

Engineering Management (2-1-0)

(Class Notes) MGIT 320

Unit 1 : Introduction (6 hrs)

Unit 2 : Planning and Organizing (6 hrs)

Unit 3 : Motivation and Leadership (6 hrs)

Unit 4 : Human Resource Management and Control (8 hrs)

Unit 5 : Emerging trends in engineering management (4 hrs)



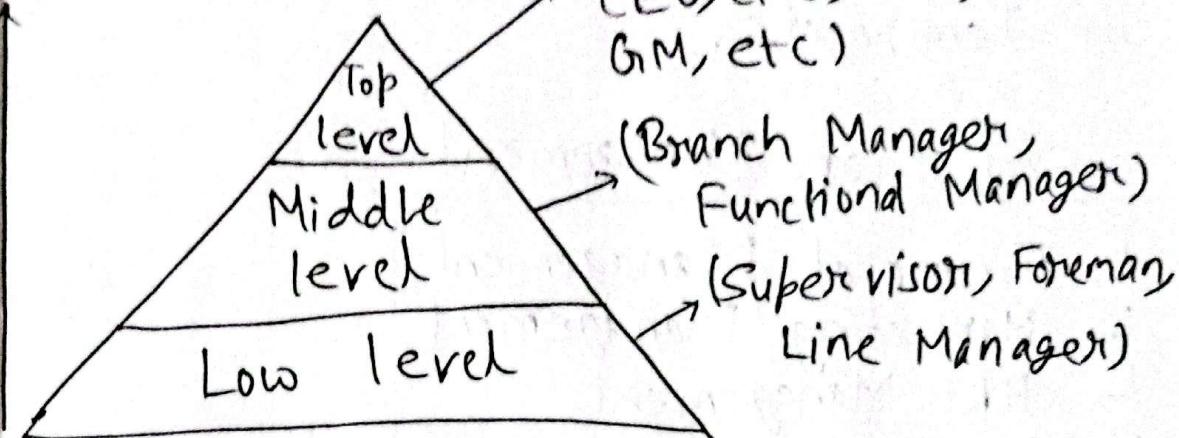
Rashant Bhatta
2022 BATCH

NAST

Unit I Introduction

Management

Levels



Functions:

- Planning → Short range (0-1) year
- Middle range (1-3) year
- Long range (3 and more)

- Organizing
- Staffing → Manpower
- Leading
- Motivating
- Directing
- Communicating
- Controlling

Principles

- division of work
- unity of objective
- unity of command
- Authority
- Responsibility
- Scalar Chain
- Equity
- Centralization and decentralization

- ↳ Team spirit
- ↳ discipline
- ↳ Unity of direction
- ↳ Remuneration
- ↳ Tenure, etc.

Scope of Management

- ↳ Financial Management
- ↳ Marketing Management
- ↳ HR Management
- ↳ Production Management
- ↳ Procurement Management
- ↳ Personal Relationship (PR) Management
- ↳ Customer Relationship (CR) Management
- ↳ Material Management
- ↳ Maintenance Management
- ↳ Office Management, etc

Organization

- ↳ Systematic arrangement of people
- ↳ association of two or more people for achieving common goal

Features

- ↳ Composition of individuals
- ↳ Achievement of common goals
- ↳ Division of Work
- ↳ Coordination
- ↳ Cooperative relationship

- ↳ Authority and Relationship
- ↳ Group Behaviour
- ↳ Performance, etc

Types

- ↳ Formal Organization
- ↳ Informal Organization
- ↳ Virtual Organization

Formal Organization

Features:

- ↳ Created intentionally
- ↳ achievement of common goals
- ↳ work specialization
- ↳ fixed authority and responsibility
- ↳ Coordination
- ↳ Scalar Chain
- ↳ Unlimited life

Informal Organization

Features:

- ↳ Created automatically
- ↳ to get psychological satisfaction
- ↳ no any fixed authority
- ↳ no source of information
- ↳ depends on time
- ↳ no scalar chain
- ↳ fixed life

Formal Organization

Advantages:

- ↳ Systematic working
- ↳ Achievement of common objective
- ↳ No overlapping of work
- ↳ Coordination
- ↳ Chain of command
- ↳ Focus more on work

Disadvantages:

- ↳ delay in action
- ↳ ignores social needs
- ↳ emphasis on work only

Informal Organization

Advantages:

- ↳ Fast Communication
- ↳ Fulfills social needs
- ↳ Correct Feedback.

Disadvantages:

- ↳ Spread rumors
- ↳ no systematic working
- ↳ may bring negative result

<u>Formal Organization</u>	<u>Informal Organization</u>
<ul style="list-style-type: none"> ↳ documentation (formal) ↳ written documentation ↳ Systematic working ↳ delay in decision making ↳ proper coordination ↳ fix chain of command ↳ emphasis more on work ↳ Create intentionally ↳ does not focus on social needs. ↳ unlimited life ↳ slow communication 	<ul style="list-style-type: none"> ↳ documentation (informal) ↳ oral documentation ↳ no systematic working ↳ decision making is fast ↳ there may not be proper coordination. ↳ no fix chain of command ↳ emphasis more on individual interest ↳ create automatically ↳ focus on social needs ↳ limited life ↳ fast communication

Importance of management

- ↳ Achievement of goals
- ↳ Resource utilization
- ↳ Productivity increment
- ↳ Cost reduction
- ↳ Decision making
- ↳ Improving staffing
- ↳ Standard of living
- ↳ Quality management
- ↳ Proper planning
- ↳ Motivating stakeholders
- ↳ Company direction
- ↳ dynamic organization, etc.

Engineering Management

Functions:

- ↳ Product development
- ↳ Operation development
- ↳ IT Systems
- ↳ Quality Management
- ↳ Decision Making, etc

Roles of Engineering Manager

- ↳ develop budgets
- ↳ assign tasks to engineers
- ↳ recruitment
- ↳ collaboration with departments
- ↳ developing project plans
- ↳ supervising engineering teams
- ↳ research and development
- ↳ manage, support and evaluate
- ↳ checking works of engineers, etc.

Unit 2

Planning and Organizing

Planning

Time Frame

- ↳ short
- ↳ ~~long~~ middle
- ↳ long

Organizational levels

- ↳ strategic - top level management
- ↳ Tactic - middle
- ↳ Operational - low

Features

- ↳ Primary function
- ↳ future oriented
- ↳ intellectual activity
- ↳ continuous process
- ↳ time frame
- ↳ based on environmental analysis
- ↳ attainable
- ↳ a means only
- ↳ economic, etc

Process

- Analysis of environment
- ↓
- Establishing goals/objectives
- ↓
- Determining planning premises
- ↓
- Identification of alternatives
- ↓
- Evaluation of alternatives
- ↓
- Selecting the best alternatives
- ↓
- Formulating supportive plans
- ↓
- Implementation of the plan.
- ↓
- Review the plan

Tools of Planning

- ↳ Forecasting
- ↳ Network technique
- ↳ Flow chart
- ↳ Gantt chart - Timeframe
- ↳ Break even analysis - Breakeven point
- ↳ Linear Programming
- ↳ simulation, etc

Importance of planning

- ↳ Focus on goal
- ↳ Minimize uncertainty
- ↳ Maintain Control
- ↳ Innovation and Creativity
- ↳ Organizational effectiveness
- ↳ Economy in operations
- ↳ Coordination
- ↳ Avoids failure

Organizing

Process:

- ↳ Division of work
- ↳ grouping of work
- ↳ delegation of authority
- ↳ coordination of work

Organization Structure

Types of organization structure

- ↳ line organization structure (military)
- ↳ functional organization structure
- ↳ Line and staff organization structure
- ↳ matrix organization structure
- ↳ network organization structure
- ↳ hybrid organization structure

(i) Line Organization Structure

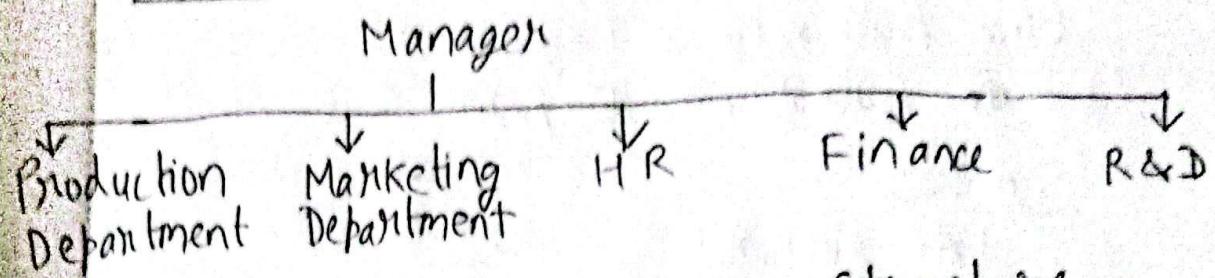


Fig: Line Organization structure

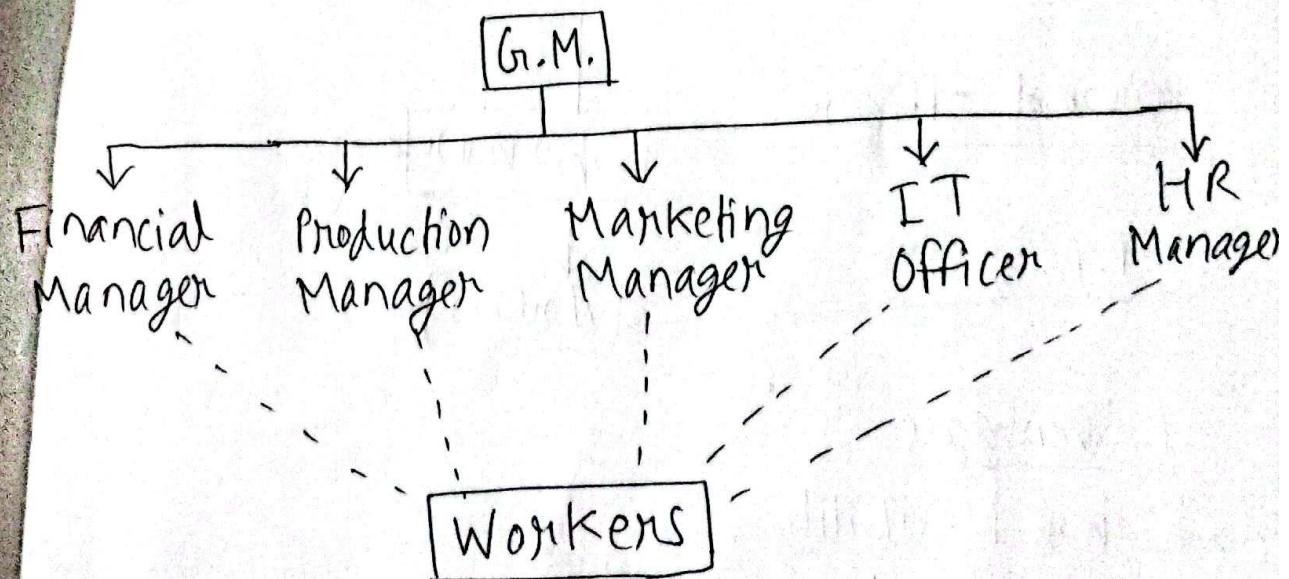
Advantages

- Simple
- Quick decision
- Discipline
- Centralized Authority
- Economical

Disadvantages

- Work overload
- Lack of specialization
- Inefficient
- Autocracy, etc

(ii) Staff or functional organization structure



Advantages

- Benefit of specialization
- Democracy
- Relief to executives
- Efficient Management

Disadvantages

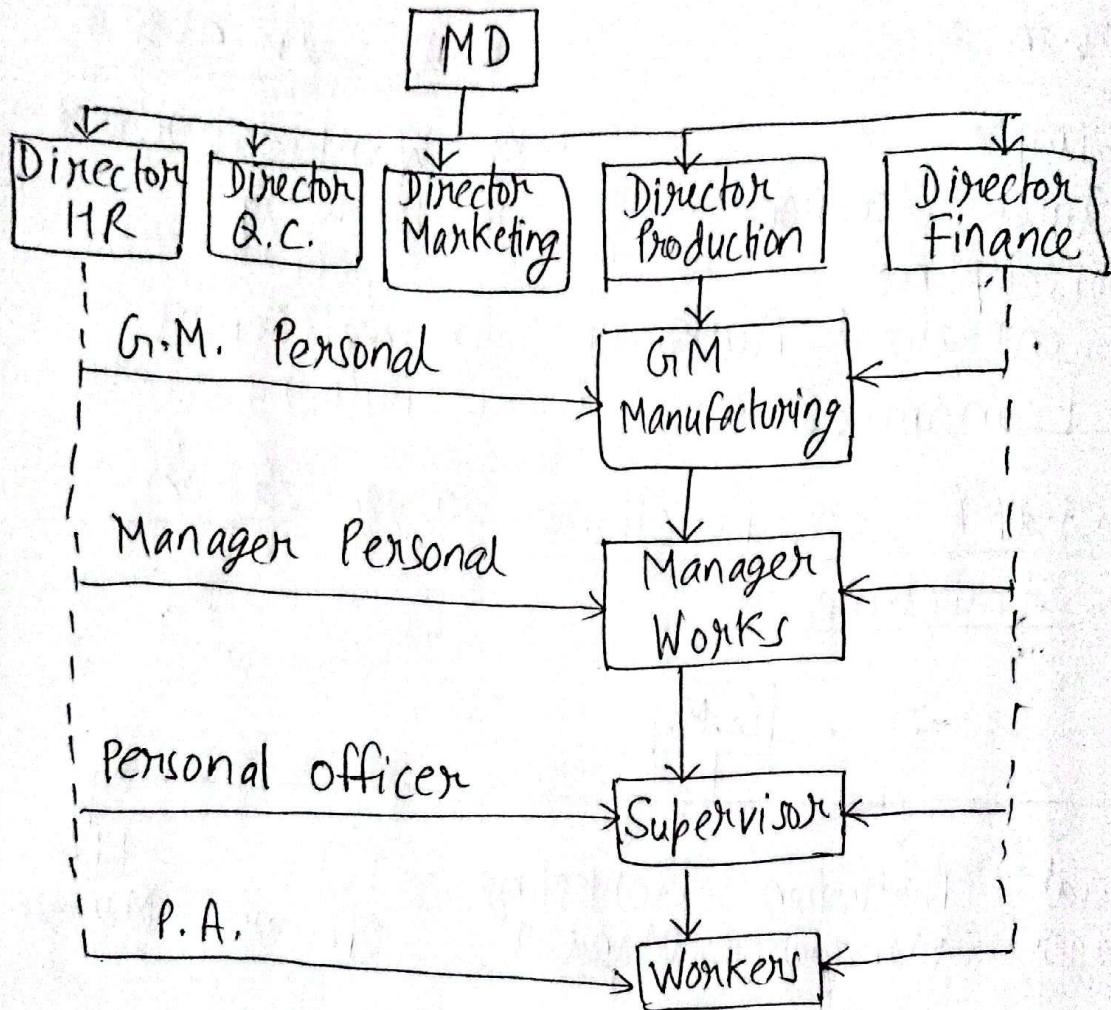
- delay in decision making
- expensive
- multiple command system
- chances of conflicts, etc.

(iii) Line & staff Organization structure

- ↳ Line Authority - Regular
- ↳ Staff Authority - Expert

Symbol

----- staff authority
— Line authority



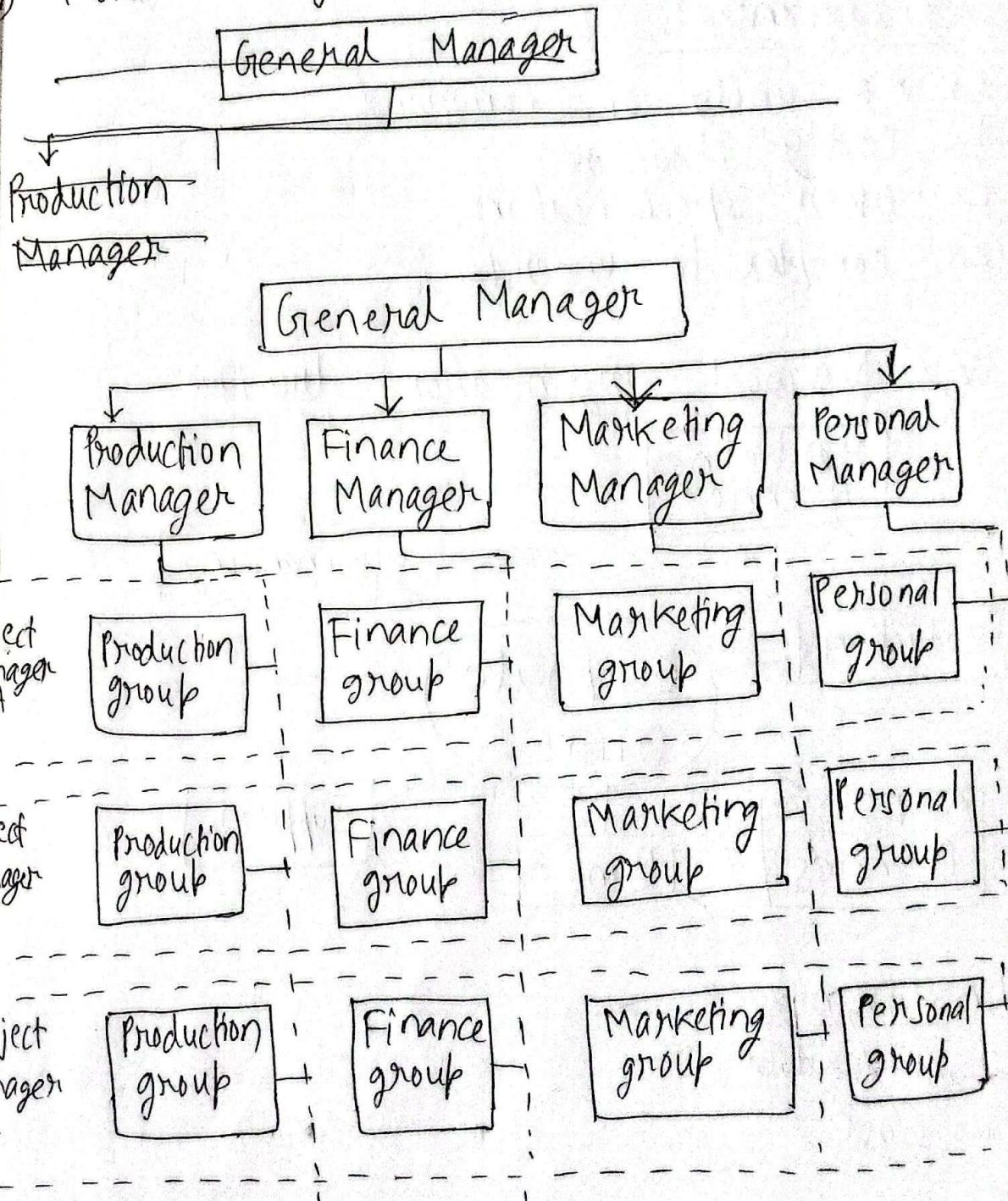
Advantages

- ↳ higher flexibility
- ↳ better control & monitoring
- ↳ expertise knowledge
- ↳ better use of resources
- ↳ efficient management

Disadvantages

- ↳ high administrative cost
- ↳ conflict between line and staff authority
- ↳ lack of coordination
- ↳ delay in decision making

(iv) Matrix Organization Structure



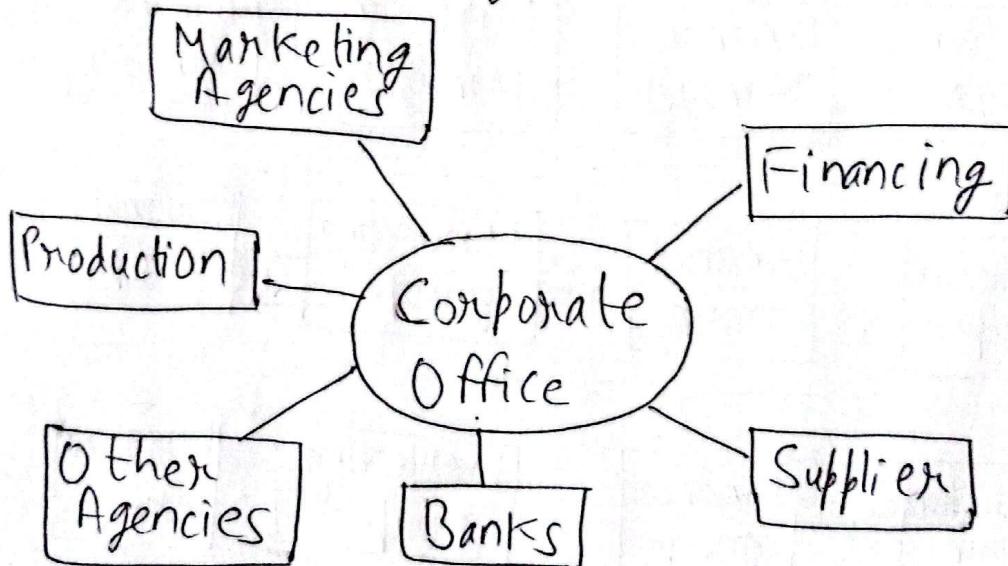
Advantages

- ↳ Better coordination and control
- ↳ adaptable to current environment
- ↳ maximum use of resources
- ↳ participative management
- ↳ relief to executives

Disadvantages

- ↳ no unity of command
- ↳ costly structure
- ↳ over specialization
- ↳ complex to understand

(V) Network Organization Structure



Advantages

- ↳ Flexible
- ↳ Cost

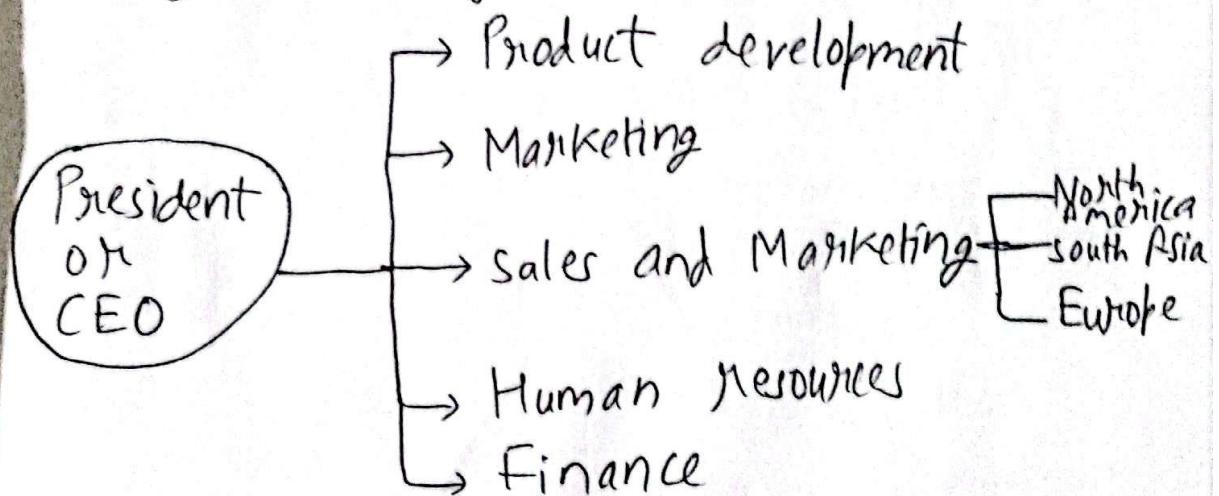
Advantages

- ↳ Eliminates departmentalization
- ↳ minimize cost
- ↳ benefits of specialization
- ↳ flexible operation
- ↳ diversification

Disadvantages

- ↳ Conflict may arise
- ↳ lack of secrecy
- ↳ difficult to coordinate
- ↳ dependency, etc.

(vi) Hybrid Organizational Structure



Advantages

- ↳ Flexible
- ↳ Cost Control
- ↳ Optimize resources use
- ↳ data based decisions
- ↳ improve collaborations

Disadvantages

- ↳ Conflicts between departments
- ↳ confusion about the authority

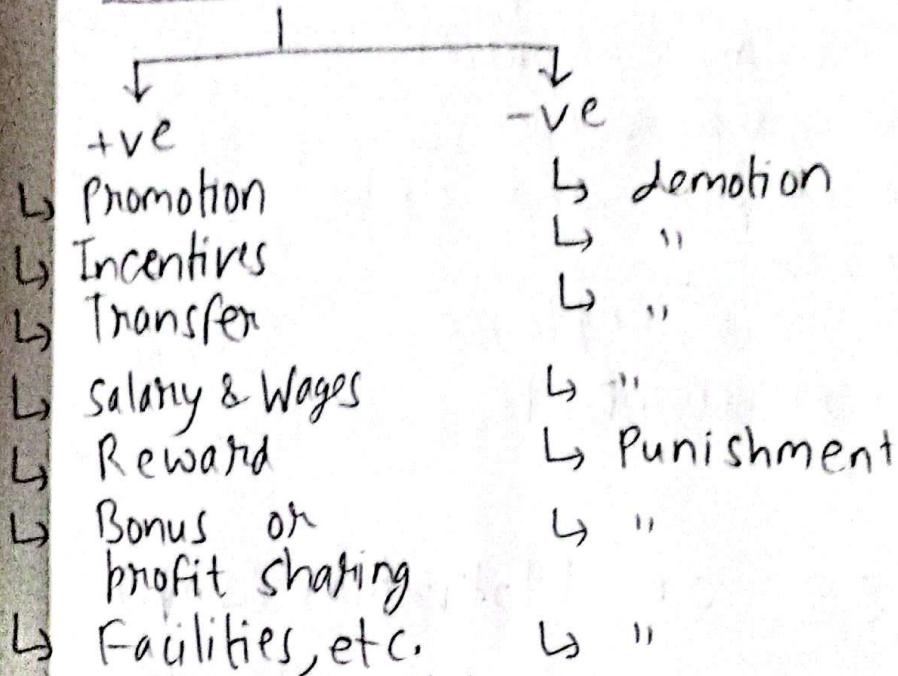
Contemporary issues in planning

- ↳ technological adoption
- ↳ globalization
- ↳ sustainability and CSR
- ↳ Economic Volatility
- ↳ Workforce management

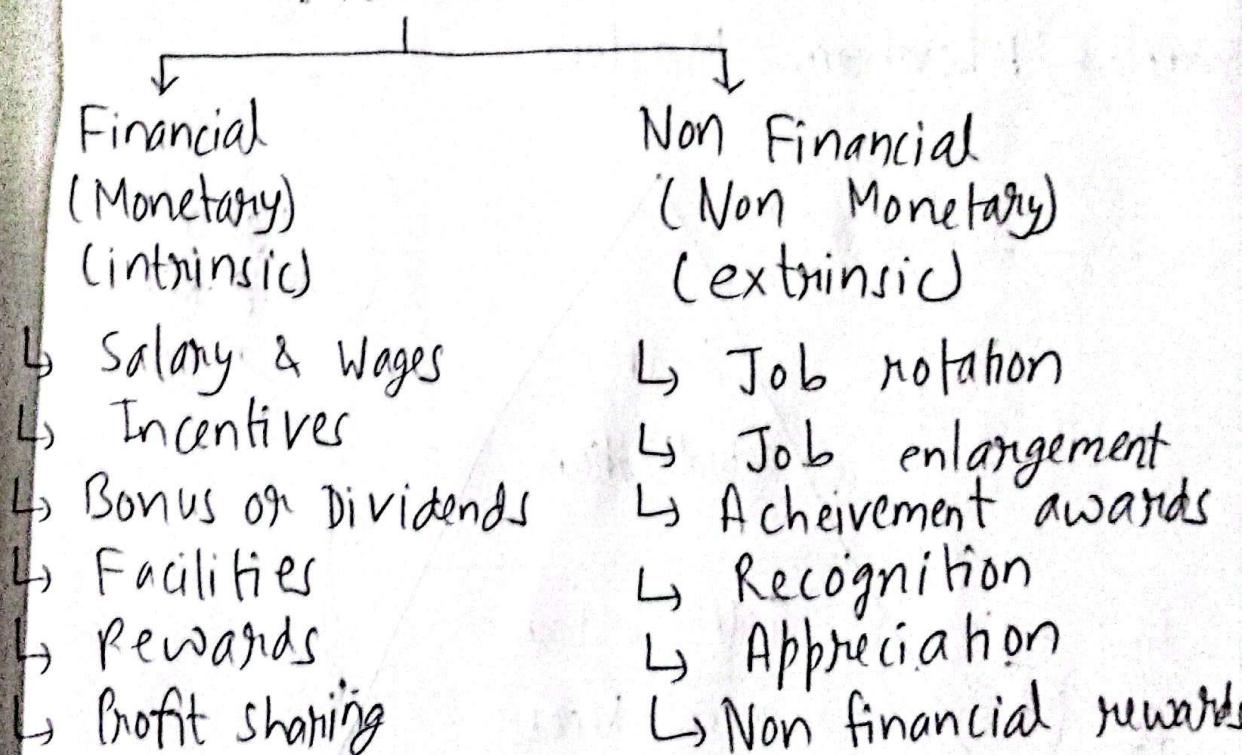
Unit 3

Motivation and Leadership

Motivation



Motivation

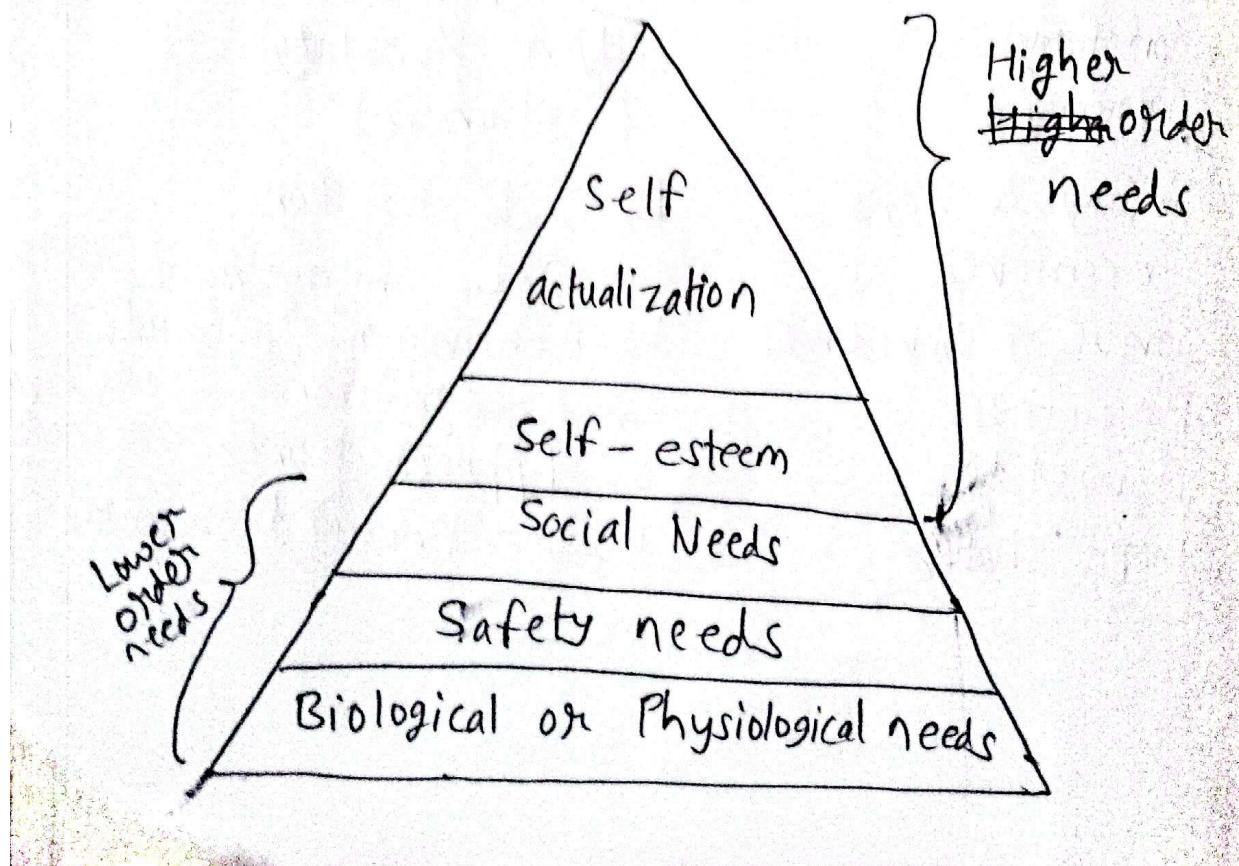


- ## Importance
- ↳ Profitable operations
 - ↳ Productivity
 - ↳ Resistance to change
 - ↳ Use of human resources
 - ↳ Employee satisfaction
 - ↳ Minimize disputes and strikes
 - ↳ Coordination
 - ↳ Retention of employee
 - ↳ Goal achievement, etc.

Theories of Motivation (Imp.)

1. Maslow's need hierarchy theory

↳ defined by Abraham Maslow



1. Biological or Physiological needs \Rightarrow food, shelter & clothing
2. Safety needs \Rightarrow job security, health
 - \hookrightarrow insurance
 - \checkmark health checkup
3. Social needs \Rightarrow affalts, love, affection, emotion etc.
4. Self-esteem \Rightarrow ego, esteem, altitude, power, position, etc.
5. Self-actualization \Rightarrow Creative, contribution,

Contribution & Criticism

Contributions & criticism

- | | |
|---------------------------------------|--|
| \hookrightarrow universal | \hookrightarrow non testable theory
<small>(non experimental)</small> |
| \hookrightarrow clearly explained | \hookrightarrow It is <small>very few samples</small> clinically derived |
| \hookrightarrow comprehensive | \hookrightarrow need classification is somewhat artificial. |
| \hookrightarrow clear prescriptions | \hookrightarrow may not apply at all times and places |
| | \hookrightarrow individual differences |

2. Herzberg's two factor theory (Dual factor theory)

↳ defined by Fredrick Herzberg

Hygiene factor
Maintenance
Extrinsic

Motivating factor
Satisfiers
Intrinsic

- ↳ External to job
- ↳ prevent dissatisfaction
- ↳ zero level motivation
- ↳ Never satisfied completely
- ↳ Money is most
- ↳ inside the job
- ↳ affect satisfaction
- ↳ encourage individuals

Contribution

- ↳ This theory provides tools to satisfy as well as motivate
- ↳ Financial benefits are not only the motivating factors.
- ↳ Advocates concept of Job enrichment

Limitation

- ↳ It is theory of job satisfaction
- ↳ does not utilize the measure of satisfaction
- ↳ ignores situational variables

3. Expectancy Theory

Victor Vroom 1964.

- Expectancy (Effort → performance)
- Instrumentality (performance → outcome)
- Valence (Value of outcome)

Motivational Force

$$= \text{Expectancy} \times \text{Instrumentality} \times \text{Valence}$$

Contributions

- ↳ Focus on rational decision making of employees
- ↳ Recognition of individual differences
- ↳ Practical
- ↳ Holistic approach
- ↳ Goal and Reward

Limitations

- ↳ Difficult in measurement
- ↳ doesn't consider intrinsic motivation
- ↳ Overemphasis on rewards
- ↳ does not consider situational variables
- ↳ does not address long term motivation.

4. Equity theory

John Stacy Adams 1963

- inputs - skill, effort, education, learning etc
- outcomes - performance, productivity, goal achievement
- comparison other - fairly comparison
with others (output-reward)
- Equity and inequity.

Contributions

- ↳ Focus on fairness
- ↳ explains employee inputs
- ↳ work relationship
- ↳ practical implication
- ↳ recognized in social context

Limitations

- ↳ subjective
- ↳ overemphasis on social context
- ↳ difficult to measure fairness
- ↳ no long term focus
- ↳ neglects non-material factors

Leadership

- ↳ influence / inspire
- ↳ follower

Nature / Features

- ↳ process of interpersonal influence
- ↳ leadership & followers
- ↳ common goals
- ↳ continuous exercise
- ↳ situational
- ↳ Rest on power
- ↳ inspiration and motivation

Need / Importance / Functions

- ↳ Goal achievement
- ↳ coordinate activities
- ↳ represent the organization
- ↳ integrate objectives
- ↳ motivate staff
- ↳ organize activities
- ↳ encourage team
- ↳ take initiation
- ↳ communication
- ↳ control and supervision

Styles

- ↳ autocratic
- ↳ democratic
- ↳ transactional / servant
- ↳ transformational

autocratic leadership style

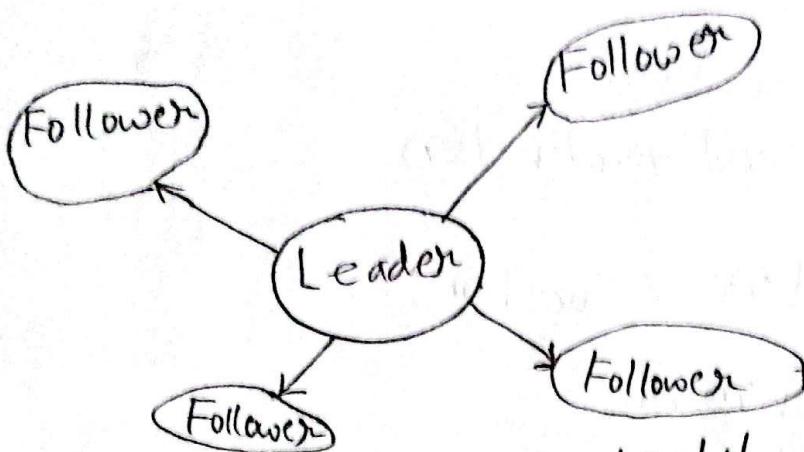


Fig: autocratic leadership style

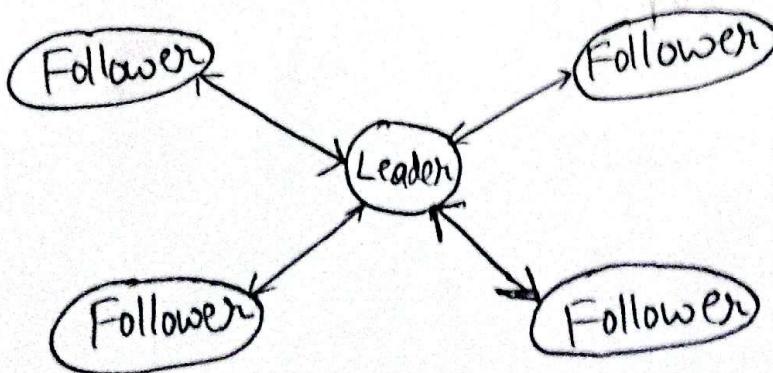
advantages

- ↳ strong discipline
- ↳ quick decision
- ↳ frequent implementation

disadvantages

- ↳ -ve motivation style
- ↳ lack of creativity
- ↳ instability

democratic leadership style



Advantages

- ↳ better discipline
- ↳ satisfaction of employee
- ↳ mutual cooperation

disadvantages

- ↳ delay in decision making
- ↳ inefficient and incompetent
- ↳ absence of discipline

Transactional and Transformational Leadership styles

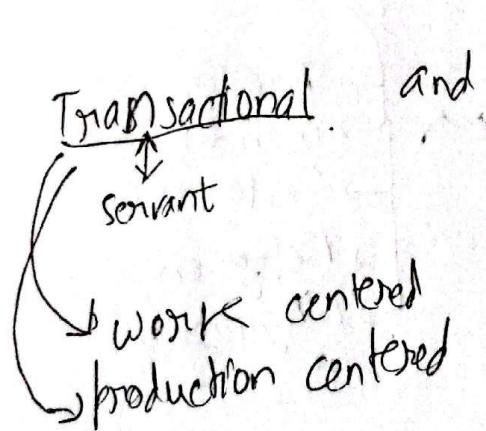
↳ Free reign (Lassiz faire)

↳ Participative management

↳ MBO (Management by Objective)

↳ MBE (Management by Exception)

New styles
not in
syllabus an
come in
short notes.



Transformational leadership styles

- ↳ opposite of transactional
- ↳ people centered (no forcing to people)
- ↳ Transform (inspire) people
- ↳ No forcing but ^{making} inspired people ~~other~~ to work by making people or employee satisfied.

Learning organization (ICT)

"mistakes are allowed".

Issues in Motivation

- ↳ Designing appropriate reward system
- ↳ motivating in challenging economic situations
- ↳ managing cross cultural challenges
- ↳ motivating unique group of employees
- ↳ (a) Motivating professionals
- (b) Motivating contingent workers
- (c) Motivating diverse workforce
- (d) Motivating low skilled workers
- (e) Motivating repetitive task workers
- ↳ work life balance

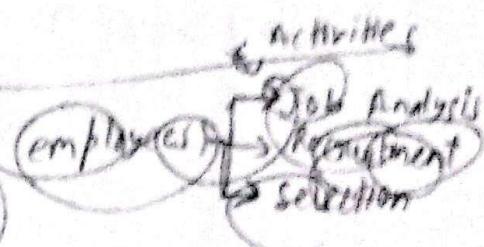
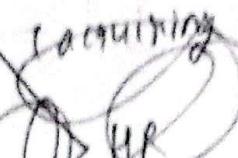
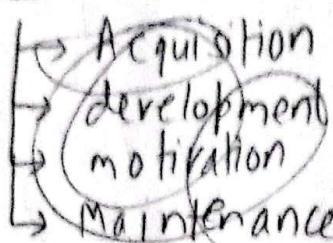
→ Age
→ Gender
→ Caste
→ Religion
→ Language

Unit 4

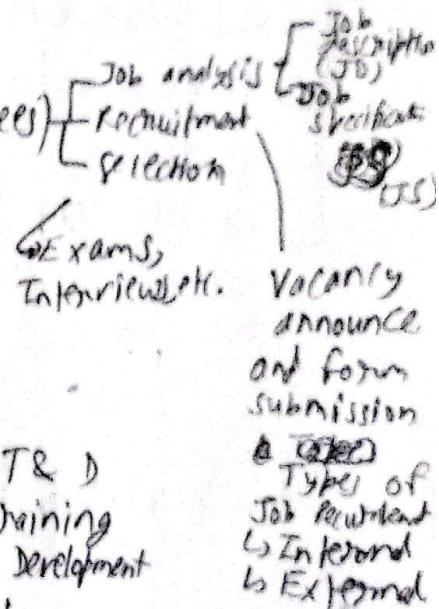
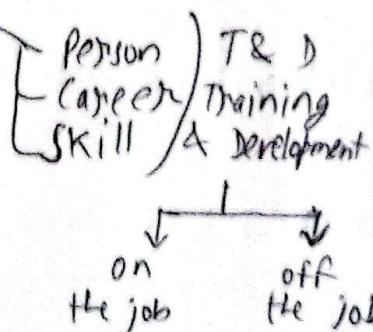
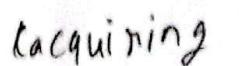
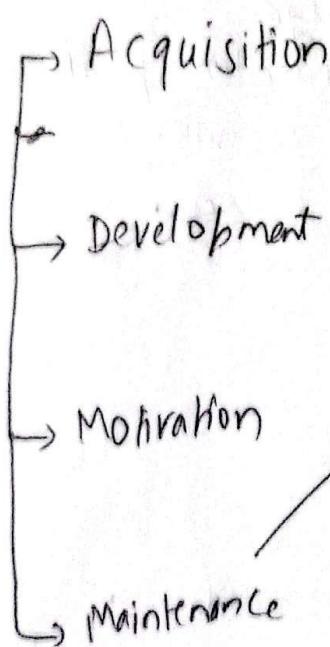
Human Resource Management

(HRM) or personnel management

Functions



Functions



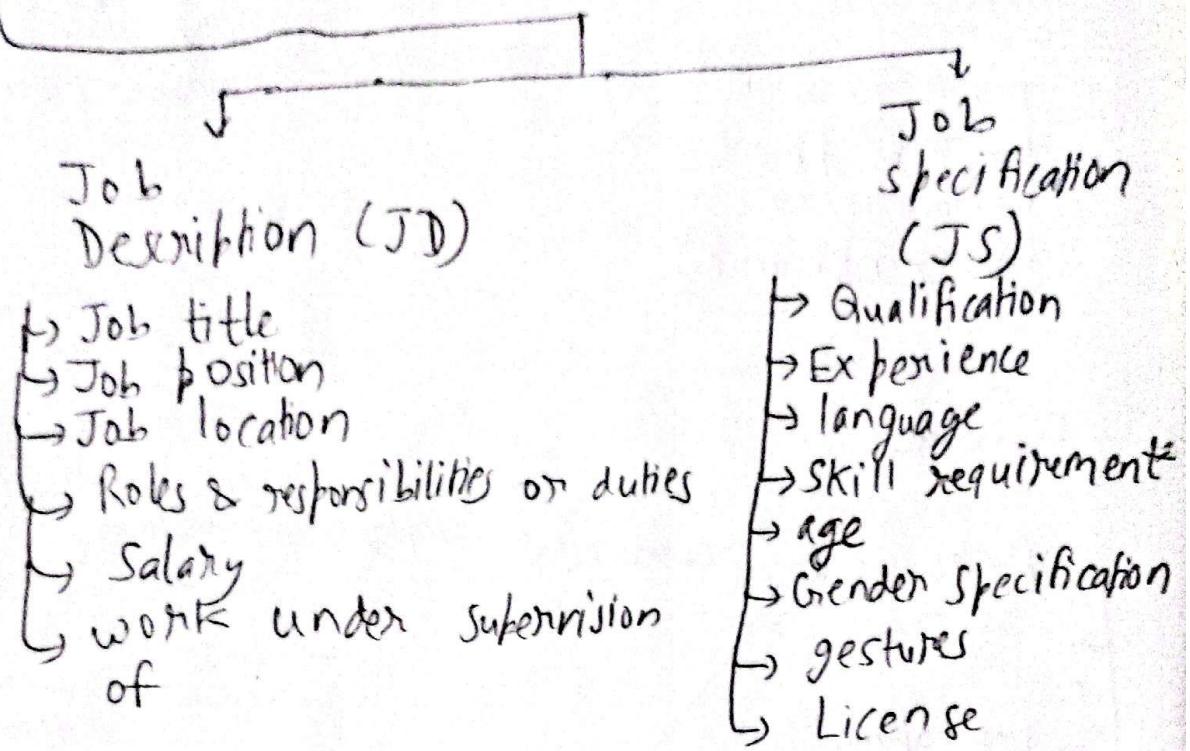
↳ ~~Types~~ Types of Job Recruitment
↳ Internal & External

Features

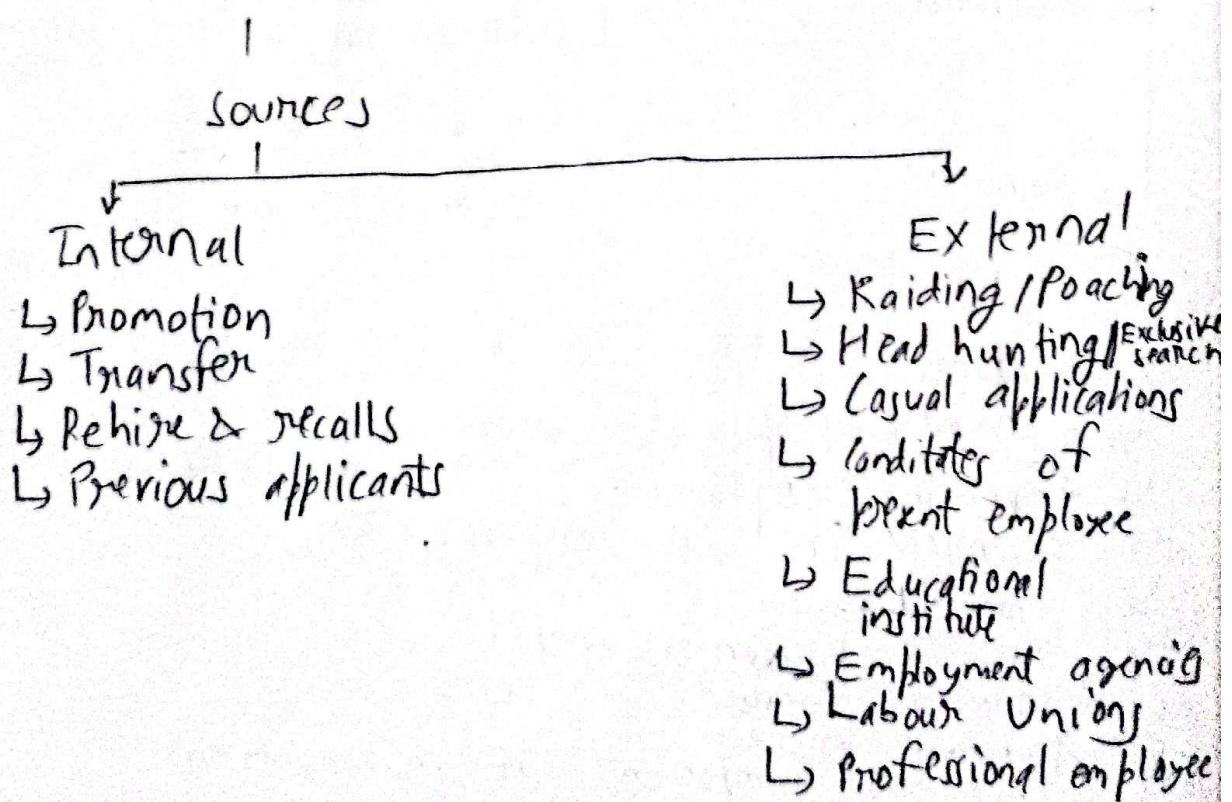
- ↳ managing people at work
- ↳ Developing employee
- ↳ Essential in all organization
- ↳ continuous
- ↳ Tool for human benefit
- ↳ strategy focused
- ↳ dynamic process
- ↳ Important component of management

Job Analysis

"Right person at right place at right time"



Recruitment & selection



Recruitment

Methods

- ↓
 - Internal
 - ↳ Job posting
 - ↳ Employee referral programs
 - ↳ HR inventories
 - Reference biodata
↳ "word of mouth"
- ↓ External
 - ↳ Radio/TV advertisement
 - ↳ Newspaper advertisement
 - ↳ E-recruiting

Process of Selection

Reception of applications

↓
~~Sort~~ Sort listing of applications
(Applications blank)

↓
Selection test →

- ↳ Written test
- ↳ Physical test
- ↳ Medical test
- ↳ Skill ability test

↓ Interview

↓ Reference check

↓ Final selection

↓ Placement

↓ Orientation

Human Resource Training

For small
mass

On-the-job

- Apprenticeship
- Job Instruction Training
- Internship
- Job rotation

for large
mass

off-the-job

- Lecture
- Case Study
- Conference
- Role Play
- Programmed instruction
- Computer assisted instructions
- Audio-visual methods
- Others

Performance Appraisal ~~for evaluation~~ (P.E) (Performance Evaluation)

Process of performance appraisal

Establish performance in standards

↓
Communicate performance expectations to employees

measure actual performance

↓
compare actual performance with standards

Discuss the appraisal with employees → +ve (inwards)
↓
Take corrective actions → -ve (punishment)

Methods of PE

3 methods:

Absolute Standard Method

→ Essay appraisal

→ Checklist method

→ Graphical rating scales

Bar diagram
Pie chart

→ Critical incident method

Employee
Set performance
Create special task

→ Forced choice Method

Google form

→ Behaviourally anchored scales

Scales

Likert

Scaled rating like
satisfactory, strongly disagree, etc.

compar

Relative Standard Method

- Individual ranking Last month This month
- Paired Comparison
- Group order ranking

(com)prehensive Method

- MBO → Target set. Does employee fulfill the target or measure of performance of employee?
- 360°

Challenges of HRM OR, challenges of Workforce

- outsourcing HR activities
- worklife balance
- Ethics
- Change in employee Expectations
- Industrial relations
- Corporate reorganizations
- Technology
- Loss of joy and pleasure (stress)
- workforce diversity

Controlling

Types:

- Pre control: - input control
- Concurrent; - process control → operation
- Post control: - output control → "product/service"

→ Man
→ Money
→ Material

Controlling

Process

- Establishment of standard
- Measurement of Actual performance
- Comparison of Actual performance with standard
- Analyse the causes of deviation
- Take corrective actions

Importance

- ↳ Execution of plan
- ↳ Improve efficiency
- ↳ Basis of future action
- ↳ Aid to decentralization
- ↳ Morale check of employee
- ↳ Means of Coordination
- ↳ Effective supervision
- ↳ Maximize productivity

Elements of effective controlling

- Suitability → Communicable
- Simplicity → Suggestive
- Objectivity → Flexibility
- Economical ^{cost} → Exceptional
- Comprehensive → Forward looking (future oriented)
 ↓
 element

ICT tools for effective control

- ERP (Enterprise resource planning)
 - ↳ SAP, Oracle, etc
- Business Intelligence (BI)
 - ↳ Power BI
- Project Management Software
 - ↳ Microsoft Project, Asana
- Supply Chain Management Software
 - ↳ Rapid response
- HRMS
 - ↳ BambooHR
- Financial & accounting Management teams
 - ↳ Excel, Fintech
- Customer Relationship Software
 - ↳ Google Duo, teams
- Document Management
 - ↳ Share point
- Cybersecurity tools
 - ↳ Umbrella, McAfee

Unit 5

Emerging Trends in Engineering Management (4 hrs).

Participative Management

Nature

- Employee involvement
- Decentralized decision making
- Collaboration
- Empowerment
- Open communication — freedom

Principles

- Shared decision-making — freedom
- Employee autonomy
- Continuous Feedback
- T & D — Training and Development
- Team Work

Advantages

- Employee motivation
- Job satisfaction
- better communication
- better decision making
- Organizational commitment
- innovation
- productivity

Disadvantages

- Time consuming
- Potential for conflict
- Resistance to change
- Dilution of Authority

Conflict Management

"disagreement between two or more parties."

- inter personal
- inter group - between staffs of different departments
- intra group - between staffs of same department
- inter- organizational
- interorganizational
- intra organizational

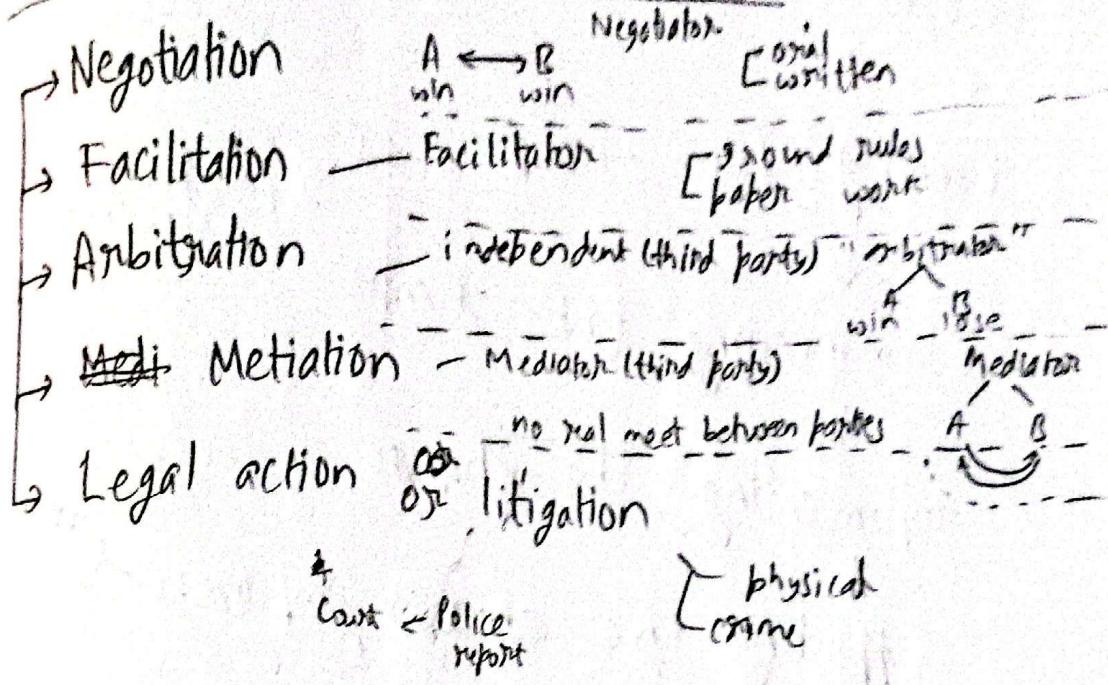
Causes or Sources

- Goal difference and interest
- Value & belief differences
- Competition for resources
- Miscommunication and mis understanding
- power imbalances
- personal and emotional factors
- Organizational issues - salary, safety, sanitation etc.
- Environmental issues - outside organizations

Imp. Q. "Conflict is not always bad". Elaborate the statement.

Conflict Resolution

Managing Conflicts (Modes, ways, techniques)



Change Management

- Structure
- Process
- Skills

Types

- Transformational Change → structure
- Transactional change → software
- Developmental Change → product
problem
- Remedial Change

Process

→ Recognize the need for change.



Planning for change



Communicating the change

internal
external



implementing the change



supporting the ~~change~~ employees

Training



Evaluating the change

Reinforcing the change

Reinforcement

Reward

Principles

- Leadership commitment
- Employee engagement
- Clear communication
- Training and development
- Monitoring progress
- Celebrating success

Resistance
to
change

Quality Management

"fitness for use"

Standards

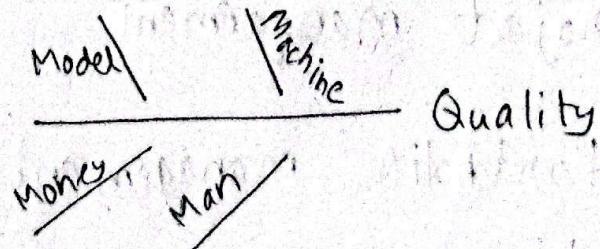
- NS
- ISI
- ISO
- ISBN
- QAA

Basics / Principles

- Customer focused
- Continuous improvement
- Employee involvement
- Process approach
- Fact based approach
- Waste management, etc or zero defect program

Tools and Technique

- PDCA (Plan-Do-Check-Act)
- Pareto Chart (80/20)
- Flow Charts
- Control Charts Mean
Range
Defective
- Cause and effect diagram or Fishbone diagram



- Six sigma - identified by Japanese

Advantages

- Customer satisfaction
- Efficiency
- Reputation
- Employee satisfaction
- Growth satisfaction
- Competition, etc

Problems

- Resistance to change
- Cost / budget
- Research and Development (R&D)
- Training & Development (T & D)

Innovation and disruption

unique/creative

small - unique

Recent engineering management concepts in ECT based projects (Imp.)

- Agile & Scrum Methodologies
- Devops & IT operations
- Lean project management
 - waste management
 - diversification
- Project Portfolio Management (PPM)
- Digital transformation and IT Governance

- AI and ML in Project Management
 - Artificial Intelligence
 - Machine Learning
- Collaboration & communication tools
 - ms teams
 - messenger
 - whatsapp
- Cyber physical systems