 500 = \mathbf{₹30,00,000}\end{aligned}$$

Way 2 (fixed ÷ CM%):

$$\begin{aligned}\text{BEP sales} &= ₹12,00,000 \div 0.40 \\ &= ₹12,00,000 \times (10 \div 4) = ₹1,20,00,000 \div 4 = \mathbf{₹30,00,000 \text{ (checks out)}}$$

Break-even point (BEP)

(a) BEP in units

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(b) BEP in ₹ sales

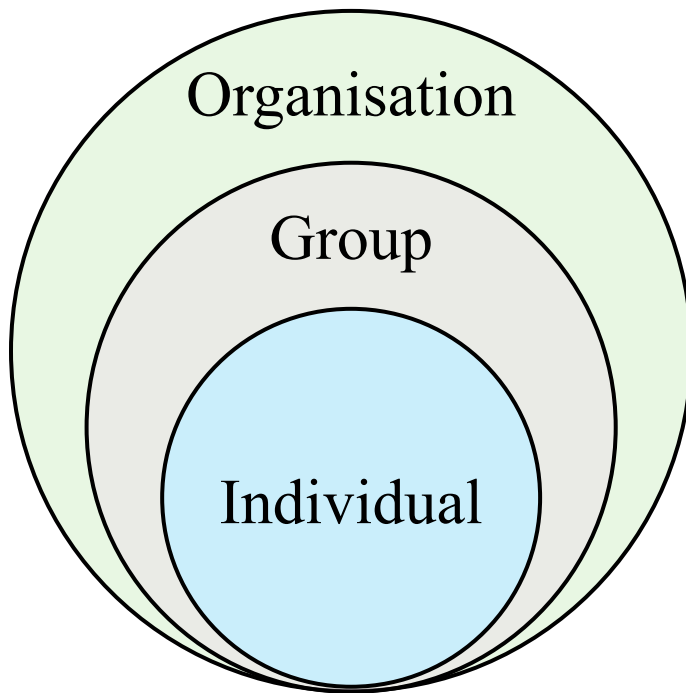
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- Systematic study and application of knowledge about how individuals and groups act within the organisations where they work.
- Investigates the impact that individuals, groups and structures have on behavior within the organisation for the purpose of improving an organisation's effectiveness.



- If need to understand boss's personality: **Individual analysis**
- How his personality affects my team: **Group level**
- How his personality affects organisation: **Organisation level**

Relation to other field

- Personality and Motivation: **Psychology**
- Team processes relies: **Sociology**
- Decision making: **Influence of Economics**
- Power and Influence in organisation: **Political Science**
- Stress and its effects on individuals: **Medical Science**
- Attitude Change, Group process: **Social Psychology**
- Individual culture, org. culture: **Anthropology**

Importance

- Roadmap for our lives
- Scientific
- Influence overall organisational events
- Basis of motivation
- Relationship building

Scope

- **Individuals:** Includes aspects as personality, perception, attitude, values, job satisfaction, leaning and motivation
- **Group:** Group dynamics, group conflicts, communication, leadership, power and politics etc.
- **Organisation:** Structure, culture and change and development.

Nature of people

- Individual differences
- A whole person
- Motivated behavior
- Value of the person

The nature of organisation

- Social system
- Mutual interest

Management's

- Philosophy
- Values
- Vision
- Goals

Organisation culture

- Formal
- Informal
- Social

Leadership

Communication

Group

Dynamics

- Motivation

Outcomes

- Performance
- Individual satisfaction
- Growth and development

Quality of
work life

Fundamentals of Individual Behaviour

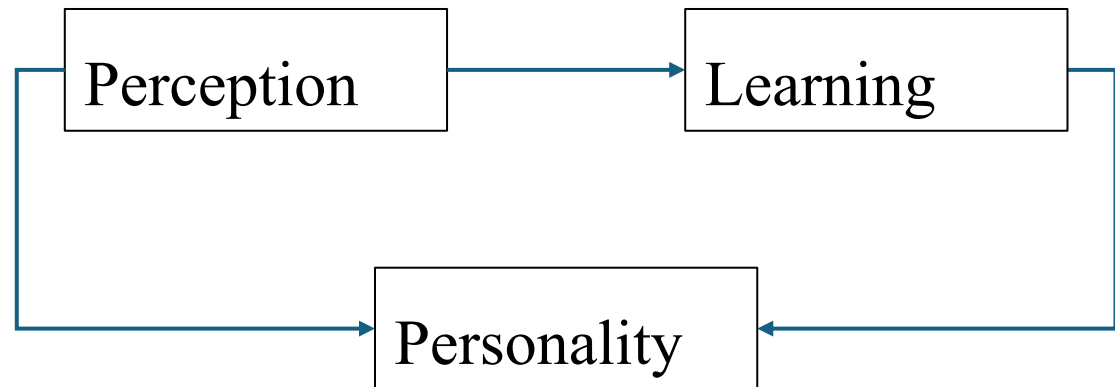
- **Psychologist ‘Kurt Levin’:** Behaviour = f(Person, Environment around him)

Inherited Characteristics

- Physical
- Intelligence
- Sex
- Age
- Religion

Learned Characteristics

- Perception
- Attitude
- Personality
- Values

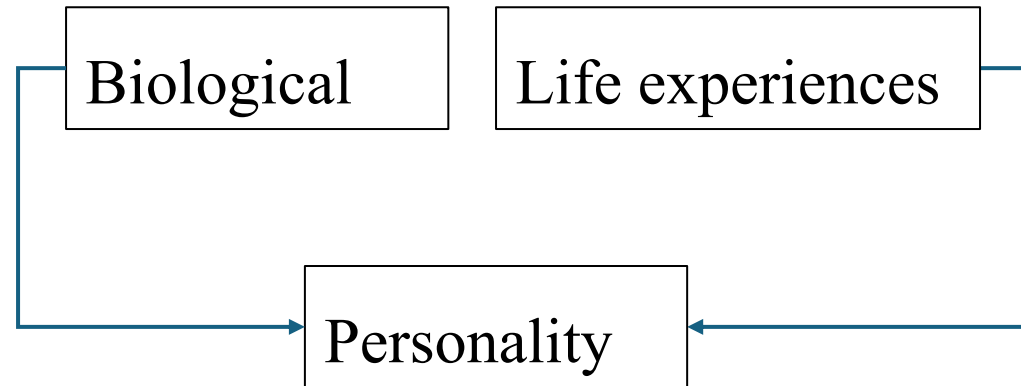


Personality

- Consists of the stable psychological traits and behavioural attributes that gives a person his or her identify.

5 personality dimensions

- Extroversion
- Agreeableness
- Conscientiousness
- Emotional stability
- Openness to experience



5 personality dimensions

- **Extroversion:** Positive emotions
- **Agreeableness:** Trust
- **Conscientiousness:** Competence/ Self-discipline
- **Emotional stability**
- **Openness to experience:** Actionable

Organisation Behavior

	Main	Opposite
1.	Reserved	Outgoing
2.	Less intelligent	More intelligent
3.	Affected by Feelings	Emotionally Stable
4.	Submissive	Dominant
5.	Serious	Happy-go-lucky
6.	Expedient	Conscientious
7.	Timid	Venturesome
8.	Tough-minded	Sensitive
9.	Trusting	Suspicious
10	Practical	Imaginative

Organisation Behavior

	Main	Opposite
11	Forthright	Shrewd
12	Self-assured	Apprehensive
13	Conservative	Experimenting
14	Group-dependent	Controlled
15	Uncontrolled	Controlled
16	Relaxed	Tense

- **Type A:** a behavior pattern involving high levels of competitiveness, time urgency, and irritability
- **Type B:** a behavior pattern characterized by a casual, laid back style.
- What is the effect of Type on health, personal relations, and task performance?

Principles of Management for Engineers



Questions ???