



Civinnovate

Discover, Learn, and Innovate in Civil Engineering

Project Monitoring, evaluation and control

4.1 Introduction

→ Monitoring and evaluation helps to improve the efficiency of on-going projects and the selection and design of future projects.

• Monitoring

→ Collecting, recording and reporting informations concerning all aspects of project performances that the project managers or others in the organization wish to know.

→ Improve project implementation and to improve future project planning and decision making.

• Controlling

→ Management function of comparing the actual achievements with the planned ones at every stage and taking necessary action, if required, to ensure the attainment of the planned goals.

→ Steps:

(i) Measuring:

Determining degree to which the progress towards objective is being made.

(ii) Evaluating:

Determining cause of and possible ways to act upon significant deviations from planned performances

(iii) Correcting:

Taking control action to correct an unfavourable trends or to take advantage of an unusually favourable trend.

4.2 Project Control System (PCS):

→ Process for continuing regular monitoring and controlling of a project

→ Functions:

(i) Ensures regular monitoring

(ii) Motivates project personnel to achieve project objectives.

4.2.1 Information provided by a PCS

→ Timely information on project progress and deviations from plans

→ True picture of work progress

→ Potential problems

→ Relationship between cost and schedule performance

→ Summarization of problems and action taken.

→ Validity of milestone in terms of time and audit requirements.

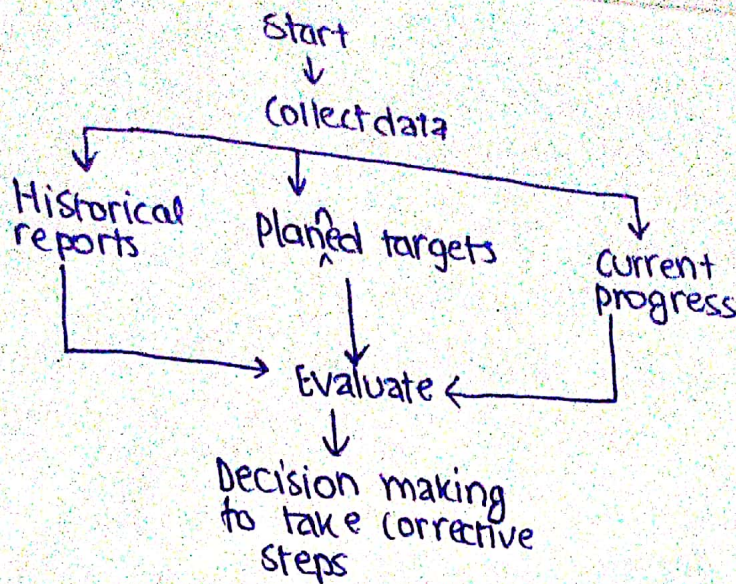


Fig: PCS

4-2-2 Elements of effective PCS (Requirement) (CASFATEEC)

- (i) Conformity to plans and activities:
 - Control should suit the plans and activities
 - how the plans are progressing
- (ii) Appropriateness to position and personalities
 - Suit the person involved.
 - Emphasis of manager should be different from supervisor.
- (iii) Simplicity
 - should be simple to understand and operate.
 - Complicated controls; confusion
 - Sophisticated tools; need training
- (iv) Accepted by the persons concerned:
 - Consultation with operating staffs.
- (v) Timeliness
 - Controls must be implemented in time
 - proper reporting of deviation and corrective actions
- (vi) Economy
 - PCS should be economical since PCS aims to keep down cost.
- (vii) Emphasis on critical factors:
 - Time, cost, quality
- (viii) Corrective plan
 - Steps to remedy defects
- (ix) Flexibility
 - can be changed in changing environment.

on achievement
appropriate information
feedback
Strive to pinprick
easily un-

- 4.2.3 Difficulties in implementing a project control system:
- Department and management gaps
 - Uniqueness of the project and its organization.
 - Human factor
 - Complex characteristics of project
 - Difficult to manage both performance & expenditure
 - Difficult coordination and communication
 - Uncertainty and change
 - Poor control and information system

- Other factors (In Nepal)
- Prime importance to cost
 - Reluctant to change
 - Inappropriate reporting system and accounting mechanism
 - Biasedness of project staff
 - Time problem will get automatically resolved
 - Culture, norms, geographic location

4.3 Areas of control of PCS

- (i) Cost control
- Starts right from beginning of project
 - Done by appropriate decision making process and financial control system.

- (ii) Quality control
- Def: The totality of features and characteristics of product, service and process, which bears on its ability to satisfy a given needs.

(iii) Progress control.

Quality attributes (SPPRADCF)

- (i) Serviceability:
 - How difficult and expensive it is to repair
 - How long it will take
- (ii) Performance:
 - Eg: color and clarity of picture in TV
- (iii) Perceived quality:
 - Feeling of confidence in the level of quality according to demand
 - Reputation of company
- (iv) Reliability:
 - Probability to run without repair
- (v) Aesthetic characteristics:
 - how an item looks, feels, tastes, smells
- (vi) Durability:
 - how long it will last
- (vii) Conformance:
 - How well the product meets specifications
- (viii) Features:
 - Eg: TV remote

→ Eg: TV remote

* Cost of quality:

→ Combination of

(i) Costs to control quality (Prevention and appraisal)

(ii) Costs of failure to control quality (internal and external failures)

→ Divided into

(i) Prevention cost:

→ Cost of preventing defective work

→ Includes: (DPPS & Wov)

- Design reviews and drawing check
- Process control
- Process orientations
- Suppliers evaluation and presentation
- Quality orientation program, education and training
- Workers training

(ii) Appraisal costs

→ Costs for auditing service procedure

→ Includes: (PPITC Wov)

- Process capability measurement
- Prototype inspection and tests
- In process and final inspection and test
- Tests, gauges, test equipment
- Checking materials furnished by suppliers
- Work in progress, goods testing and inspection

(iii) Internal failure costs:

→ Product in factory > not being sold

→ Includes: (RRREL CAS)

- Redesign
- Reworking and downtime
- Retesting defective items
- Expenses for producing scraped items
- Lost value of items sold as seconds
- Cost of delays
- Administration time to review materials (Disposition)
- Scrap

(iv) External failure costs:

→ Product sold

→ Include:

- Warranty cost
- Product liability (Insurance)
- Consumer affairs
- Field service
- Product returns, recalls.

evolution of quality management

(i) Inspection:
→ One or more characteristics of product is examined compared with specific required
→ Done in manufacturing process > incoming goods.
→ Goods not conforming to specification > scrapped, reworked

(ii) Quality control
→ Raw materials and intermediate stage product testing
→ Process control
→ Self inspection by operator
→ Performance data
→ Feedback information to operators, supervisors

(iii) Quality Assurance:
→ Plan to provide adequate confidence that the product will satisfy the requirement of quality.
→ Includes:
• Statistical Process control
• Analysis of failures
• Use of quality cost
• Advance quality planning
• System audits and third party approval

(iv) Total quality management:
→ Application of quality management principles to all aspects of the business.
→ QM is defined; aspect of overall management function that determines and implements quality policy; responsibility of top management
→ Improve sales, finance, personnel, partnership
→ Aspects: costs, safety, prompt service, design, environment protection etc.

Stages of quality control

- Input (Incoming goods, services and information)
- Process (In process)
- Output (End product)

Tools for quality control:

- Well written specification
- National and International standards (codes): NS, ISI, BSI, ISO
- International organizations: WHO, UNO, FAO
- Procedural guidelines
- Training

Quality system:

→ Provision to ensure quality is protected and promoted throughout the activities

Quality plan:

→ Document to specify quality practices, resources, and sequences of activities relevant to a particular product, service, contract or project.

→ Should define:

- Quality objective
- Allocation of responsibilities
- Methods used
- Testing, inspection, audit programs
- Method of modification
- Other measures; meet objective

Quality circle:

→ Group of employees who meet regularly for about an hour every week to discuss, identify, analyze and resolve work related problems > improvement in total performance > enrichment of their work life

→ Technique of participative management for improving quality, quantity, efficiency, safety.

Quality Management Tools (B.C.P.C)

(i) Brain storming:

→ Idea-generating process through group creativity

(ii) Cause and effect analysis:

→ For investigating root causes of problems

→ Eradicate it

(iii) Process Flow chart

→ Process converts input into output by doing work

→ FC helps to picture a process where overlaps, duplication and iterative loops are easily identified.

(iv) Check list

→ Collection of different activities accompanied with required quality standards in each activity expressed in a sequential order

→ Each item is checked with stipulated performance standard

4.5 Project Control Cycle:

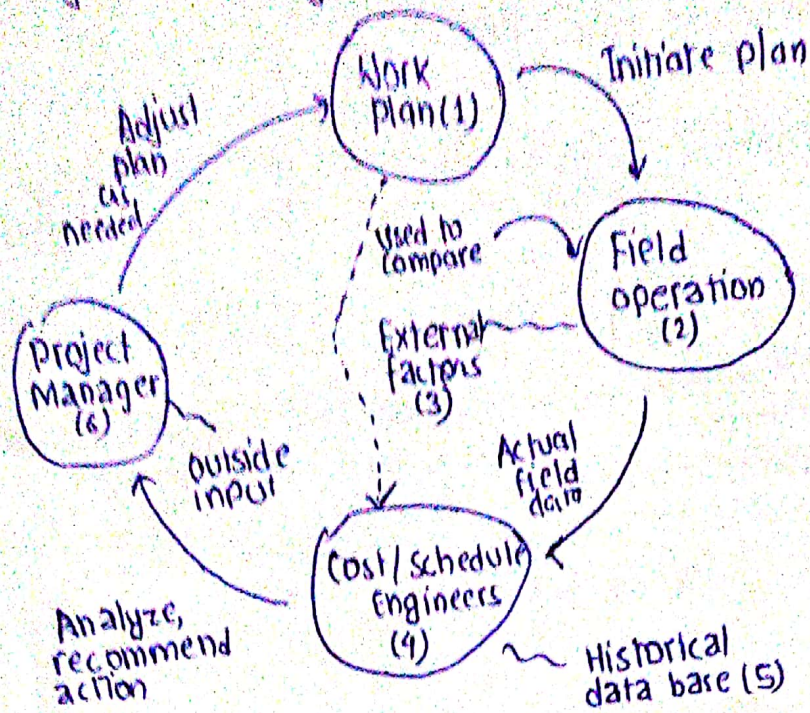


Fig: Project control cycle

Item (1):

- Includes budget, schedule and other planning information
- Equipment, people and materials needed at job site

Item (2)

- Initiate field operation
- Utilization of resources monitored by supervisors

Item (3)

- Impacts of external factors (strike, vandalism, bad weather) on field operation

Item (4)

- Coordination of data field and comparison with initial plan.
- Technical people who established initial work plan are responsible for recommending adjustments to plans.

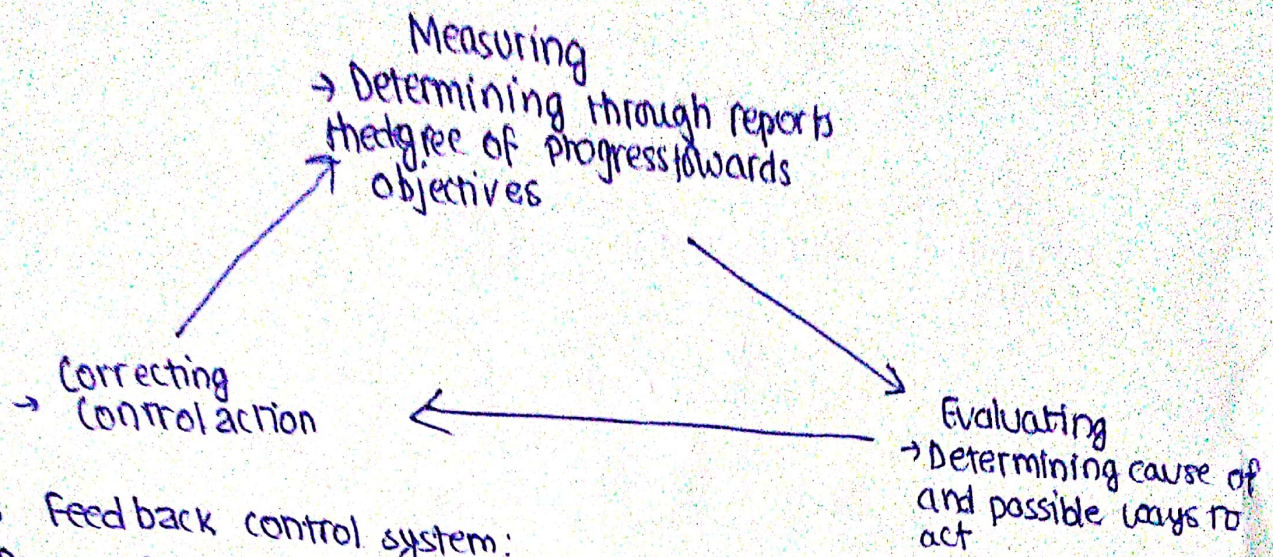
Item (5)

- Permanent storage of information for use in future

Item (6)

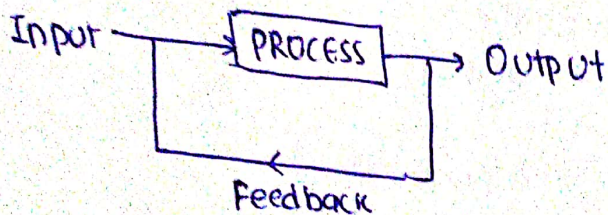
- Final decision point in control process
- Goal of the PCS is to deliver the decision makers accurate & timely project status information
- Measurement of actual progress
- Management now decides best course of action to be taken.

Project control system cycle:



4.6 Feed back control system:

→ Process of extracting information from the output level and feeding it back to the input level.



- Backward looking method of analysis
- Due to disturbances, the output of a project may not be similar to the planned ones.
- In FCS, the difference between them is obtained by subtracting plan data from implementation data to be given a positive or negative variance.
- Information is given to the concerned person, who take corrective actions.
- Comparison is made between:
 - (i) Scheduled and actual start dates
 - (ii) scheduled and actual time of activity
 - (iii) Scheduled and actual milestones
 - (iv) Estimated and actually spent quantity of materials
 - (v) Budgeted and actual cost
 - (vi) Budgeted and actual man hours
 - (vii) Budgeted and actual unit cost

- Process of controlling the expenditure in a project at all stages seems to increase through its development
- Controlling changes to project budget.
- Small firms: Tighter monetary control (fewer projects, risk, failure high)
- Large firms: Less sophisticated control system
- CC, concerned with
 - Influencing the factors which create changes.
 - Change in cost baseline
 - Managing changes

Cost control and time:

→ As project advances, chance of reducing cost reduces

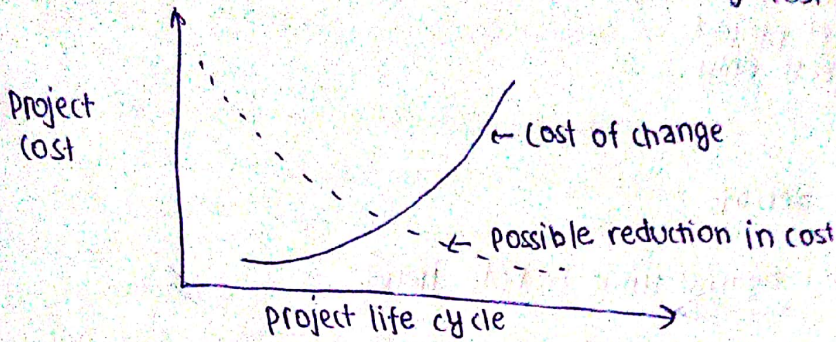


Fig: Cost Reduction analysis

Inputs to cost control

1. Cost baseline
2. Performance reports
3. Change request

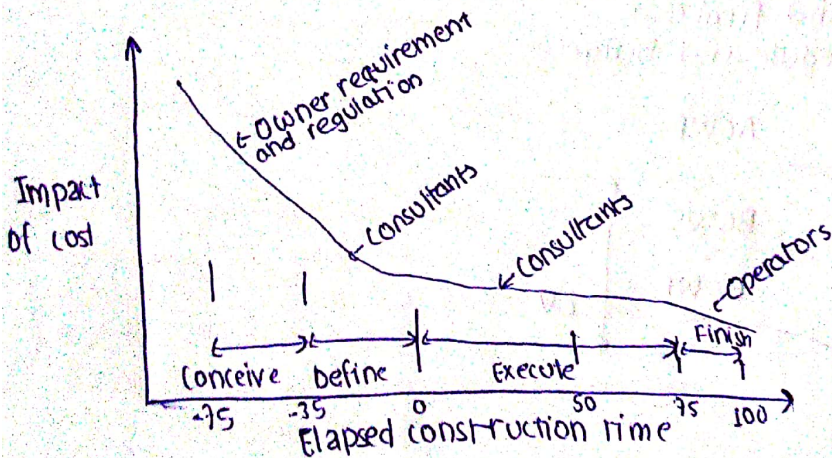


Fig: Ability to influence cost

Elements of cost control (O C I C)

1. Observations:
 - on material consumed, manpower and equipment employed etc.
2. Comparison
 - Observed data compared with designed standard (variance)
3. Identify reasons for variance
 - check purchase price of materials, quality, wastage, work condition etc.
4. Corrective action
 - Bringing cost back in track. → Re-scheduling of projects.

4. Methods of cost control

1. Short term planning and control:
 - Project is broken down in smaller components
 - Short term plans are made for weeks and days
 - Such plans are easy to monitor and evaluate
 - less degree of uncertainties.

2. Accounting method of control

(i) Overall profit/loss account:

- is prepared after project is completed.
- Profit/loss determined > Reasons determined
- Informations are used for next project
- generally used for small projects only

(ii) Profit/loss on evaluation date

- Accounting is done for various periods
- large project.
- PL for every month > plotted against time to note trend.

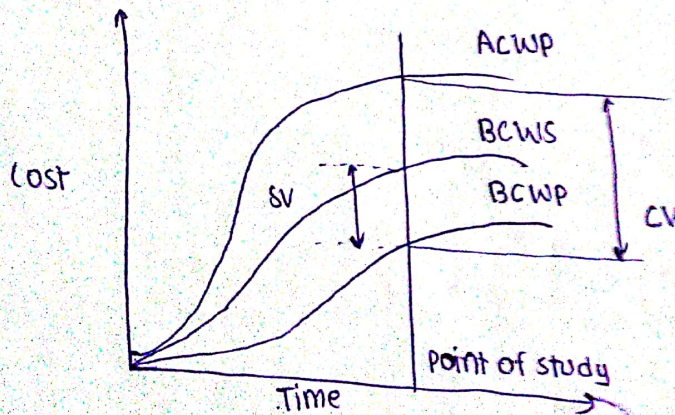
(iii) Unit costing:

- Unit cost of each item is checked
- Compared with planned cost of item

3. Project cost models

(i) Earned value analysis (EVA)

- Is a method of measuring a project's progress at any given point of time
- forecasting its completion date and final cost
- Analyzing variances in the schedule and budget.



Earned value analysis

- BCWS (Budgeted cost for work scheduled) (Planned value)
 - Budgeted amount of cost for work scheduled to be accomplished + amount of effort scheduled
 - simply, value of work that should have been done at a given time i.e. expected expenditure at given point of time
- BCWP (Budgeted cost for work performed) (Earned value)
 - Value of work done at a given point of time
 - Budgeted amount of cost for completed work + Budgeted level of effort

ACWP (Actual cost for work performed) / Actual value:

→ Actually spent in completing work within a given time period

Variances:

1. Cost Variance (CV) = BCWP - ACWP

2. Schedule Variance (SV) = BCWP - BCWS

• $CV(\%) = (CV/BCWP) \times 100$

• $SV(\%) = (SV/BCWS) \times 100$

• Schedule performance index (SPI) = BCWP / BCWS

• Cost performance index (CPI) = BCWP / ACWP

New duration estimate = Original time estimate / SPI

New cost estimate = Original cost estimate / CPI

4.8 Work breakdown structure (WBS)

→ Organize the project process efficiently

→ The manner in which project is structured

→ Systematic and logical breakdown of a project into several components by dividing a project into major components, each of which is further sub divided into smaller components

→ First step in planning the execution of project.

→ Every major & minor activities are well accounted.

→ Project manager.

→ The smaller components should be:

• Manageable → special authority and responsibility can be assigned.

• Independent → Minimum interference and dependency on other ongoing elements

• Integratable → Total package can be seen

• Measurable in terms of progress

Advantages / Uses of WBS

→ Planning can be done

→ Costs and budgets can be established.

→ Risk analysis can be done

→ Control and contract administration

→ Establishment of schedules

→ Network analysis

→ Responsibility matrix

→ Coordination can be established

→ When summed up, total plan can be described.

Role of WBS:

→ Improve accuracy to estimate cost

→ Collecting and organizing actual cost.

→ Performance measurement and control

→ Distribution of responsibility.

Levels of WBS:

→ Six level structure

1. Total program
2. Project
3. Task
4. Sub tasks
5. Work package
6. Level of effort

} specified by project management office

} contractor

Eg:

eg-2

Characteristics of WBS:

- Top three levels: Integrated effort not department specific
- Sum of all elements in one level = sum of all work in next lower level
- Each element of work should be assigned to one and only one level of effort
- Must be accompanied by description of the scope of effort required.

Preparation of WBS

→ In setting up WBS, tasks should:

- Have clearly defined start and end dates
- Be usable as communication tool
- Be estimated on a "total" time duration
- Be structured so that a minimum of project office control and documentation is necessary.

Work package characteristics:

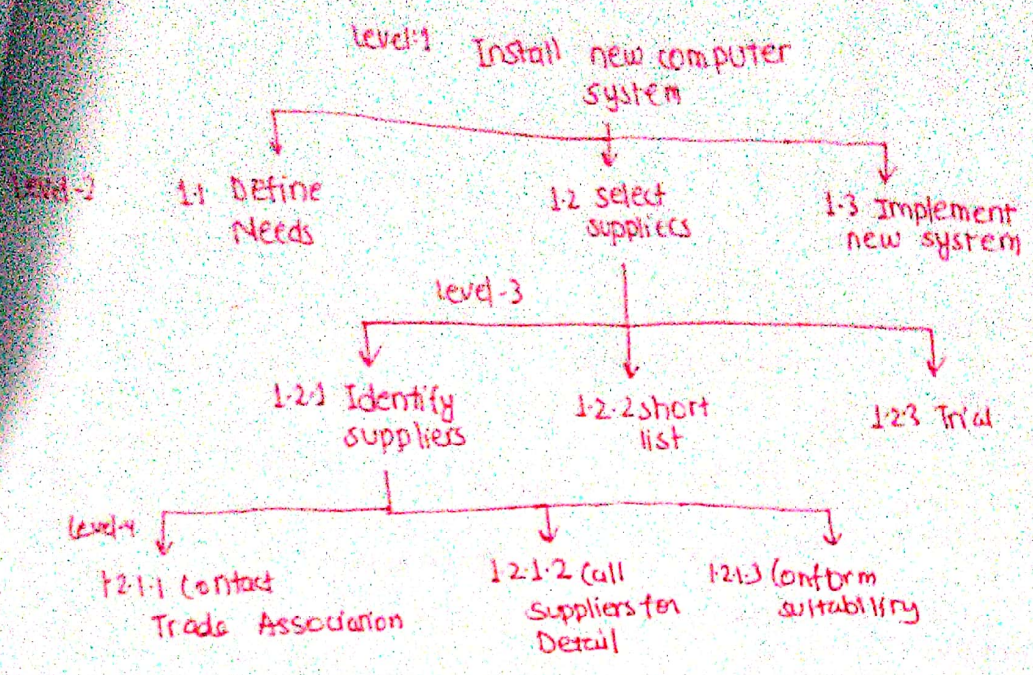
- Represents units of work at the level where the work is performed.
- Clear date of commencement and end
- Specifies budget.
- Limits the work to be performed to relatively short periods of time
- Clearly distinguishes one work package from all others assigned to a single functional group.

Criteria for developing WBS.

- Easy to understand
- All schedules should follow WBS
- No attempt should be made to subdivide work arbitrarily to the lower possible level.
- Maintain flexibility
- WBS can be used to segregate recurring from non-recurring costs.
- Most WBS elements range from 0.5-2% of total project budget (lowest control level)
- Can act as tangible milestones

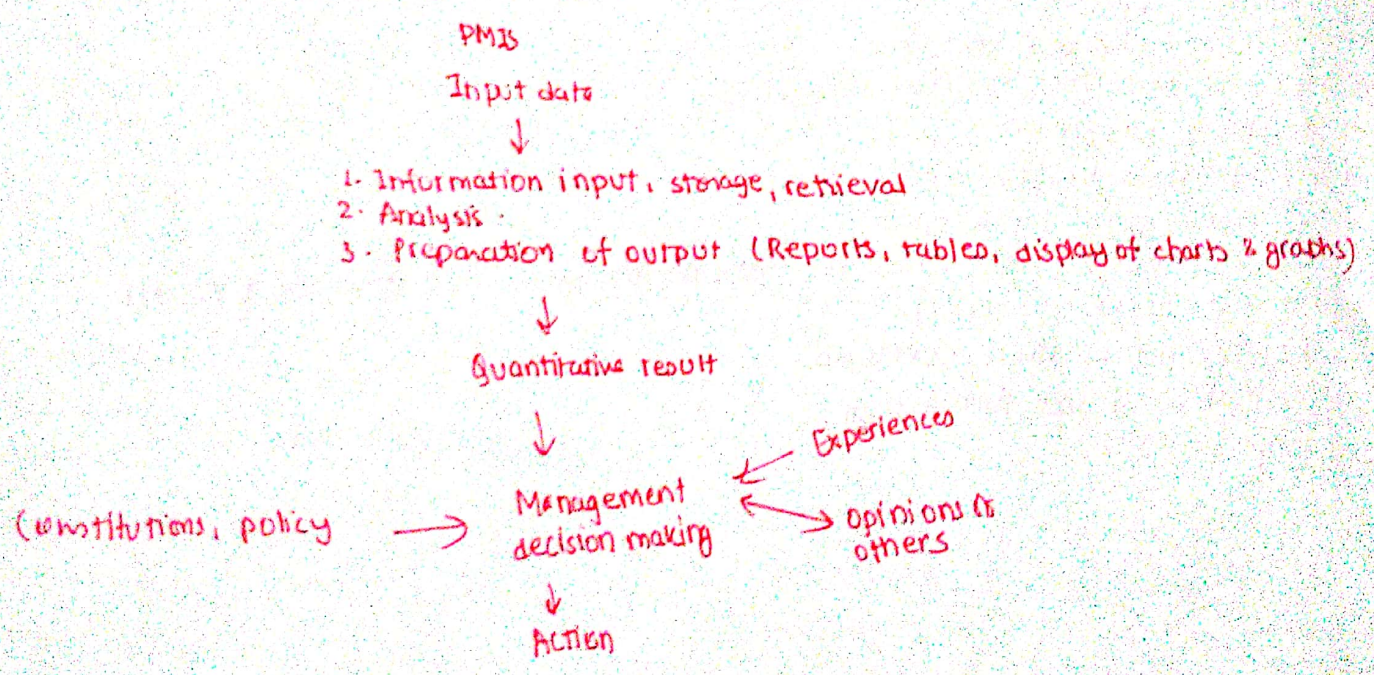
Tree diagram

Eg:



4.9 Project Management Information System (PMIS)

→ System of database for project to obtain, abstract, store, retrieve and analyze data to produce information for the use by managers in planning, controlling and decision making



Objective of PMIS

- reduce project duration
- make better use of resources
- increase resources productivity
- decrease cost
- bring new facts to the knowledge
- Reduce uncertainty in decision making

- ### ii) Aim of PMIS
- Effective communications with the users
 - Reliable and logical data supply
 - Essential information and feedback
 - Clear interpretation of feedback
 - Rational analysis of information

- ### iii) Requirements
- Report on achievement & deviations should be quick hitting
 - Appropriate information with required accuracy
 - Strive to pinpoint root causes
 - Easily understandable and usable
 - Should predict potential presence of deviations and disasters
 - Well coordinated (communication)
 - Consistent with project policies, procedures and guidelines.
 - Provide information in standardized form
 - Provide " " on cost, time, performance
 - Decision and expectation oriented.
 - Reflect management needs for making & executing decisions in management of project resources.

- ### iv) Advantages
- Promotes understanding
 - Quantifies risk
 - Comprehend change in project
 - Basis to monitor evaluate progress
 - Identify problem
 - helps to make better decision
 - facilitates project planning
 - informs project stakeholders about progress & status of project
 - simplifies project control.
 - Reduces information overload.
 - facilitates project transaction.
 - targets control.

Chapter 5

5-1 Introduction: (Project Risk)

- Chances of things not turning out to be exactly as planned
- combination of the probability of negative events and its consequences.

$$\text{Project Risk} = \sum (\text{Events} \times \text{Probabilities} \times \text{Events}) \text{ (consequences)}$$

- Lack of predictability about problem structure, outcomes or consequences in a decision or planning situation.
- Includes both threats to the project's objectives and opportunities to improve on those objectives

Risk management:

- Systematic process of planning for, identifying, analyzing, responding to and monitoring project risk.
- Art and science of identifying, assigning and responding to risk throughout the life of a project and in the best interests of meeting project objectives.

→ Includes;

- Risk identification
- Risk quantification
- Risk response development
- Risk response control

- Involves process, tools, techniques that will help the project manager maximize the probability and consequences of positive events and minimize the " " " " adverse events.

→ subset of project management.

Why? (Importance)

- supports sound business, program management and engineering processes
- allows management to be proactive than reactive
- Enables honest and open communication among all stakeholders, both internal and external to organization.
- Improve project success.
- Minimize potential risks and maximize potential opportunities.

A Project Risk Management (PRM):

- Means of improving the likelihood that a project will be completed on time and within budget, combined with mechanisms for mitigating risks uncovered during risk management.

Benefits:

- Probabilistic approach for project completion date and budget rather than single value
- Major risks identified > Mitigating actions

- Team building and communication
- # Performed by impartial third party experts.
- # Uncertainties include:
 - Questions of material & parts quality
 - Delays in delivering sufficient materials
 - Budgetary and personnel changes

Stage of PRM

- (i) Risk assessment:
 - Can take place at any time during the project
- (ii) Risk control:
 - cannot be effective without a previous risk assessment

5.2 Nature of project risk:

1. Nation / Region:

- (i) Political situation - War, revolution, civil disorders inconsistency of government policy
- (ii) Economical and financial situation: GNP decreases, Per capita ↓, interest rate fluctuation, Inflation rate ↑, currency exchange rate fluctuation, tax rate ↑
- (iii) Social Environment: Crime, bribe, corruption.

2. Construction industry

- (i) Market fluctuations: Demanding decreasing structure changes
- (ii) Law and regulations: Import/Export restriction
- (iii) Contract system: Non standard contract form; difference in legal relationship between partners
- (iv) Standard and codes: Inconsistencies of design, Differences in safety and health care, pollution

3. Company:

- (i) Employer / Owner: Unclear requirements, funding shortage
- (ii) Architect: Unclear detail design; unfamiliar with local standards and codes
- (iii) Labor and sub contractors: Disturbances / strikes

4. Internal:

- cash flow unbalance
- Human resource shortage

5. Materials & Equipments: Unfavourable sub suppliers, Faulty materials supply.

6. Project

- (i) Defective physical works: poor design, damages by human errors, defective materials, no quality control

- (iii) Schedule delay: Incomplete design, late construction, bad weather.
- (iv) Cost overruns: Labour/material price fluctuation, inaccurate estimation, inadequate insurances.

7. Force Majeure:

Earthquake, fire, flood. (difficult to predict)

5.3 Types of project risks:

1. Construction phase risk:

(a) Completion risk

- Greatest risk for financier
- Such delays increases may delay loan repayment.

Mechanism for minimizing it:

- Completion guarantees (pay all debts and liquidated charges)
- Ensuring sponsors have a significant financial interest in the success of project > so they remain committed
- Requiring the project to be developed in time within budget contracts, secured by performance bonds or guaranteed by third party.
- Experts' report on design and construction of project
- Evaluation of works in different stages to ensure that the construction is progressing as planned.

2. Operation phase risk

(a) Resource / Reserve risk:

- Inadequate inputs for a project.
- Eg: less mines, less passengers for railway.

reserves for

Minimization method

- Experts' report
- Correct estimates based on survey and other empirical evidence.
- Long term supply contracts
- Obtaining guarantees that there will be minimum level of inputs
- "Take or pay" off-take contracts.

(b) Operating risks

- Increase in operating costs
- No capacity to continue to generate the quantity and quality of the planned output
- Eg: Shortage of skilled labor.

Minimize methods

- project to be operated by reputed and financially sound operation.
- Performance secured by performance bonds.

- Project to be operated by reputed and financially sound operation.
- Performance secured by performance bonds.
- Provision of detailed reports on operations of project
- Controlling cash flows by requiring the proceeds of the sale product to be paid into tightly regulated proceed account to ensure the funds are used for approved operating costs only.

(c) Market/Off-take risk:

- Risk that a buyer cannot be found for the product
- Minimized by acceptable forward sales contract.

3. Risks common to both construction and operation phases.

(a) Participants / Credit Risk:

- Risks associated with sponsors and borrowers.
- whether they have sufficient resources to manage construction and operation of project.
- Minimize: Financiers need to satisfy themselves that the project participants have necessary human resources, experience in past and are financially strong

(b) Technical risk

- Technical difficulties in the construction and management / operation of projects plants and equipments.
- Minimized by:
 - Preferring tried and tested technologies to new unproven technologies.
 - Experts reports on the proposed technology
- Are managed during loan period by requiring maintenance retention account.

(c) Currency risk:

- Depreciation in loan currencies. (Increase cost of construction)
- Depreciation in revenue currencies.
- Minimized by
 - Sales contract currencies and supply contract currencies; (same)
 - Denominating loan in most relevant currency
 - Requiring suitable foreign currency hedging contracts to be entered into

(d) Regulatory / Approval Risks:

- Government licenses & approvals not being issued
- Excessive taxation or rigid requirements as to local supply and distribution.
- Minimized by:
 - Obtaining legal opinions confirming compliance with applicable laws

Inputs to cost control

1. Cost baseline

(e) Political risk

→ Political instability, strikes, suspension of foreign currencies.

Minimized by:

→ Requiring host country agreements that project will not be interfered.

→ Political risk insurance

→ Involving financiers from different countries.

(f) Force Majeure risk

→ Unpredictable risk which can render the operation or construction of project either temporarily or permanently.

Minimized by:

→ Conducting due diligence as to the possibility of the relevant risks

→ Allocating such risks to other parties.

5.4 Analysis of major source of risk:

1. Change in project scope and requirements:

→ As a project progresses, team may later find that the scope and requirements should be revised due to user requirements, technical feasibility etc.

Effect: Increased cost, delay.

2. Design errors and omissions

→ Unintentional errors

→ Eg: Improperly sized equipments, design calculation error

3. Inadequately defined roles and responsibilities.

→ Changes in project management structures

→ Inadequately defined roles

→ Eg: Ineffective project communication, different expectation, lack of common direction.

4. Inaccurate costs and schedule estimates.

→ Due to ineffective project planning

→ Effect: Entire project will go in wrong direction, giving birth to many issues, delay, increased project cost, incorrect project time line and budget.

5. Insufficient skilled staff:

→ Affects project at the implementation stage

→ No technical knowledge, effective management expertise and problem solving skills

→ Inefficiency

6. Force Majeure

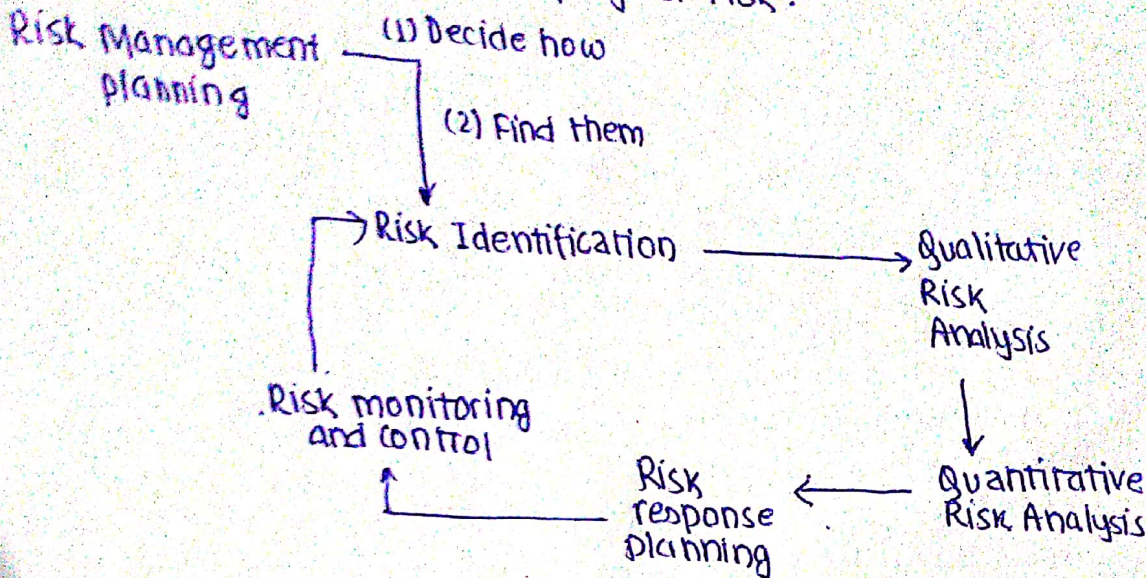
→ Risk that is uncontrollable

→ Act of God, civil disorder, war, national emergency, omission of government authority, fire, explosion flood.

... of government authority, war, national emergency, omission
of fire, explosion flood.

7. New technology:
- Hard for a team to predict risks.
 - Change strategy of project
 - Increased project costs and time

5.5 Effective Management of project risk:



(i) Risk Management planning:

- Project development team assign project team members to create a project risk management plan

- It identifies and establishes risk in the project plan
- Use a spread sheet that shows risks and responses in abbreviated form

(ii) Risk identification:

- Identifying potential project risks and documenting them
- Use sample risk list, own knowledge, consulting experts
- Considering risks, methods (opportunities), symptoms & warning signs that indicate the risk is likely to occur.

(iii) Qualitative and quantitative analysis:

- Qualitative:
 - Assess the importance of identified risks
 - Developed prioritized lists
 - Probability of occurring
 - Impact on project's objectives.
 - Sort risks in high, moderate & low risk categories.
- Quantitative:
 - Numerically estimating probability that project will meet its cost and time objectives.
 - Statistical techniques
 - Specialized softwares.

Risk impact:

- Risk hazard is materialized > results in risk impact
- Eg: Risk hazard: Insufficient numbers of skilled labor
Risk impact: Extending the schedule of the project
- expressed as qualitative rating; high, medium, low.
- Depends on opinion of managers
- Also expressed as numerical measure between 0 and 1.

→ 0: Not serious, 1: Catastrophic

$$\rightarrow CIF = W_1 \times TI + W_2 \times CI + W_3 \times SI \quad (\text{Assume risk impacts are independent})$$

where,

CIF = Composite impact factor

W_1, W_2, W_3 are valued from 0 to 1 and $W_1 + W_2 + W_3 = 1$

TI = Technical impact

CI = Cost impact

SI = Schedule impact

→ CIF = 0 "no impact"

CIF = 1 "The most severe impact"

Risk Consequences:

→ (can be expressed in

(i) as a simple numerical rating

$$RCR = CLF + CIF - (CLF \times CIF) \quad (0-1)$$

RCR = Risk consequence rating

CIF = Composite impact factors

CLF = Composite likelihood factors

RCR > 0.7 : High risk project

RCR < 0.2 : Low risk project

RCR = 0.48 : Moderate level risk.

(ii) Risk Consequence = Impact x Likelihood

→ Risk consequence on project duration and project cost are risk time, RT and risk cost, RC respectively

RT = Corrective time x Likelihood

RC = Corrective cost x Likelihood

Note:

If corrective ^{time} and cost cannot be estimated, then

Expected project completion time, ET = BTE (1 + likelihood)

Expected project completion cost, EC = BCE (1 + likelihood)

BTE = Baseline time estimate

BCE = Baseline cost estimate

BLE = Baseline cost estimate

(iv) Risk response planning:

- focuses on high risk items
- Identified and assigns parties to take responsibility of each risk response.
- Identifies best strategy for risk
- And design specific actions to implement strategy
- Strategies and actions:
 - (a) Avoidance:
 - Eliminate risk, protect project objectives from its impact.
 - Achieve this by changing scope, adding time & resources
 - (b) Transference:
 - Transfers financial impact of risk
 - Insurance
 - (c) Mitigation
 - Reduce the probability of a risk event and its consequences to an acceptable threshold
 - (d) Acceptance:
 - Accept certain risk
 - Risk donot change project plan to deal with risk

(v) Risk Monitoring and control

- Keeps track of identified risk, residual risk and new risks.
- Execution of RRP and evaluates effectiveness
- continues for the whole life.

Terminologies:

1. Risk management plan (RMP):

- Document prepared after risk management planning meetings
- Describes way, mechanism of performing risk identification, analysis, response planning, monitoring and controlling mechanism.

2. Risk register (RR)

- A record to document results of risk management process
- Contains:
 - List of identified risks with description
 - List of potential responses
 - Root causes of risk
 - Updated risk categories.

3. Contingency plan

- Developed in advance to respond to risks that arise during project
- The most usual risk acceptance response is to establish a contingency allowance or reserve
- Allowance; determined by impact (computed at an acceptable level of risk exposure, for the risks that have been accepted).

Chapter: 6

6.1 Project Finance:

- Financing in which lenders look primarily to the cash flows and assets of that project as the source of payment of their loans.
- Long term financing of infrastructure and industrial projects based on the projected cash flows of the project rather than the balance sheets of the project sponsors.
- Involves equity investors (sponsors) and syndicate of banks that provides loan (non-recourse loans mostly)

Conventional financing

- Cash flow from different assets and business are co-mingled (for payment of loan)
- End use of funds is not strictly monitored
- No monitor of performance and interested in only repayment of their money

Project financing

- Cash flow from the project related assets alone are considered for assessing the repaying capacity.
- Creditors ensure proper use of funds
- Keen to watch the performance of the enterprise and suggest remedial measures, if necessary.

6.2 Capital Budgeting:

- Firm's decision to invest its current funds most efficiently in long term activities for future benefits over years.

Long term activities = Affects firm's operations beyond the one year period.

6.2-1 Nature of investment decision:

- (i) Investment in fixed assets
- (ii) Investment in current assets (x)

Capital budgeting evaluates in terms of expenditure and benefits.

Capital budgeting decision include following types of investment
→ Addition, Disposition, modification, replacement of assets in long term basis.

- Introducing a new product
- Expanding the business

• Different alternatives' comparison > Evaluation of alternatives (aim: Maximizing market value of the firm)

Criteria: Minimum rate of return

Market value ↑ if project yields a rate higher than min ROR.

Important of features of CB:

- Exchange of current fund for future benefit
- Funds-invested in long term activities
- Invested only if future benefits occur over series of years.

2.2 Importance of Capital Budgeting:

1. Have long term implications on the firm; Influence its risks complexion.
2. Involve commitment of large amount of funds
3. Irreversible decision:
 - Very difficult to find market for capital goods
 - Only solution: scrap the asset; incur loss
4. Among most difficult decisions:
 - Requires assessment of future events; difficult due to economic, political, social and technological forces.

2.3 Capital Budgeting Process: (CFSE)

→ Done by highest level of management.

(i) Project generation

- Development of proposal for investment decision.
- Proposal of any type from top management level to workers.
- Eg: Proposal of adding new equipment
- Healthy firm > continuous flow of profitable investment proposals.

(ii) Project evaluation:

- Done by experts
- Points to be considered:
 - Estimate cash flow
 - Selection criteria
 - Estimated benefit over cost

→ Steps:

- Estimation of benefit and costs in terms of cash flow (Time value of money)
- Selection of appropriate criteria to judge the viability of the project.

→ Risk associated should be handled

→ Criteria; consistent with firm's objective of maximizing its market value.

(iii) Project selection

- Vary from firm to firm
- Top management committee for approval
- However, projects are screened at different levels

(iv) Project execution:

- Funds are appropriated for capital expenditure.
- Plans are made by project execution committee or top management
- Ensure funds are spent appropriately after getting permission
- Monthly budget reports

6.3 Investment decision criteria

↳ Evaluation criterias:

- Provide ranking of projects in order of their viability.
- Solve the problem of choosing among alternative
- Acceptable to any investment project
- Bigger benefit than smaller ones; early benefits than latter ones
- Means of distinguishing between acceptable and unacceptable projects.

A. Traditional criteria

a. Payback period:

- Number of years required to recover the original cash outlay invested in a project.
- If annual cash inflow is constant,

$$\text{Pay back time} = \frac{\text{Cash invested}}{\text{Annual cash inflow}}$$

- If annual cash inflow is not constant,

$$\text{Pay back time} \Rightarrow \text{Time obtained by adding up the cash inflow until total} = \text{Initial cash outlay}$$

Advantages:

- Simple to understand
- Easy to calculate
- Costs less
- Less time
- Shorter payback period → A company can have more favorable short run effect on earning per share.
- Riskiness of project can be tackled by having shorter payback time
- Early recovery of investment (Emphasizes on)

Disadvantages

- Fails to account cash inflow earned after payback period.
- Does not consider entire cash inflow yielded by project
- Fails to consider pattern of cash inflow in terms of magnitude and time.
- Administrative difficulties to find maximum acceptable payback period
- Not consistent with the objective of maximizing market value

Acceptance rule:

- Two mutually exclusive projects; shorter pay back period; selected
- Ranking of project.

→ Simple payback period

- Discounted payback period.

- Why? (Important)
- supports sound business, program management and engineering process
 - allows management to be proactive than reactive
 - communication among all stakeholders, both

b. Accounting rate of return

$$ARR = \frac{\text{Average income after tax}}{\text{Average investment}} = \frac{(\text{Income} - \text{expenses} - \text{Tax}) / \text{No. of years}}{(\text{Original investment} + \text{Salvage}) / 2}$$

Advantages:

- Simple to understand
- Easy to calculate
- Readily calculated using accounting data
- Costless
- Uses entire income in calculation

Disadvantages:

- Ignores time value of money
- No use of cash flows
- Does not consider length of project lives
- Does not allow the fact that profit can be re-invested.
- Incompatible with firm's objective.

Acceptance rule

- $ARR > \text{Minimum rate (hurdle)}$

B. Discounted Cash flow (DCF) criteria

a. Net present value

- Present value of cash inflow and outflow are calculated
- NPV is difference between them

Advantages

- Considers all cash flow
- True measure of profitability
- Recognizes time value of money.

Disadvantages

- Tedious job
- Sensitive to discount rate
- Requires calculation of opportunity cost (difficult concept)

Acceptance rule:

- $NPV > 0$

b. Internal rate of return:
 → Rate which equates the PV of cash inflow with PV of cash outflow of an investment
 → Rate at which NPV=0

- Advantages:
- Considers all cash flow
 - Measures profitability
 - Time value of money
 - Consistent with wealth maximization principle

- Disadvantages:
- Tedious
 - Difficult to understand

Acceptance
 → $IRR \geq MARR$

c. Profitability index / (B/C ratio)

→ Ratio of PV of future inflow at required rate of return to present value of cash outflow.

Acceptance:

→ $BCR \geq 1$

Formula:

$$1. PV = A \left(\frac{(1+i)^N - 1}{i(1+i)^N} \right)$$

$$2. P = F(1+i)^{-N}$$

$$3. A = F \left(\frac{(1+i)^N}{i} \right)$$

6.4 Capital structure Planning:

6.4.1 Definition of terms:

1. Capital:
 - Wealth utilized for economic advantage
2. Equity capital (Common share):
 - Supplied by its owner in expectation that a profit will be earned and used
 - but there is no assurance that a profit will be earned.
3. Debt capital
 - Borrowed capital which must be repaid with a fixed rate of interest within a specific time.
 - Borrower does not share profit.

4. Bond:

- Long term debt given to the lender, stipulating the terms of re-payment and other conditions.
- Issued in unit of Rs 100 each, with a defined rate of interest.
- collateral → Less interest rate → financial, educational, gov, private comp.

5. Debentures:

- Unsecured bond or secured
- No collateral as security (Risk ↑)
- More interest rate
- Issued by private companies with strong credit position.
- Eg: Bonds issued by Himalayan bank.

Liquidity: First priority to bond holders then debenture holders

Convertible to shares: Debentures, Not in bonds.

6. Preference share capital.

- Characteristics of both equity and debt capital.
- Two types of dividends:
 - (i) Based on fixed %; paid after tax deduction
 - (ii) Based on earnings

Preference share

- Dividend % fixed
- First priority
- If bankrupt

- ① Loans
- ② Pr
- ③ Equity

- No trading in stock market
- No impact of increase or decrease in share price
- Lesser risk
- No voting rights

- Cannot be part of management
- Co-owners but no control
- Investment is done by financial institution, wealthy individuals, family offices

- Exit options
1. Company buyback
 2. Convertible to common equity

→ Why?

- Flexible to buy back

Equity share

- Depends on profit
- After preference of PSH

→ More risk.

→ Voting rights (Board of directors)

- Co-owners with control
- Institutional & Retail investors

1. Sell on stock market
2. Co. buy back.

- To raise capital w/o debt
- Reduce higher debt risk / Bankruptcy
- Don't have to pay fixed returns to members.

~~Internal rate of return~~

Capital structure planning:

- Financial planning
- Composition of long term sources of funds, such as debentures, debt, bonds, preference share, equity share. Capital including reserve and surplus.
- While planning, one needs decide:
 - Long term debt
 - Bond
 - Equity share
- Optimum capital structure

6.4.2 Basis for planning capital structure:

- Done in such a way that long term market price per share is maximized and interests of different groups of people is met.
 - Promoters
 - Creditors
 - Employees
 - Society and government

→ Capital structure is appropriate when debt-capital ratio = 47.45-75% (60±15%)

6.4.3 Features of sound capital structure:

1. Profitability
 - Should be advantages
 - Max. use of leverage (Debt/Equity) at a min. cost within the constraints.
2. Solvency
 - Debt threatens solvency > should be added only upto a level so that no risk
3. Flexibility:
 - Means firm's capital structure's decision ability to meet its dynamic need.
 - Company's capital structure should be flexible
 - Company should be able to adopt its capital structure without delay & cost
4. Conservation:
 - Cash flow ability of the company
 - Debt capacity of the company should not be exceeded
5. Control:
 - Should involve min. risk of loss of control
 - The risk of loss of control can be reduced by distributing shares widely and in small lots.

6.4.4 Determinants of capital structure

- ti) Leverage effect on earnings per share (EPS):
 - Use of fixed cost source to finance the assets of the company is leverage
 - Influence of EPS when debt or preference share capital is used against equity share capital is leverage effect

(i) Leverage effect on earnings per share (EPS):
→ Use of fixed cost source to finance the assets of the company is leverage
→ Influence of EPS when debt or preference share capital is used against equity share capital is leverage effect

→ Because: (a) Cost of debt is usually lower
(b) Interest paid on debt or bond is from pre tax profit.

(ii) Growth and stability of shares: sales:

→ Firm having stable sales can employ large debt

→ Eg. Consumer good industries

• Shows high fluctuations

• Do not employ large loans

public utilities

• Stable & predictable

• Employ large amount of debt

(iii) Cost of capital

→ Cheaper capital (usually debt)

→ But debt can be expensive when it reaches a point due to increased risk

(iv) Size of the company:

→ Small firm: Difficulty in raising long term loans.

• High rate of interest

• Highly restrictive covenants in loan agreements

• Inflexibility; Interference

→ Large firms: Flexible

• Can obtain loans at easy terms

• Can sell common shares, preference shares, debentures to public.

(v) Marketability:

→ Readiness of investors to purchase a particular type of security in a given period of time

→ Does not influence initial capital structure

→ Decide appropriate timing of security issues

→ Eg. If share market is depressed, company should not issue it, but debt and wait to issue common shares till the share market revives.

(vi) Floatation costs:

→ Incurred only when funds are raised.

→ Floatation costs of debt < Cost of floating an equity issue



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