

# **Chapter 1.0**

## **Introduction of Project and Project Management**

©

**Er. Subash K. Bhattarai**

**B.E Civil / PGDESD / MPA/ MSC Construction Management**



Some well Known  
Definition



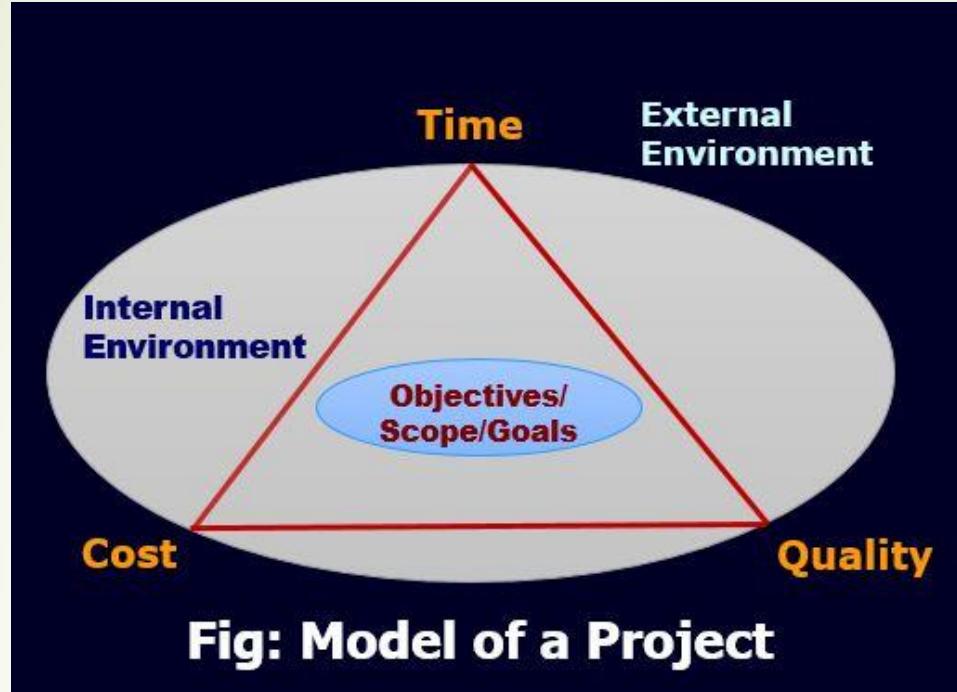
**“A project is a combination of human and non-human resources pulled together in a temporary organizations to achieve a specified purpose”**

**Cleland and King**

**“A project is a temporary endeavor undertaken to create a unique product or service”**  
**Project Management Institute of USA**

**For our purpose**

**A project is *any set of activities* designed to attain the specific objective within the constraints of *time, cost and quality* in a *dynamic environment*.**



### Resources (Inputs) for any Project

#### 5 M's

- Material
- Manpower
- Machine
- Money &
- Minute (Time)

### Resources (Inputs) for any Project

- Human resources
  - Skilled
  - Unskilled
  - Semi-skilled
- Non-Human Resources

# From where project originates?

Projects generally originates from Policy prior to Plan (Policy: reduction in load shedding)



# Always do Remember !!

A good project is that which is:

**Technically feasible**

**Economically viable**

**Socially acceptable**

**Politically suitable &**

**Environmentally friendly**

Because projects are considered as cutting edge of any development

Example of Project ??

A Hydropower project, A Dam Construction, An irrigation project, A residential Building Project, A training programme for IG and livelihood activities, an EQ resistant training programme for masons. Etc....

# 1.1 Characteristics of Project

- **Specific objectives**

- Project is carried out to meet certain objective/s. Objectives are heart of any project.

- **Life Span**

- Project starts at certain point of time and do complete. Usually project has fixed timeframe to deliver the output

- **Unique**

- No two projects are similar. Each project is unique. Uniqueness is due to different client, contractor, scope, areas, site location, cost, quantity, time etc.....

- **Constraints**

- Limitations are always there in any project. Time, cost and quality are major constraints

- **Flexibility**

- Projects are not rigid in nature. Flexibility in terms of cost, time and quality are there

# Characteristics of Project

## Resource Integration

Projects integrates and utilizes Human and Non-Human resources as per need.

## Planning and Control

Plan before do. Control on action with respect to what you have planned !  
**(PLAN-DO-CHECK)**

## Risk and Uncertainties

Every project is risky, meaning there is a chance things won't turn out exactly as planned. Uncertain events increases the chances of risk.

## Contracting and subcontracting

Package of contracts and sub-contracts. Main contract and divided into sub-contract

## Beneficiaries

Project has always a target group. For whom the project output is going to be delivered ??

## Progressive elaboration

There is always a space for improvement. A project may be further progressively elaborated

# 1.2 Classification of Project

Project can be classified into many types. Various ways of classifying project are as follows:

**According to  
Sponsorship  
(Who Sponsors??)**

Customer sponsorship

- Sponsorship by an individual or a party

Organization

- By firm, company

Contractor

- To sub contractor

Government Organizations

- Department, office

International Non-Government organizations

- Non-governmental Organizations

## According to Nature (assigned to whom???)

### Individual

- Assigned to a single employee in an organization

### Staff

- Assigned to a group of employee within same department

### Special

- Authority assigned to external expert/specialist/consultant

### Complex

- Assigned to staff from many departments

## According to Orientation (end result or output ??)

### Product

- Manufacturing or engineering

### Process or Service

- Training or income generation activities

## According to Speed (Time Schedule ??)

### Normal

- In normal time frame

### Crash

- Decreasing the time with increase in cost or resources

### Disaster

- Working on crisis, emergency.  
Through round the clock.



## **According to Funding source (Participation, Loan, Grant or Subsidy??)**

- Mega
- Major
- Medium
- Small
- Micro

### **Indigenous**

- FUNDED FROM OWN SOURCE

### **Foreign**

- Joint venture
  - Usually For Private Construction Partners (International Contractor JV Nepali Contractor, Hazma JV Shrestha Contractor For Road)
- Bilateral
  - Two Countries (JICA, GIZ, DFID, KOICA)
- Multilateral
  - Multiple Countries (UN AGENCIES, ADB, WB)

## **According to Size**

## According to Technique

### Labor Intensive

- Labor based. 80 % human resources and 20 % capital (money or equipment)

#### Advantages of labor intensive

- Employment generation
- Decentralization
- Favorable distribution of income
- More production in cheaper rate
- Saving foreign exchange
- Better utilization of local resources
- Scope of employment for women (gender and social inclusion)

#### Disadvantages of labor intensive

- Static and short term in nature
- Income to the people having low marginal tendency to save
- No possibility of improved and advanced skill enhancement

### Capital intensive

- Capital based. Machine and equipment. 80 % capital and 20 % HR

#### Advantages of Capital intensive

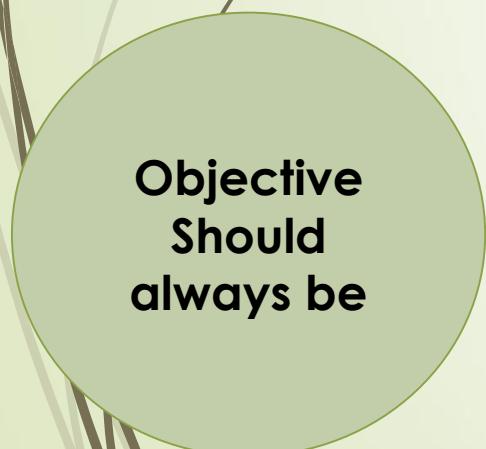
- Rapid growth of economy
- Modern and efficient method of production
- More profitable
- Skill development
- Far reaching effect
- Faster rate of construction

#### Disadvantages of Capital intensive

- Needs huge capital
- adverse effect on balance of payment
- Pollutions

# 1.3 Project objective and Goal

- ▶ **Goal (TARGET)**
  - ▶ Goal provides direction to project
  - ▶ It guides action of project
  - ▶ Goal is the end result to be achieved
- ▶ **Objective**
  - ▶ Setting of objective is to meet the GOAL
  - ▶ A specific result that a person or system aims to achieve within a time frame and with available resources.
  - ▶ In general, objectives are more specific and easier to measure than goals.

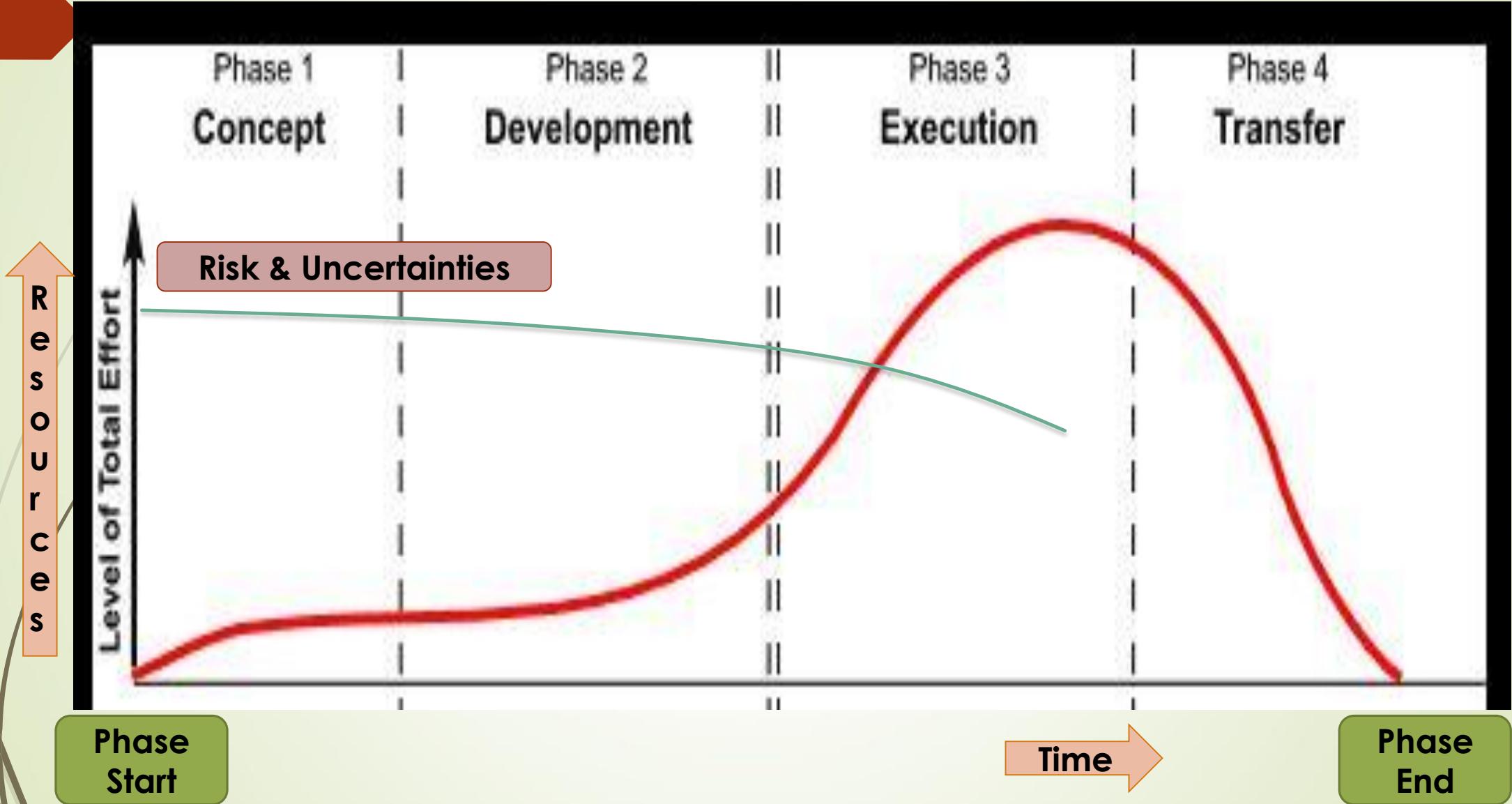


# 1.4 Project life cycle phases

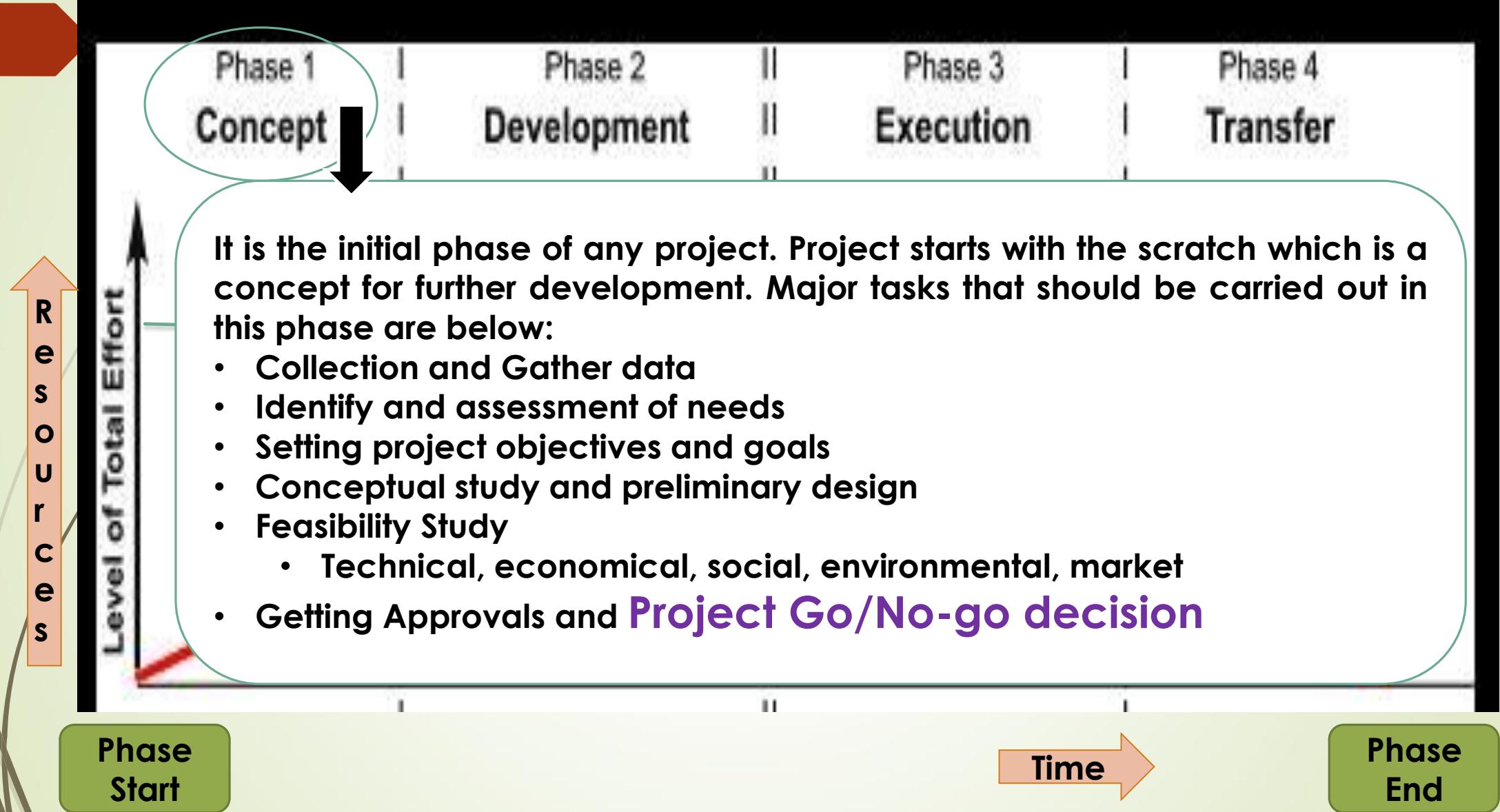
- ▶ Every project has certain phases of development.
- ▶ A clear understanding of these phases permits managers to better control of project resources in achieving the desired objective and goals.
- ▶ The phases of development collectively is known as project life cycle project life cycle phases.
- ▶ In general, every construction project has 4 different phases of development.
- ▶ Phase starts with project initiation and ends with project termination.
- ▶ The phases of project life cycle are
  - ▶ Project initiation or concept **C**
  - ▶ Project planning or development **D**
  - ▶ Project implementation or execution **E**
  - ▶ Project termination/transfer or close out or finish **F**

The project life cycle phases is defined as in figure

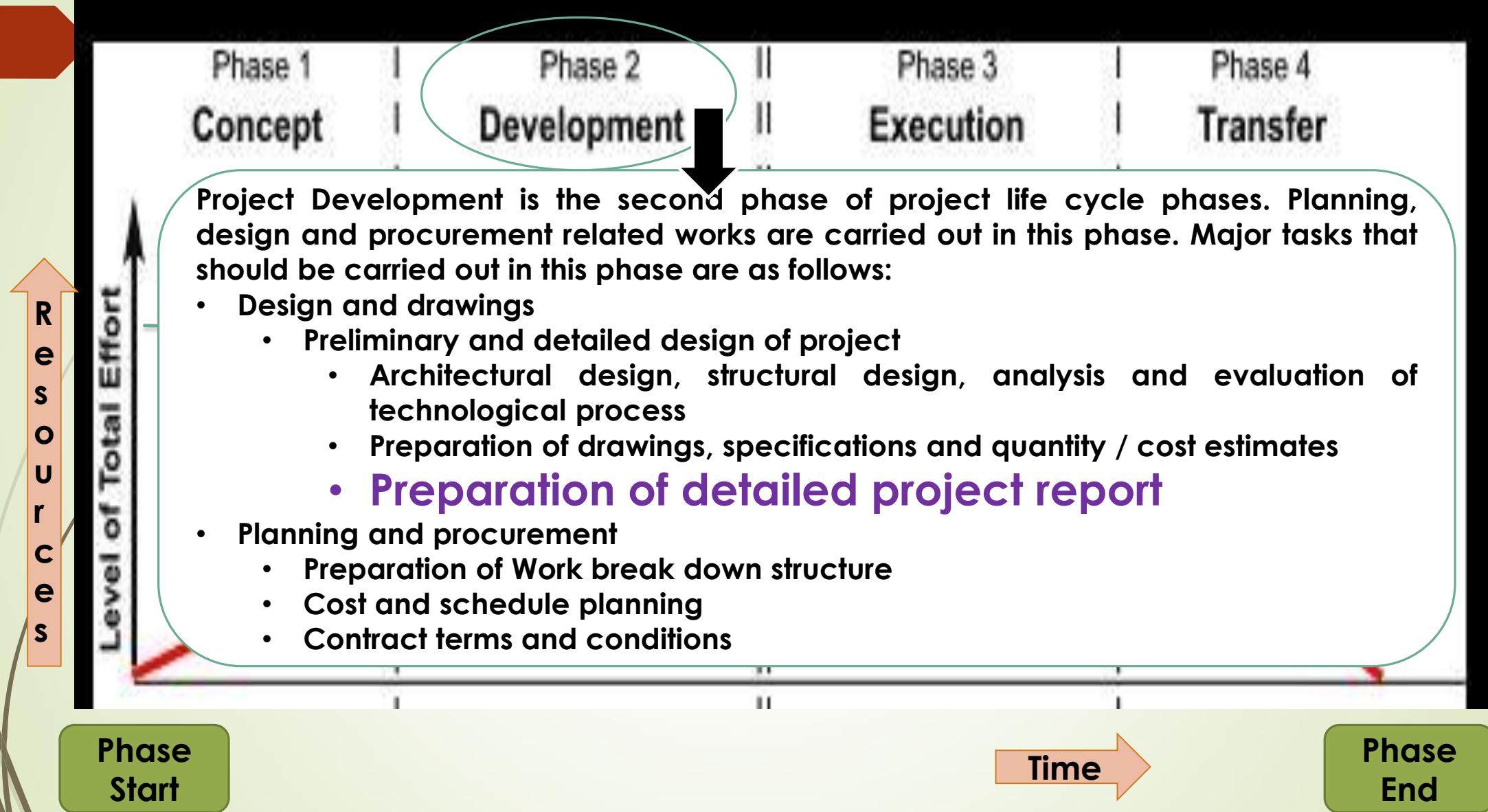
# Project life cycle phases



# Project life cycle phases



# Project life cycle phases



# Project life cycle phases



Project Execution is also known as project implementation. Relatively this is the longest phase in project life cycle. This phase includes application of paper work (DPR prepared in earlier phase) physically in the real field. Major tasks that should be carried out in this phase are as follows:

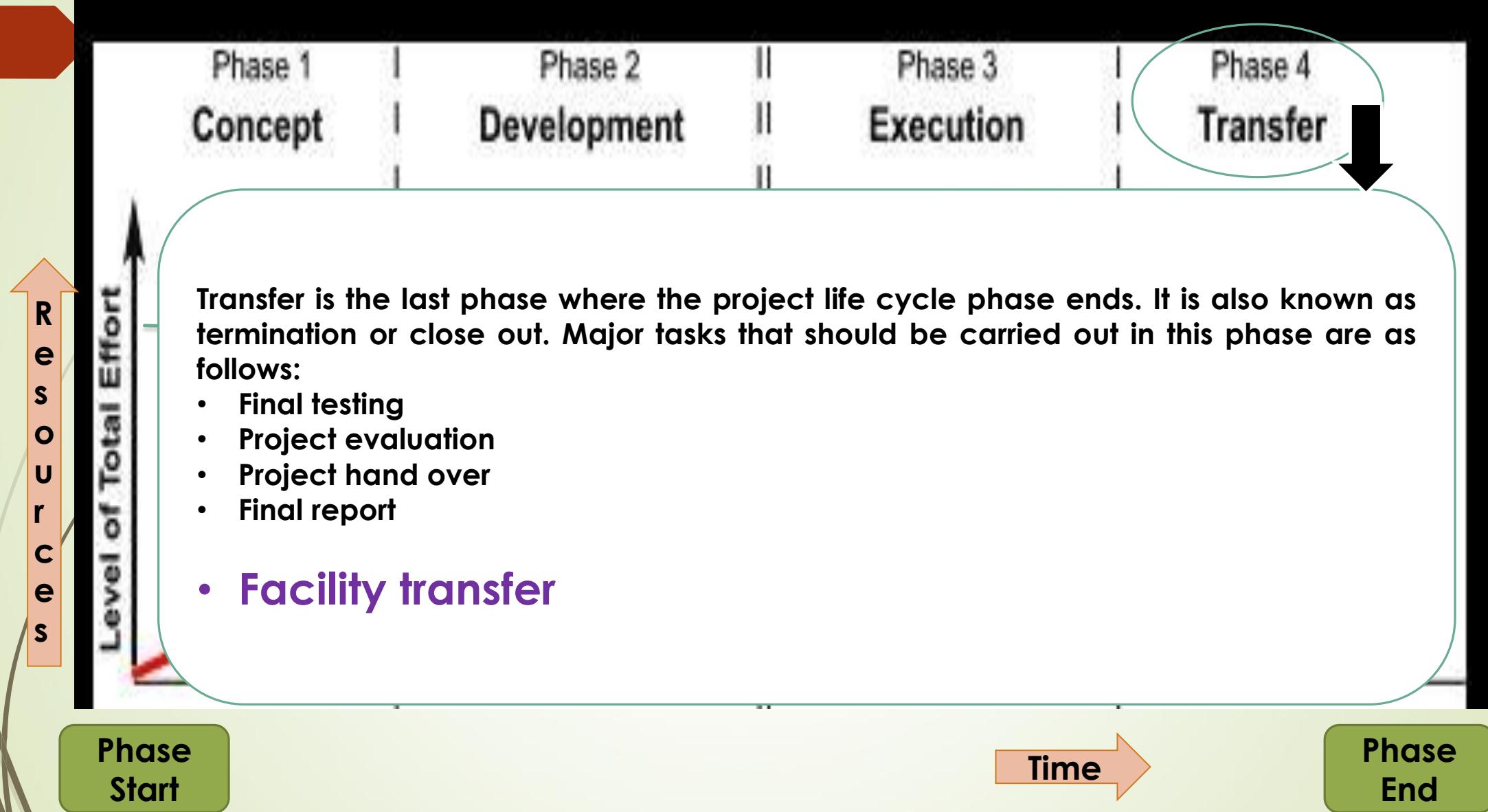
- Mobilization of human and non-human resources in accomplishing the activities defined in earlier phase
- Execution of work
- Testing is done if any
- Monitoring, evaluation and controlling of progress
- Supervision of works
- Resolve issues if any
- Risk management
- **Deliver facility and substantial completion of project**

Phase Start

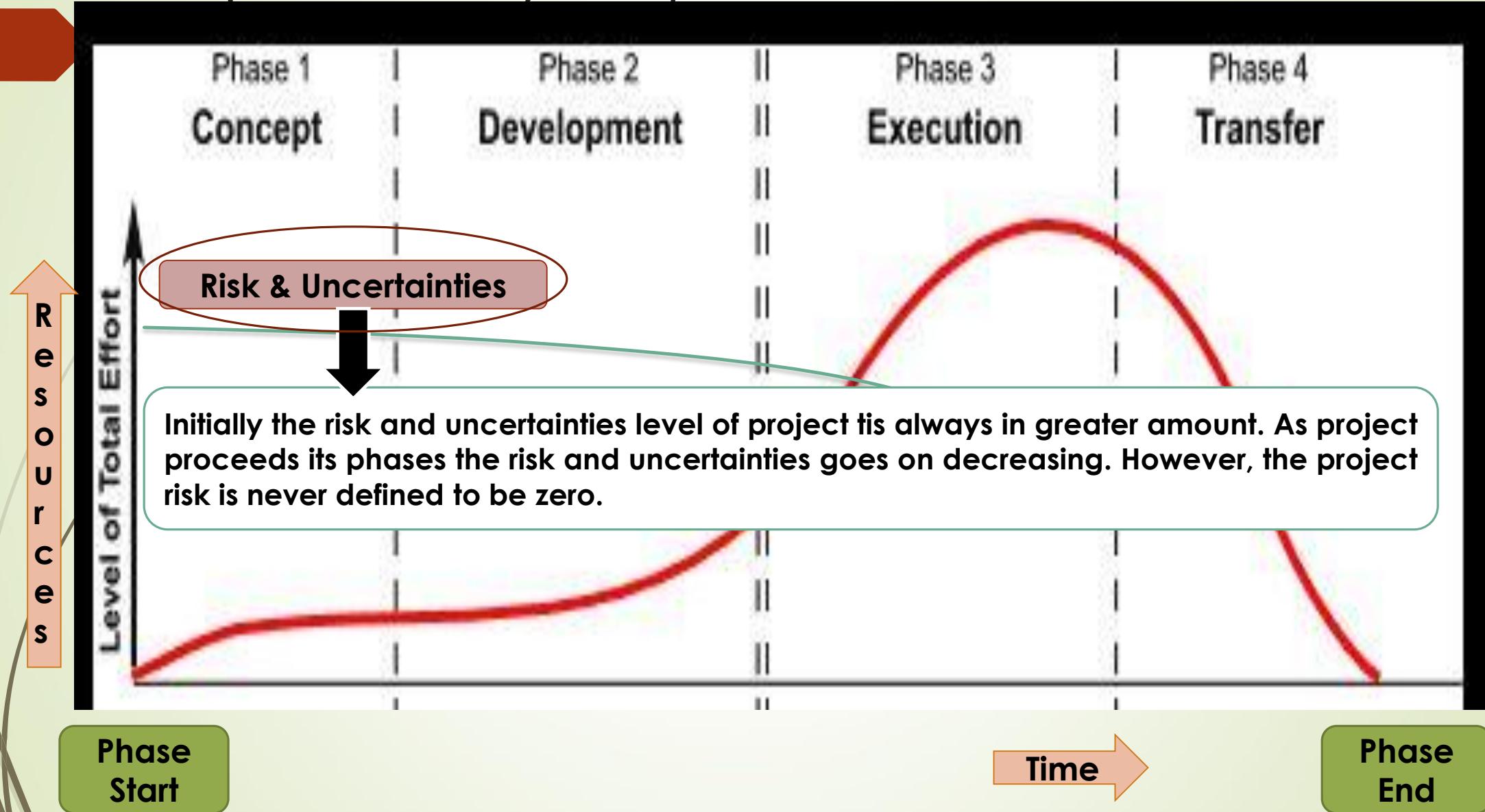
Time

Phase End

# Project life cycle phases

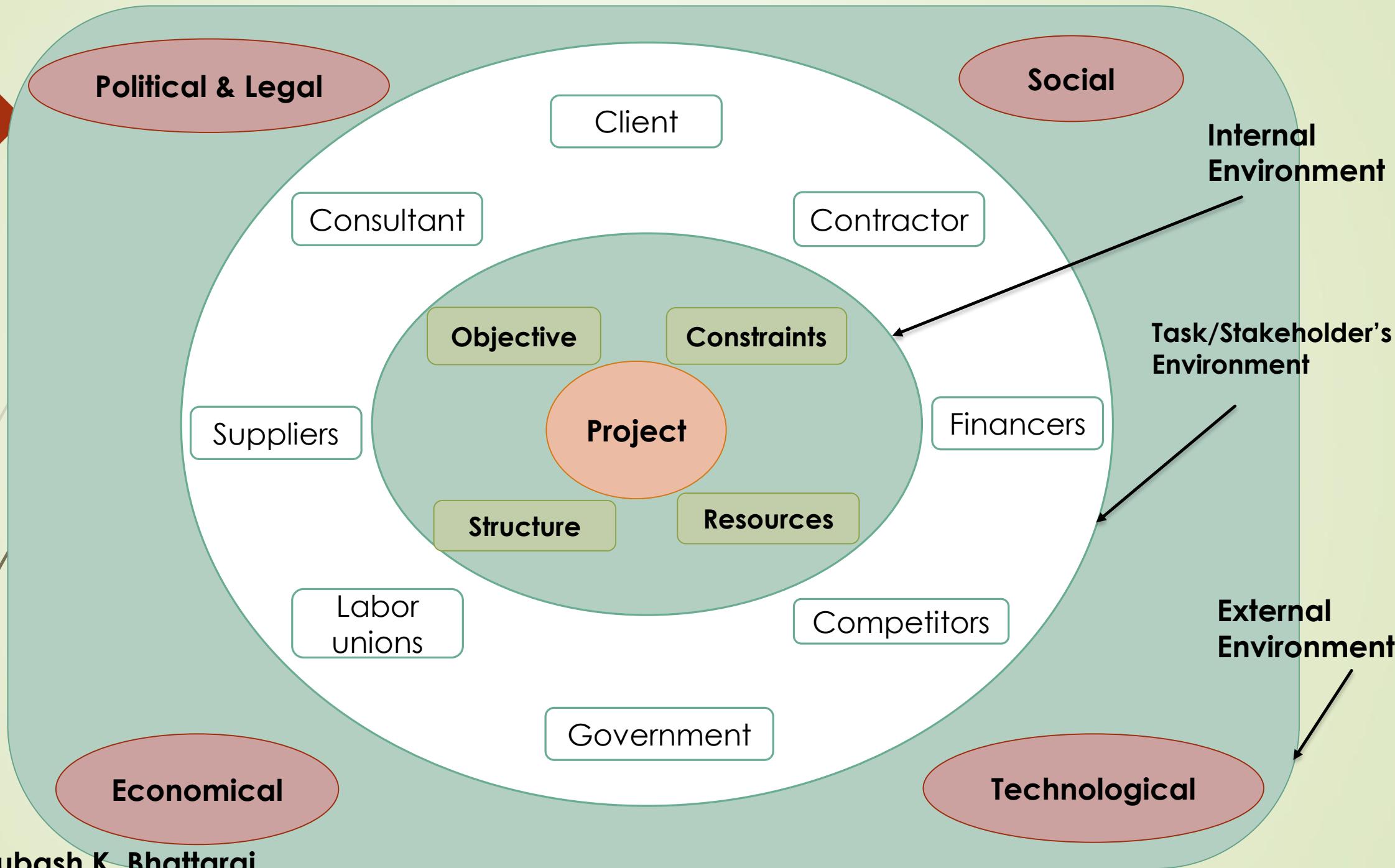


# Project life cycle phases



# 1.5 Project Environment

- ▶ Literally, **project means a planned investment undertaken to deliver a unique product or service as an output** and **environment is defined as surroundings in which someone or something lives.**
- ▶ Project environment refers to surroundings or elements where project execution takes place. Project environment affects the project.
- ▶ Environment consist of forces that influence the project's ability to achieve its objective.
- ▶ Project always do operates in rapidly changing dynamic environment so project should continually adapt to the environmental changes.
- ▶ Basically there are three different types environment consisting of forces (factor affecting the project) in a project.
  - ▶ Internal environment
  - ▶ Task or stakeholder's environment
  - ▶ External environment



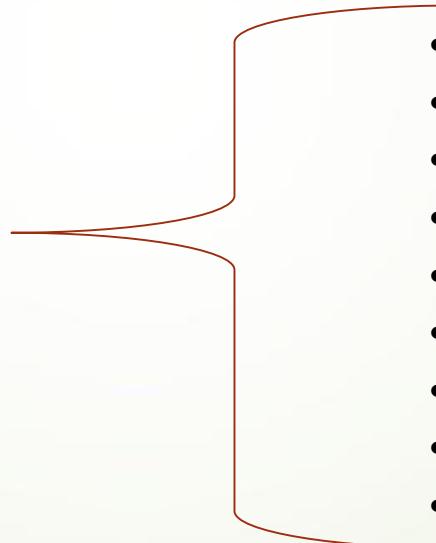
# 1.6 Introduction to Project Management

- ▶ It is a new way of thinking about management. It manages complexity and change in a dynamic environment.
- ▶ It makes efficient use of resources for better client satisfaction
- ▶ Project management is a system approach for efficient and effective achievement of project objectives through:
  - ▶ Assignment of total project responsibility and accountability to a single person i.e. **project manager**
  - ▶ Coordination across and with the stakeholders
  - ▶ Proper utilization of planning and control tools for better resource use within constraints of time, cost and quality

**Project management is the planning, organizing, directing and controlling of organization resources to complete specific goals and objectives**



# Characteristics of a Project management

- ▶ Objective oriented
  - ▶ Change oriented
  - ▶ Single responsibility center
  - ▶ Team based
  - ▶ Functional coordination
  - ▶ Planning & control
  - ▶ Constraints
  - ▶ Body of knowledge (BOK)
- 
- Scope mgmt.
  - Time mgmt.
  - Change mgmt.
  - Integration mgmt.
  - Cost and schedule mgmt.
  - HR mgmt.
  - Quality mgmt.
  - Risk mgmt.
  - Procurement mgmt.

# Benefits and limitations of Project Management

## Benefits



- ▶ PM is a new approach to management for achieving the objectives of time bound complex project efficiently and effectively
  - ▶ Environmental adaptation
  - ▶ Change management (flexibility)
  - ▶ Result oriented
  - ▶ Coordination
  - ▶ Team development
  - ▶ Re-engineering
  - ▶ Timely correction
  - ▶ Customer satisfaction

## Limitations



- Team related problems
- Conflicts between stakeholders
- Lack of long range planning (time bound)
- Problem in authority delegation
- Organizational barriers

# Try once !! Home assignment

- ▶ In your opinion which environment is important in project? Justify with reasons.

**Achievement of 1<sup>st</sup> objective of the Course  
To introduce the basic knowledge on project an  
project environment ???**



End of Chapter One,  
THANK YOU  
See you on Chapter 2

# **CHAPTER**

# **2.0**

**PROJECT APPRAISAL**

**&**

**PROJECT FORMULATION**

©

**Er. Subash K. Bhattarai**

**B.E Civil / PGDESD / MPA/ MSC Construction Management**

# CONTENTS

- ❖ 2.1 Concept of Project Appraisal
- ❖ 2.2 Project Proposal ( Technical and Financial)
- ❖ 2.3 Procedure of Developing Project Proposal
- ❖ 2.4 Project Formulation Technique

## **2.1 CONCEPT OF PROJECT APPRAISAL**



### **PROJECT APPRAISAL**

- *Meaning*
- *Criteria*
- *Why is it Necessary?*

Project appraisal is a generic term used to refer the **process of assessing** the investment proposals.

It is a technique of evaluating, analyzing the investments and effort of calculating the **project's viability**.

Project appraisal is an **overall assessment** of the **relevancy**, **feasibility** and **sustainability** of a project prior to making decision **whether to undertake it or not ??**

**WHY ?**



**Project appraisal is done to answer two basic questions:**

- Will the project meet **its objectives** as well as the larger need of the societies or country?
- How does project **compare with other projects (alternatives)** in term of funds and other resources?

# **APPRAISAL FACTORS (TYPES OF PROJECT APPRAISAL)**

The **feasibility study** serves as the **groundwork** for project appraisal. The **aspects** covered in feasibility study are re-examined during the appraisal.

- **Technical appraisal (assessment)**
- **Economic appraisal (assessment)**
- **Financial appraisal (assessment)**
- **Management appraisal (assessment)**
- **Marketing appraisal (assessment)**
- **Environmental appraisal (assessment)**

# **TECHNICAL APPRAISAL (ASSESSMENT)**

- It ascertains **whether the prerequisites** for the successful commissioning of the project with respect to technical solutions, technical specifications, technical risks and uncertainties, local resources availability, size, location, geology etc.

# **ECONOMIC APPRAISAL (ASSESSMENT)**

- ▶ It is also known as **social cost benefit analysis** concerned with judging a project from the larger social point of view.
- ▶ It ascertains the contribution of the project on **self sufficiency, employment generation and social order.**
- ▶ Similarly it measures the **impact** of the project on **saving, investment, distribution of income** in the society.

# **FINANCIAL APPRAISAL (ASSESSMENT)**

- It focuses on the **financial viability** of the project. In simple words, whether this project will be able to satisfy **the return expectations to capital**.
- The aspects to be looked during financial analysis include an **investment outlay**, **cost of capital**, means of **financing**, **projected profitability**, **break even points**, **cash flows**, investment worth judged in terms of various criteria of merit and risk.

# **MANAGEMENT APPRAISAL (ASSESSMENT)**

- ▶ Management analysis focuses on project organization, management, institutional relationships and management capabilities in planning, organizing, staffing, leading, implementing and controlling.

# **MARKETING APPRAISAL (ASSESSMENT)**

- Marketing analysis is primarily concerned with marketing related issues. It will analyze the aggregate demand, **sales forecast**, **estimated revenue**, **market share** etc.

# **ENVIRONMENTAL APPRAISAL (ASSESSMENT)**

Environmental assessment is concerned with the **impact** of the project on **environmental issues** such as environmental damage by the proposed project and environmental restoration measures. Initial Environmental Examination IEE, Environmental Impact Assessment EIA are reexamined.

*Social Appraisal is also carried out separately as per need however, it is assumed to be a part of Economic Appraisal*

## **AFTER APPRAISAL**

*Once the appraisal is completed and the results come positive, the funding agency approves the project and the project is ready to move for planning followed by implementation.*

## **2.2 PROJECT PROPOSAL (TECHNICAL AND FINANCIAL)**

- A project proposal is common and better understood in academic, commercial, industrial and governmental sectors.
- The proposal could be a request for a grant to conduct academic research or to sell an item or to build infrastructure or to conduct income generation training and capacity development.
- A proposal is basic document containing the explanation of all activities to be performed while undertaking an investment venture.
- In other words, it is written document prepared to do something in a pre-planned way with the view to successfully carry out the proposed assignment

# ***What Questions does proposal should be able to answer?***

Generally project proposal should satisfactorily answer the following questions:

- What are you preparing to do?
- Why you are proposing to do?
- What specific results you are expecting from it?
- What is the proposed schedule?
- What is the cost of resources?
- What are significant and limitations?
- How the outputs are measured?

# ***PROPOSAL WRITING: SCIENCE OR ART?***

Proposal writing may be considered as management **science** as well as an **art**.

- It is management **science** in the sense that writing proposal essentially requires a careful consideration of the following points:
  - Identification and selection of right project/s from different point of view
  - Formulation of reasonable and achievable objective or objectives
  - Selection of appropriate design/method for executing project activities
  - Effective and efficient use of scarce resources (doing right things at right time)

- On the other hand it is an **art** in the sense that the proposal we prepare should **have a sales value**.
  - The sales value depends upon how much convincing strength lies in our proposal and how tactfully you organize and present it.
  - The **words** we use, the **sentences** we construct and the **logic** we give in your project proposal make significance for its approval and disapproval.

# **CONTENTS OF PROPOSAL**

- Every project is unique and different to each other.  
For instance, **the development of project proposals relating**
  - to establish drinking water supply,
  - to construct a school building,
  - conducting detailed feasibility study of hydropower (DPR),
  - to provide some health facilities,
  - to conduct socioeconomic survey,
  - to conduct training packages etc.
  - **may differ to great extent.**

- Since each project proposal entails its own uniqueness, it is not possible to get a standard format for developing a project proposal equally applicable for all types and natures of projects.
- However, the contents of all types of project proposal are broadly classified into two parts: **technical** and **financial**.
- Some time **management** part is highlighted separately from technical part.

# **TECHNICAL PART OF PROJECT PROPOSAL**

Technical part of the proposal gives the technical details and descriptions of the project. The contents of technical part are:

- **Problem statement :**

Description of the project problem (Rationale)

- **Special requirements:**

Any special requirements as specified in TOR/RFP/Bid/Tender Notice etc. by client is described

- **Test and inspections:**

Procedures related to testing, quality assurance, reliability and compliance along with specifications are prepared

- **Logistics:**
  - details of equipment, facilities, skills and administrative aspects are listed
- **Reporting:**
  - formats, timing and nature of reporting should be highlighted
- **CV/Bio-Data:**
  - CV of key persons for the execution of the proposed project is listed along with details
- **Capability statement:**
  - organizational capability and past similar work experience is focused in this part

# **FINANCIAL PART OF THE PROJECT PROPOSAL**

It deals with the **financial details** of the project. The financial part of proposal covers the aspects like:

- Cost of basic materials
- Statement of work
- Cost summary
- Supporting schedules
- Profit statement
- Elements of cost
- Cost break down and work break down structures
- Cost estimating techniques

*In this part generally format of BOQ (provided along with TOR or bid document) is prepared and rate is quoted for the proposed work.*

# **MANAGEMENT PART OF THE PROPOSAL**

It incorporates the **administrative and management capability** of the proposing organization in terms of:

- Organizational structure
- The financial stability
- Financial litigation history
- Accounting system
- Employee safety, health & Labor related aspects
- Cost and schedules
- Past work experiences

[NGO proposal sample.doc](#)

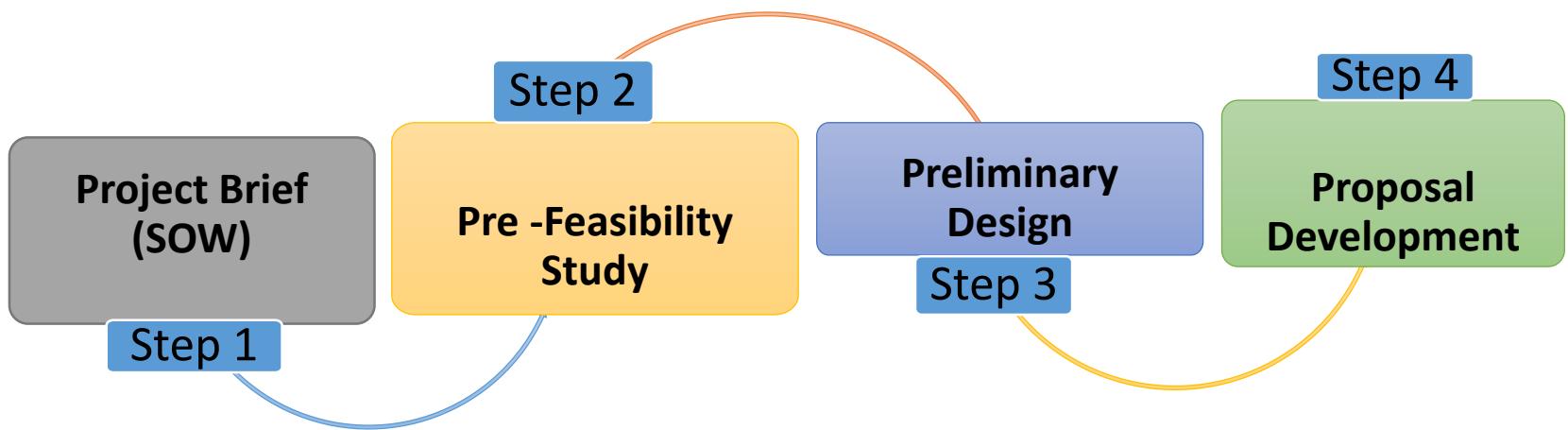
[proposal\\_guidelines.pdf](#)

[Project Proposal Template.doc](#)

[Contents of a Proposal.docx](#)

[Academic Proposal Format.docx](#)

## **2.3 PROCEDURES OF DEVELOPING PROJECT PROPOSAL**



# Project Brief (Statement of Work)

## Step 1

- Statement of work is prepared by the client at the project formulation phase.
- It is also known as **wish list** of the client which describes the needs and requirements.
- It is provided by the client in the form of TOR Terms of Reference or SOW scope of the work.

## **The major contents covered in TOR / SOW are:**

- Need and description of the project
- Scope of the project
- Predetermined objectives and output / outcomes of the project
- Funding constraints and budget
- Specifications, quality assurance and acceptance criteria
- Project schedules
- Reporting system
- Monitoring and evaluation mechanism etc.

[..\..\..\..\..\1. Subash's Working Folder\Documents\Freelancing\TOR MTMP.PDF](#)

[..\..\..\..\..\1. Subash's Working Folder\Documents\Freelancing\Tor\\_road  
Dpr Bhimeswor.pdf](#)

## Pre / Feasibility Study

- This study is carried to find the **implementability** of the proposed project.
- It covers the aspects like technical analysis, economic analysis, financial analysis, marketing analysis, management analysis and environmental analysis.
- Technical feasibility is the main focus aspect of pre/feasibility study

# Preliminary Design/Design

## Step 3

- ▶ This phase is also known as **conceptual design** or architectural design.
- ▶ It is the expanded form of project idea and is based on pre/feasibility study.
- ▶ The objective of this phase is to create a design that will correctly and completely implements the requirements shown by study.
- ▶ It includes technical aspects like survey, engineering drawings, project schedule, WBS, estimated project cost etc.

## Proposal Development

It contains following details:

**Project title:** a proposal **begins** with the title.

**Executive summary:** a brief ES should be prepared which describes the **brief information** and **objectives** of the project

**Project description:**  
it provides the **general description** of the project.

**Project objective:**  
The objective should be **SMART**. General objective is set up followed by specific

**Project component:**  
Major **sub sectors** are specified if any

**Methods of implementation:**  
It deals with the description about the **implementation methods** proposed for the project

**Project schedule:**  
**Bar chart, network schedule for proposed project duration**

**Project budget:**  
**cost component and sub components are detailed. Itemized in expenses head should be mentioned**

**Project monitoring and evaluation:**  
**mechanism of M&E. logical framework can be provided.**

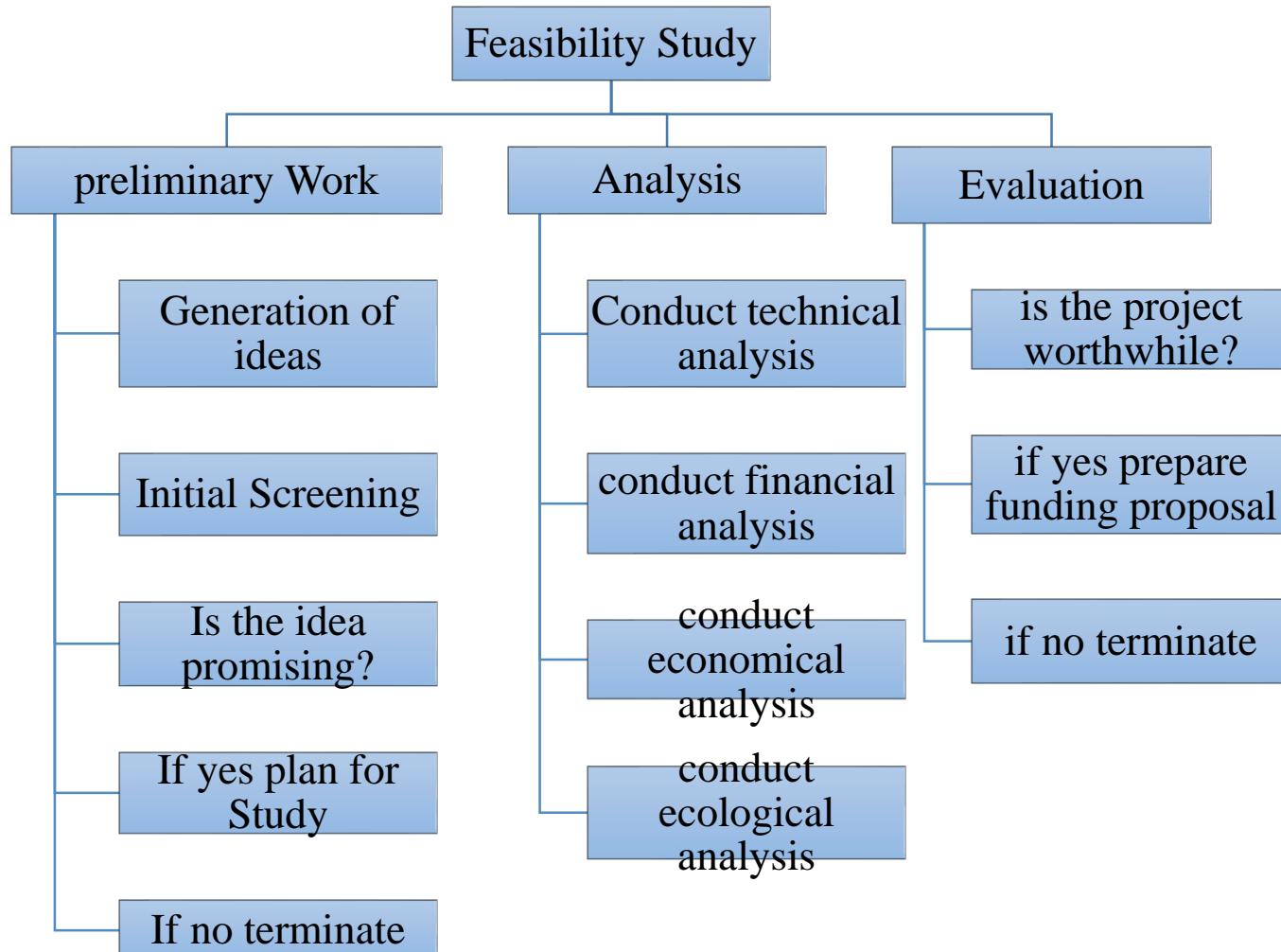
*Appendices for separate supporting documents like tax clearance certificate, firm registration certificate, VAT registration certificate, previous work experience, signed CVs etc. can be provided with proposal.*

## **2.4 TECHNIQUES OF PROJECT FORMULATION**

- Various techniques are available for project formulation. They are
  - Feasibility analysis
  - Cost Benefit analysis
  - Input output analysis
  - Environmental / ecological analysis
  - Network analysis
  - Financial analysis

# FEASIBILITY ANALYSIS

- Feasibility analysis makes it possible to screen out non-feasible project idea and selection of project idea. Feasibility analysis answers which project (s) to undertake.



# **THE ASPECTS OF FEASIBILITY ANALYSIS ARE**

- *Technical analysis:*
- *Economic analysis:*
- *Marketing analysis:*
- *Management analysis:*
- *Financial analysis:*
- *Environmental analysis:*
- *Socio-political analysis*

# **COST- BENEFIT ANALYSIS**

- In simple term it is known as economic analysis of the investment proposal from the larger social point of view. Therefore it is regarded as social cost benefit analysis (SCBA) in general.
- Cost benefit analysis is the comparison of different projects competing for the same resource budgets.
- It is an analytical tool in decision making which enables a systematic comparison to be made between the estimated cost of undertaking a project and the estimated value and benefits which may arise from the operation of such a project. It is used in both sectors public and private.
- For private sectors, CBA examines the profitability but for public sector it examines the social profitability. Social profitability is determined in terms of **economic growth, income redistribution, employment generation, social development and poverty reduction.**

# **INPUT OUTPUT ANALYSIS**

- It deals with the analysis of human and non-human resources that serves as inputs for the project. The inputs such as labor, capital, HR, information and physical resources etc. are used in order to produce finished goods or services in sectors and industries. In any investment project the inputs are analyzed and reviewed.

# ENVIRONMENTAL ANALYSIS

- It studies the impact of the project on the environment. The areas of focus for environmental analysis are Environment Suitability and Environment Impact.
  - Environmental Suitability: A Resource management aspect of project is given prime consideration to examine the project as environmental suitability.
  - Environmental Impact: Environmental Impact Assessment is carried out to identify the impact of the project in environment. The mitigation measures for the probable impact are justified in EIA.

**END OF CHAPTER 2**

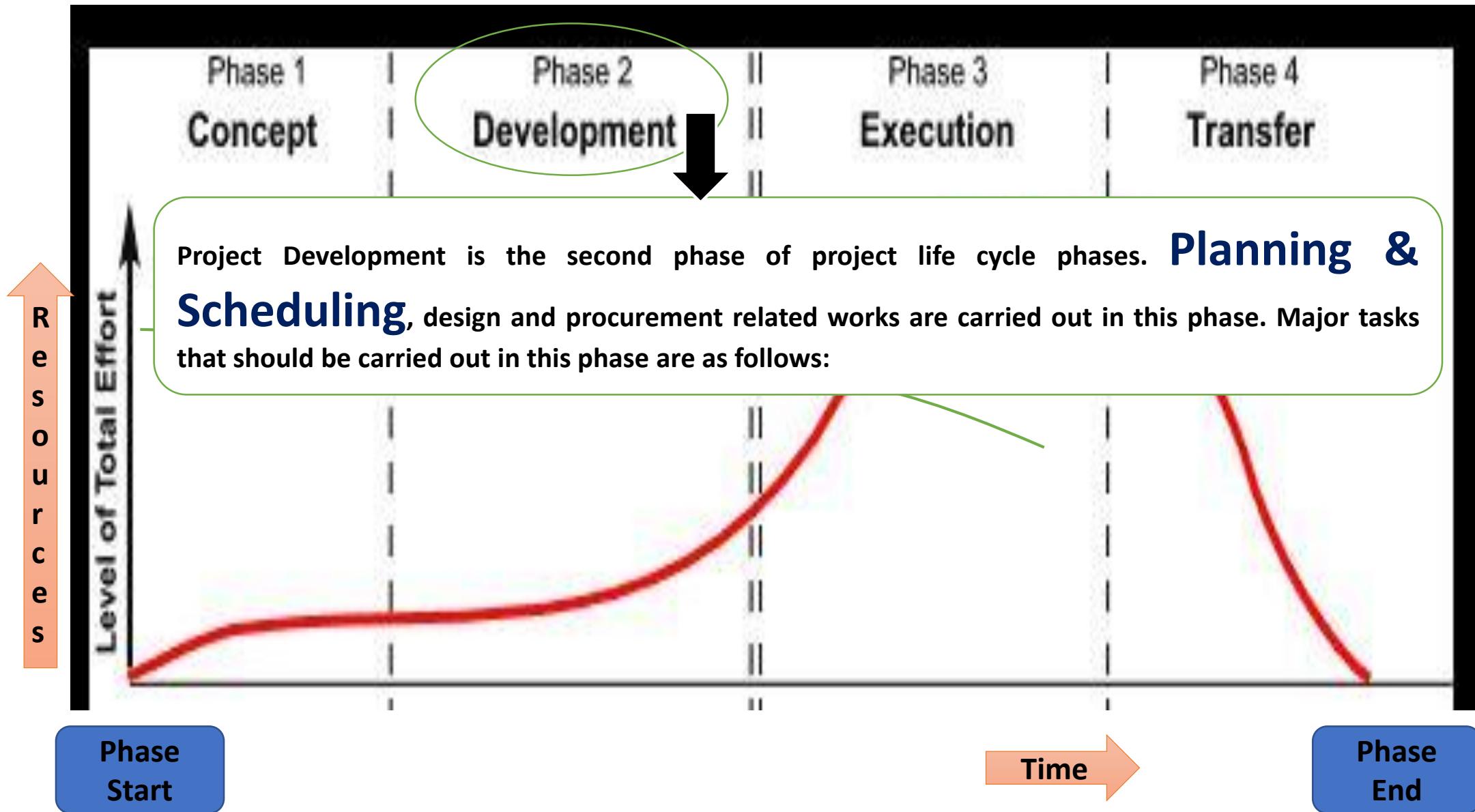
# CHAPTER 3

# PROJECT PLANNING

&

# SCHEDULING

# Recall: Project life cycle phases



# Concept of Project Planning and its Importance

*"If you fail to plan, you are bound to fail"*

- Planning is the **most important constituent** of the project
- In the simplest sense planning is the **mental process**
- It **forms the basis** for the project scope, schedule
- Managers who do not plan cannot control because they have no yardstick to judge the progress.

# Planning Components

- **What:** Work Breakdown Structure
- **How:** Plans and Specifications
- **Who:** Organization Breakdown Structure
- **How much:** Cost Breakdown Structure (via estimate)
- **When:** Schedule

Function of deciding what has to be done, how, by whom, by when and with what i.e. doing the job in the mind.



# features of planning

- Process : Follows Certain Steps
- Future/Goal Oriented : Always anticipates the future target
- Intellectual Process : Needs Imagination, Foresight, Vision and Judgement
- Primary Function : Basis for other functions of management
- Pervasiveness : Indispensable , every project, level of mgmt and organization requires
- Continuous : Ongoing Process, is updated as required

# **Importance : Planning is done to**

- Eliminate or reduce uncertainty
- Improve efficiency of the operations
- Obtain better understanding of the objectives
- Provide basis for monitoring and controlling
- Keep the plan under constant review and make action when necessary to correct the situation
- Improve decision making

# Scheduling

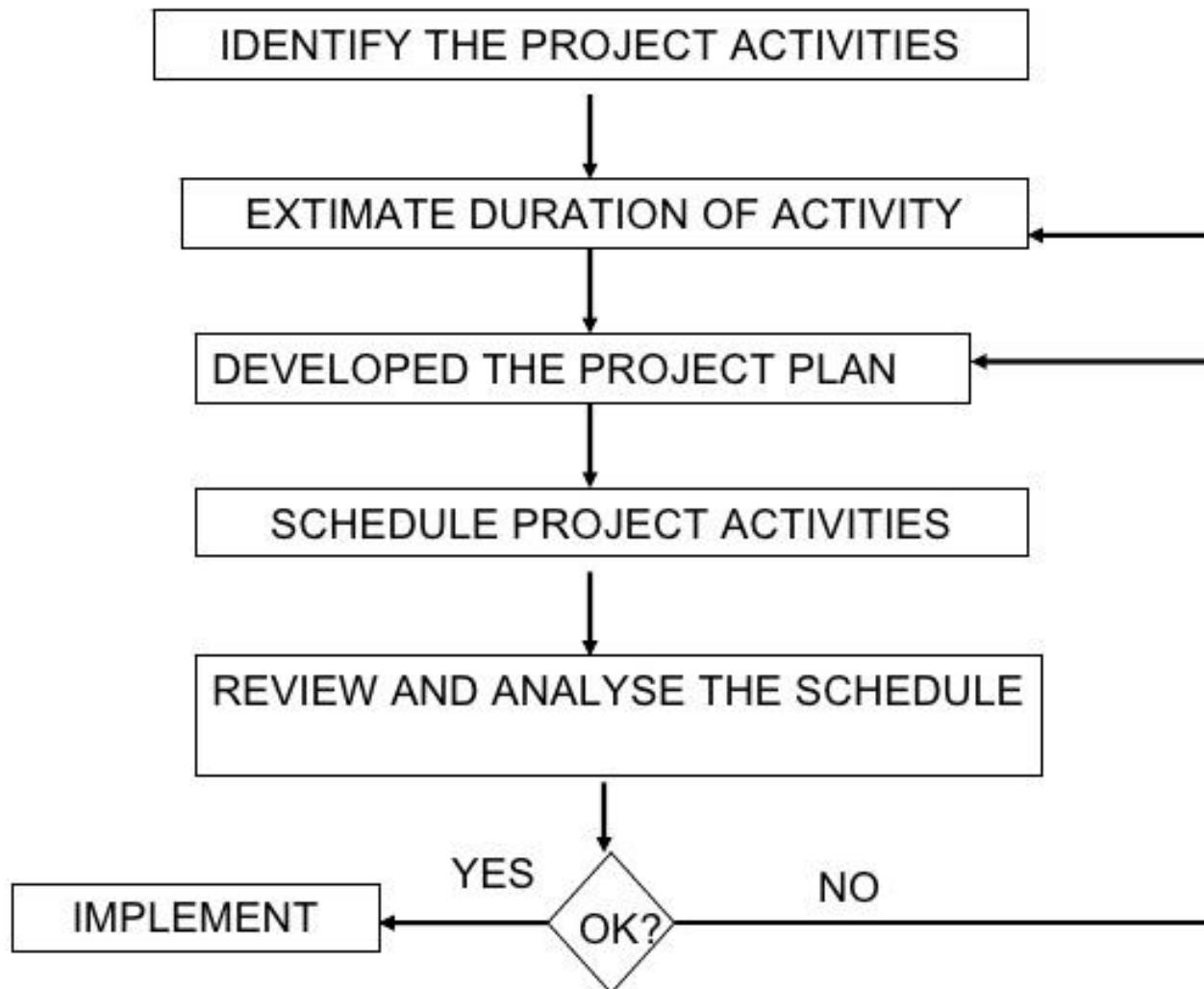
- **Scheduling** is laying out of the actual jobs of the project in the time order in which they have to be performed
- Schedule is a graphical representation of time management in a project.
- Schedule shows the starting and completion dates of each activity and the sequential relationship among them in a project

## *Use of scheduling*

### **Following are the use of scheduling**

- The quantity of work involved, labor, material, equipment and money required at each stage of work can be determined by scheduling.
- The activity completion time and project completion time can be determined
- The actual progress of the work can be checked from time to time by scheduling
- The project can be carried out in systematic manner by the use of scheduling
- The project can be controlled (control of resources)

## The Planning & Scheduling Process



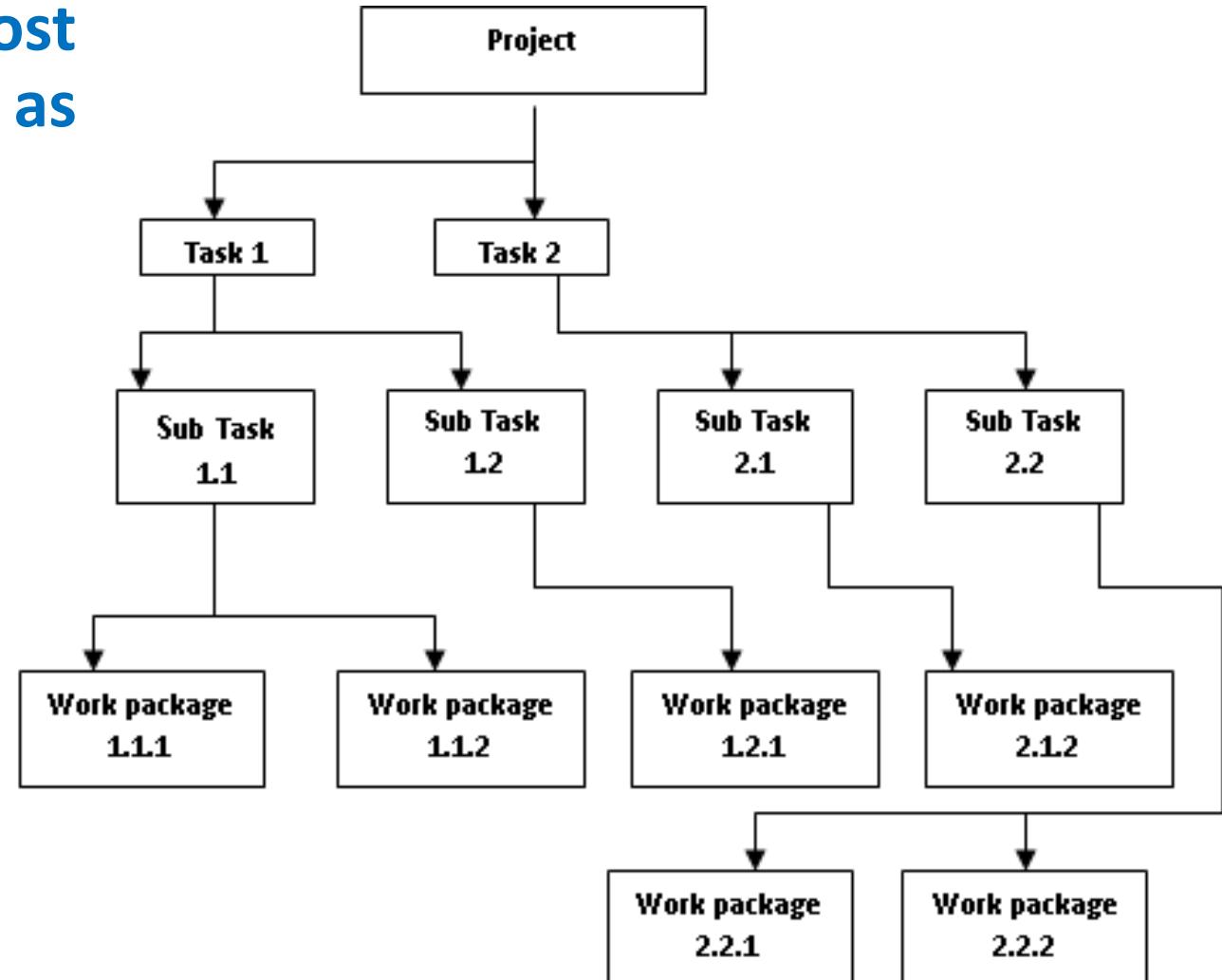
# Work Breakdown Structure

- Work breakdown structure, represents a systematic and logical breakdown of a project into several components.
- It is constructed by dividing a project into major components, each of which is further sub-divided into smaller components.
- The process is continued till a breakdown accomplishes manageable unit of works for which responsibility can be defined.
  - **Work not in the WBS is outside the scope of the project**
  - **WBS is usually an operative tool used by contractors**
- First step towards constructing a schedule
- Central role in project monitoring and control

# Levels of WBS

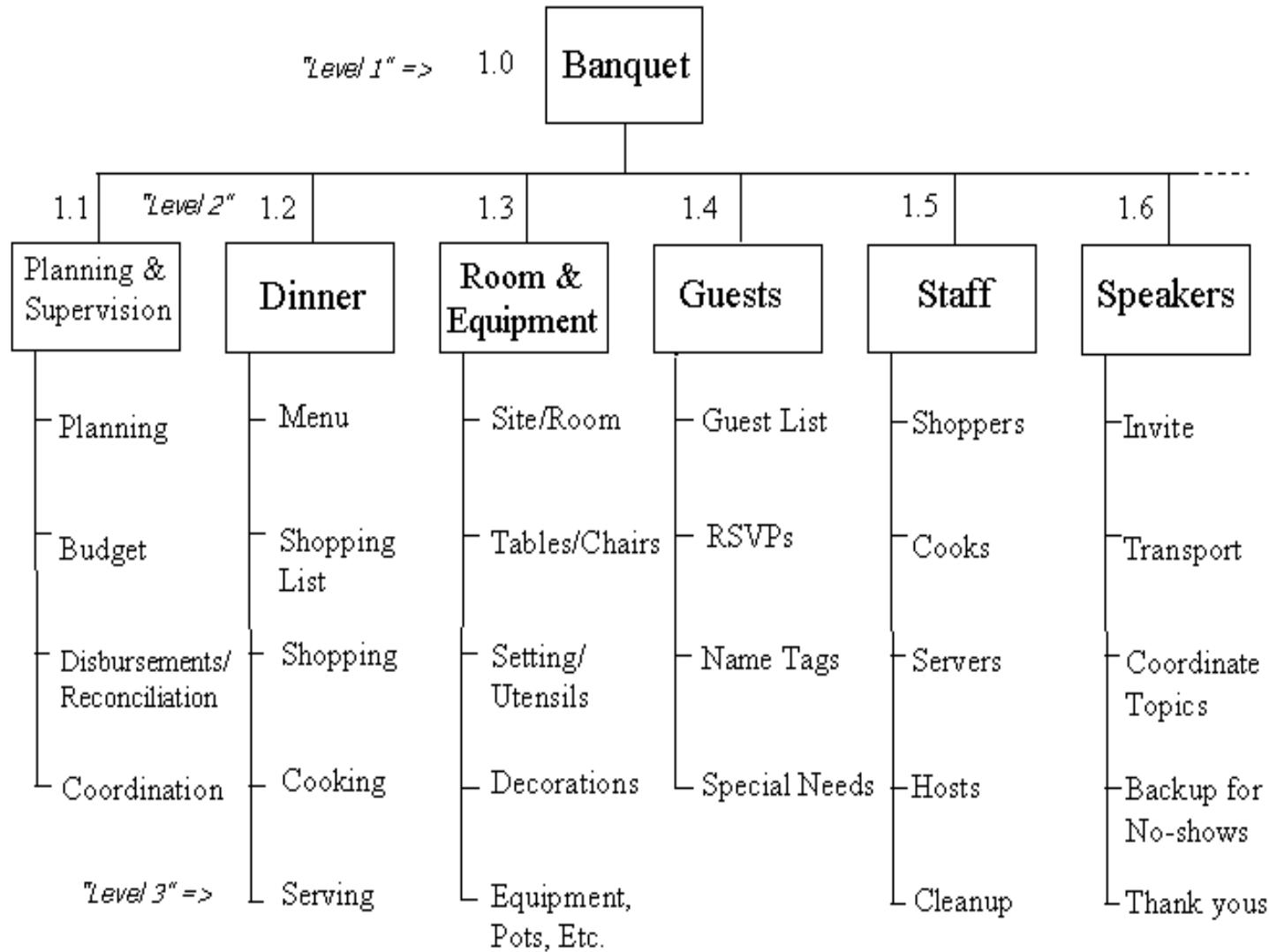
Although a variety of Work Breakdown Structures exist, the most common is the six-level structure as shown below:

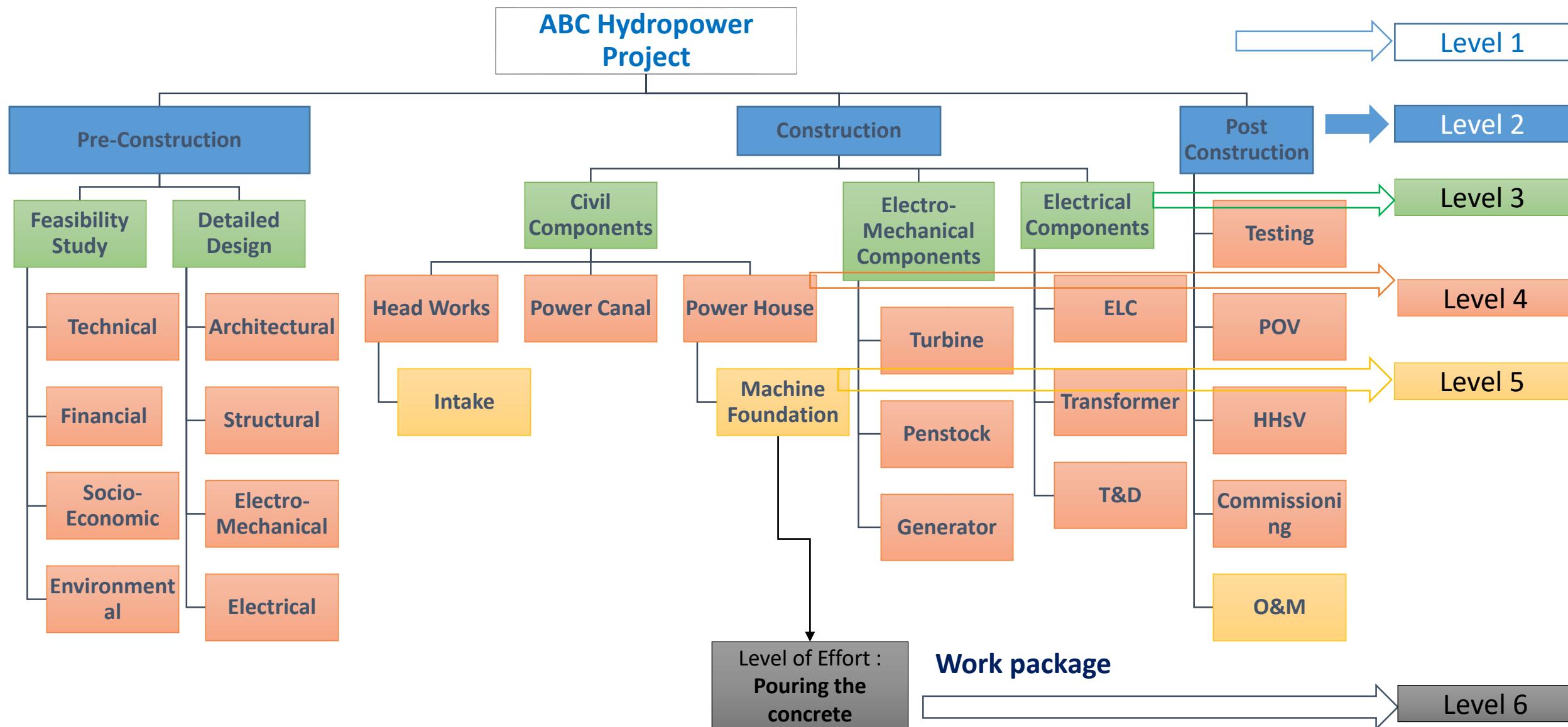
- Level 1: Total program
- Level 2: Project
- Level 3: Task (activity)
- Level 4: Sub-tasks
- Level 5: Work package
- Level 6: Level of effort

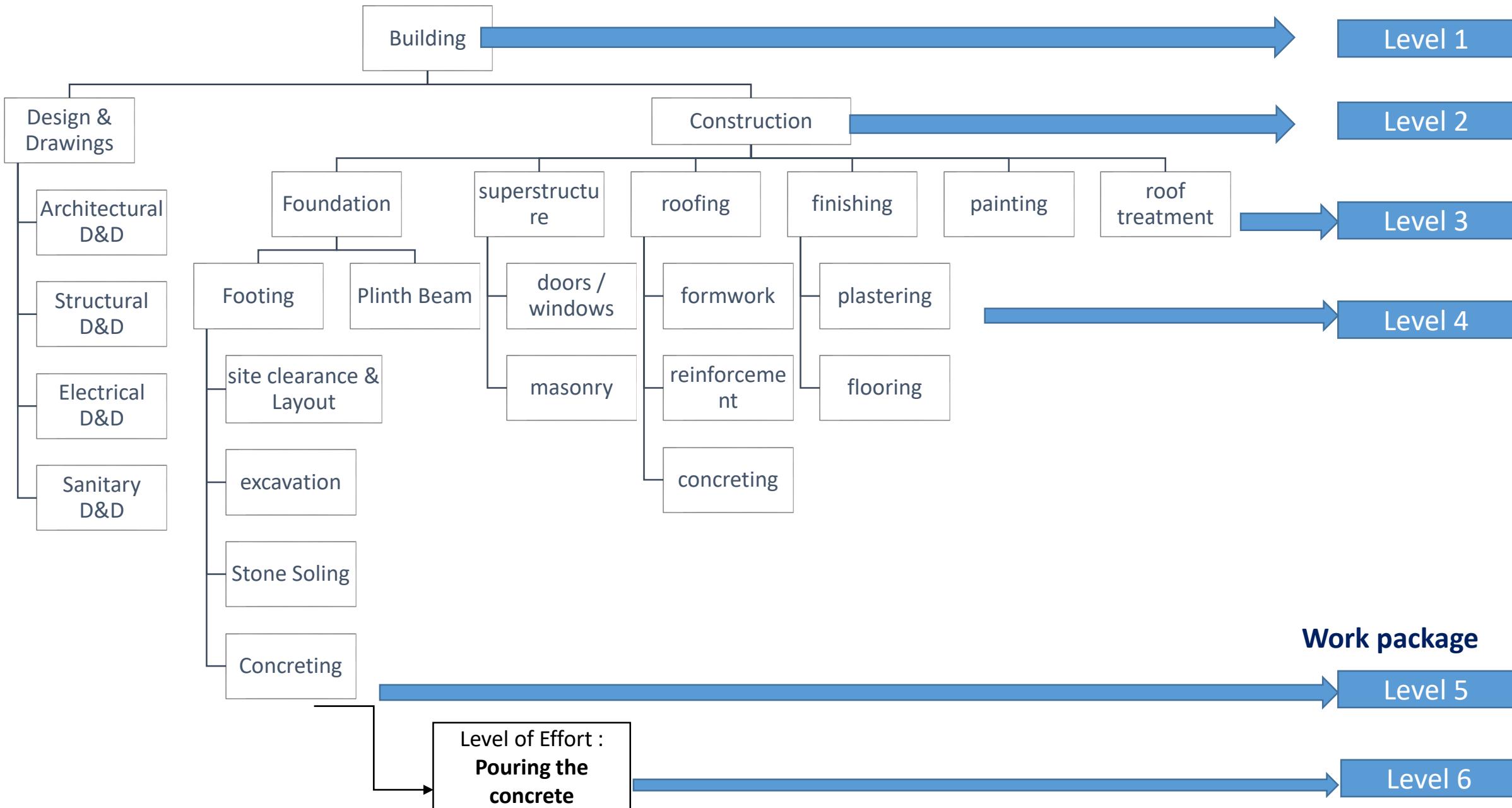


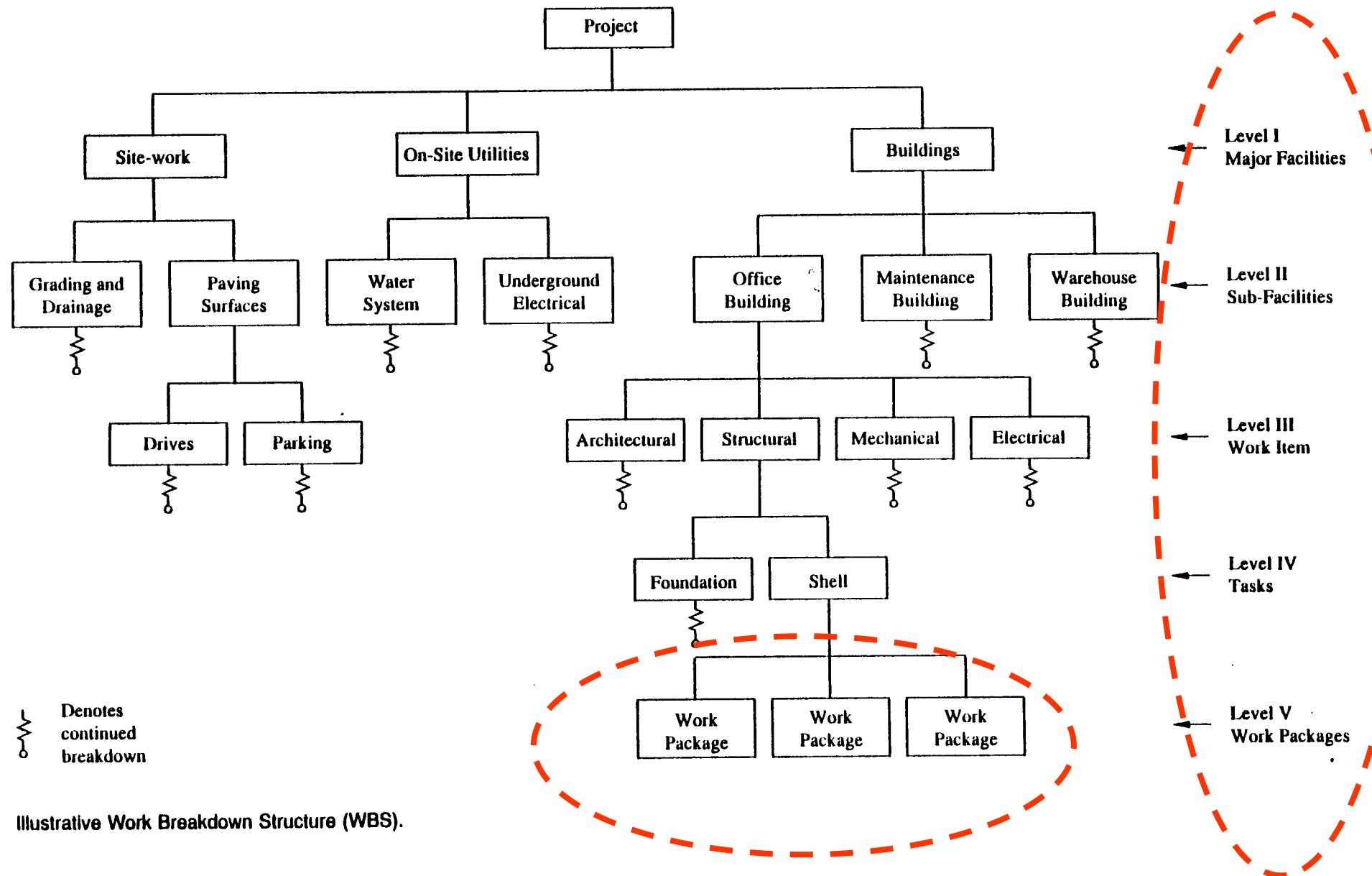
# WBS: Example

## WBS Example - Banquet









# Work Package

- Lowest level
- Distinguish from Others
- Single Responsible Organization
- Assigned Start and Finish
- Assigned Budget
- Limited Duration

# Advantages / Uses of WBS

The WBS provides a common framework for work from which the following important aspects can be covered:

- Planning can be performed
- Costs and budgets can be established
- Risk analysis can be done
- Control and contract administration can be done
- Schedules can be established
- Network analysis can be done
- Responsibility matrix can be established
- Coordination can be established
- When summed up, the total program can be described.

# Project Scheduling with Bar Chart, CPM & PERT

# Bar chart

- The **oldest formal planning tool** is the bar chart.
- It is developed as a production control tool in **1917 by Henry L. Gantt**, an American **mechanical engineer**, Hence also called as Gantt chart
- A **Gantt chart provides a graphical illustration of a schedule that helps to plan, coordinate, and track specific tasks in a project**
- A **Gantt chart is constructed with a horizontal axis representing the total time span of the project(for example, days, weeks, or months) and a vertical axis representing the Activities / tasks that make up the project**

## How to draw a Bar Chart?

- Listing of work activities
  - Estimation of work duration
  - Identifying start and completion date in calendar format
  - Drawing each activity as a horizontal bar in chronological order according to its start date.

**A project consist of 8 activities A,B,C,D,E,F,G,H with their time of completion as follows.**

Activity	Duration (weeks)
A	2
B	4
C	2
D	4
E	6
F	4
G	5
H	4

- Activity A and B can be performed in parallel
- Activity C and D cannot start until Activity A is complete.
- Activity E cannot start until the half the work of Activity C is complete.
- Activity F can start only after Activity D is complete.
- Activity G succeeds Activity C
- H is the last activity which should succeed activity E.

## BAR CHART FOR ABOVE EXAMPLE

Task Name	Duration	Predecessors	Dec 16, '18						Dec 23, '18						Dec 30, '18						
			S	M	T	W	T	F	S	S	M	T	W	T	F	S	S	M	T	W	S
Activity A	2 days																				
Activity B	4 days																				
Activity C	2 days	1																			
Activity D	4 days	1																			
Activity E	6 days	3SS+1 day																			
Activity F	4 days																				
Activity G	5 days	4																			
Activity H	4 days	3																			
Project Complete	0 days	5																			

## **Advantages of Bar chart:**

- It is simple to understand
- It is easy to prepare, consume less resources and economical
- It can be used to show progress. Simple "fill in the bar"
- It can be used for resource planning such as manpower planning, budgeting etc.
- It gives clear pictorial model of the project.

## **Limitations of Bar chart**

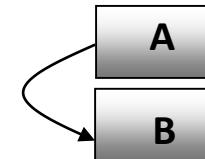
1. There may be physical limit to the size of the bar chart
2. The relations between activities cannot be shown clearly.
3. Each activity receives equal importance due to the lack of special indication in the chart.
4. It cannot be used as control device for large projects.
5. It is difficult to show critical path, critical activities and floats available.
6. Data is hard to manipulate
7. Updating means drawing the entire chart again and again

- **Milestone chart**
- To overcome some of the limitations of Bar chart, Milestone Chart and Linked bar charts are developed.
- Milestone chart is a modification over the original Gantt chart (bar chart). Milestones are the key events i.e. start or end of the activity. A Chart that graphically depicts key events along a timescale, usually with triangles representing each event, is called milestone chart.

## Linked Bar chart

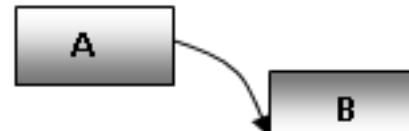
- One of the main drawbacks of simple bar chart is that it does not show the interrelationship between activities. The links between tasks are the heart of project scheduling. Linked bar chart uses the links (arrow) to show the relationship between activities. There are mainly four types of relationship between activities.

- (Activity B must start when activity A starts)



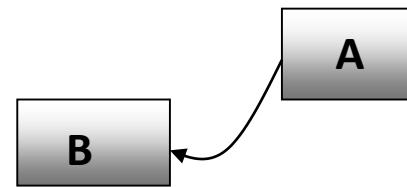
Start - to - Start

- (Activity B cannot start until Activity A is finished)



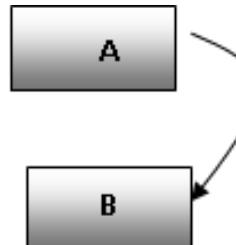
Finish - to - Start

- (Activity B finishes when activity A starts)



Start - to - Finish

- (Activity B must be finished when activity A finishes)



Finish - to - Finish

# Network Analysis

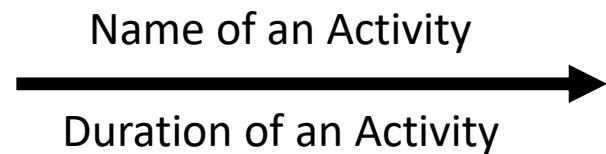
- Modern tools of project management
- Project involving large number of activities makes project complex, so conventional method like bar chart is inefficient
- Complex projects if not scheduled correctly / properly results in either under estimation or overestimation of project duration
- Two popular network based scheduling method has been developed
  - Critical Path Method (CPM)
  - Programme Evaluation and Review Technique (PERT)

# Critical Path Method (CPM)

- The critical path method (CPM) is a project modeling technique developed in the late 1950s by Morgan R. Walker of DuPont and James E. Kelley Jr. of Remington Rand.
- It was initially prepared as shutdown schedule of a chemical project
- Critical Path Analysis is commonly used with all forms of projects, including construction, aerospace and defense, software development, research projects, product development, engineering, and plant maintenance.
- Any project with interdependent activities can apply this method of mathematical analysis.
- The first time CPM was used for major skyscraper development in 1966 while constructing the former World Trade Center Twin Towers in New York City

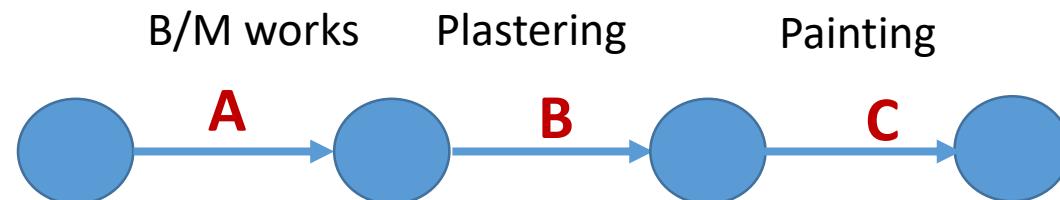
# CPM Network Terminologies (using A-O-A)

**Activity:** Any identifiable jobs which consumes resources. It is represented by an arrow

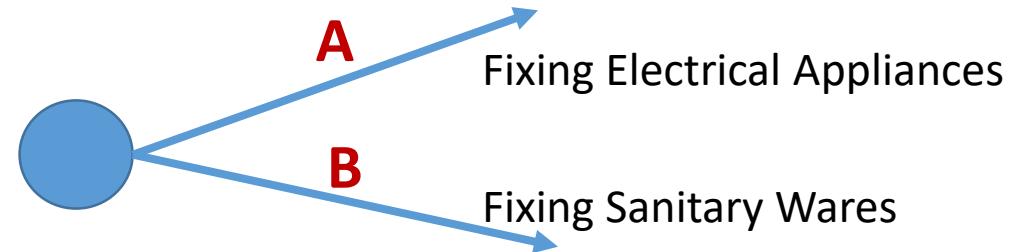


**Relation between Activity:**

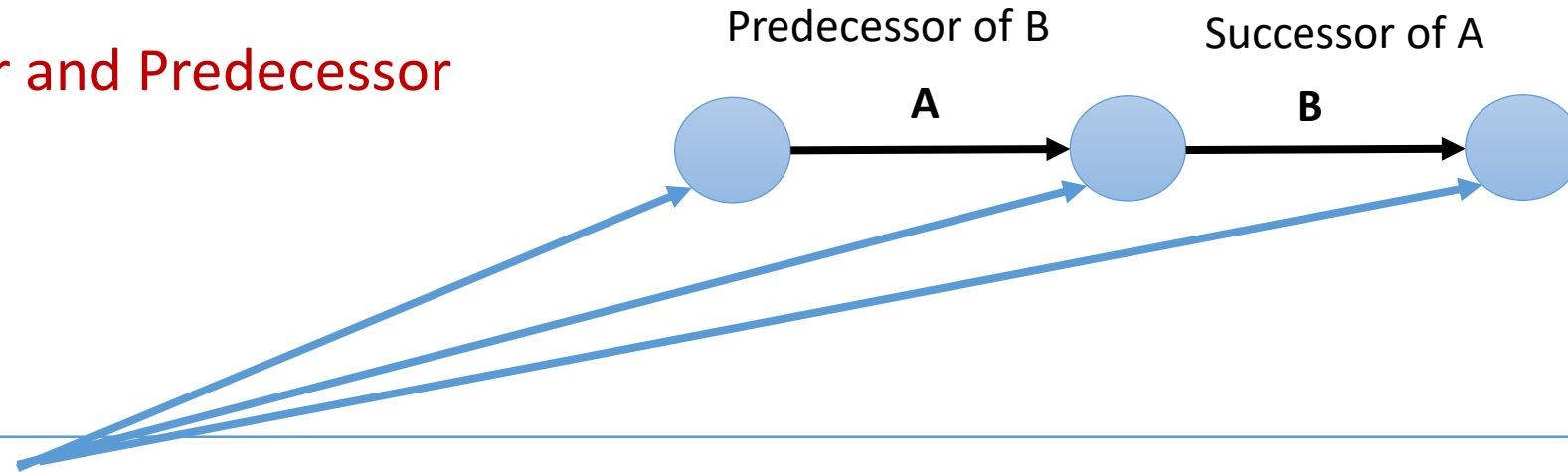
**1. Serial / sequential activities**



**2. Concurrent / Parallel activities**



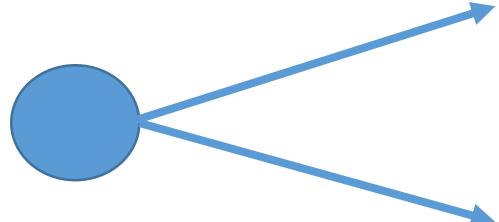
## Successor and Predecessor



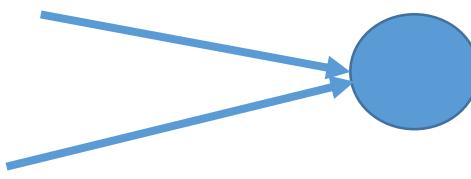
**Event ( Nodes):** The beginning or end of the activity is known as event. It represents specific point of time and does not consume any resources. Circle in the network represents an event.

## Types of Events

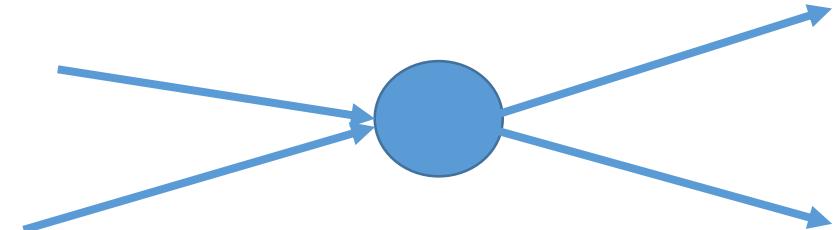
1. Tail / Burst Event



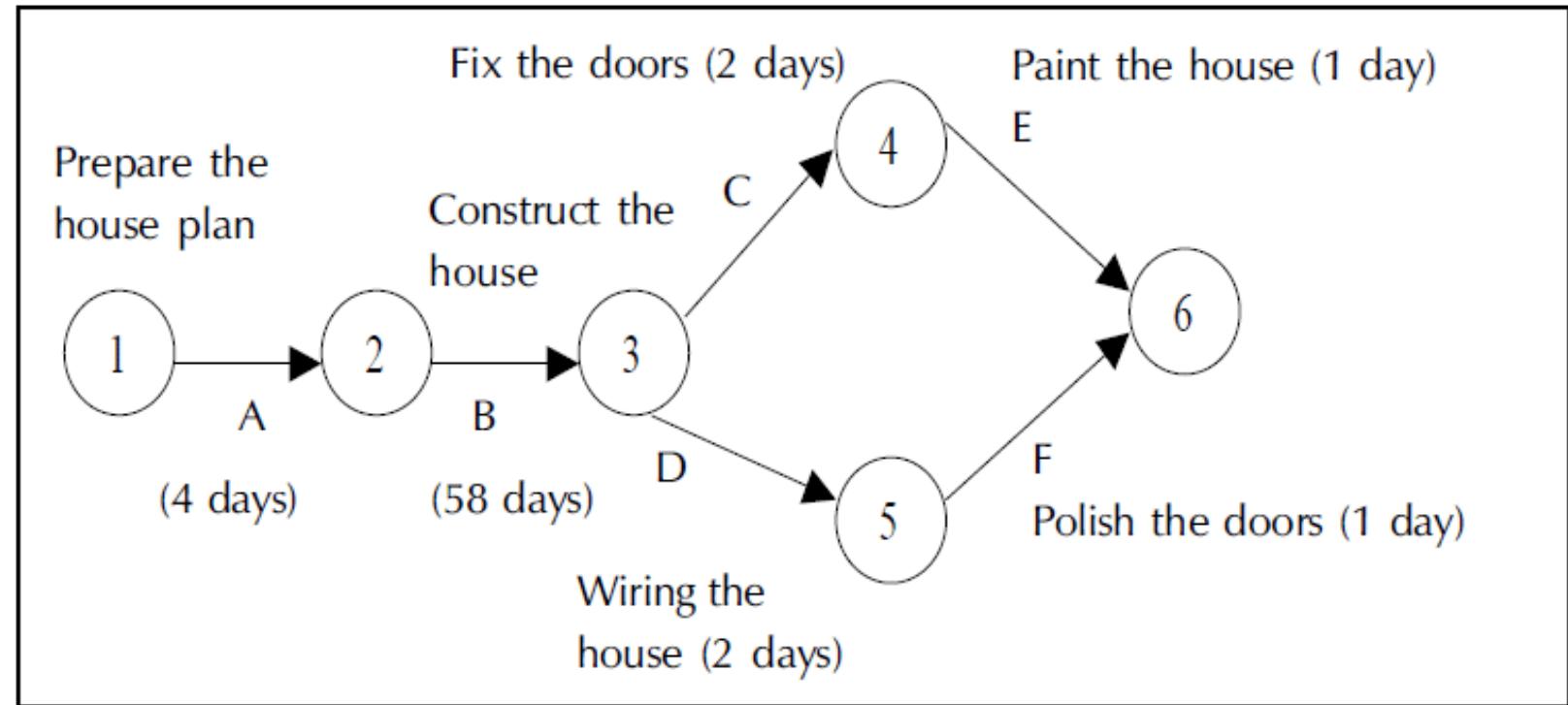
2. Head / Merge Event



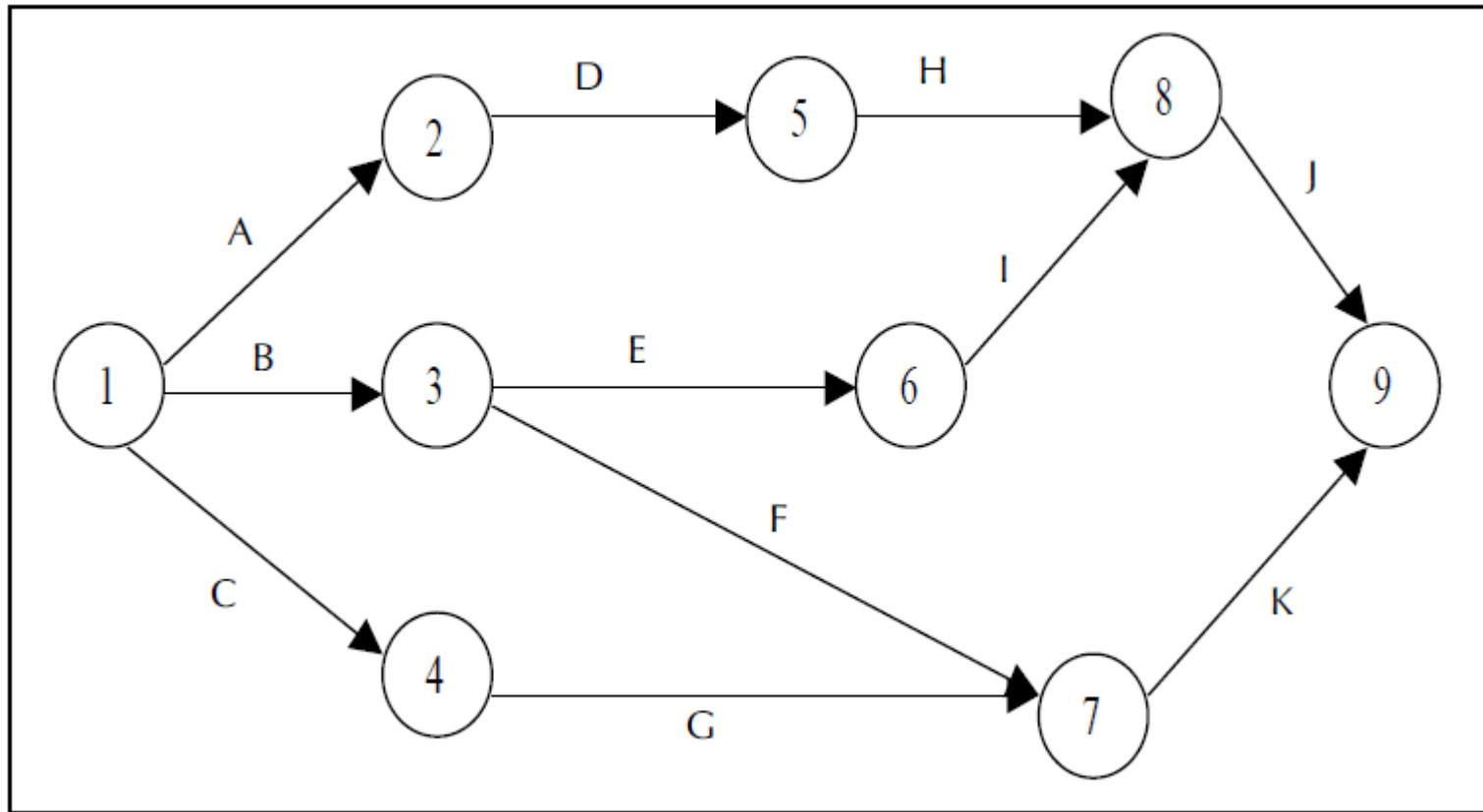
3. Dual Role Event



S.N	Activity	Predecessor
1	A	-
2	B	A
3	C	B
4	D	B
5	E	C
6	F	D



S.N	Activity	Predecessor
1	A	-
2	B	-
3	C	-
4	D	A
5	E	B
6	F	B
7	G	C
8	H	D
9	I	E
10	J	H,I
11	K	F,G

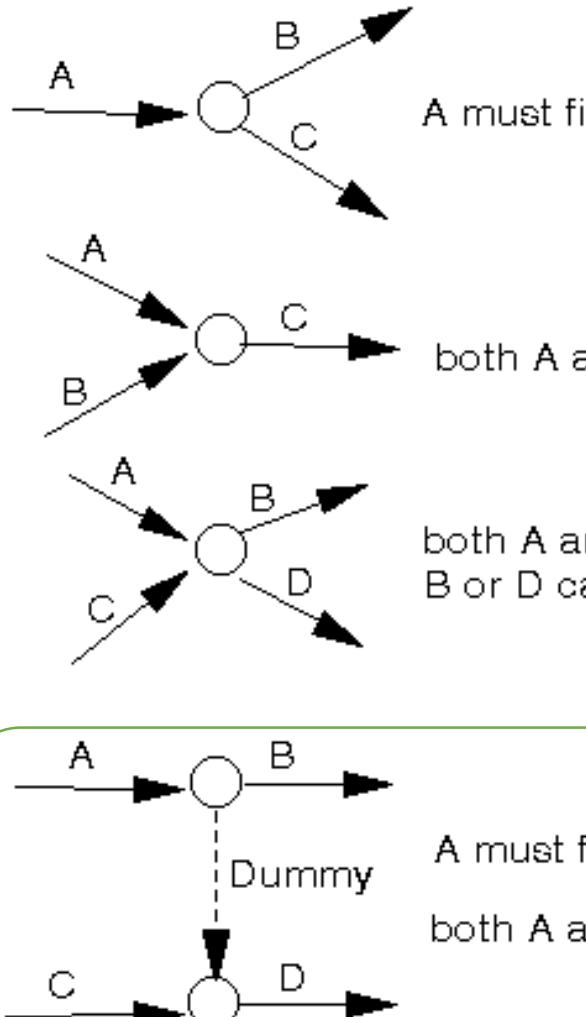


# Dummy activity: | The Project Network

to serve two purpose

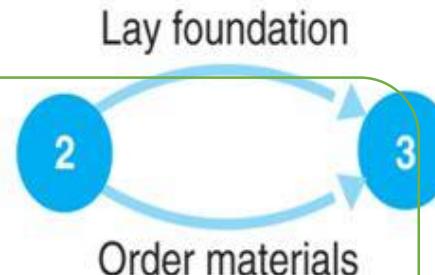
## Dummy Activities

ed

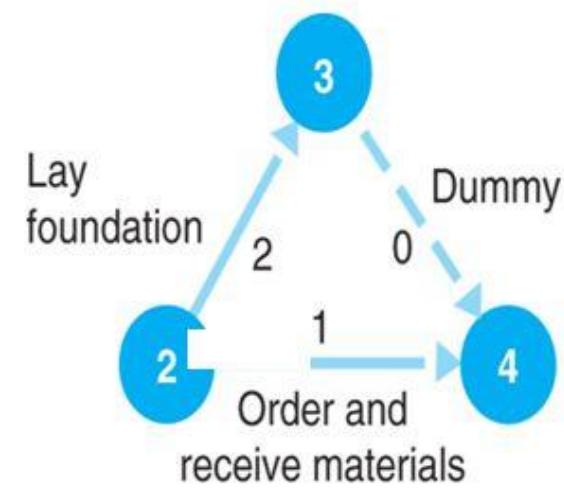


- A **dummy activity** shows a **precedence relationship** but reflects no passage of time.
- Two or more activities cannot share the same start and end nodes.

1y



(a) Incorrect precedence relationship

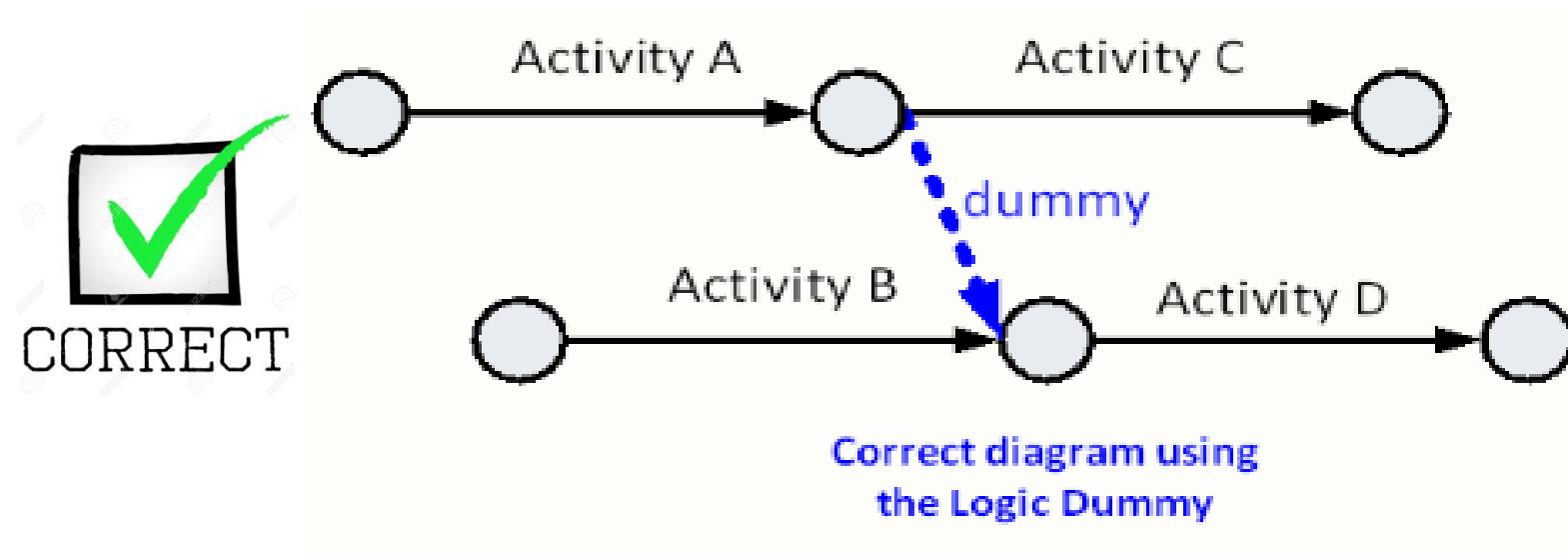
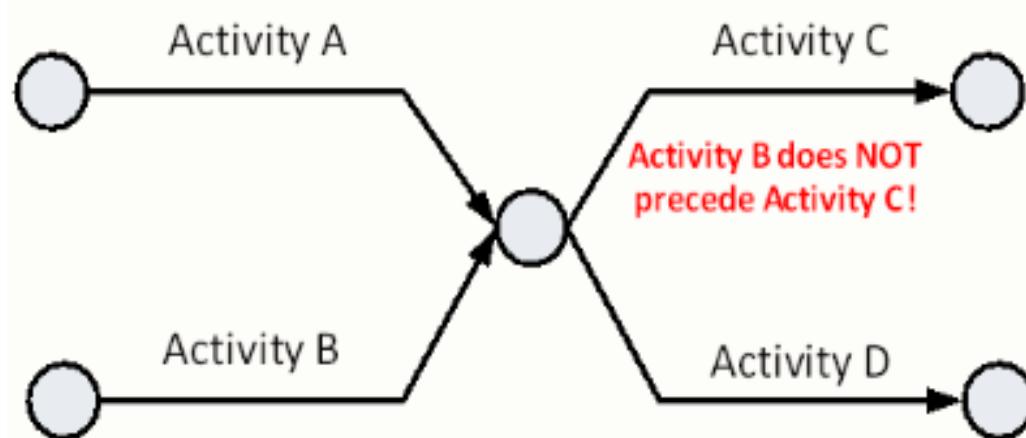


(b) Correct precedence relationship

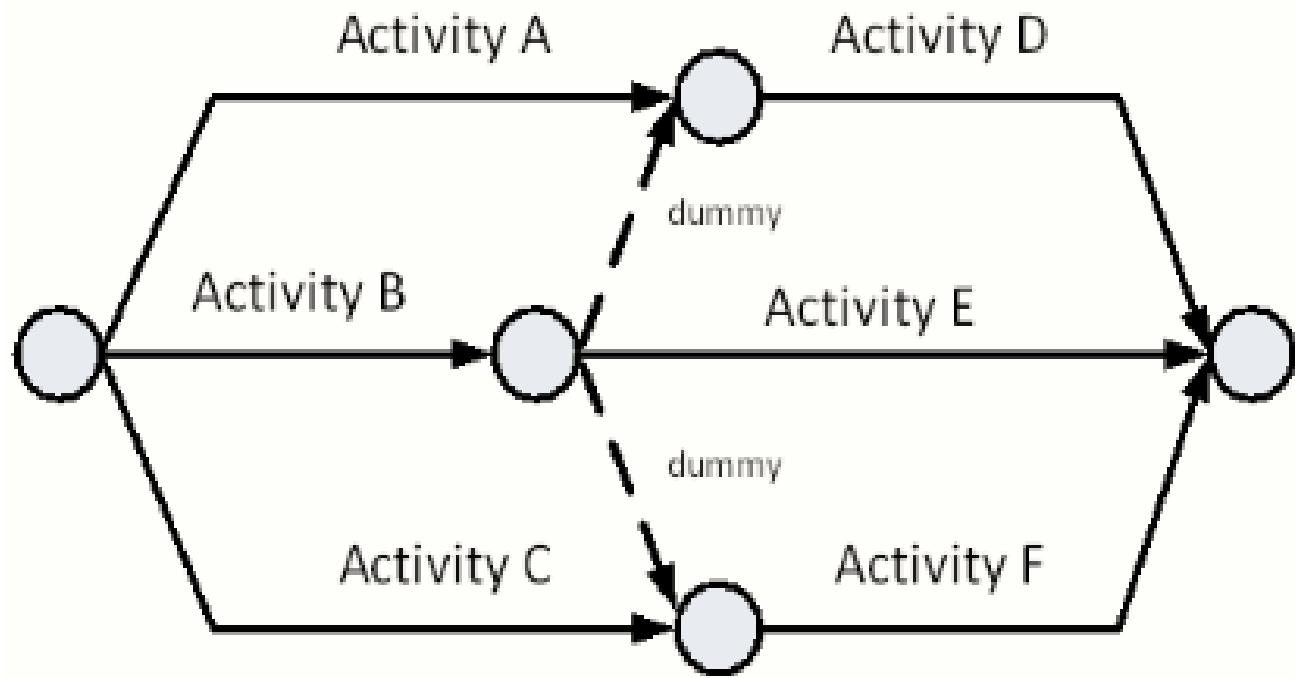
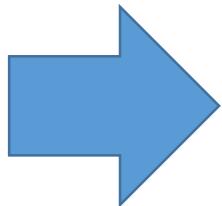
Figure: A dummy activity

# Use of Dummies

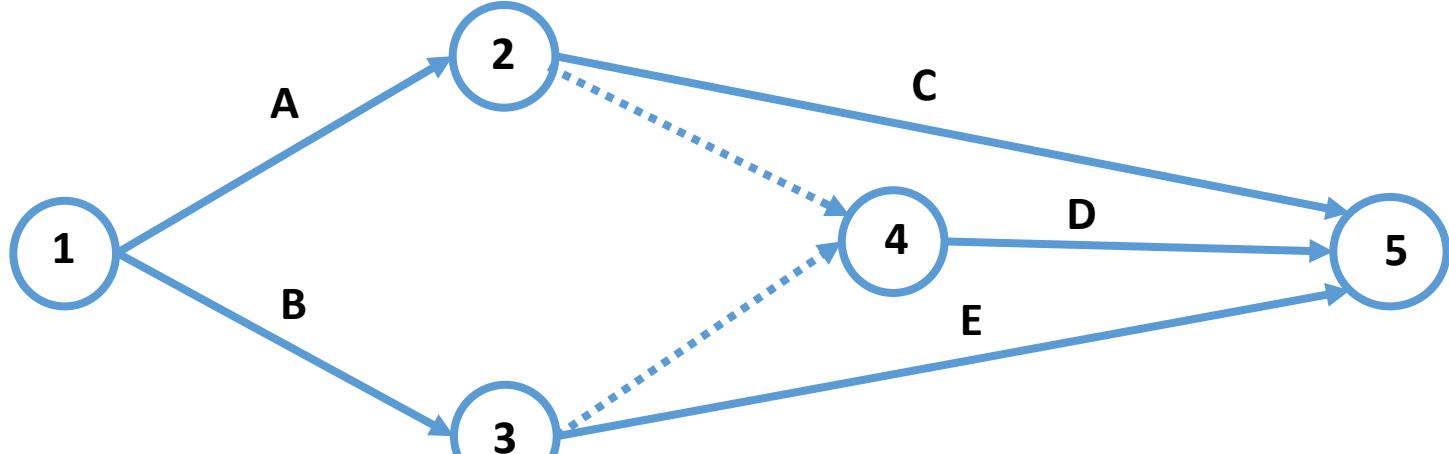
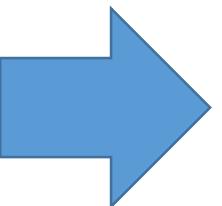
Activity	Predecessor
A	None
B	None
C	A
D	A, B



Activity	Predecessor
A	None
B	None
C	None
D	A, B
E	B
F	B, C

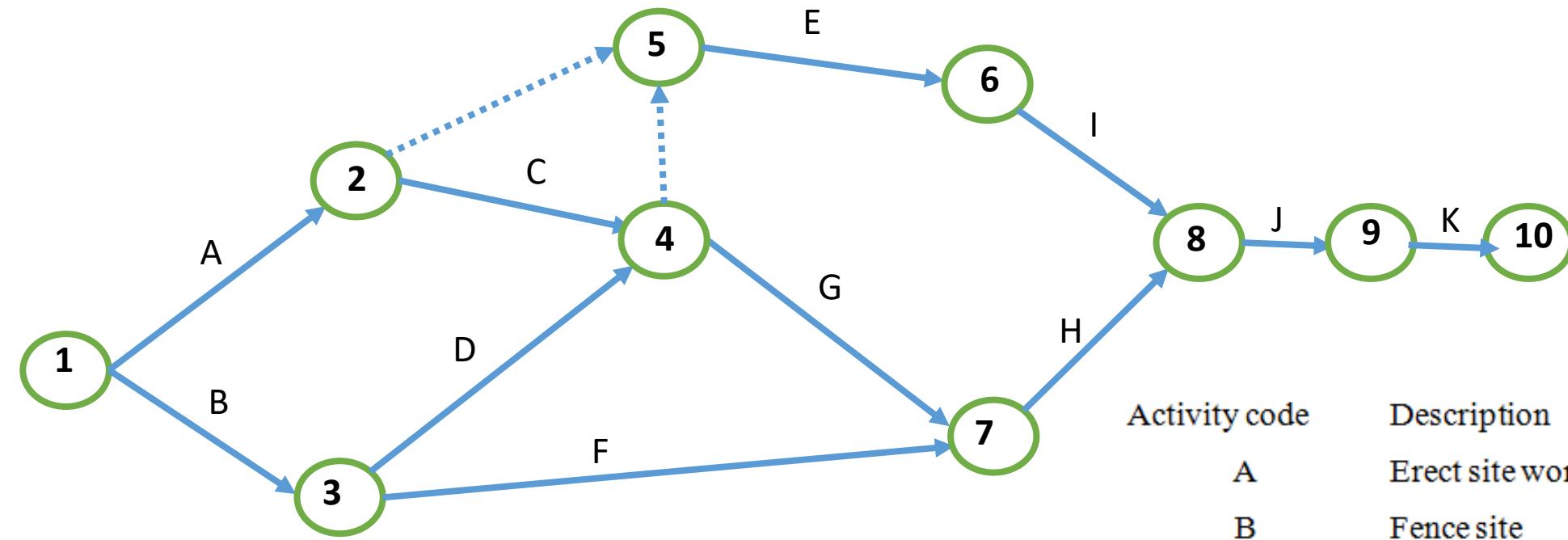


Activity	Predecessor
A	None
B	None
C	A
D	A, B
E	B



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

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



Activity code	Description	Prerequisites
A	Erect site workshop	-
B	Fence site	-
C	Bend reinforcement	A
D	Dig foundation	B
E	Fabricate steel work	A, C
F	Install concrete plant	B
G	Place reinforcement	C, D
H	Concrete foundation	G, F
I	Paint steel work	E
J	Erect steel work	H, I
K	Give finishing touch	J

# Chapter 4.0

## **Project implementation and controlling**

©

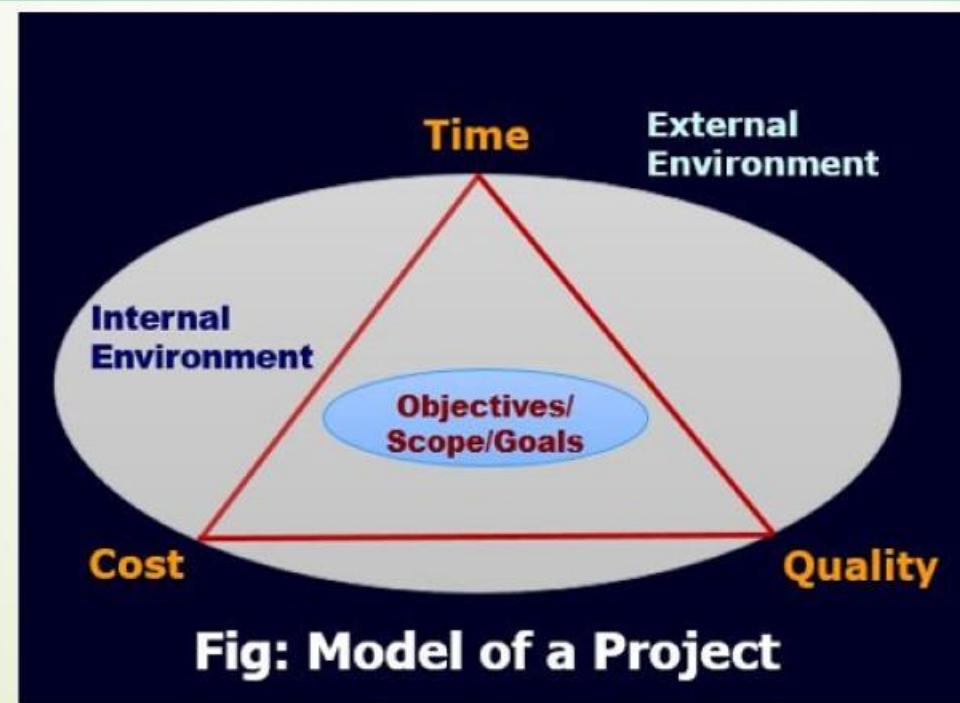
**Er. Subash K. Bhattarai**

**B.E Civil / PGDESD / MPA/ MSC Construction Management**

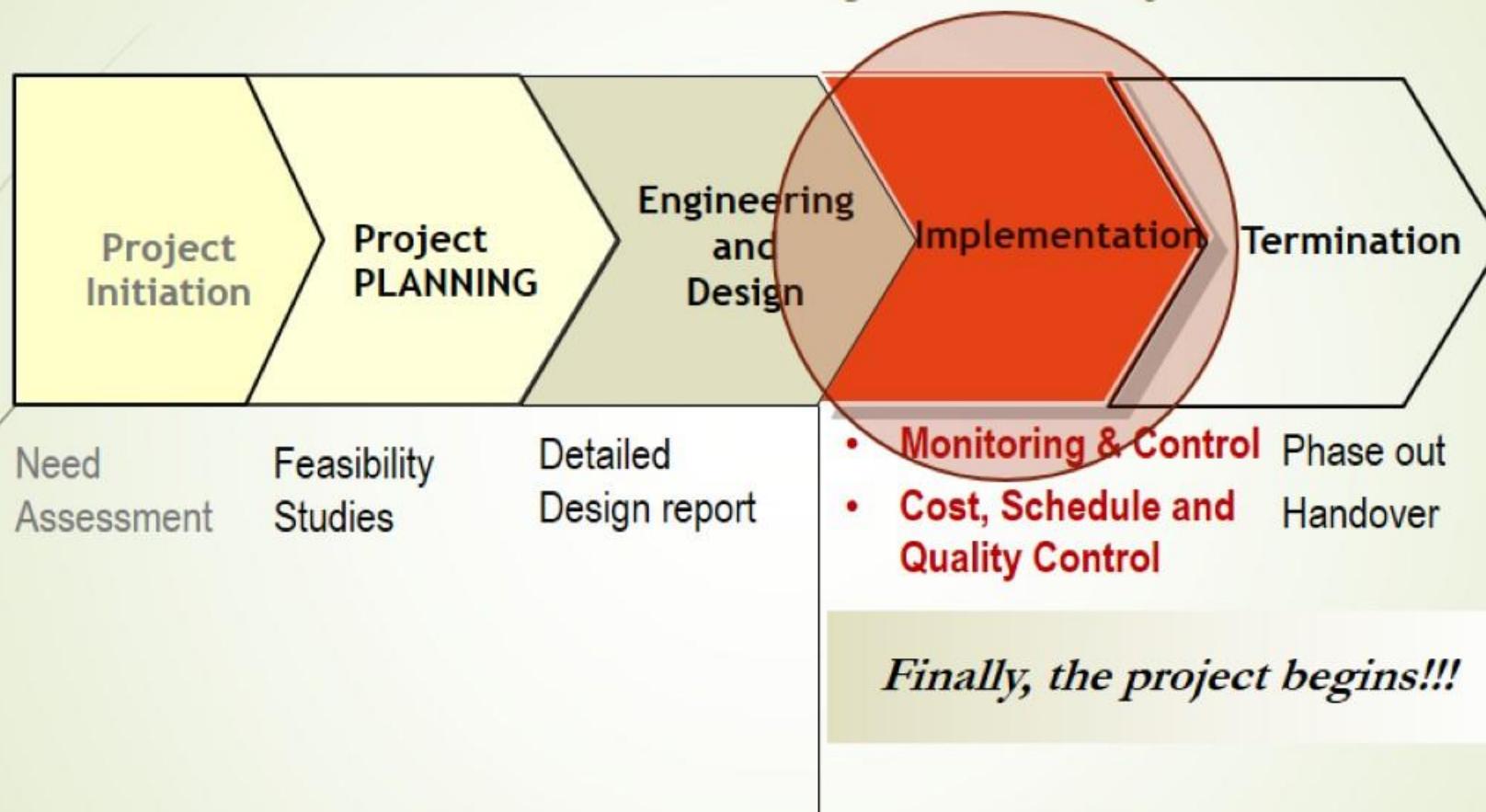
## Recall :



A project is **any set of activities** designed to attain the **specific objective** within the constraints of **time, cost and quality** in a **dynamic environment**.



## Recall: The 5 Phases of Project Life Cycle



## 4.1 Introduction to Monitoring, Evaluation and Controlling

### Monitoring

अनुगमन

- Monitoring refers to the timely gathering of information to review of project implementation. It is on-going management review key factors of project implementation performance.
- It aims to ensure that project inputs, schedules, outputs and other actions are proceeding according to the project plan.
- It is done during the project implementation phase



## Evaluation

## मूल्यांकन

- Evaluation is an objective and systematic judgmental process for determining relevance, efficiency, effectiveness and impact of project performance. It is assessment of project during implementation.
- Evaluation is done to improve project implementation and to improve future project planning and decision making. It is an external activity in the project.

**Evaluation can be of the following types:**

- On-going
- Mid-Term
- Terminal
- Ex Post



**How are we doing?**



## Controlling

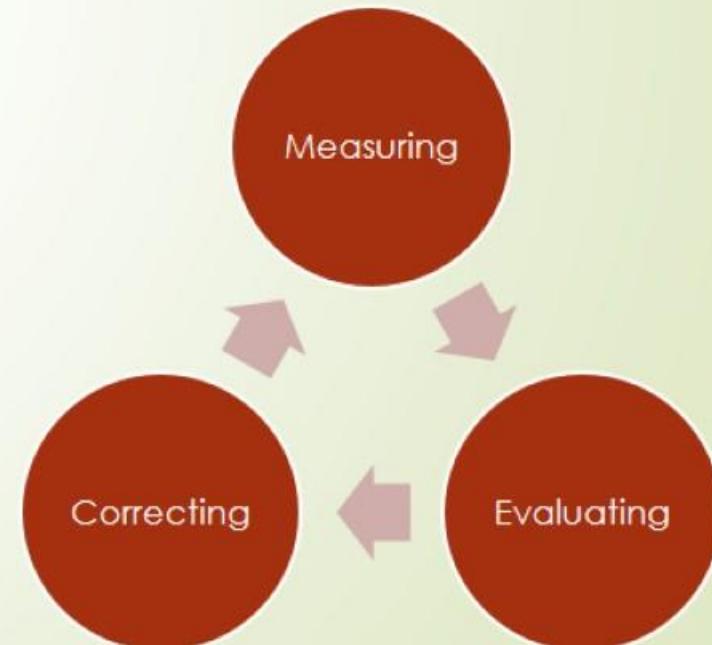
## नियन्त्रण

Controlling is the 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. It includes three step processes- measuring, evaluating and correcting.

**Measuring:** determining through formal and informal reports the degree to which the progress towards objective is being made

**Evaluating:** determining cause and of possible ways to act upon significant deviations from planned performance

**Correcting:** Taking control action to correct an unfavorable trends or to take advantage of an unusually favorable trend



## 4.2 Project Control

- ▶ **Project controls** are the data gathering, management and analytical processes used to predict, understand and constructively influence the time and cost outcomes of a **project**; through the communication of information in formats that assist effective management and decision making.
- ▶ Control is an essential function of management. It ensures that the right things are done in the right manner and at the right time

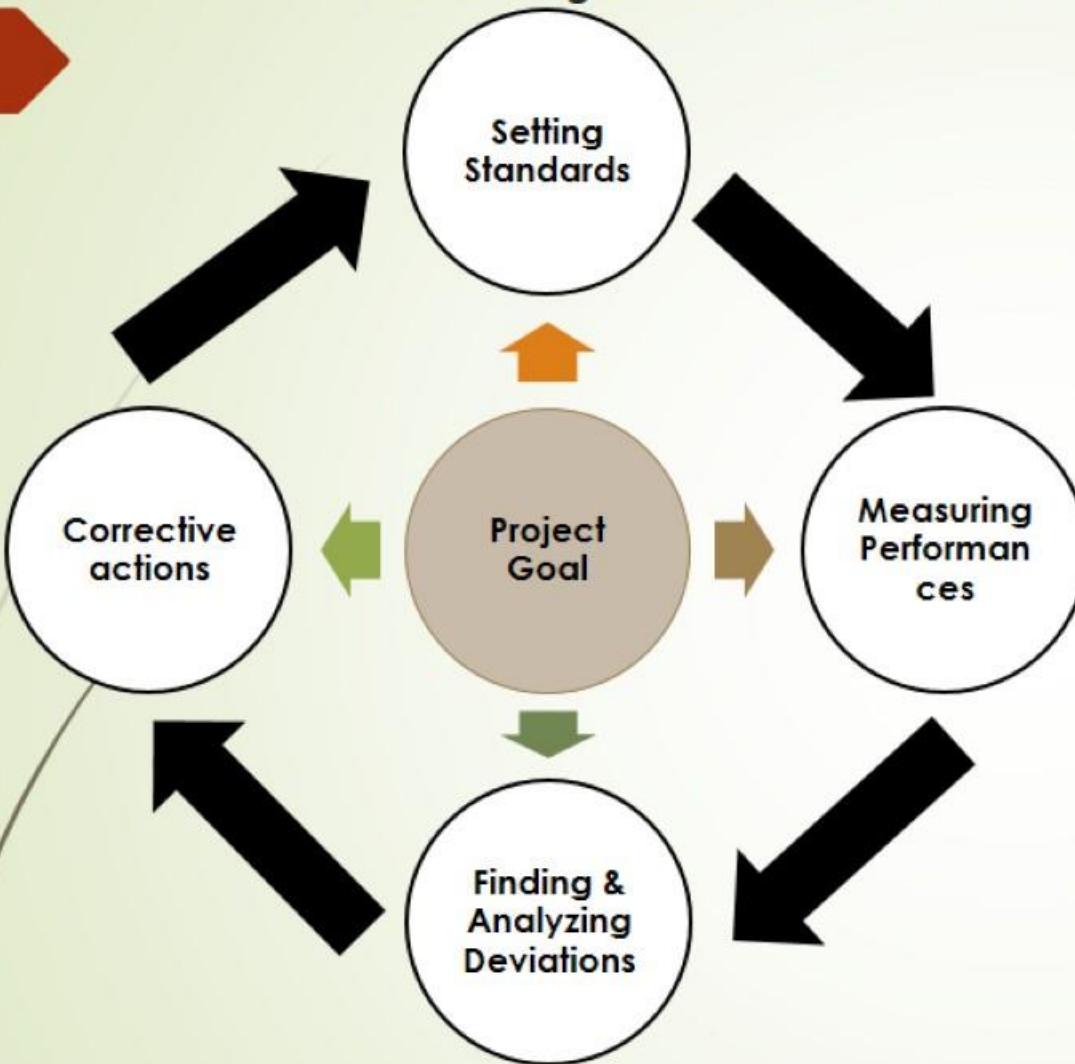
**Types of Control:** Control can be of the following types:

**Pre-control (Feed-forward control):** It is inputs-based. It is initiated before the start of the activity. It anticipates problems in advance and takes preventive corrective actions. Examples are: specifications for quality control, capital budgeting methods, acquisition of right human resources.

**Concurrent Control (Yes/No Control) :** It is transformation-based. it is initiated during the implementation of the activity. It consists of actions to ensure that operations are being conducted according to plans. Problems are corrected as they arise. Example is quality control from process to process.

**Post Control (Feedback Control):** it is output-based. it is initiated after the completion of the activity. It is based on feedback of performance results. Example is financial analysis

## 4.3 Project Control Cycle



1. **Setting Standards (What should be done?)**
2. **Measuring Performance (What actually was done?)**
3. **Finding Deviations (Extent and causes of difference)**
4. **Corrective Actions (Future Standards)**

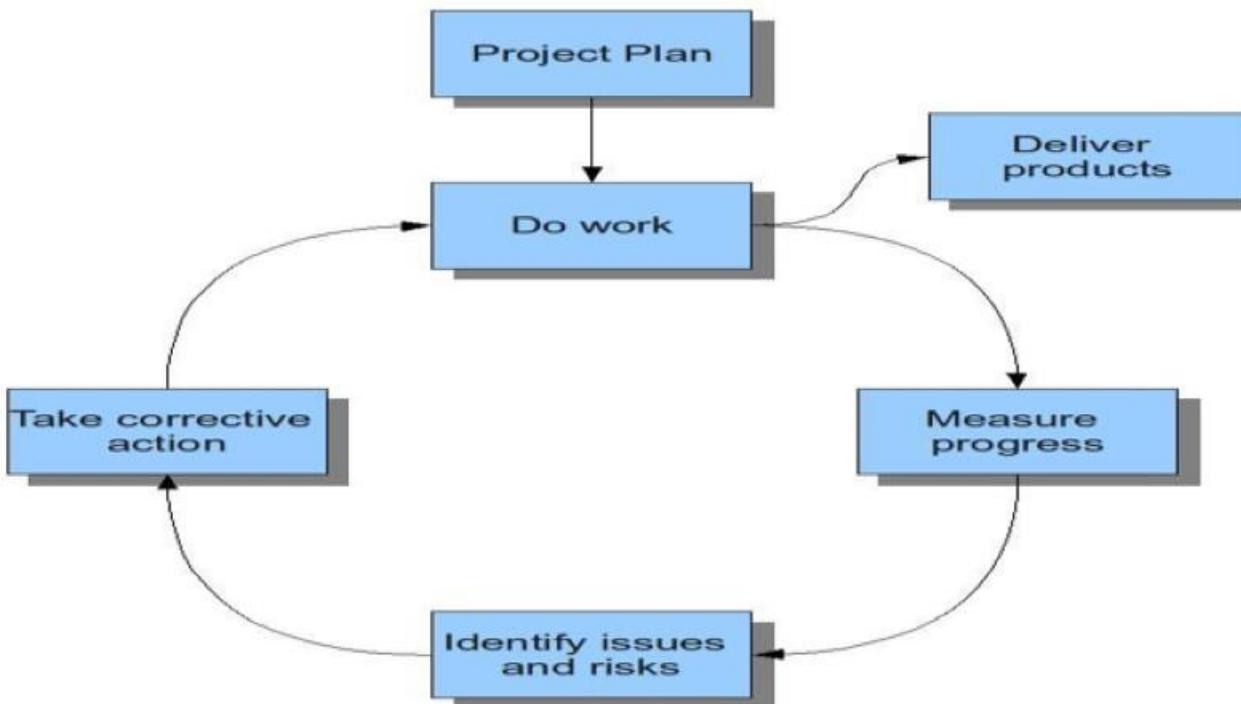
The actions can be:

- Do nothing
- Correct deviations
- Change Standards:

- Control is managerial process. It is interrelated with planning. Planning provides standards for control.
- Control measures actual performance and compares it with standards to identify deviations. Deviations are analyzed to take corrective actions.

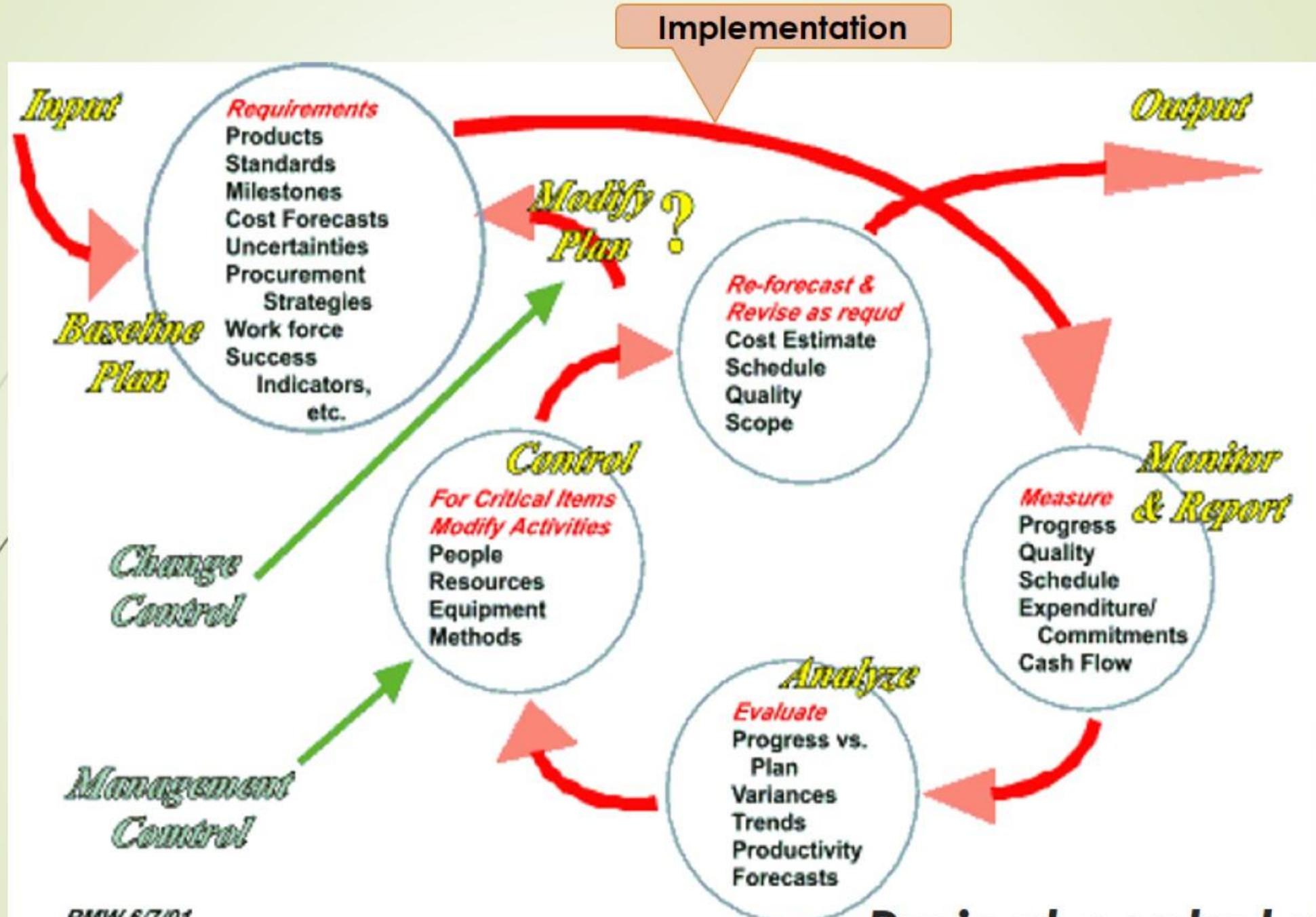
# Project control system

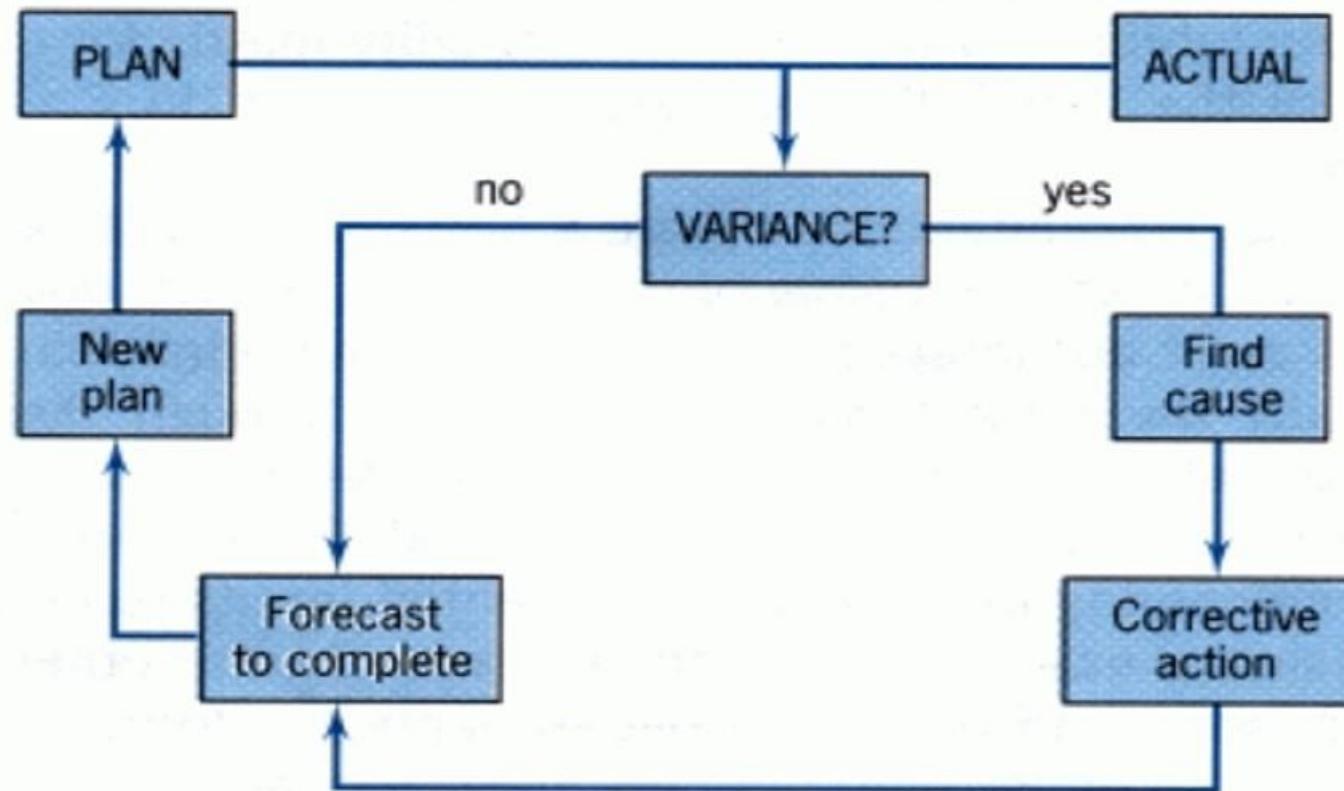
- Project control system is a process or mechanism for continuing regular monitoring and controlling of a project. It serves two major functions.
- Ensures regular monitoring of performances
- Motivates project personnel to strive for achieving project objectives



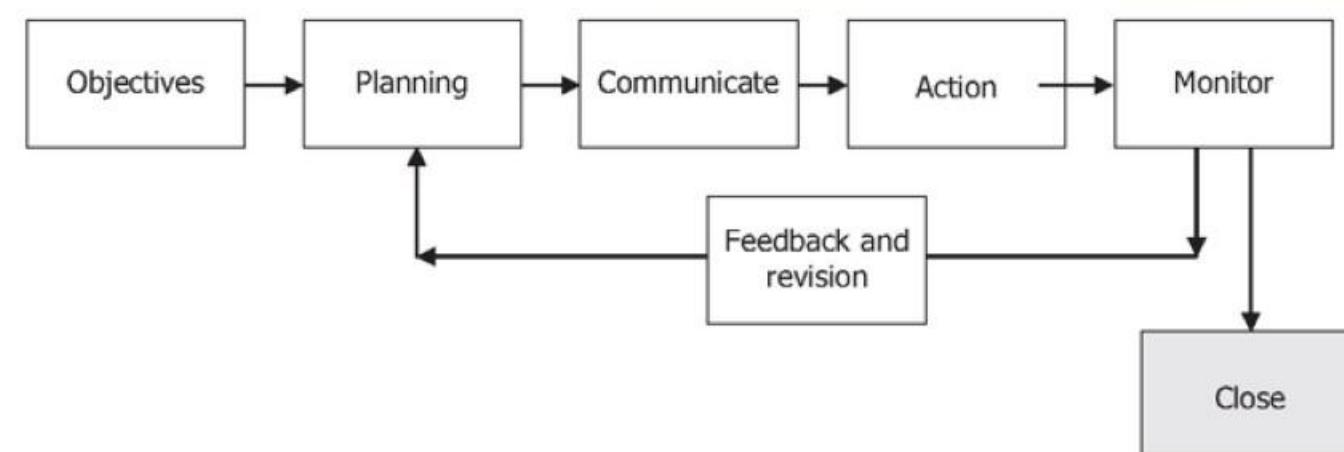
Some important information a project control system should provide to the project manager:

- True picture of work progress
- Relationship between cost and schedule performances
- Potential problems
- Practical level of summarization of the problem and action take
- Audit ability





## Feedback Control Cycle



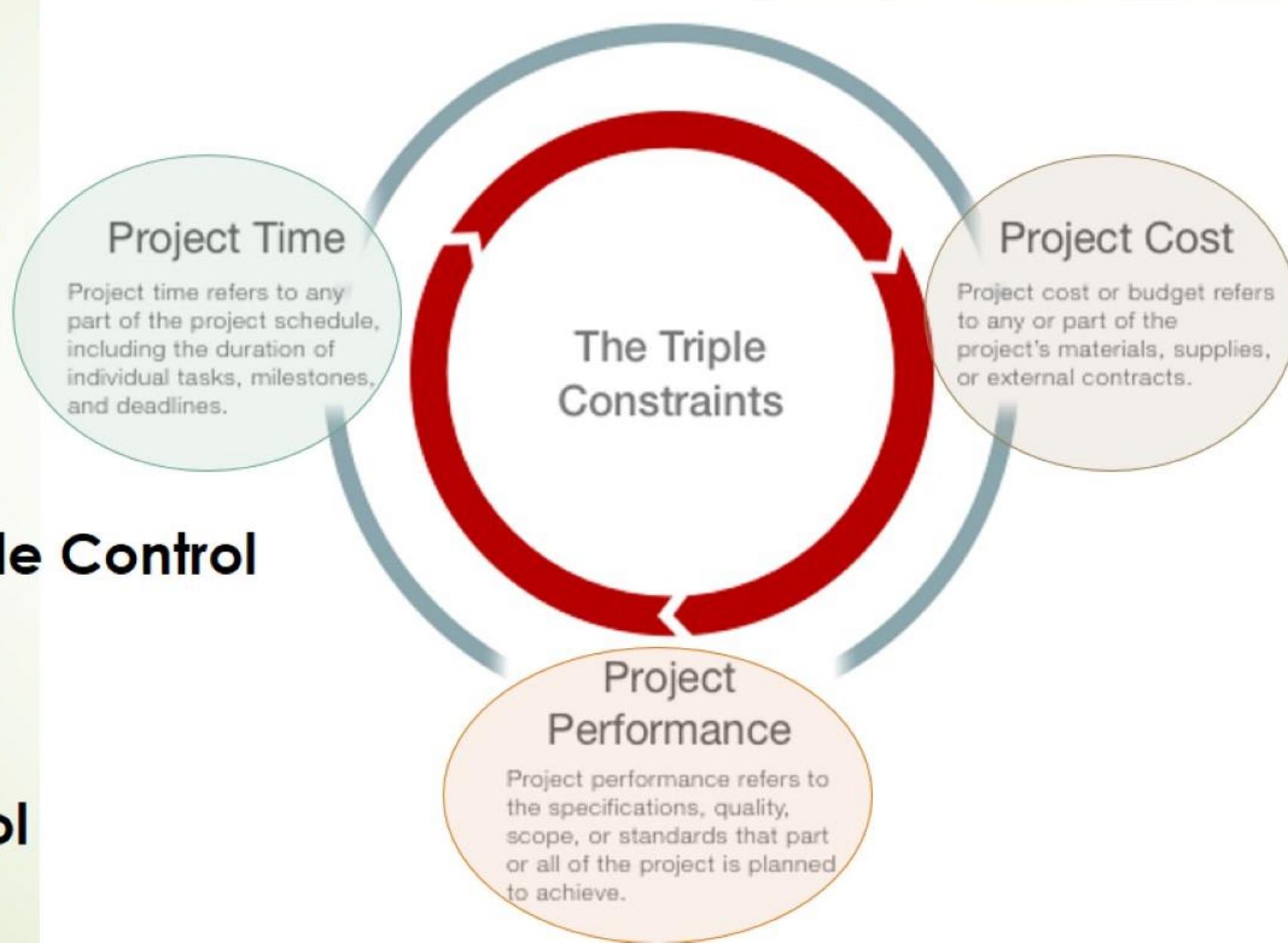
## 4.4 Elements /Areas for Project Control

- The project constraints consisting of time, cost, and quality performance serve as the key areas for project control.

**Time/ Schedule Control**

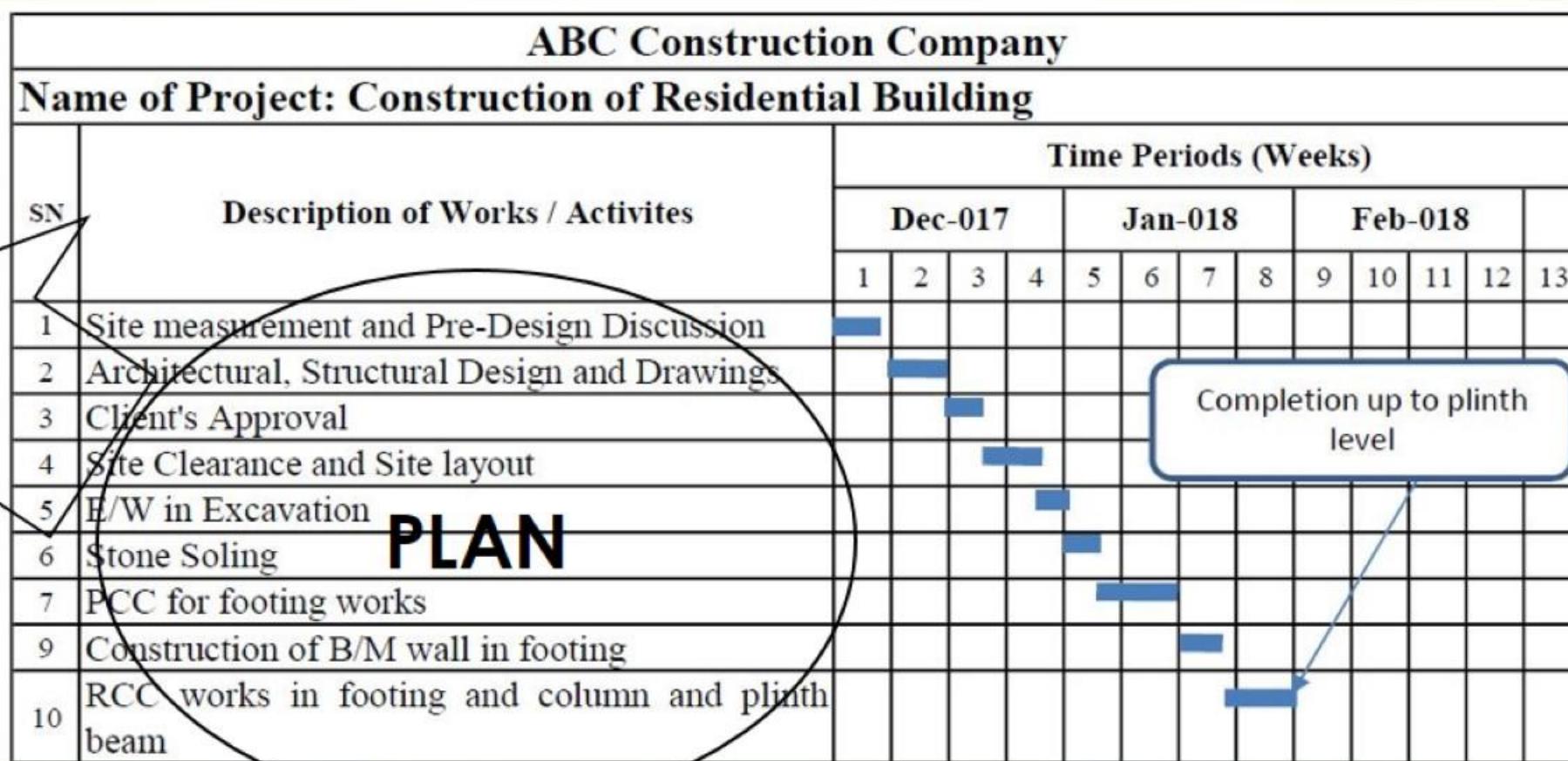
**Cost Control**

**Quality Control**



## 4.5 Project Schedule Control

- Time is one resources that we manage and control; it is non renewable. Schedules are graphical representation of time management on a project.



## *Updating*

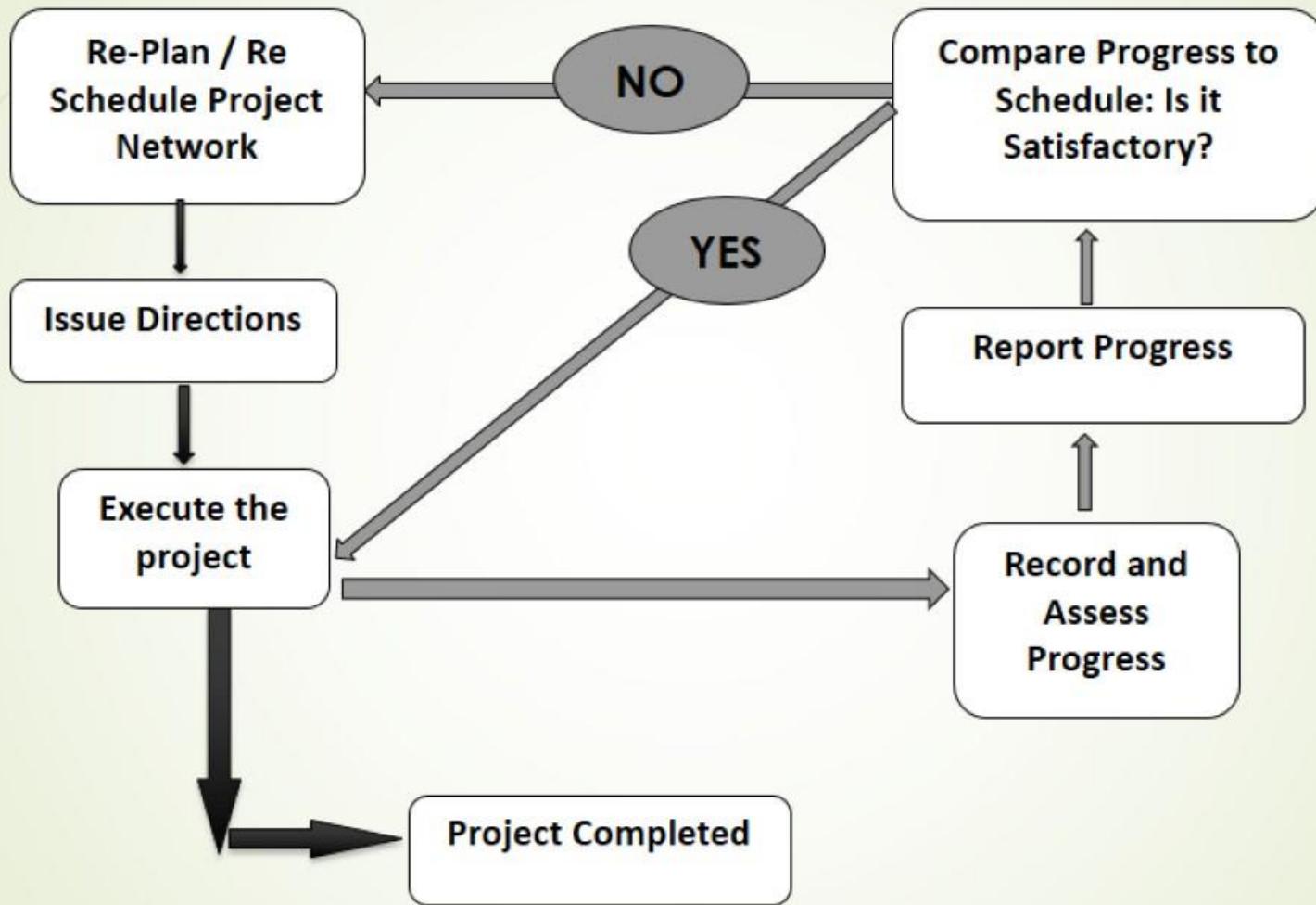
- 
- The process of **re-planning** and **rescheduling** based on the results which serve as a guidance for decision by performing calculations made by taking into consideration of **new knowledge** and **latest information** at an **intermediate stage** of the project thus modifying the original schedule / network, is known as the process of Updating

### *Data required for updating*

The following information is necessary to update the plan at an intermediate stage of execution of a project:

- Original Schedule / Network
- Original Schedule / Network calculation chart
- Stage at which the updating is being done (Monitoring completed)
- Execution position of the project at that stage and
- New information and knowledge, that affects the duration time of the activities to be performed

# *The updating cycle*



**Measure Work Progress**

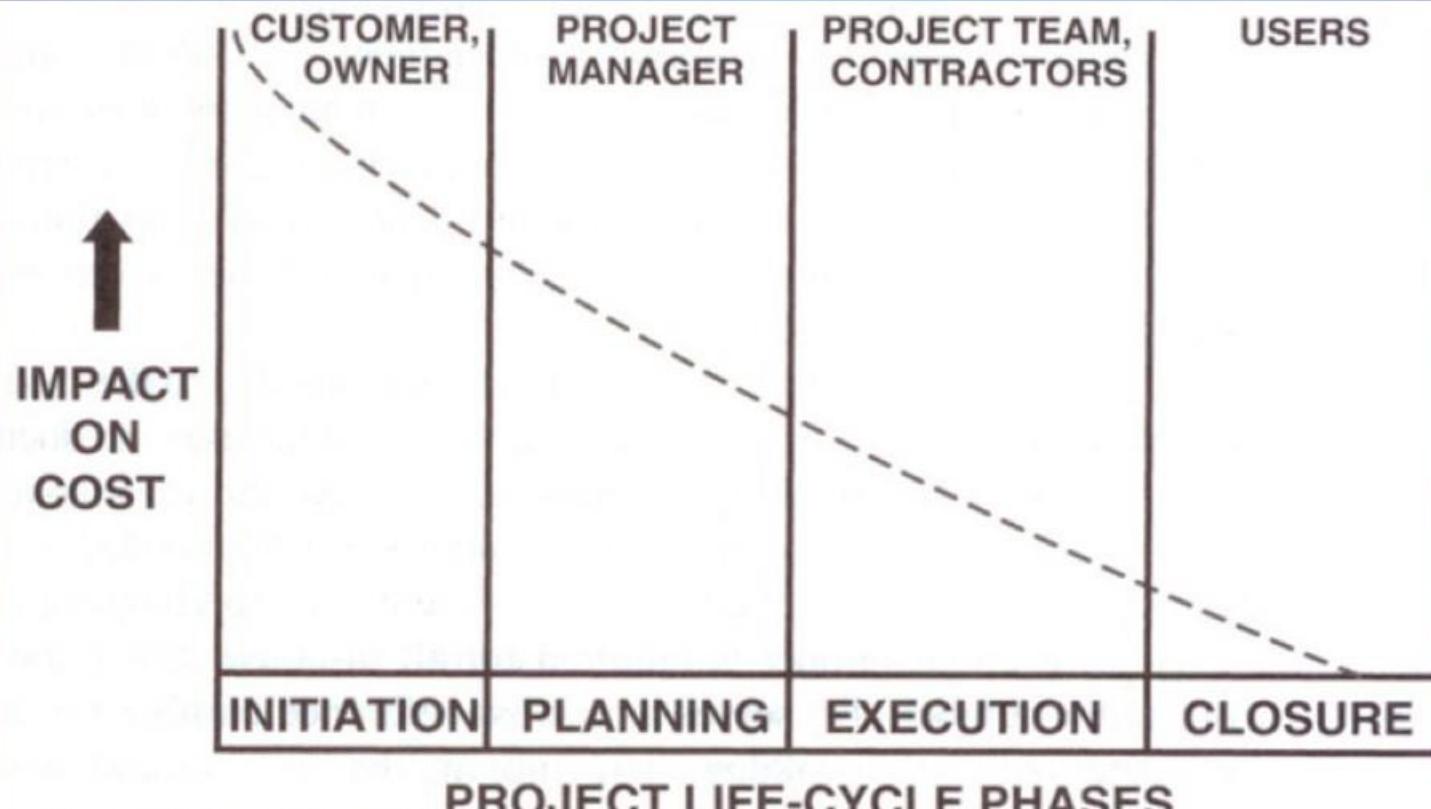
**Scheduling Control:**  
They control technical performance.

- ▶ The techniques are:
- ▶ Work Breakdown Structure (WBS)
- ▶ Bar chart
- ▶ Network Analysis (PERT/CPM)
- ▶ Line of Balance (LOB)

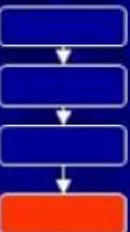
## 4.6 Project Cost Control

- Cost control may be broadly defined as the process of controlling the expenditure in a project at all stages from its inception through its development.

### Ability to Influence Cost



# Cost Control



Inputs	Tools	Outputs
<ul style="list-style-type: none"><li>1. Cost Baseline</li><li>2. Performance Reports</li><li>3. Change Requests</li><li>4. Cost Management Plan</li></ul>	<ul style="list-style-type: none"><li>1. Cost Change Control System</li><li>2. Performance Measurement</li><li>3. Earned Value Management</li><li>4. Additional Planning</li><li>5. Computerized Tools</li></ul>	<ul style="list-style-type: none"><li>1. Revised Cost Estimates</li><li>2. Budget Updates</li><li>3. Corrective Action</li><li>4. Estimate at Completion</li><li>5. Project Closeout</li><li>6. Lessons learned</li></ul>

- Understand what is driving variances, good and bad, and decide what action to take.

# **General methods of cost control**

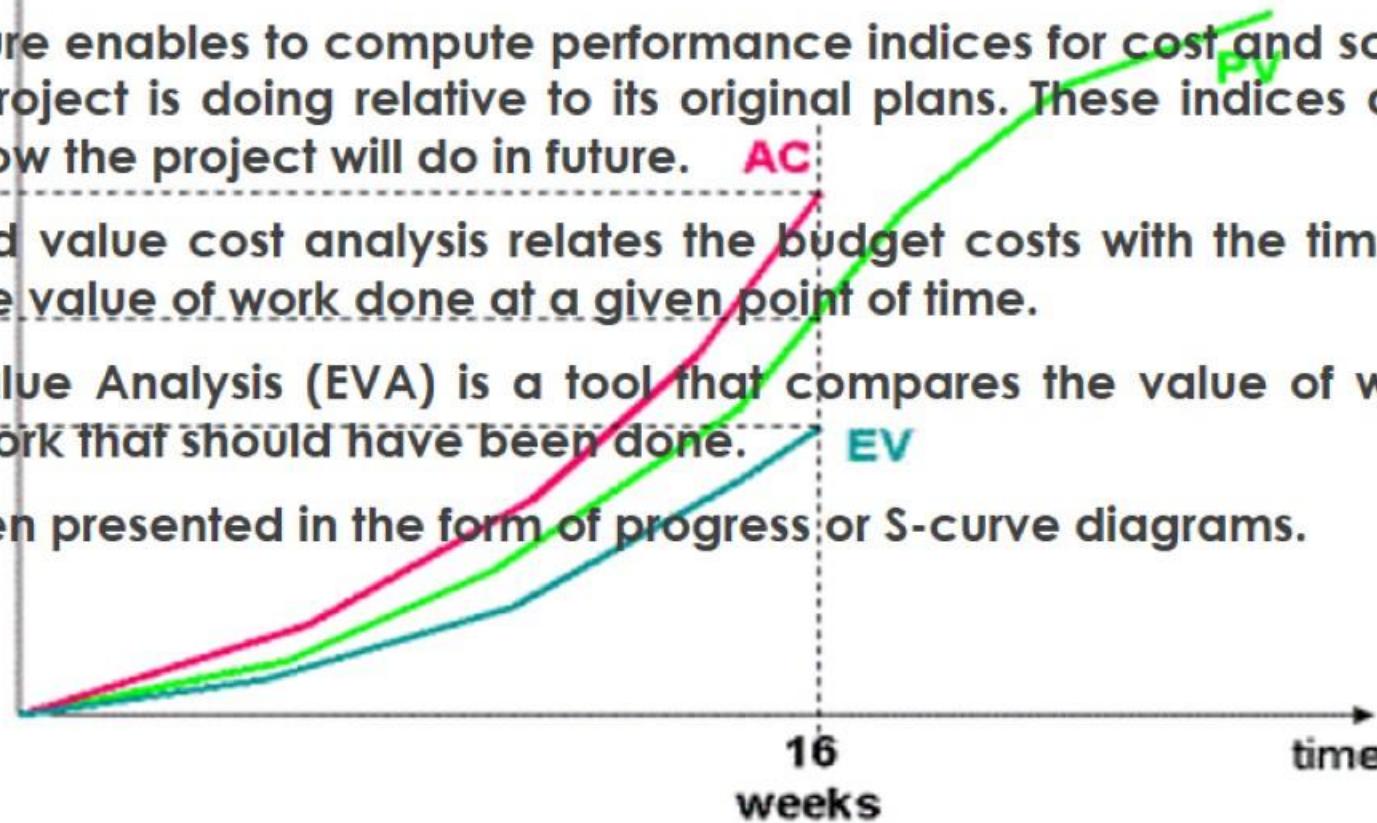
- ▶ 1. Short term planning and control
  - ▶ In this method project is broken down in much smaller components and short term plan for weeks or days are prepared. Such plans are easy to evaluate and monitor.
- ▶ 2. Accounting methods of control
  - ▶ A. Overall profit/ loss account
    - ▶ Balance sheet
  - ▶ B. Profit-loss on valuation dates

<b>Item of work</b>	<b>Unit</b>	<b>Tender Cost</b>	<b>Actual Cost</b>	<b>Variance</b>	<b>Remarks</b>
<b>E/W in Excavation</b>	Cu.m	200	130	70	Profit
<b>PCC (1:3:6)</b>	Cu.m	4800	4600	200	Profit
<b>RCC</b>	Cu.m	6500	6700	200	Loss

- ▶ 3. Project Cost Models (S-curves)

## Project cost curves (models/S-curve) / Earned Value Analysis

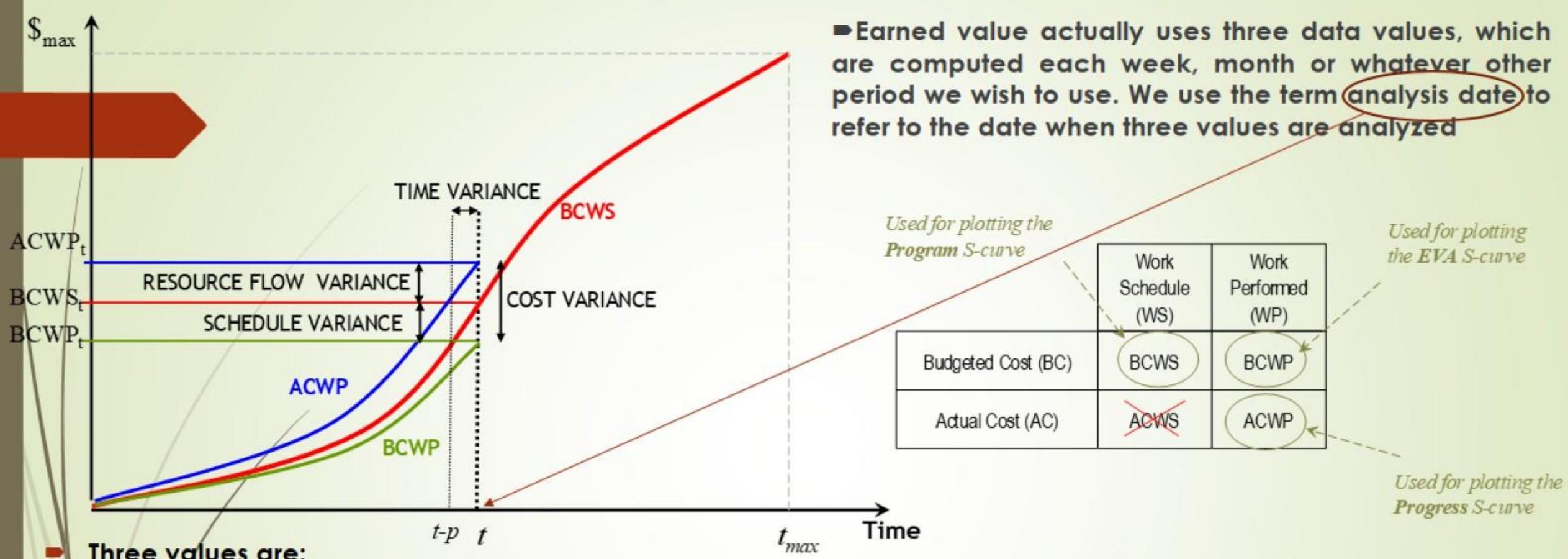
- EVA is a way to measure the amount of work actually performed on a project (i.e., to measure its progress) and to forecast a project's cost and date of completion. The method relies on a key measure known as earned value.
- This measure enables to compute performance indices for cost and schedule, which tells how the project is doing relative to its original plans. These indices also enable one to forecast how the project will do in future.
- The earned value cost analysis relates the budget costs with the time progress. Earned value is the value of work done at a given point of time.
- Earned Value Analysis (EVA) is a tool that compares the value of work done with the value of work that should have been done.
- EVA is often presented in the form of progress or S-curve diagrams.



PV = Planned Value

AC = Actual Cost

EV = Earned Value



- Three values are:

- Budgeted Cost for Work Scheduled (BCWS)**. It represents the cumulative, time-phased cost projections made in the budget for activities that are scheduled to be performed. It shows what is planned for execution. It answers the question related to “**how much did we plan to spend as of this date?**” (**How much work was planned to complete?**)
- Budgeted Cost for Work Performed (BCWP)** or the value earned. It shows the cumulative cost budgeted for the work performed. It answers the question related to “**how much work (progress) has been actually achieved or earned?**”
- Actual Cost for Work Performed (ACWP)**. It represents the cumulative actual cost incurred on date in accomplishing the work. It answers the question related to “**how much have we actually spent (amount of money)?**”

► Earned value actually uses three data values, which are computed each week, month or whatever other period we wish to use. We use the term **analysis date** to refer to the date when three values are analyzed

## Some Derived Metrics in EVA (parameters in EVA)

<u>1. Variances</u>	Formula	Interpretation
Cost Variance	$CV = BCWP - ACWP$	<ul style="list-style-type: none"> <li>If CV is +ve, cost under run (actual budget expense is less than planned)</li> <li>If CV is -ve, cost overrun (actual budget expense is greater than planned)</li> <li>If CV is 0 No cost variance (actual expense is equal to planned)</li> </ul>
Schedule Variance	$SV = BCWP - BCWS$	<ul style="list-style-type: none"> <li>If SV is +ve, Schedule under run (actual schedule is ahead of planned)</li> <li>If SV is -ve, Schedule overrun (actual schedule is behind of planned)</li> <li>If SV is 0 No Schedule variance (actual Schedule is equal to planned)</li> </ul>

<u>2. Variances expressed in percentage</u>		
CV %	$\frac{BCWP - ACWP}{BCWP} * 100 \%$	Over budget or under budget expresses in % , by what % does the cost under run or over run
SV %	$\frac{BCWP - BCWS}{BCWS} * 100 \%$	Behind or A head Schedule expressed in % , by what % does the Schedule under run or over run

### 3. Indices

Cost performance index	$CPI = BCWP / ACWP$	<ul style="list-style-type: none"><li>• If <math>CPI \geq 1</math>, Better Performance for Cost, less budget</li><li>• If <math>CPI &lt; 1</math>, Poor Performance for Cost, more budget</li></ul>
Schedule Performance Index	$SPI = BCWP / BCWS$	<ul style="list-style-type: none"><li>• If <math>SPI \geq 1</math>, Better Performance in Schedule, ahead of schedule</li><li>• If <math>SPI &lt; 1</math>, Poor Performance in Schedule, behind of schedule</li></ul>

### 4. Trends & Fore Cast

Estimate at Completion	$EAC = \text{Total project Cost} / CPI$	
Schedule at Completion	$SAC = \text{original project duration} / SPI$	

### 5. Variance at Completion (VAC)

VAC(cost)	$VAC = \text{Original Project budget} - EAC$	
VAC (Schedule)	$VAC = \text{Original Project Duration} - SAC$	

- Er. Sharma was responsible for 125 cum of excavation to be done in 10 days with the expenditure of Rs 12,50,000. At the end of 3<sup>rd</sup> day he managed to complete 40 cum of excavation with expense of Rs 3,75,000. Perform earned value analysis and comment on his performance.

**Sol<sup>n</sup>.**

Total work = 125m<sup>3</sup> of excavation

Total project duration = 10 days

Total project cost = Rs. 12,50,000

Monitoring(Analysis) date = 3<sup>rd</sup> day from start of work

Work completed at this date = 40m<sup>3</sup> of excavation

Expenses for completed work so far = Rs. 3,75,000

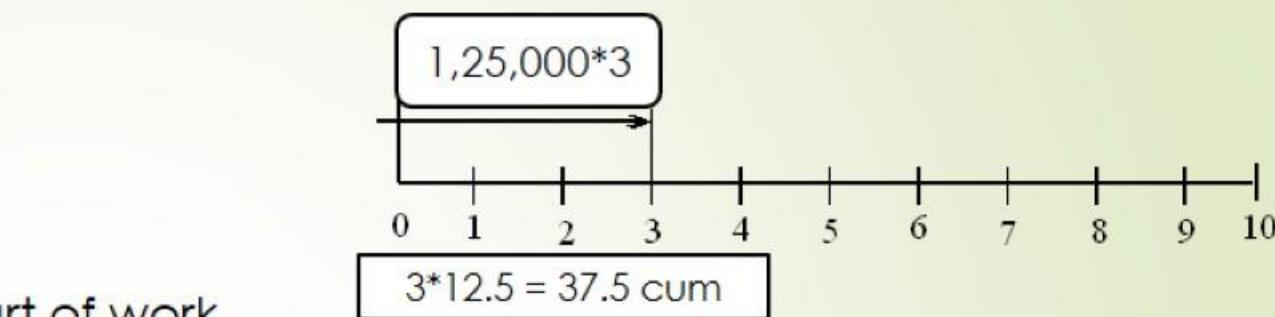
#### Budgeted Cost for work scheduled (BCWS):

Cost of excavation for 10 days = Rs. 12,50,000

∴ Cost per day as per schedule = Rs. 12,50,000/10

$$= \text{Rs. } 1,25,000$$

$$\therefore \text{Scheduled cost for 3 days} = 3 \times 1,25,000 = \text{Rs. } 3,75,000$$



OR

Total Excavation works = 125 cum  
Excavation per day = 125/10 = 12.5 cum  
Total scheduled work of excavation for three days =  $3 \times 12.5 = 37.5$  cum  
Total scheduled cost up to three days =  $37.5 \times 10000 = \text{Rs. } 3,75,000$

#### Actual Cost of Work Performed (ACWP)

Actual expenses of work performed up to monitoring date = Rs. 3,75,000

#### Budgeted Cost of Work Performed (BCWP)

Cost per m<sup>3</sup> of excavation = Rs. 10,000

Performed work up to monitoring date = 40m<sup>3</sup>

∴ Scheduled cost or Budgeted cost of work performed =  $10,000 \times 40 = \text{Rs. } 400000$

**[This is value earned from work performed]**



## Old Question

- A construction work had to be completed in 10 days with 50 labour days at Rs 1000 per day i.e. with total cost of Rs 50,000. at the end of third day, only 25 % work was completed with the use of 18 labour days at Rs 800 per day. Perform EVA and comment on the performances.



## 4.7 Project Quality Control

### What is Quality?

**Quality in business, engineering and manufacturing** has a pragmatic interpretation as the non-inferiority or superiority of something; it is also defined as *fitness for purpose*.

Quality is a perceptual, conditional, and somewhat subjective attribute and may be understood differently by different people.

According to advanced learner dictionary, quality is degree of goodness

### **Other defines quality as:**

- ▶ conformance to requirements
- ▶ Zero defects
- ▶ Consistent conformance to expectation
- ▶ Doing things right the first time
- ▶ Quality is the totality of characteristics of an entity that bears on its ability to satisfy stated and implied needs

## Facts regarding quality

- ▶ Quality is not grade
  - ▶ (grade is an indicator of category or rank related to features that cover different sets of needs for products or services intended for the same functional use.)
  - ▶ Level is a general indication of the extent of departure from the ideal.
  - ▶ A high grade article can be of inadequate quality as far as satisfying needs and vice versa. E.g. a luxurious hotel with poor services or small highway motel with excellent service)
- ▶ Quality is means of achieving project success. It is not the goal in itself
- ▶ Process / service quality is more than product quality
- ▶ Quality standards do not demand the best quality; they establish the minimum requirements to be achieved
- ▶ Quality does not happen by accident, it has to be properly planned and implemented
- ▶ Quality costs more, but lack of quality costs even more

# Dimensions of Quality (Attributes)

## Garvin's Product Quality Dimensions

product's primary operating characteristics

1. Performance

additional characteristics

2. Features

3. Reliability

will not fail within a specific time period

4. Conformance

precision



length of a product's life

5. Durability

6. Serviceability

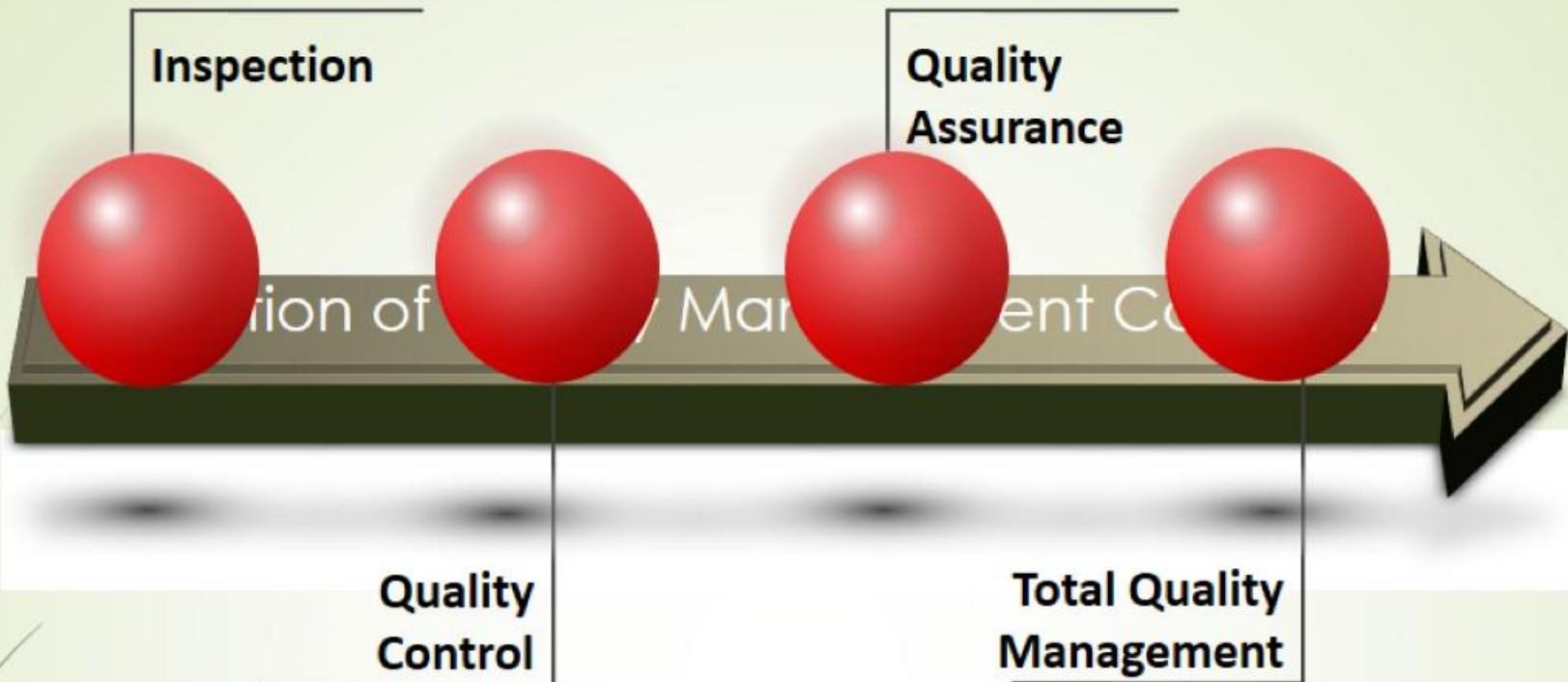
speed

7. Aesthetics

subjective dimension

8. Perceived Quality

indirect measures



*What to do?*

### QUALITY CONTROL

- Detection
- Output Verified
- Method?
  - Inspections
    - Sample or 100%
  - Inspectors

*Who does?*

### QUALITY ASSURANCE

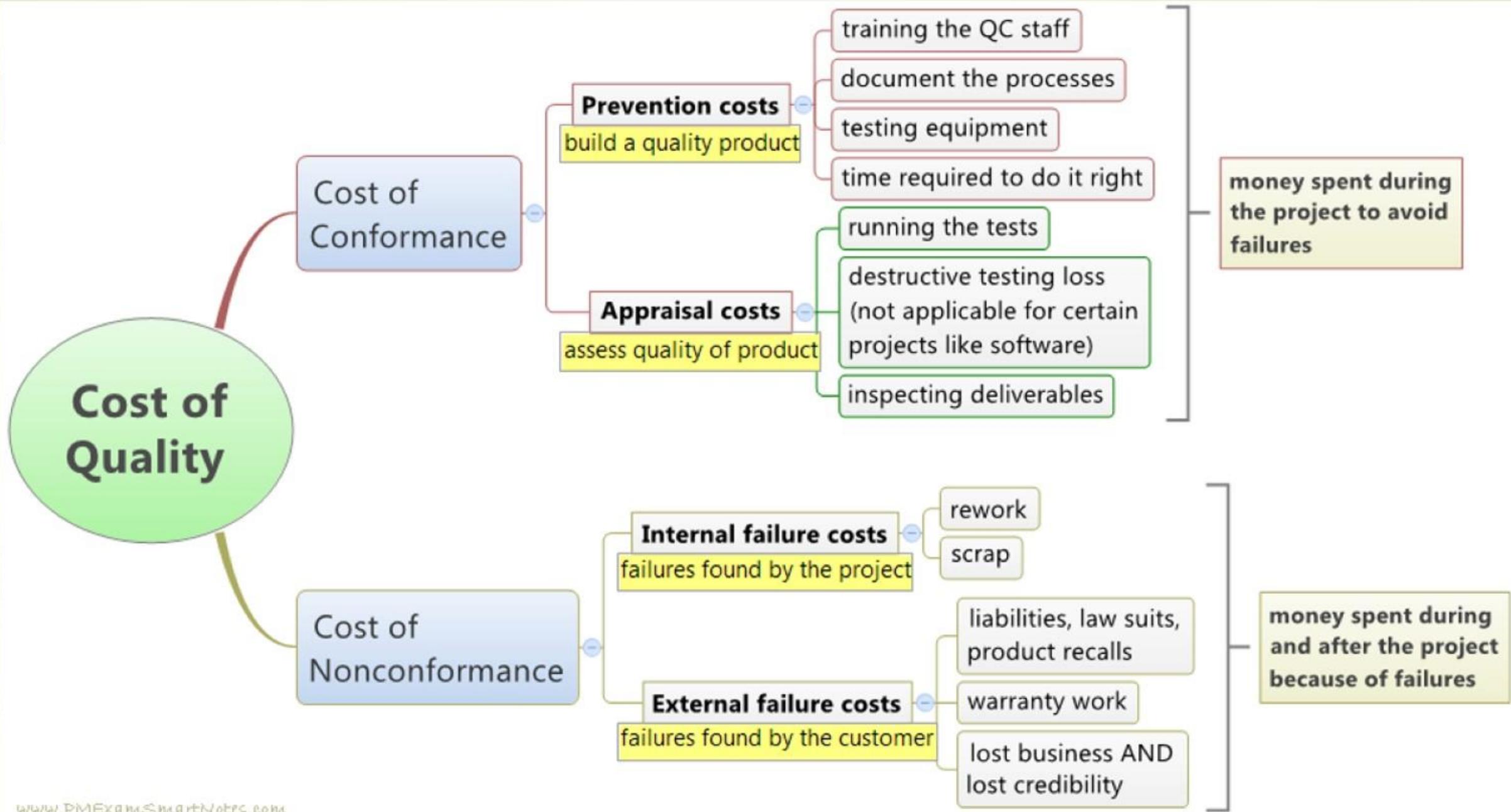
- Prevention
- Work Procedures
- Audit
  - Samples
- QA Organization

### TOTAL QUALITY

- Improvement
- Work Processes
- Quality Circles
  - all work processes
- All employees

# Quality Costs

- ▶ Quality cost can be divided into two parts:
- ▶ **A. Quality Management Cost**
- ▶ **Prevention Cost:** Cost involved in activities to ensure right first time performance, e.g., costs of:
  - ▶ quality planning
  - ▶ new products review
  - ▶ process planning
  - ▶ process control
  - ▶ quality audits
  - ▶ supplier quality evaluation
  - ▶ training
- ▶ **Appraisal Cost:** Cost involved in activities that check whether right first time is achieved, e.g., cost of:
  - ▶ incoming inspection and test
  - ▶ final inspection and test
  - ▶ product quality audits
  - ▶ maintaining accuracy of test equipment
  - ▶ Evaluation of stocks etc.



# Quality Cost contd..

## B. Failure Cost

- Cost involved in the activities which result from not confirming to right first time and includes:
  - Internal Failure Cost (Scrap, Rework, Failure Analysis, Re-inspection, Scrap and rework from suppliers etc.)
  - External Failure Cost (Warranty Charge, Returned Material etc.)
  - Intangible Quality Cost (Loss of goodwill of the company)



## 4.8 Introduction to Project Management Information System

### Project Management Information System (PMIS)

- ▶ Project Management Information System is a database for the project. It collects, analyses, stores, retrieves, and disseminates project information for making project decisions. It consists of people, equipment and procedures.
- ▶ PMIS is a communication device. Project Management Information System is based on various forms and reports that generate written information for decision making and control.

### *Essentials requirements of PMIS*

- The PMIS should be factual and objective based on reliable data
- A report on achievement and deviations should be quick hitting
- It should contain the appropriate information with required level of accuracy
- It should strive to pinpoint root causes with accuracy
- It should be easily understandable and usable



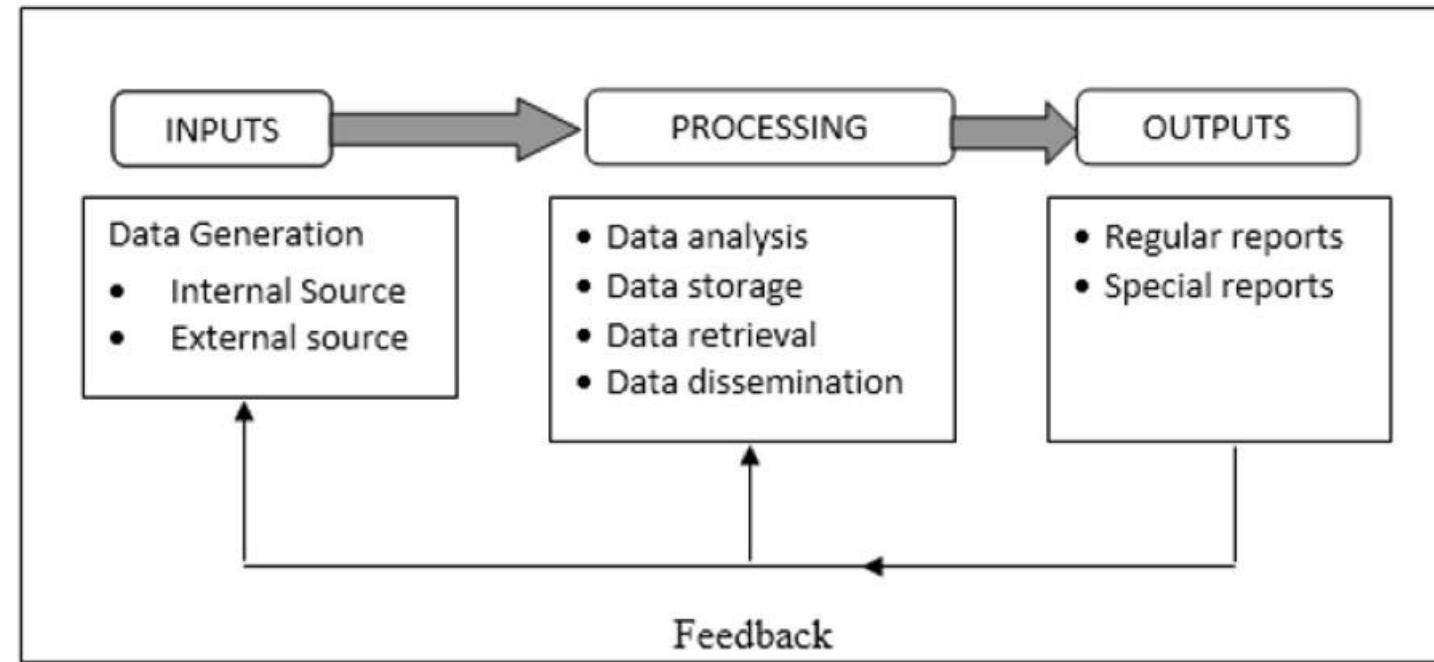
## **Advantages of PMIS**

PMIS is vital for proper functioning of the project. It offers the following benefits

- ▶ Promote better understanding in project
- ▶ It helps to target control by quantifying risks and initiating correcting action
- ▶ It helps to comprehend change in project
- ▶ It provides basis to monitor, evaluate and show the interrelationship among cost, Schedule and technical performance of entire project
- ▶ It helps to identify project problem before they occur
- ▶ It helps to make better decision and execution of those decisions
- ▶ It facilitates project planning
- ▶ It informs the project stakeholders about the progress and status of project

## *Elements of PMIS*

The project management information system consists of inputs-transformation-outputs-feedback,



*Fig: Project Management Information System*



© Alamy Stock Photo

End of Chapter Four  
THANK YOU  
See you in Chapter 5



# CHAPTER 5.0

# PROJECT RISK MANAGEMENT

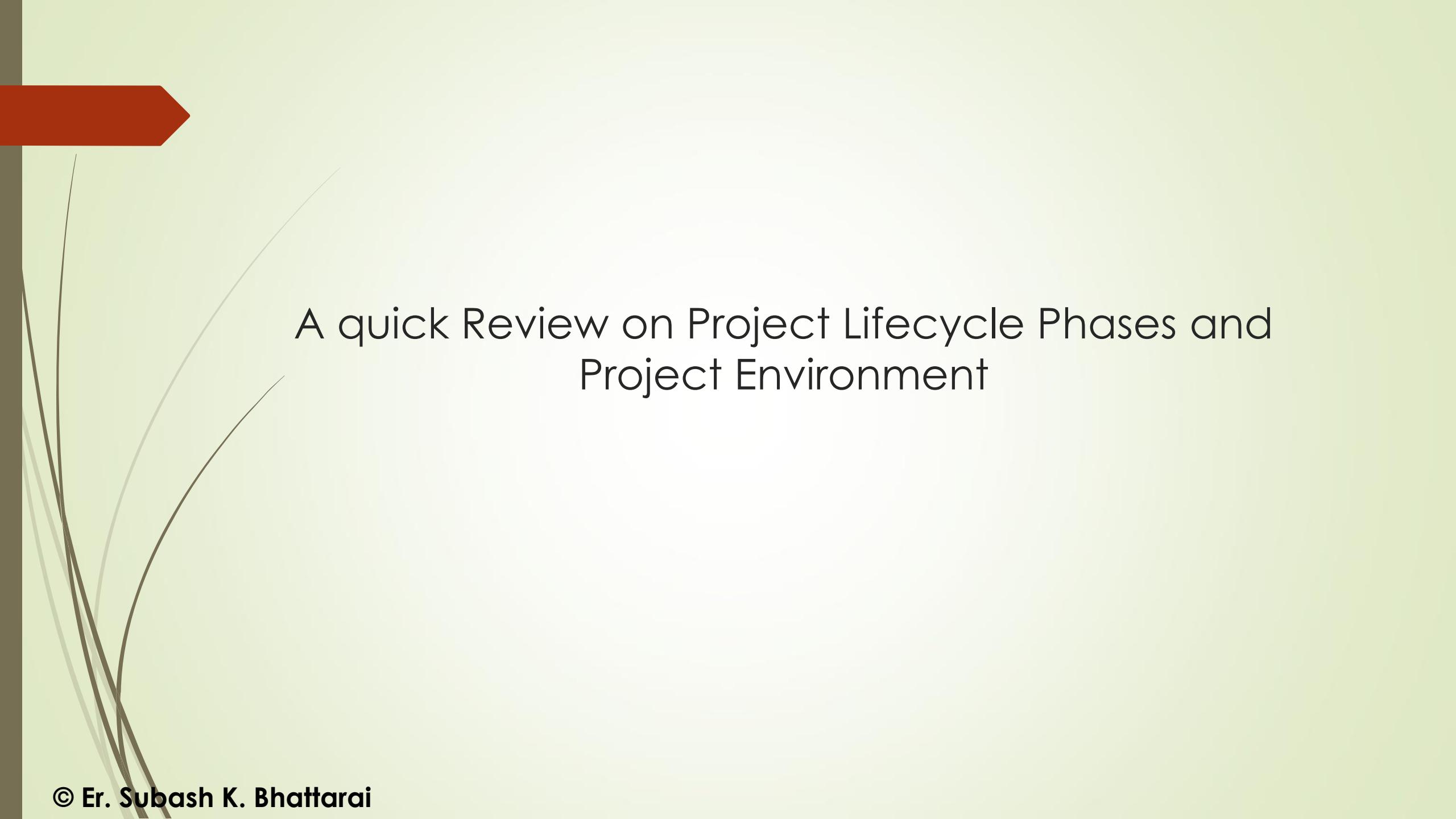
©

Er. Subash K. Bhattarai

B.E Civil / PGDESD / MPA/ MSC Construction Management

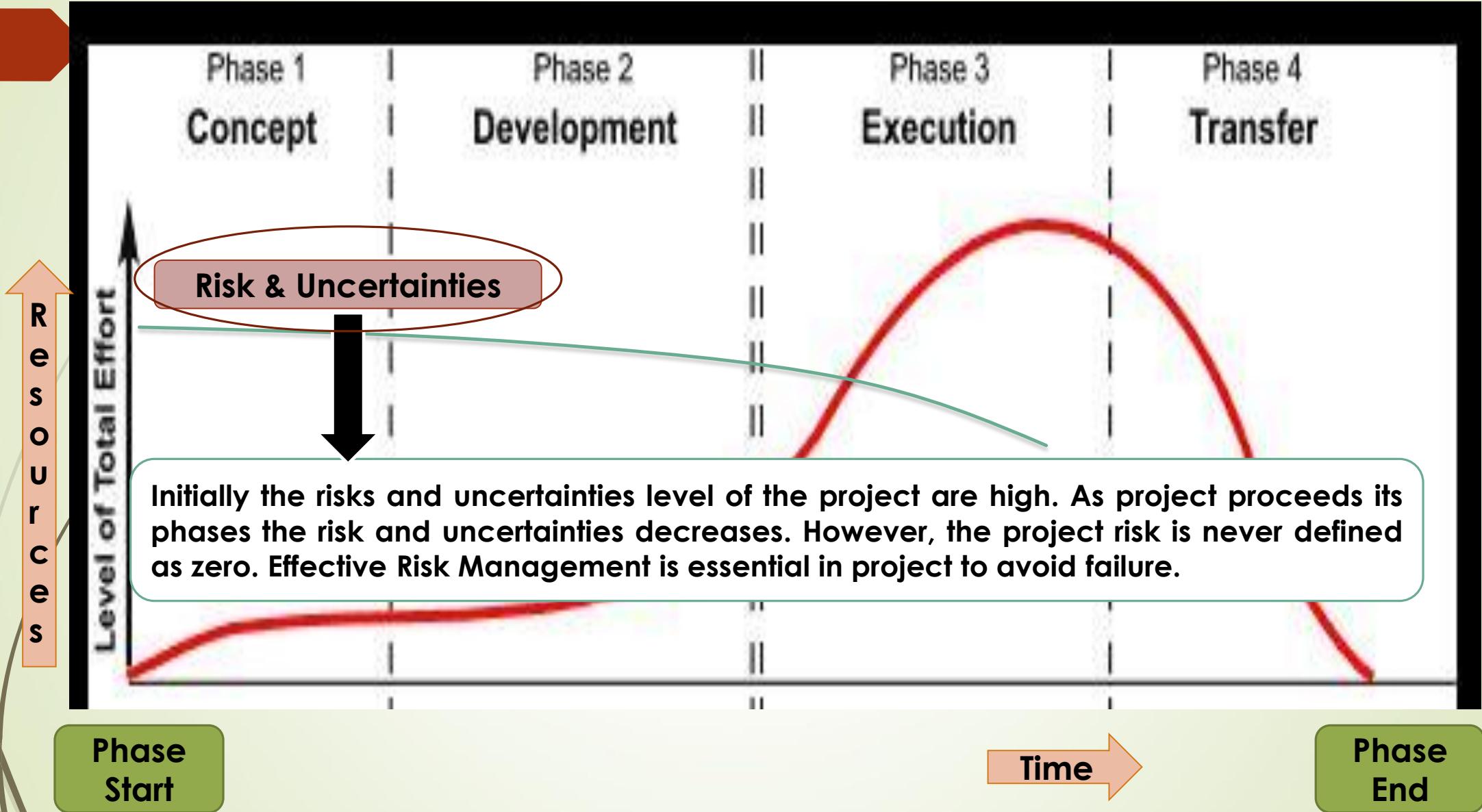
# Chapters

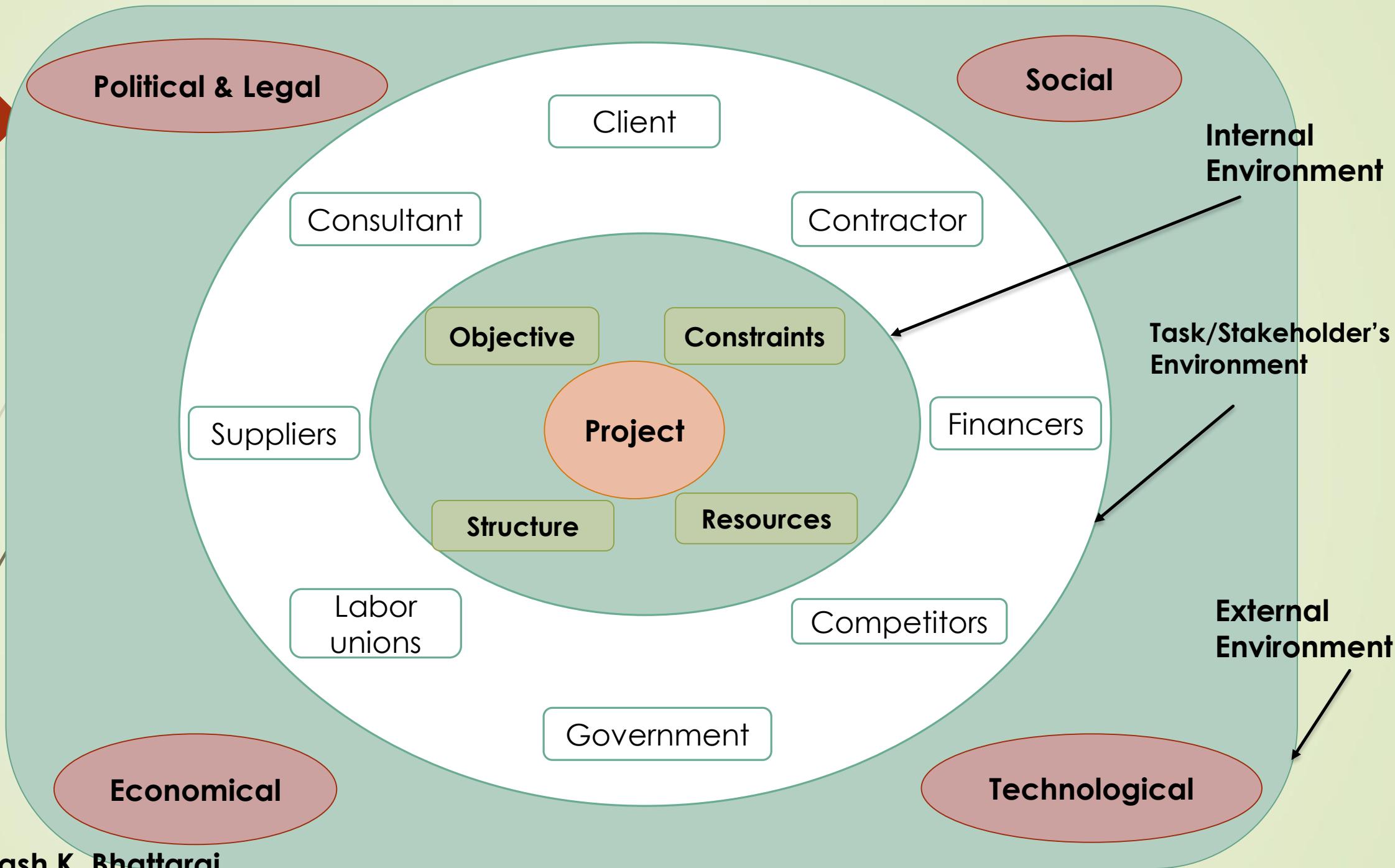
- ▶ **5.1 Introduction to Project Risk**
- ▶ **5.2 Types of Project Risk**
- ▶ **5.3 Analysis of Major Sources of Risk**
- ▶ **5.4 Effective Management of Project Risk / Risk Management Process**
  - ▶ Risk management planning
  - ▶ Risk identification
  - ▶ Qualitative risk analysis
  - ▶ Quantitative risk analysis
  - ▶ Risk response
  - ▶ Risk monitoring and control



## A quick Review on Project Lifecycle Phases and Project Environment

# Project life cycle phases





# 5.1 INTRODUCTION TO PROJECT RISK

***"When our World was created, nobody remembered to include Certainty"***  
- PETTER BERNSTEIN

- Every project is risky, meaning there is a chance things won't turn out exactly as planned.
- Project outcomes are determined by many things, some that are unpredictable and over which project managers have little control.
- Risk level is associated with the certainty level about technical, schedule and cost outcomes.
- High certainty outcomes have low-risk; low- certainty outcomes have high risks.
- Certainty derives from knowledge and experience gained in prior projects, as well as from management's ability to control project outcomes and respond to emerging problems.
- In general, risk is a function of uniqueness of a project and the experience of the project team. ***Risk = f (uniqueness, experience of project team)***

# Project Risk

Project risk is an uncertain event or condition that, if it occurs, has a positive or negative effect on a project objective.

A risk has a cause and, if it occurs, an impact.

For example, the cause may be having limited personnel assigned to the project.

The risk event is that may take longer than planned or the personnel may not be adequate for the task.

Project risk includes both threats to the project's objectives and opportunities to improve on those objectives.

The notion of project risk involves two concepts:

- The likelihood that some problematical event will occur.
- The impact of the event if it does occur.

Risk is also the joint function of: ***Risk = f (likelihood, impact)***

## 5.2 TYPES OF PROJECT RISK

Broadly, there are five main categories of risk types associated with project management.

### 1. External Risks

External events are mainly outside the control of the project manager and, in most cases, the organization. Examples:

- ▶ Marketplace developments—rapid developments can cause an abrupt change of direction
- ▶ Market risks include competition, foreign exchange, commodity markets, and interest rate risk, as well as liquidity and credit risks
- ▶ Government regulatory changes
- ▶ Industry-specific procedures—new standards, issues
- ▶ Legal issues-disputes, lawsuits, and court orders
- ▶ Change-driven factors-new products, services, changes in market
- ▶ Disasters such as fire, flood, earthquake, or other natural disaster
- ▶ Risks associated with labor strikes; and civil unrest
- ▶ Emergency destruction of communications

## 2. Cost Risks

Many of these types of risks are directly or indirectly under the project manager's control or within his or her area of influence. Cost risk, typically escalation of project costs due to poor cost estimating accuracy and scope creep. Examples of cost risk include those arising from:

- Cost overruns by project teams or subcontractors, vendors, and consultants
- Scope creep, expansion, and change that has not been managed
- Poor estimating or errors that result in unforeseen costs
- Overrun of budget and schedule

### 3. Schedule Risks

Schedule risks can cause project failure by missing or delaying a market opportunity for a product or service. Schedule risk is the risk that activities will take longer than expected. Slippages in schedule typically increase costs and, also, delay the receipt of project benefits, with a possible loss of competitive advantage. Such risks are caused by:

- ▶ Inaccurate estimating, resulting in errors
- ▶ Increased effort to solve technical, operational, and external problems
- ▶ Resource shortfalls, including staffing delays, insufficient resources, and unrealistic expectations of assigned resources
- ▶ Unplanned resource assignment—loss of staff to other, higher-priority projects

## 4. Technology Risks

Technology risks can result from a wide variety of circumstances. The result is failure to meet systems' target functionality or performance expectations. Performance risk is the risk that the project will fail to produce results consistent with project specifications. Typical examples are:

- ▶ Problems with immature technology
- ▶ Poor workmanship
- ▶ Inferior materials
- ▶ Improper human resources
- ▶ Use of the wrong tools
- ▶ Software that is untested or fails to work properly
- ▶ Requirement changes with no change management
- ▶ Failure to understand or account for product complexity
- ▶ Integration problems
- ▶ Poor Software/hardware performance issues—poor response times, bugs, errors

## 5. Operational Risks

Operational risks are characterized by an inability to implement large-scale change effectively. Such risks can result in failure to realize the intended or expected benefits of the project. Typical causes are:

- ▶ Inadequate resolution of priorities or conflicts
- ▶ Failure to designate authority to key people
- ▶ Insufficient communication or lack of communication plan
- ▶ Size of transaction volumes—too great or too small
- ▶ Rollout and implementation risks—too much, too soon
- ▶ Poor implementation, procurement etc

## **5.3 ANALYSIS OF MAJOR SOURCES OF RISK**

### **A. Internal Sources of risk:**

- ▶ Internal risks originate inside the project and project managers and stakeholders usually have a measure of control over these. Two main categories of internal risk source are market risk and technical risk

#### **1. Market risk**

Market risk is the risk of not fulfilling either market needs or the requirements of particular customers. The sources of market risk include

- ▶ Incompletely / in adequately defined market or customer needs
- ▶ Failure to identify changing needs
- ▶ Failure to identify newly introduce products by competitors

#### **2. Technical risk**

Technical risk is the risk of not meeting time, cost or performance requirements due to technical problems with the end-item or project activities.

## 5.3 Analysis of Major Sources of Risk Contd..

### B. External Sources of risk:

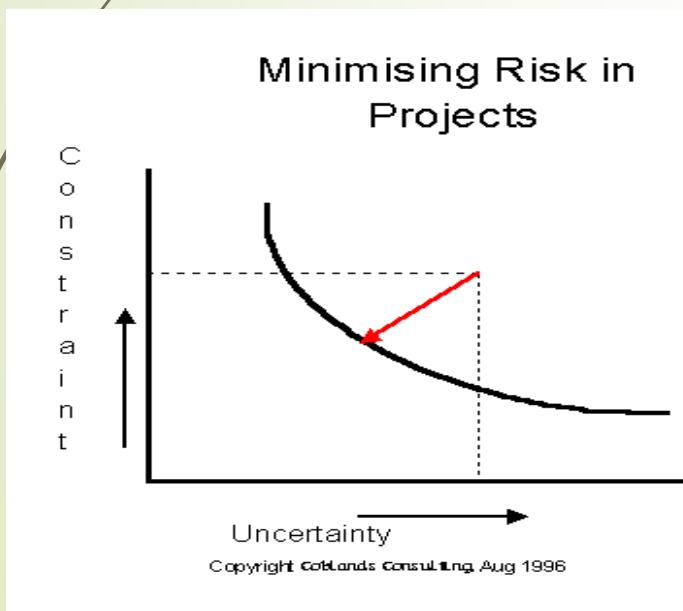
External risk include only risk that stem from sources outside the project. Project managers and stakeholders usually have little or no control over these. External risk hazards include changes in:

- ▶ Market conditions
- ▶ Competitor's actions
- ▶ Government regulations
- ▶ Interest rates
- ▶ Customer needs and behavior
- ▶ Weather (adverse)
- ▶ Labor availability (Strikes / Walkouts)
- ▶ Material / labor resources (Shortages) etc.

## 5.4 EFFECTIVE MANAGEMENT OF PROJECT RISK / RISK MANAGEMENT PROCESSES

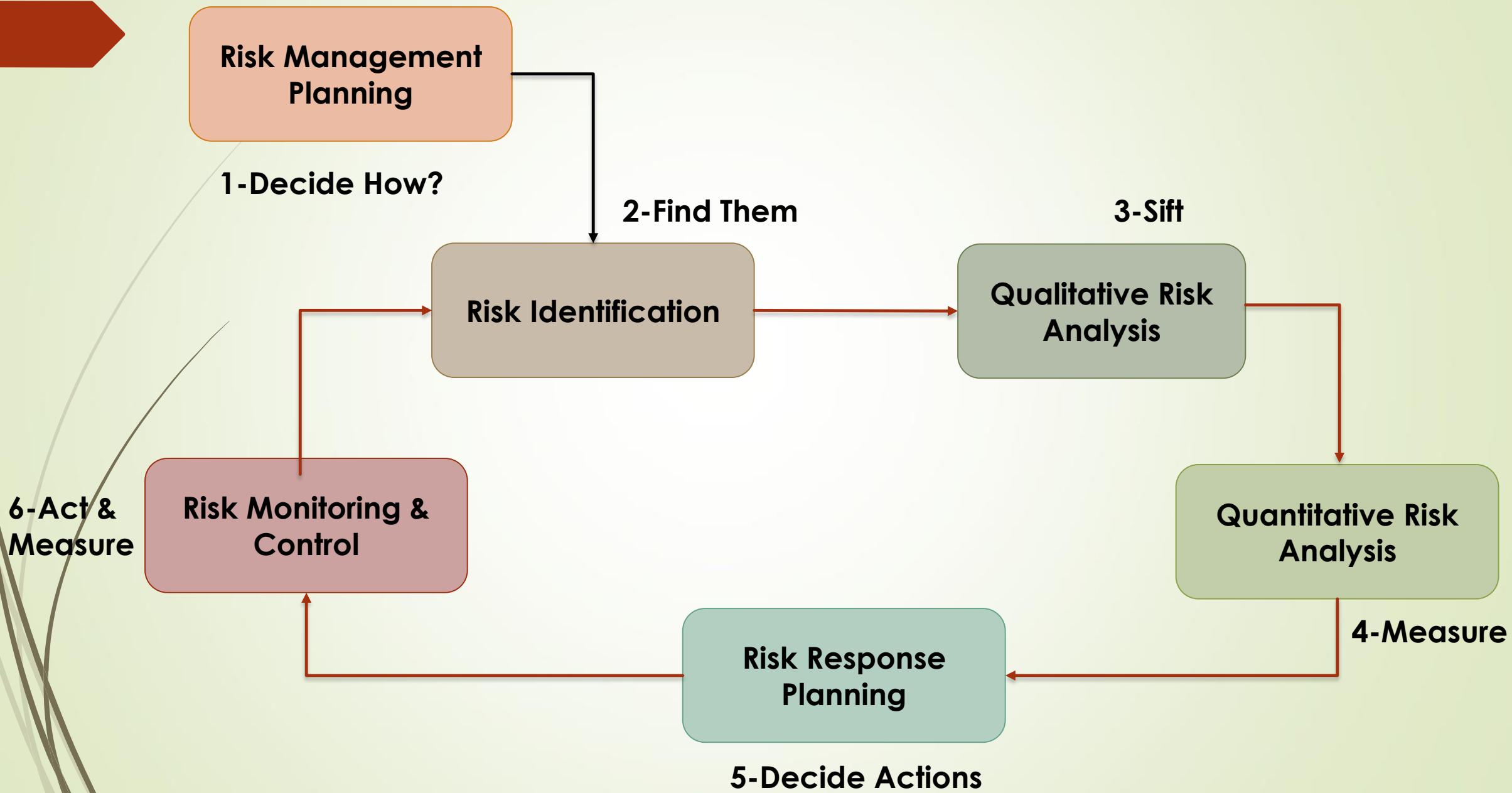
### Risk Management

- ▶ Risk management is the systematic application of the risk management processes on a project. The processes consist of risk management planning, identification, analysis, responding, and monitoring & control.
- ▶ The objective of risk management is to maximize the probability and impact of positive events and minimize the probability and consequences of events adverse to project objectives



The curved line indicates the '**acceptable level of risk**', whatever that may be in the individual case. The risk may be reduced to an acceptable level by **reducing either or both of uncertainty and constraint**. In practice, few people have the opportunity to reduce constraint, so most focus on the reduction of uncertainty. It is also worth noting from the diagram that total elimination of risk is rarely achieved. So we have to consider how to manage that remaining risk most effectively.

# RISK MGMT CYCLE



# 1. Risk Management Planning

Risk management planning is the process of deciding how to approach and perform the risk management activities for a project.

- ▶ Risk management planning is the first step of risk management process in a project.
- ▶ The documents related to project environment factors, project scope, project management plan required for the risk management plan are required for the risk management planning.
- ▶ **Stakeholder's risk tolerance** is prime matter. After having these documents a risk planning meeting is carried out on the behalf of PM and all other stakeholders to prepare the **risk management plan**.

## **Risk Management Plan (RMP)**

- ▶ It is the document prepared after the risk management planning meetings which shows/describes the way, mechanism and methods of performing risk identification, risk analysis, response planning and risk Monitoring and controlling mechanism

## 2. Risk Identification

- ▶ The process of identifying the risk with the involvement of various participants of project is known as risk identification.
- ▶ The participants can be project team, risk management team, subject matter experts, customers, end users, outside experts etc.
- ▶ The various sources are analyzed in order to identify the associated risk with the project through risk identification.
- ▶ Risk management plan and risk break down structures are required for the risk identification process.
- ▶ Review of documents related to project files, checklists information gathering technique like brainstorming, Delphi technique, interviewing, SWOT analysis, assumption analysis and diagramming techniques are used for risk identification process. **Risk register** is prepared after completion of the risk identification process.

### **Risk Register (RR)**

- ▶ Risk register is a record to document the results of the risk management process. It contains the following information.
  - ▶ List of identified risks with description
  - ▶ List of potential responses
  - ▶ Root causes of risk
  - ▶ Updated risk categories

### **3. Qualitative Risk Analysis**

- ▶ Qualitative risk analysis is the application of methods for ranking the identified risks according to their potential effect on project objectives. This process prioritizes risks according to their potential effect on project objectives
- ▶ The RMP and RR is required for the qualitative risk analysis process. The risk probability and impact assessment is carried out. The risk probability and impact are rated and presented in matrix known as probability-impact matrix

### **4. Quantitative risk analysis**

- ▶ Quantitative risk analysis analyze numerically the effect of project risk on a project objective.
- ▶ Interviewing and expert judgment is carried out for gathering and representation of data where as various modeling technique like Monte Carlo, simulation, sensitivity analysis, decision tree analysis are used for the quantitative risk analysis process

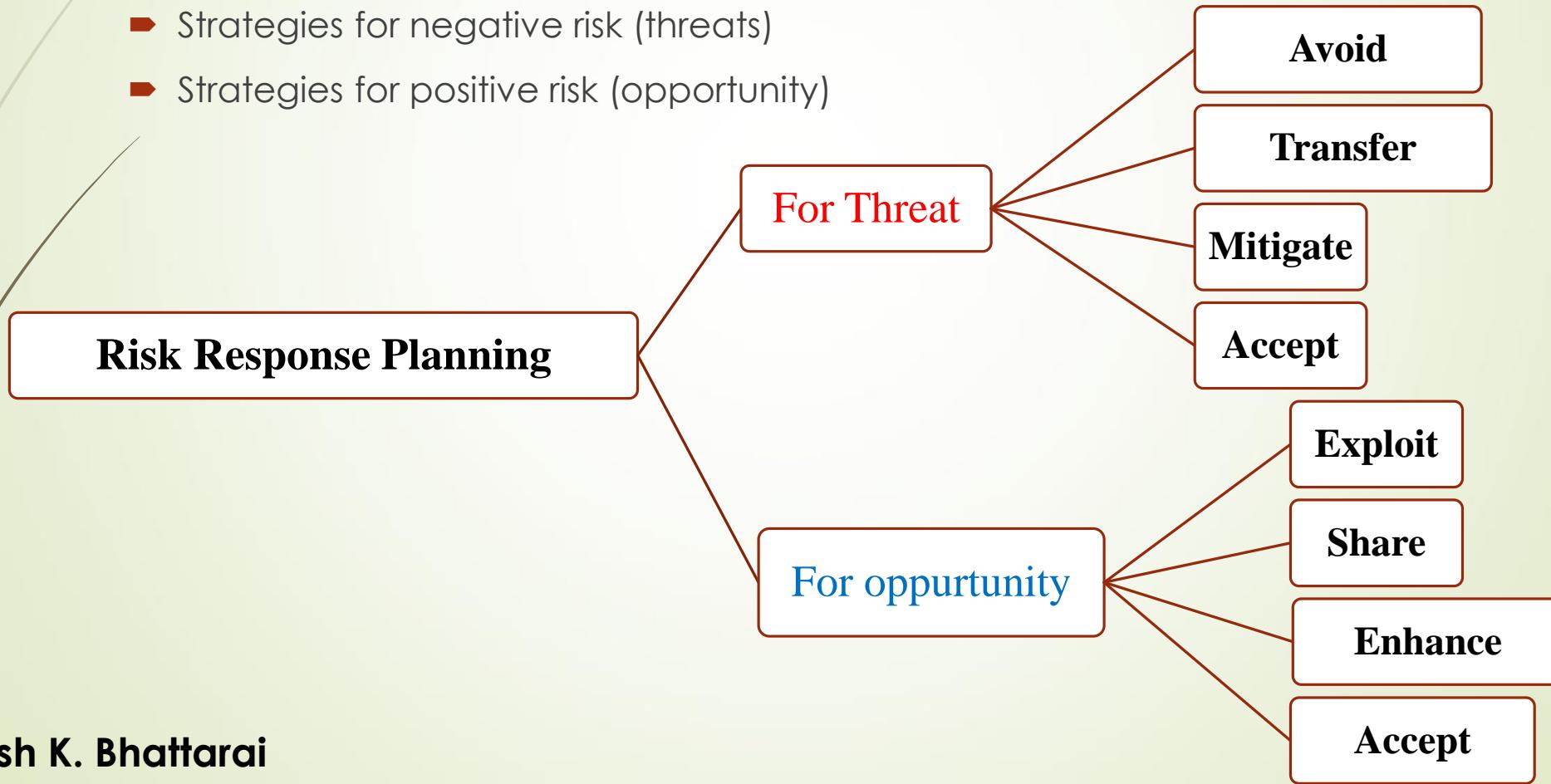
Evaluating Impact of a Risk on Major Project Objectives (ordinal scale or cardinal, non-linear scale)					
Project Objective	Very Low .05	Low .1	Moderate .2	High .4	Very High .8
Cost	Insignificant Cost Increase	<5% Cost Increase	5–10% Cost Increase	10–20% Cost Increase	>20% Cost Increase
Schedule	Insignificant Schedule Slippage	Schedule Slippage <5%	Overall Project Slippage 5–10%	Overall Project Slippage 10–20%	Overall Project Schedule Slips >20%
Scope	Scope Decrease Barely Noticeable	Minor Areas of Scope Are Affected	Major Areas of Scope Are Affected	Scope Reduction Unacceptable to the Client	Project End Item Is Effectively Useless
Quality	Quality Degradation Barely Noticeable	Only Very Demanding Applications Are Affected	Quality Reduction Requires Client Approval	Quality Reduction Unacceptable to the Client	Project End Item Is Effectively Unusable

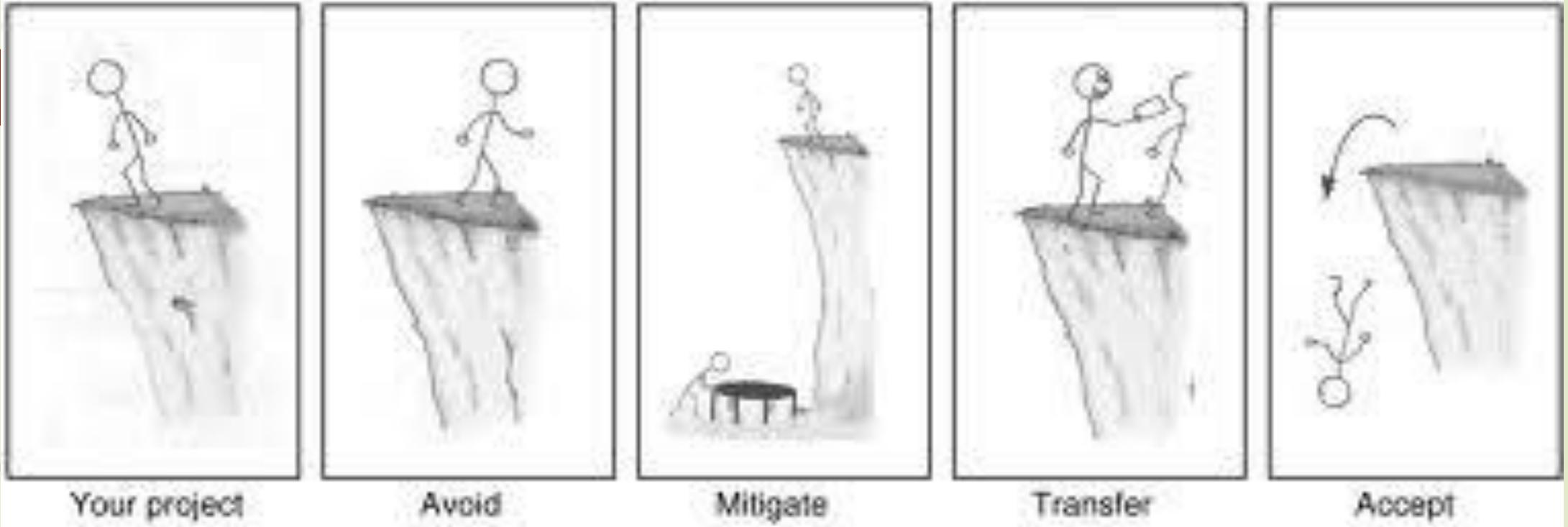
The impacts on project objectives can be assessed on a scale from Very Low to Very High or on a numerical scale. The numerical (cardinal) scale shown here is non-linear, indicating that the organization wishes specifically to avoid risks with high and very-high impact.

**Figure 11-2.** Rating Impacts for a Risk

# 5. Risk Response Planning

- ▶ Risk response planning addresses the matter of how to deal with risk. Risk response must be proportional to the severity of the risk, cost effective, timely, realistic and accepted as well as owned by all concerned parties of the risk management.
- ▶ Risk response can be carried out by using following two strategies.
  - ▶ Strategies for negative risk (threats)
  - ▶ Strategies for positive risk (opportunity)





## Strategies for negative risk (threats)

## **Negative risks are response by either of the following techniques**

### **Risk avoidance**

- ▶ Risk avoidance is the process to avoid the risk by changing the project plan to eliminate the risk. It can also be carried out by relaxing the relevant objectives by extending the schedule or increasing the cost in project. All risk cannot be avoided, but some may.
- ▶ Examples of risk avoidance are: add resources, improve communication, avoid unfamiliar sub-contractor, adopt familiar approach etc.

### **Risk Transfer**

- ▶ Transfer the risk to the third party who will carry the risk impact and ownership of the response. Risk transfer is most effective in dealing with financial risk exposure.
- ▶ The transfer of risk liability to sub-contractor, the use of risk insurance and payment of risk premium, performance bonds, warranties etc. are examples of risk transfer.

## Risk Mitigation

- ▶ Risk mitigation aims at reducing the probability and/or impact of a risk to within an acceptable threshold. The probability/Impact should be mitigated before the risk takes place.
- ▶ Examples of risk mitigation are: adopting less complex process, adding resources to the schedule, conducting more engineering tests and inspections etc.

## Risk Acceptance

- ▶ Acceptance indicates a decision not to make any changes to the project plan to deal with a risk or that a suitable response strategy cannot be identified. This strategy can be used for both negative and positive risks
- ▶ There are two types of acceptance:
  - ▶ Active acceptance: may include developing a contingency plan to execute should a risk occur.
  - ▶ Passive acceptance: requires no action. The project team will deal with the risk as it occurs.

## 6. Risk Monitoring and Controlling

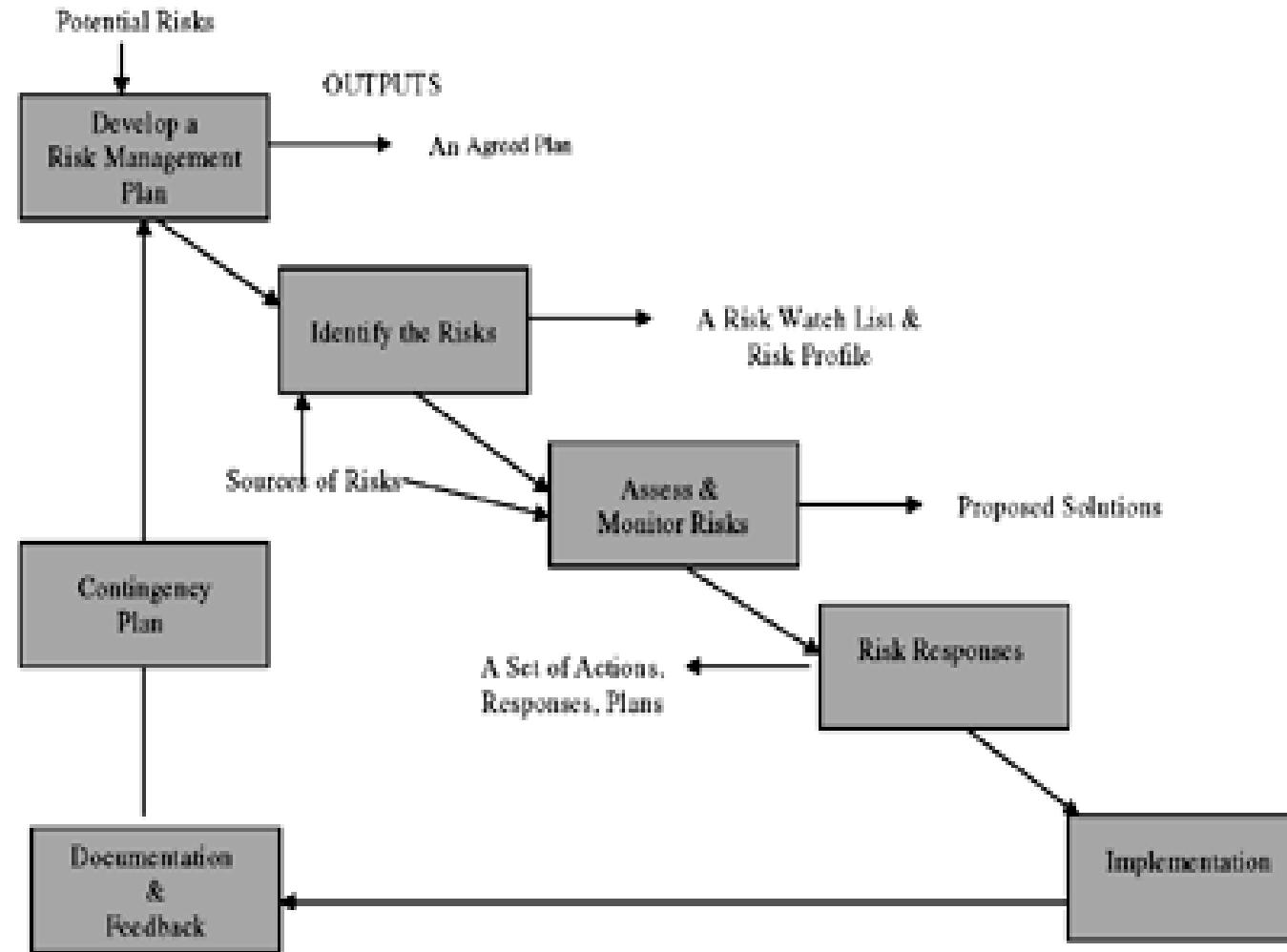
**Risk monitoring and control is required in order to:**

- ▶ Ensure the execution of the risk plans and evaluate their effectiveness in reducing risk.
- ▶ Keep track of the identified risks, including the watch list.
- ▶ Monitor trigger conditions for contingencies
- ▶ Monitor residual risks and identify new risks arising during project execution.

**Risk monitoring and control is carried out by following methods:**

- ▶ Risk Reassessment
- ▶ Risk audits
- ▶ Reserve Analysis
- ▶ Status meetings

## Risk Management - Process Flow



								<i>Integrated Risk Management Framework</i>
	<i>PRAM Guide</i> (APM, 2004)	<i>PMBOK</i> , Chapter 11 (PMI, 2004)	<i>M_o_R Guideline</i> (OGC, 2007a)	<i>AS/NZS4360</i> (Standards Australia International Ltd, 2004)	<i>A Risk Management Standard</i> (AIRMIC, ALARM, IRM, 2002)	<i>The Orange Book</i> (HM Treasury, 2004)	<i>(Treasury Board of Canada Secretariat, 2007)</i>	
Context establishment	(1) Initiate  • Define  • Focus	(1) Risk management planning  • Context  • Identify the risks	(1) Identify  • Context  • Identify the risks	(1) Establish the context  • Risk assessment  • Identify the risks	(1) The organization's strategic objectives  • Identify the risks	(1) Establishing context  • Risk environment  • Context  • The extended enterprise  • Identifying issues  • Setting Context	(1) Risk identification  • Identifying issues  • Setting Context	
Risk analysis	(2) Identify  • Assess • Structure  • Ownership  • Estimate	(2) Risk identification  • Qualitative risk analysis	(3) Assess  • Estimate	(2) Assess  • Estimate	(2) Analyze the risks  • Risk identification  • Risk description  • Risk estimation  • Risk evaluation	(2) Risk assessment  • Risk analysis  • Risk identification  • Risk description  • Risk estimation  • Risk evaluation	(2) Identifying risks  • Assessing key risk areas  • Measuring likelihood and impact  • Ranking risks	
Risk evaluation	(1) Evaluate			(1) Evaluate	(1) Evaluate the risks		(3) Risk response	
Control and monitoring	(4) Plan responses  • Risk event responses  • Project risk responses	(4) Quantitative risk analysis  • Risk response planning  • Risk monitoring and control >  (5) Implement responses	(5) Risk response planning  • Risk monitoring and control >	(3) Plan  • Implement  • Monitor and review	(3) Treat the risks  • Decision  • Risk treatment  • Residual risk reporting  • Monitoring	(3) Risk reporting  • Risk treatment  • Risk reporting  • Monitoring	(4) Addressing risks  • Selecting a strategy  • Implementing the strategy	
Communication	(6) Manage process		(5) Communicate  • Communicate and consult	(8) Modification  • Formal audit	(6) Communication and learning  • Continuous learning and communication	(5) Continuous learning and communication	(4) Monitoring and evaluation  • Monitoring, evaluating and adjusting	

**Table I.**  
Comparison of risk management guides



# END OF CHAPTER 5



---

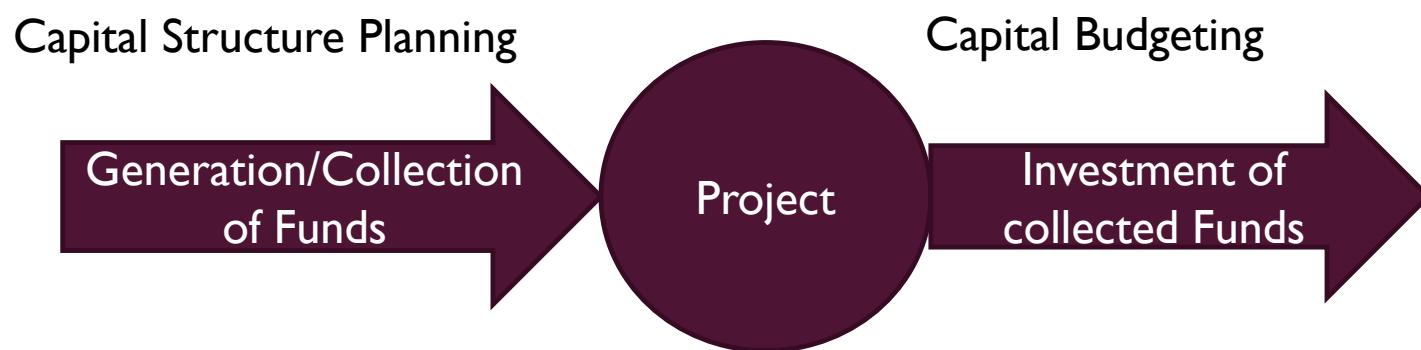
---

# PROJECT FINANCE

## CHAPTER SIX

# PROJECT FINANCE

- Project finance is the long term financing of infrastructure and industrial (manufacturing) projects based upon the projected cash flows of the project rather than the balance sheets of the project sponsors



## **PARTIES INVOLVED IN PROJECT FINANCING**

- There are several parties in a project financing depending on the type and the scale of a project. The most usual parties to a project financing are;
  - Project itself
  - Sponsors
  - Financial Advisors
  - Technical Advisors
  - Legal Advisors
  - Debt Financiers
  - Equity Investors
  - Regulatory Agencies
  - Multilateral Agencies

## CAPITAL STRUCTURE PLANNING

Capital structure, sometime known as financial plan (Capital plan or financial plan) refers to the composition (makeup) of long-term sources of funds, such as debentures, long-term debt, preference share capital, and equity share capital including reserve and surplus

## TERMINOLOGIES USED IN CAPITAL STRUCTURE PLANNING

- **Capital:** Capital is a term describing wealth, which may be utilized to economic advantages. Cash, land, equipment, raw material, finished products, human etc. are the forms of such capital.
- **Equity capital:** Equity capital (common share) is supplied and used by its owner in the expectation that a profit will be earned. There is no assurance that a profit will, in fact, be gained or that the invested capital will be recovered. Likewise, there are no limitations placed on the use of the funds except those imposed by the owner themselves
- **Debt capital:** Debt capital is the borrowed capital. When borrowed funds are used, a fixed rate of interests must be paid to the supplier of the capital, and the debt must be repaid at a specified time. The borrower of the debt does not share the profits resulting from the use of the capital.

- **Bond:** A bond is essentially a long-term note given to the lender by the borrower, stipulating the terms of re-payment and other conditions.
- **Debentures:** A debenture is a bond issued without any collateral. It is also known as unsecured bond. Thus, debenture holders are the general creditor of the company. A company having strong credit position and highly profitable investment, and high amount of assets issue debenture. Bonds issued by Himalayan Bank Limited and Investment Bank Limited are example of debenture.
- **Preference share capital:** Preference share capital is that capital which has the characteristics of both the equity capital and debt capital. Two types of dividends are provided to preference shareholders. They are:
  - Dividends based on fixed percentage (like debt capital), which is paid after tax deduction,
  - Dividends based on earning (like the one paid to equity share holders).

# BASIS FOR PLANNING CAPITAL STRUCTURE

- Planning of capital structure should be done in such a way that long-term market price per share should be maximized and interest of different groups of people is to be met.
  - Promoters/ Investors (equity shareholders)
  - Creditors
  - Employees
  - Society and government
- While planning capital structure, one needs to decide on the following aspects:
  - Long term debt
  - Bond
  - Promoters'/Investors investment (equity share)

# IMPORTANT FEATURES OF A SOUND CAPITAL STRUCTURE

- A sound or appropriate capital structure should have following features:
  - Profitability:
  - Solvency
  - Flexibility
  - Conservation
  - Control

## DEBT CAPITAL RATIO

- In general, a capital structure is said to be appropriate when the debt - capital ratio varies between 45 and 75 ( $60 \pm 15\%$ )

# DETERMINANTS OF THE CAPITAL STRUCTURE

1. Leverage effect on earnings per share (EPS)
2. Growth and stability of sales
3. Cost of capital
4. Size of the company
5. Marketability, and
6. Flotation costs

SOM

■ Initia  
offer  
seek  
com|

company is  
companies  
ly owned

← → C https://www.sharesansar.com/newsdetail/universal-power-collects-application-for-299-lakh-units-in-ipo-till-today-unsubscribed-shares

## Universal Power collects application for 2.99 lakh units in IPO till today; Unsubscribed shares to be floated for general public



देश भरिको कहुनैपनि बैंकको कहुनैपनि प.टि.एम. बाट निःशुल्क रकम निकालन सकिने



To open your online account Click Here

Thu, Jan 24, 2019 2:41 PM on IPO/FPO News, Latest, Stock Market,



Universal Power Company Limited is issuing 21,00,350 unit shares at Rs 100 per share as Initial Public Offering (IPO) to the locals of Dolka district till Magh 13, 2075.

Siddhartha Capital Limited has been appointed as the issue manager for the IPO issuance.

According to the officials at Siddhartha Capital, a total of 3,544 applications have been received applying for 2,99,102 unit shares. Since the issue has already been extended it can't be further extended from Magh 13, 2075 even if the issue goes undersubscribed.

Hence, the unsubscribed will be added to the IPO that will be issued for General Public afterward.





- A follow company of addition through additional

public  
c issue  
; gone  
raise

NMB Bank to issue 1,14,15,163 units FPO shares at Rs.333 per unit from 30th Jestha; LTP stands at Rs 395; minimum units to apply is 10 kitta



बैंक पनि/ साथी पनि

राळो पनि/ ताळो पनि

Tue, Jun 5, 2018 3:00 AM on IPO/FPO News, Latest, Stock Market,



NMB Bank Limited will be issuing a total of **1,14,15,163 units further shares at a price of Rs 333 per share** (a premium of Rs 233 per share in addition to par value of Rs 100 per share) from 30th Jestha, 2075. The latest closing date for this FPO issue is 3rd Ashad, 2075 if fully subscribed or else this FPO issue can be extended up to 28th Ashad, 2075.

The minimum units to apply for this FPO is 10 kitta i.e. Rs 3330 and maximum is (0.5% of the total issue) i.e. 57,070 units amounting Rs 1,90,04,310.



# IPO VS FPO

## Comparison Chart

BASIS FOR COMPARISON	IPO	FPO
Meaning	Initial Public Offering (IPO) refers to an offer of securities made to the public for subscription, by the company.	Follow-on Public Offering (FPO) means an offer of securities for subscription to public, by an publicly traded enterprise.
What is it?	First public issue	Second or third public issue
Issuer	Unlisted Company	Listed Company
Objective	Raising capital through public investment.	Subsequent public investment.
Risk	High	Comparatively low

## DIVIDEND, BONUS SHARE, RIGHT SHARE

- A **dividend** is the distribution of reward from a portion of company's earnings, and is paid to a class of its shareholders. Dividends are decided and managed by the company's board of directors, though they must be approved by the shareholders through their voting rights. Dividends can be issued as cash payments, as shares of stock, or other property, though cash dividends are the most common.
- A **bonus issue**, also known as a **scrip issue** or a **capitalization issue**, is an offer of free additional **shares** to existing shareholders. A company may decide to distribute further **shares** as an alternative to increasing the dividend payout. For example, a company may give one **bonus share** for every five **shares** held.
- **Right shares** are the shares that are issued by a company for its existing shareholders. The existing shareholders have their right to subscribe to these shares unless some special rights reserve them for some other persons

## EXAMPLE

A firm has total capital of Rs. 10, 00,000 which consists of 3000 ordinary share @ Rs 100 per share, Rs. 200,000 preference share at 10% interest per year and Rs. 5, 00,000 debts at 12% interest per year. If firm's earnings before interest and tax are Rs 2,50,000 and tax rate applicable is 30%, determine earning per share.

### Solution

- Ordinary share = 3000@ Rs 100
- Preference share = 2, 00,000 @10% per year
- Debt Capital = 5, 00,000 @ 12% per year
- Total Capital = 10, 00,000

- a.Firm's earnings before interest and tax (EBIT) = 2,50,000
- b.Interest on loan = 12% of Rs 5,00,000 = 60,000
- c.Earnings after interest before tax (EAIBT) = (a-b) = 1,90,000
- d.Tax @ 30% of EAIBT = 57,000
- e.Earning after interest and tax (EAIT) = (c-d) = 133,000
- f.Interest (dividend) to preference shareholders = 10% of 2,00,000 = 20,000
- g.Dividends to ordinary shareholders = (e-f) = 1,13,000
- h.Earnings per share (EPS) = 1,13,000 / 3,000 = **Rs. 37.67**

## EXAMPLE

- A firm has equity capital consisting of 4000 ordinary share @ Rs 100 per share and loan of Rs. 8,00,000 borrowed at an interest rate of 10% per year. The firm wants to raise Rs. 10,00,000 to finance its investment and is considering two alternative methods of financing i.e.
  - To issue 4,000 common shares @ Rs. 100 each and to borrow Rs 6,00,000 at 12% interest and
  - To issue 2000 common shares @ Rs. 100; to issue 3,00,000 preference share at an interest rate of 10% and to borrow Rs. 5,00,000 at 12% interest.
- If the firm's earnings before interest and tax is Rs. 3,50,000 and the tax rate applicable is 30%, determine earning per share to decide on the alternatives.

By analyzing both options, we can conclude that earning per share (EPS) is Rs 19.5 in option 2 as against Rs 17.32 in option 1. So the firm should choose option 2.

### Solution

Existing capital structure

- 4000 ordinary share @ Rs 100 per share
- Rs 8, 00,000 loan @ 10% interest per year
- Additional capital required is Rs. 10, 00,000

#### Option 1

- 4000 common (ordinary) shares @ Rs 100
- Rs 6, 00,000 loan @ 12% interest per year

#### Option 2

- 2000 common (ordinary) shares @ Rs 100
- Rs 3, 00,000 preference share @ 10% interest per year
- Rs 5, 00,000 loan @ 12% interest per year

### Total capital structure of Option 1

- Ordinary share =  $4000 + 4000 = 8000$  @Rs 100
- Rs 8, 00,000 loan @ 10% per year and
- Rs 6, 00,000 loan @ 12% interest per year
  - (a) Earning before interest and tax (EBIT) = Rs 3,50,000
  - (b) Interest on loan = 10% of 8,00,000 + 12% 6,00,000 = Rs. 152,000
  - (c) Earning after interest before tax (EAIBT) = (a-b)Rs. 1,98,000
  - (d) Tax 30% of EAIBT = Rs. 59400
  - (e) Earning after interest and tax = (c-d) =Rs. 1,38,600
  - (f) Dividend (interest) on preference shareholders = 0
  - (g) Dividend to equity shareholders = Rs.1,38,600
  - (h) Earning Per share =  $Rs.1,38,600 / 8000 = \text{Rs. } 17.32$

### Total capital structure of Option 2

- Ordinary share =  $4000 + 2000 = 6000$  @Rs 100
- Preference share = Rs. 3, 00,000 @ 10% interest per year
- Loan Rs 8, 00,000 @ 10% interest per year and Rs. 5, 00,000 @ 12% interest per year.
  - (a) Earning before interest and tax (EBIT) = Rs 3,50,000
  - (b) Interest on loan = 10% of 8,00,000 + 12% 5,00,000 = Rs. 1,40,000
  - (c) Earning after interest before tax (EAIBT) = (a-b)Rs. 2,10,000
  - (d) Tax 30% of EAIBT = Rs. 63,000
  - (e) Earning after interest and tax = (c-d) =Rs. 1,47,000
  - (f) Dividend (interest) on preference shareholders = 10% of 3,00,000 = Rs. 30,000
  - (g) Dividend to equity shareholders =  $Rs.1,47,000 - 30000 = 1,17,000$
  - (h) Earning Per share =  $1,17,000 / 6,000 = \text{Rs. } 19.50$