



Department of Civil Engineering

Study Material

UNIT-IV

PROJECT PLANNING AND CONTROL

1. Introduction to Project Planning and Control

Definition

Project Planning and Control is the process of defining project objectives, developing plans to achieve them, monitoring progress, and taking corrective actions whenever necessary.

Planning determines what should be done, while control ensures that activities are performed according to plan.

Objectives

- Complete project on time.
- Complete project within budget.
- Achieve required quality standards.
- Utilize resources efficiently.
- Monitor project performance.

Importance

- Reduces uncertainties.
- Improves coordination.
- Facilitates decision-making.
- Ensures effective project execution.
- Minimizes project risks.

2. Planning Steps

Definition

Project planning involves determining project objectives and establishing the activities required to achieve those objectives.

Steps in Project Planning

Step 1: Define Project Objectives

Clearly identify:

- Project goals
- Deliverables
- Scope



Example:

Construction of a residential apartment complex.

Step 2: Develop Work Breakdown Structure (WBS)

Break the project into smaller manageable activities.

Example:

Project

↓

Design

↓

Procurement

↓

Construction

↓

Testing

Step 3: Identify Activities

List all activities necessary to complete the project.

Examples:

- Site preparation
- Foundation work
- Structural construction
- Finishing work

Step 4: Sequence Activities

Determine logical relationships between activities.

Example:

Foundation work must be completed before column construction.

Step 5: Estimate Resources

Identify:

- Labor
- Materials
- Equipment



- Finance

Step 6: Estimate Duration

Determine time required for each activity.

Example:

Activity	Duration
Excavation	5 Days
Foundation	10 Days
Columns	7 Days

Step 7: Prepare Schedule

Develop:

- Gantt Chart
- Network Diagram
- CPM Schedule

Step 8: Budget Preparation

Estimate total project cost.

Step 9: Risk Planning

Identify possible project risks.

Step 10: Establish Monitoring Mechanisms

Develop reporting and control systems.

3. Scheduling

Definition

Scheduling is the process of assigning start and finish times to project activities.

Objectives

- Ensure timely completion.
- Optimize resource utilization.

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- Coordinate project activities.

Types of Schedules

Master Schedule

Overall project schedule.

Detailed Schedule

Activity-wise schedule.

Milestone Schedule

Major project events are highlighted.

Scheduling Techniques

1. Bar Chart (Gantt Chart)

Developed by Henry Gantt.

Shows activities versus time.

Advantages

- Simple and easy to understand.
- Useful for progress monitoring.

Limitations

- Does not show activity dependencies.
- Difficult for large projects.

2. Milestone Charts

Used to track important project events.

Examples:

- Design completion
- Material procurement
- Project completion

3. Network Scheduling

Includes:

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- CPM
- PERT

4. Network Diagrams

Definition

A Network Diagram is a graphical representation of project activities and their relationships.

Purpose

- Show activity sequence.
- Identify critical activities.
- Calculate project duration.

Components of Network Diagram

Activity

A task requiring time and resources.

Represented by arrows or nodes.

Event

Represents start or completion of activities.

Dummy Activity

Shows logical dependency only.

Duration = Zero.

Types of Network Diagrams

Activity on Arrow (AOA)

Activities represented by arrows.

Activity on Node (AON)

Activities represented by nodes.

Example

$A \rightarrow B \rightarrow C \rightarrow D$

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Where:

- A = Design
- B = Procurement
- C = Construction
- D = Testing

5. Network Analysis

Definition

Network Analysis is a project planning technique used to analyze activity relationships and determine project duration.

Objectives

- Identify project duration.
- Determine critical activities.
- Optimize resource utilization.

Major Techniques

Critical Path Method (CPM)

Program Evaluation and Review
Technique (PERT)

6. Critical Path Method (CPM)

Definition

CPM is a network-based scheduling technique used for projects with known activity durations.

Characteristics

- Deterministic approach.
- Fixed activity times.
- Suitable for construction projects.

Important Terms

Earliest Start Time (ES)

Earliest possible start of an activity.

Earliest Finish Time (EF)

$EF = ES + \text{Duration}$

Latest Finish Time (LF)

Latest allowable finish time.



Latest Start Time (LS)

$$LS = LF - \text{Duration}$$

Float (Slack)

Extra time available without affecting project completion.

$$\text{Float} = LS - ES$$

Critical Path

The longest path through the network.

Activities on critical path have:

- Zero float
- No delay tolerance

Formula

$$\text{Critical Path} = \text{Longest Duration Path}$$

Advantages of CPM

- Effective scheduling tool.
- Identifies critical activities.
- Improves resource allocation.

Limitations

- Assumes fixed activity durations.
- Difficult for highly uncertain projects.

7. Program Evaluation and Review Technique (PERT)

Definition

PERT is a network analysis technique used when activity durations are uncertain.

Time Estimates

Optimistic Time (T_o)

Minimum time.

Most Likely Time (T_m)

Expected time.



Pessimistic Time (T_p)

Maximum time.

Expected Time Formula

$$TE = T_o + 4T_m + T_p \quad TE = \frac{T_o + 4T_m + T_p}{6} \quad TE = 6T_o + 4T_m + T_p$$

Advantages

- Handles uncertainty.
- Suitable for R&D projects.

Limitations

- Complex calculations.
- Requires probability estimates.

8. Quality Management in Projects

Definition

Quality Management ensures that project deliverables meet customer requirements and standards.

Objectives

- Customer satisfaction.
- Defect prevention.
- Continuous improvement.

Components of Quality Management

Quality Planning

Establish quality standards.

Quality Assurance (QA)

Ensure compliance with standards.

Quality Control (QC)

Inspect and test deliverables.

Quality Management Tools



Checklists

Used for inspections.

Pareto Analysis

Identifies major causes of defects.

Cause and Effect Diagram

Also called Fishbone Diagram.

Control Charts

Monitor process performance.

Benefits

- Reduced rework.
- Improved customer satisfaction.
- Better project performance.

9. Project Execution

Definition

Project Execution is the phase where planned activities are carried out.

Objectives

- Produce project deliverables.
- Utilize resources effectively.
- Achieve project goals.

Activities in Project Execution

Resource Mobilization

Allocation of manpower and equipment.

Team Management

Managing project personnel.

Procurement



Purchasing materials and services.

Communication Management

Information sharing among stakeholders.

Stakeholder Management

Managing stakeholder expectations.

Challenges

- Resource shortages.
- Cost overruns.
- Schedule delays.
- Quality issues.

10. Monitoring and Control

Definition

Monitoring and Control involves tracking project performance and taking corrective actions.

Objectives

- Compare actual performance with plan.
- Detect deviations.
- Implement corrective measures.

Monitoring Activities

Schedule Monitoring

Track project progress.

Cost Monitoring

Compare actual and planned costs.

Quality Monitoring

Ensure quality standards.

Risk Monitoring

Track identified risks.



Control Actions

Corrective Action

Fix existing problems.

Preventive Action

Avoid future problems.

Performance Indicators

Schedule Performance Index (SPI)

$SPI = \frac{\text{Earned Value}}{\text{Planned Value}}$

Cost Performance Index (CPI)

$CPI = \frac{\text{Earned Value}}{\text{Actual Cost}}$

11. Agile Project Management

Definition

Agile Project Management is an iterative and flexible approach that emphasizes customer collaboration and continuous improvement.

Principles of Agile

- Customer satisfaction.
- Continuous delivery.
- Adaptability to change.
- Team collaboration.

Agile Life Cycle

Concept

Project vision and requirements.

Inception

Team formation and planning.

Iteration

Development cycles.

Release



Product delivery.

Maintenance

Ongoing improvements.

Advantages

- Faster delivery.
- Flexibility.
- Better customer involvement.

Limitations

- Requires experienced teams.
- Difficult in large projects.

12. Scrum Framework

Definition

Scrum is a popular Agile framework used for managing complex projects.

Scrum Roles

Product Owner

Represents customer interests.

Scrum Master

Facilitates Scrum process.

Development Team

Executes project work.

Scrum Events

Sprint

Fixed time iteration (usually 2–4 weeks).

Sprint Planning

Planning sprint activities.

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Daily Scrum

15-minute daily meeting.

Sprint Review

Review completed work.

Sprint Retrospective

Identify improvements.

Scrum Artifacts

Product Backlog

List of project requirements.

Sprint Backlog

Tasks selected for a sprint.

Increment

Completed work delivered.

Benefits

- Faster feedback.
- Improved teamwork.
- Increased productivity.

13. Lean Production and Project Management

Definition

Lean Production is a management philosophy focused on eliminating waste and maximizing value.

Originally developed by the company Toyota Motor Corporation through the Toyota Production System.

Principles of Lean

1. Identify Value

Understand customer requirements.



2. Map Value Stream

Analyze process flow.

3. Create Flow

Ensure smooth workflow.

4. Establish Pull System

Produce only when needed.

5. Pursue Perfection

Continuous improvement.

Types of Waste (Muda)

Overproduction

Producing more than required.

Waiting

Idle resources.

Transportation

Unnecessary movement.

Inventory

Excess stock.

Defects

Rework and corrections.

Motion

Unnecessary worker movement.

Overprocessing

Extra work not required.



Lean Tools

5S System

- Sort
- Set in Order
- Shine
- Standardize
- Sustain

Kaizen

Continuous improvement.

Just-In-Time (JIT)

Produce only when needed.

Value Stream Mapping

Analyze process flow.

Benefits of Lean Project Management

- Reduced waste.
- Lower project cost.
- Faster project completion.
- Improved quality.
- Better customer satisfaction.