

A Project is a temporary endeavor undertaken to create a unique product or service.

## Project vs. Operations

**Projects are temporary efforts to create unique products or services**

**Projects focus on creating something new.**

### Examples of projects:

Construction: Building a new home,  
Marketing: Developing a marketing plan,  
Manufacturing: Creating a new product  
Event: Organizing a fundraising event.

**Operations are the ongoing activities that produce and deliver these products repeatedly.**

**Operations ensure consistent production and efficiency**

### Examples of operations:

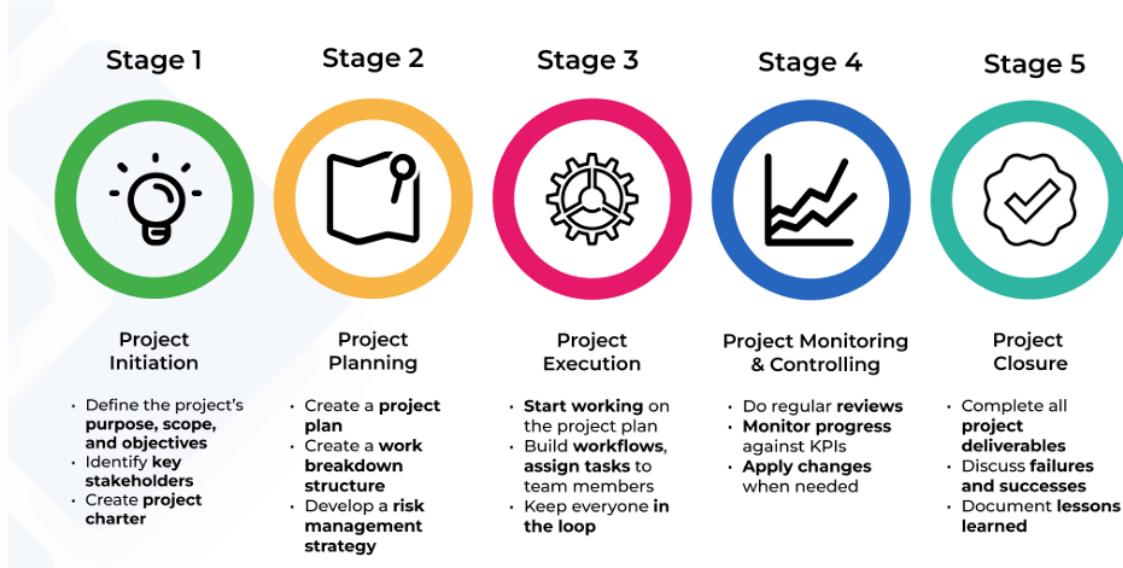
Construction: Infrastructure maintenance-  
Repairing an electrical panel,  
Manufacturing: Producing goods  
Services: Supporting the business's system-  
Scheduling staff shifts

Project management is the application of processes, methods, skills, knowledge and experience to achieve specific project objectives according to the project acceptance criteria within agreed parameters- (by APM Body Of Knowledge- APMBOK). Project management has final deliverables that are constrained to a finite timescale and budget.

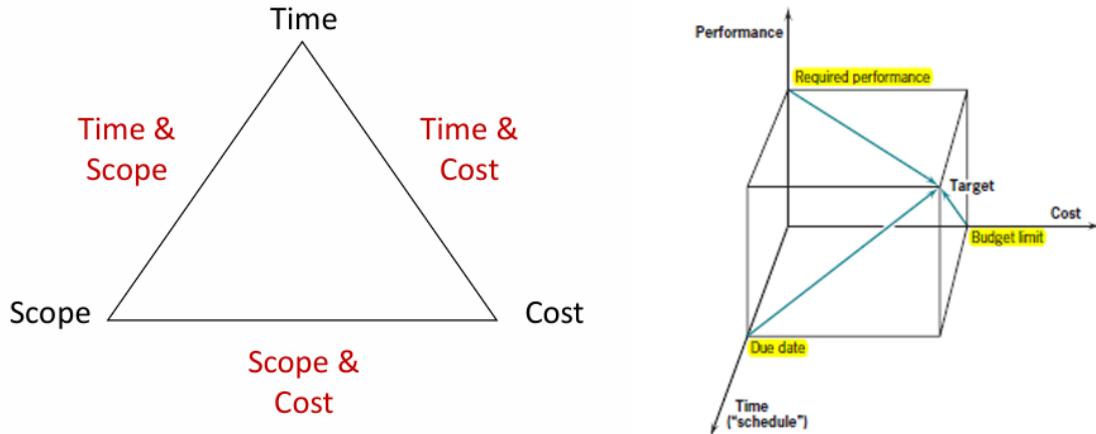
## Necessity of Project Management



## Stages in Project Management



## How Does the Triple Constraint Work?



## What is a Project Life Cycle?

A **Project Life Cycle (PLC)** is the sequence of phases that a project goes through from its initiation to completion. It provides a structured approach to managing projects, ensuring efficient execution, resource allocation, and goal achievement. The life cycle helps project managers track progress, manage risks, and ensure project success.

## Phases of the Project Life Cycle

The project life cycle consists of **four major phases**:

## 1. Initiation Phase

📌 **Objective:** Define the project at a broad level and determine its feasibility.

📌 **Key Activities:**

- Identify project goals, scope, and objectives.
- Conduct feasibility studies.
- Identify stakeholders and form the project team.
- Develop a **Project Charter** (formal document with objectives, constraints, and key stakeholders).
- Obtain necessary approvals.

📌 **Example:** A company planning to develop a new mobile app starts by defining its purpose, expected audience, and budget constraints.

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## 2. Planning Phase

📌 **Objective:** Develop a roadmap with detailed tasks, resources, schedules, and risk management strategies.

📌 **Key Activities:**

- Develop a **Work Breakdown Structure (WBS)** (dividing tasks into manageable units).
- Define project scope, schedule, and deliverables.
- Estimate costs and allocate resources.
- Develop a risk management plan.
- Create a **Gantt chart** or PERT/CPM charts for scheduling.

📌 **Example:** In a software development project, this phase includes setting milestones, estimating time for each module, and assigning tasks to developers.

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## 3. Execution Phase

📌 **Objective:** Carry out the project plan, manage teams, and ensure deliverables are met.

📌 **Key Activities:**

- Assign tasks and coordinate teams.
- Monitor project progress and make necessary adjustments.
- Conduct quality assurance and ensure compliance.

- Manage risks and resolve conflicts.
- Communicate with stakeholders regularly.

📌 *Example:* In a construction project, this phase includes procuring materials, hiring workers, and starting construction activities.

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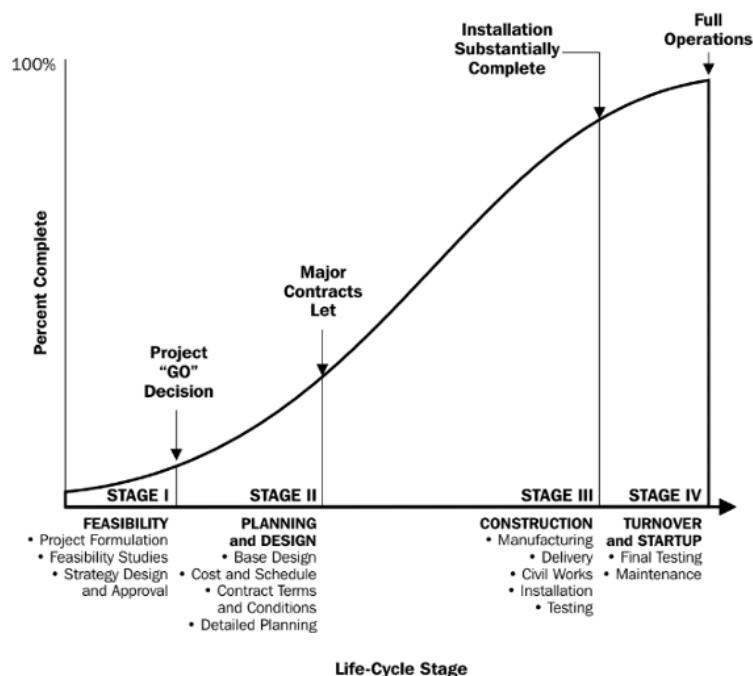
#### 4. Closure Phase

📌 *Objective:* Finalize the project, evaluate outcomes, and document lessons learned.

📌 *Key Activities:*

- Deliver final project report.
- Obtain client/stakeholder acceptance.
- Conduct project audit and performance evaluation.
- Release project resources and disband the team.
- Document lessons learned for future improvements.

📌 *Example:* After developing a website, the development team hands over the final product, provides necessary training, and archives the project documents.



Example: Project cycle for a Construction Project by Peter W. G. Morris

## Project Manager's Role

- Responsible for coordinating and integrating activities across multiple and functional lines
- Understand operations of line organizations
- Familiar with technology
- Master if in R&D activities

## Strong communication skills

- Strong interpersonal skills
- Ability to
- balance technical and managerial functions;
- overcome organizational constraints;
- cope with and survive risks

## Function of Project Managers in Negotiating and Resolving Conflicts

Project managers play a crucial role in ensuring that projects run smoothly by effectively negotiating and resolving conflicts that arise during execution. Their responsibilities in these areas include:

### 1. Identifying and Understanding Conflicts

- Recognizing potential and existing conflicts within the team, stakeholders, or external parties.
- Understanding the root causes, such as resource allocation, technical disagreements, or communication gaps.

### 2. Conflict Resolution Strategies

- **Collaboration:** Encouraging open discussions to find mutually beneficial solutions.
- **Compromise:** Finding a middle ground where all parties agree to give up something.
- **Accommodation:** One party yields to maintain harmony if the conflict is minor.
- **Avoidance:** Ignoring trivial conflicts to prevent unnecessary disruptions.
- **Forcing:** Imposing a decision when quick action is required.

### 3. Negotiation Skills

- **Active Listening:** Understanding concerns and perspectives before making decisions.

- **Effective Communication:** Clearly conveying goals, expectations, and solutions.
- **Emotional Intelligence:** Managing emotions and fostering positive relationships.
- **Problem-Solving:** Analyzing issues logically to propose the best solutions.
- **Decision-Making:** Making informed choices to balance project constraints.

#### **4. Stakeholder Engagement**

- Managing expectations and ensuring alignment between clients, teams, and sponsors.
- Mediating disputes between internal and external stakeholders to maintain project progress.

#### **5. Preventive Measures**

- Establishing clear project goals, responsibilities, and communication channels.
- Setting up conflict management frameworks within the project plan.

#### **6. Ensuring Team Productivity and Motivation**

- Creating a positive work environment by resolving conflicts constructively.
- Encouraging teamwork and collaboration to avoid further disputes.

#### **Example Scenario**

A project team faces a dispute over software design choices. The project manager facilitates a meeting, encourages both sides to present their concerns, and proposes a hybrid approach incorporating the best of both ideas. This resolution keeps the project on track and maintains team morale.

By effectively negotiating and resolving conflicts, project managers ensure smooth project execution, improve teamwork, and minimize risks associated with disputes.

#### **Comparison of Functional, Pure Project, and Matrix Organizational Structures**

The PDF covers three main organizational structures:

1. **Functional Organization**
  2. **Projectized (Pure Project) Organization**
  3. **Matrix Organization (Weak, Balanced, Strong)**
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## 1. Functional Organizational Structure

### 📌 Definition (From PDF):

- Classic **hierarchical structure**, where employees are grouped by functions (HR, IT, Finance, etc.).
- Project work is managed within these functional departments.
- The project manager has **limited authority**, while functional managers **control decisions and resources**.

### 📌 Advantages (From PDF):

- ✓ **Flexibility** in utilizing staff and expertise.
- ✓ Encourages **technological continuity and professional growth**.
- ✓ Resources are efficiently **grouped within departments**.

### 📌 Disadvantages (From PDF):

- ✗ Slow response to clients due to **department-based decision-making**.
- ✗ No single person is **fully responsible for the project**.
- ✗ Weak cross-functional communication.
- ✗ Projects are **not the core focus** of the organization.

### 📌 Example:

A **bank** where IT employees report to the IT department head but work on digital banking projects **under functional control**.

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## 2. Pure Project (Projectized) Organizational Structure

### 📌 Definition (From PDF):

- **Project manager has full authority** over the project and resources.
- The project team is **dedicated full-time** to the project.
- Functional departments have minimal influence.

### 📌 Advantages (From PDF):

- ✓ **Fast communication and decision-making**.
- ✓ Employees are **fully committed** to the project, leading to **higher efficiency**.
- ✓ **Simpler structure** with direct reporting to the project manager.
- ✓ **Stronger focus** on project completion.

### 📌 Disadvantages (From PDF):

- ✗ **Duplication of staff**, as each project needs its own resources.

- ✖ Difficulty in **hiring specialized employees** for long-term projects.
- ✖ Uncertainty for employees after project completion ("Life after project" issue).
- ✖ Risk of **inconsistencies in policies and procedures**.

📌 **Example:**

A **construction company** where a dedicated team is assigned to build a bridge, with the project manager having **full authority**.

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### 3. Matrix Organizational Structure

📌 **Definition (From PDF):**

- **Combination of Functional and Projectized structures.**
- Employees **report to both** a functional manager and a project manager.
- Resources are shared across multiple projects.

📌 **Types of Matrix Organizations (From PDF):**

- ◆ **Weak Matrix** – Functional managers have more authority; project managers work as coordinators.
- ◆ **Balanced Matrix** – Authority is **shared equally** between project and functional managers.
- ◆ **Strong Matrix** – Project managers **have more authority** than functional managers.

📌 **Advantages (From PDF):**

- ✓ **Access to shared resources**, avoiding duplication.
- ✓ Rapid response to client demands.
- ✓ **Better balance** of resources for multiple projects.
- ✓ Employees have a **functional "home"** after project completion.

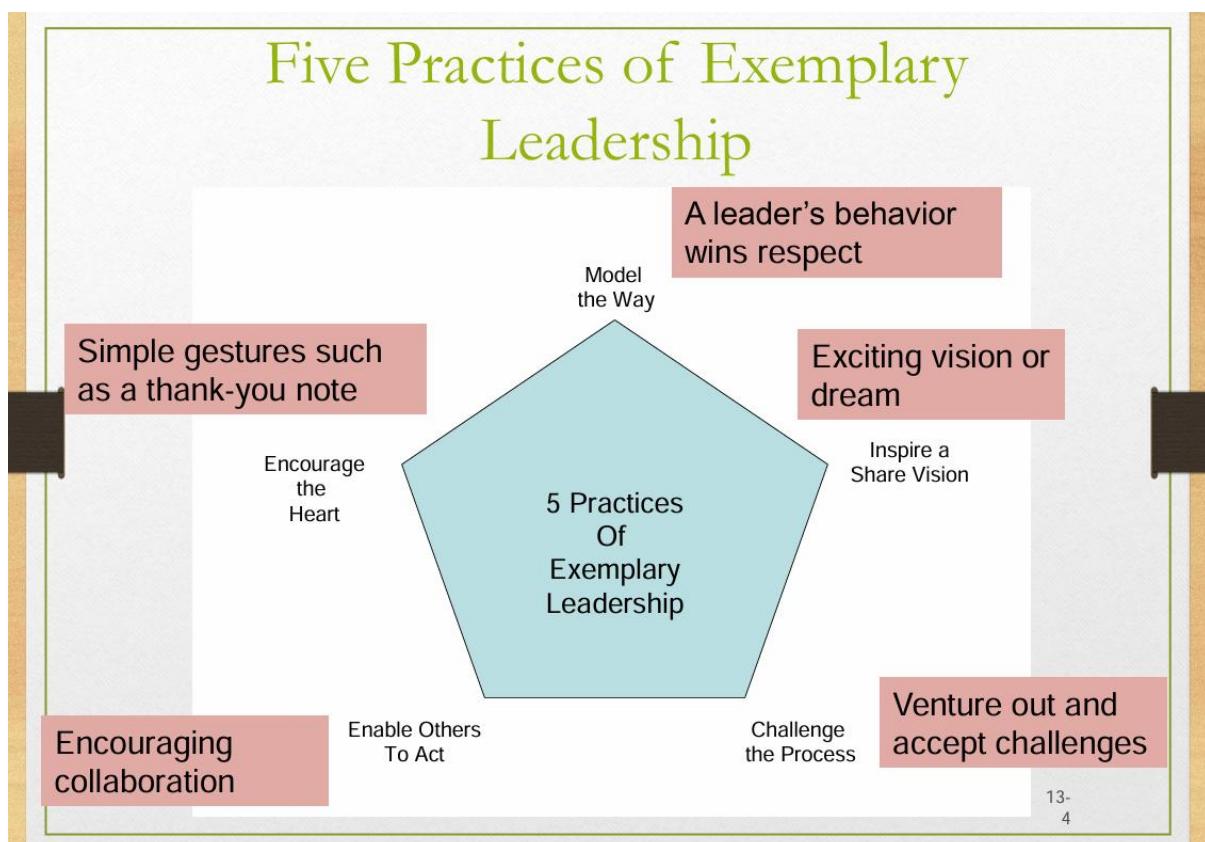
📌 **Disadvantages (From PDF):**

- ✖ **Conflicts** due to dual reporting (functional vs. project managers).
- ✖ Complex structure requiring **strong coordination and communication**.
- ✖ Decision-making can be **slower** than in pure project structures.

📌 **Example:**

An **automobile company** where engineers report to both the **R&D department head** and **various project managers** working on different car models.

Project Characteristics	Organization Structure	Functional	Matrix			Projectized
			Weak Matrix	Balanced Matrix	Strong Matrix	
Project Manager's Authority	Little or None	Low	Low to Moderate	Moderate to High	High to Almost Total	
Resource Availability	Little or None	Low	Low to Moderate	Moderate to High	High to Almost Total	
Who manages the project budget	Functional Manager	Functional Manager	Mixed	Project Manager	Project Manager	
Project Manager's Role	Part-time	Part-time	Full-time	Full-time	Full-time	
Project Management Administrative Staff	Part-time	Part-time	Part-time	Full-time	Full-time	



project selection models should follow these key criteria:

1. **Realism** – The model should reflect actual business constraints like budget, resources, and risks.
2. **Capability** – The model should consider external factors like market trends and internal factors like resource availability.
3. **Flexibility** – It should adapt to environmental changes, such as new technologies or regulations.
4. **Ease of Use** – It should be easy to implement without requiring excessive expertise.
5. **Cost Efficiency** – The model should not be more expensive than the potential benefits of the project.
6. **Easy Computerization** – It should allow data storage and processing through standard tools like Excel.

Once these criteria are established, **project selection models** (non-numeric and numeric) help organizations decide which projects to pursue.

### Non-Numeric Project Selection Models

Non-numeric models do not use financial metrics but rather **strategic and qualitative factors** for project selection.

#### 1. The Sacred Cow Model

- 📌 **Definition:** A project is initiated by a senior executive or influential figure, often without thorough evaluation.
- 📌 **Example:** A CEO personally suggests developing an AI chatbot because they believe it will enhance customer service, even if financial feasibility is not analyzed.

#### 2. Operating Necessity Model

- 📌 **Definition:** A project is selected because it is crucial for business operations.
- 📌 **Example:** A bank upgrades its cybersecurity infrastructure after a cyberattack to prevent future breaches.

#### 3. Competitive Necessity Model

- 📌 **Definition:** A project is undertaken to maintain or gain a competitive advantage.
- 📌 **Example:** A telecom company launches **5G services** to stay competitive against rivals.

#### 4. Product Line Extension Model

- 📌 **Definition:** A project is selected based on how well it expands or enhances an existing product line.

❖ **Example:** A smartphone company develops a **budget-friendly version** of its premium model to attract new customers.

## 5. Comparative Benefit Model

❖ **Definition:** Used when multiple projects exist, and the organization selects the one with the most overall benefits.

❖ **Example:** A hospital has to choose between upgrading its MRI machines or building a new research lab. The project with greater impact is selected.

Numeric Models	Profitability Models
<ul style="list-style-type: none"> <li>• Profit/Profitability Models           <ul style="list-style-type: none"> <li>1. Payback Period</li> <li>2. Discounted Cash Flow</li> <li>3. Internal Rate of Return</li> <li>4. Profitability Index</li> </ul> </li> <li>• Scoring Models           <ul style="list-style-type: none"> <li>1. Unweighted 0–1 Factor Model</li> <li>2. Unweighted Factor Scoring Model</li> </ul> </li> </ul>	<p style="text-align: center;"><b>PROFITABILITY MODELS</b></p> <ol style="list-style-type: none"> <li><b>1. Payback Period:</b> Everyone investing in a business wants a situation where he/she will be able to recover his investment within a period of time. However, the payback period establishes how an investor or an organization can regain its initial investment in a business or project within a stipulated time frame. It is the time required to regain one's invested money in a project. The shorter the time required to recover the invested money in the project, the better the project. A project with longer payback period is not considered favorable. <math>\text{Payback period} = \frac{\text{Investment cost}}{\text{Annual net cash flow}}</math>. Remember, the longer the payback period, the riskier the project.</li> </ol>
<p><b>Problem 1</b></p> <p>Two new Internet site projects are proposed to a young start-up company. Project A will cost \$250,000 to implement and is expected to have annual net cash flows of \$75,000. Project B will cost \$150,000 to implement and should generate annual net cash flows of \$52,000. The company is very concerned about their cash flow. Using the payback period, which project is better, from a cash flow standpoint?</p> <p><b>Solution:</b> For Project A: Initial investment = \$250,000 Annual net cash flow = \$75,000 Payback period = Initial investment / Annual net cash flow = \$250,000 / \$75,000 = 3.33 years</p>	<p>For Project B: Initial investment = \$150,000 Annual net cash flow = \$52,000 Payback period = Initial investment / Annual net cash flow = \$150,000 / \$52,000 = 2.88 years</p> <ol style="list-style-type: none"> <li><b>2. Discounted Cash Flow/ Net present value (NPV):</b> This technique considers the cost of the project and its returns in evaluating project viability over a period of time. It is the difference between the present value of incoming cash and the present value of cash outflows. NPV is a financial technique used to evaluate the profitability of an expected project and it is simply value minus cost. A positive cash flow implies a favorable project that is, a project worth undertaking by an organization and a negative cash flow points to a project that is unfavorable. Management usually accepts the project if the sum of the net present values of all estimated cash flows over the life of the project is positive. NPV unlike the payback period strongly considers value for money in any investment.</li> </ol> <p><math>\text{NPV} = \text{Total present value of cash Inflows} - \text{Present value of initial investment}</math></p>
<p><b>Problem 2 (a)</b></p> <p>A four-year financial project has net cash flows of \$20,000; \$25,000; \$30,000; and \$50,000 in the next four years. It will cost \$75,000 to implement the project. If the required rate of return is 0.2, conduct a discounted cash flow calculation to determine the NPV.</p> <p><b>Solution:</b> Cost of Project = \$75,000 Cash flow year 1 = \$20,000 Cash flow year 2 = \$25,000 Cash flow year 3 = \$30,000 Cash flow year 4 = \$50,000 Required return = 0.20 <math>\text{NPV} = \text{Total present value of cash Inflows} - \text{Present value of initial investment}</math> <math>\text{NPV} = [\\$20,000/1.20 + \\$25,000/1.20^2 + \\$30,000/1.20^3 + \\$50,000/1.20^4] - \\$75,000</math> <math>\text{NPV} = \\$50.54</math></p>	<p><b>Problem 2 (b)</b></p> <p>What would happen to the NPV of the above project if the inflation rate was expected to be 4 percent in each of the next four years?</p> <p><b>Solution:</b> Inflation rate = 4% Annual Rate = (Required return - Inflation rate) / (1 + Inflation rate) • Annual Rate = (0.20 - 0.04) / 1.04 = 0.1538 <math>\text{NPV} = \text{Total present value of cash Inflows} - \text{Present value of initial investment}</math> • <math>\text{NPV} = [(\\$20,000/1.1538) + (\\$25,000/1.1538^2) + (\\$30,000/1.1538^3) + (\\$50,000/1.1538^4)] - \\$75,000</math> <math>\text{NPV} = \\$8,857.45</math> • Project should be accepted as NPV is positive</p>
<p><b>3. Internal rate of return (IRR):</b> This financial technique is used to estimate the viability of a project. IRR is the rate of return that compares the present value of a project's expected gains with the present value of its costs.</p> <p>The IRR does not include external factors affecting the project but rather quantifies the rate of return over time for an investment. It is used by an organization to compare one project to another or to determine whether a particular project is viable. It is worth noting, that the higher the IRR, the higher the net cash flowing to the investor. A larger project with a lower IRR is more preferred by an organization to a smaller project with higher IRR, because the larger project will be able to generate higher cash flows.</p> <p><math>\text{IRR} = \frac{(\text{Current value} - \text{Original value}) / \text{Original value}}{100}</math></p>	<p><b>4. Profitability index/ Benefit cost ratio:</b> It is estimated using the net present value of expected cash flows divided by the initial cash invested in the project.</p> <p>The project is deemed acceptable when it has a ratio greater than 1. A profitability index less than 1, shows that the present value of the project is less than the initial investment capital; and that is not favorable for the project. On the other hand, a profitability index greater than 1, is favorable for a project and such project can be accepted by management.</p> <p><math>\text{Profitability index} = \frac{\text{PV of future cash flow}}{\text{Initial Investment}}</math></p>

<b>Scoring Models</b>	<b>2. Unweighted Factor Scoring Model</b>
<p><b>1. Unweighted 0–1 Factor Model</b></p> <p>The management lists the factors that are considered in rating a project. Management consists of a team of raters who help selection of the project.</p> <p>The people involved in the team must be familiar with the organizational goals. In this model, the list of factors is provided to the team of raters and the project is selected on the basis of the score given to it.</p> <p>Management selects the project with the highest factor score.</p> <p>The advantage of using this technique is that it gives equal weightage to all the raters and produces an explicit final result.</p> <p>The disadvantage of unweighted 0–1 factor model is that the raters are forced to choose either 'qualified' or 'not qualified' for a particular factor.</p>	<p><b>2. Unweighted Factor Scoring Model</b></p> <p>The unweighted factor scoring model overcomes this limitation by constructing a simple linear measure of scale from 1–5.</p> <p>In this model, the raters can select any of the values on a scale of 1 to 5 in which 5 is very good, 4 is good, 3 is fair, 2 is poor and 1 is very poor.</p> <p>The management can also include a factor, the expected future profit from a particular project in the next 3 years.</p>

## Project Portfolio

- A portfolio is defined as projects, programs, subsidiary portfolios, and operations managed as a group to achieve strategic objectives.
- Portfolio management is defined as the centralized management of one or more portfolios to achieve strategic objectives. The programs or projects of the portfolio may not necessarily be interdependent or directly related.
- Attempts to link project to goals and strategy of organisation
- Occurs throughout lifecycle of project

### PROJECT PORTFOLIO PROCESS (PPP)

It is the project selection process described by detailing an eight-step process that holds promise for improving an organization's project management maturity and at the same time ties the projects more closely to the organization's goals.

- Step 1: Establish a Project Council
- Step 2: Identify Project Categories & Criteria
- Step 3: Collect Project Data
- Step 4: Assess Resource Availability
- Step 5: Reduce Project and Criteria Set
- Step 6: Prioritize Projects within Categories
- Step 7: Select the projects to be funded and held in reserve
- Step 8: Implement the Process

Cont....

### 2. Identify Project Categories & Criteria

- Various projects categories are identified
  - So that it will be spread appropriately to meet various goals of the organization
  - Discriminate between good and better projects
  - Criteria's are weighted to reflect their relative importance
- First step is to list goals of each existing and proposed project

### 1. Establish a Project Council

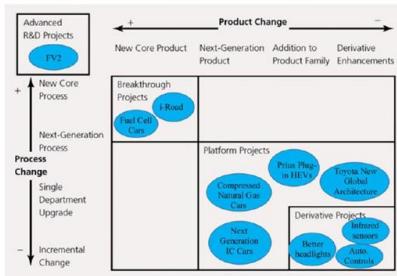
- To establish and articulate strategic direction of projects
- Also responsible for allocating funds, resources and skills
- Council
  - Senior Managers
  - the project managers of major projects;
  - the head of the Project Management Office, if one exists;
  - particularly relevant general managers;
  - those who can identify key opportunities and risks facing the organization; and
  - anyone who can derail the progress of the PPP later on in the process.

### Aggregate Project Plan

An aggregate project plan (APP) is the process of creating development goals and objectives and thereby improving productivity as well as development capabilities.

- Categories proposed by Weelwright and Clark
  1. **Derivative Projects:** can vary from additions or augmentations to existing products or simple price reductions over time. Example: special edition car paints.
  2. **Platform Projects:** major changes from existing products/services or the way the product/service is made or delivered. Example- new car model
  3. **Breakthrough Projects:** the highest risk and the highest reward category. Example- Hybrid Cars
  4. **R&D Projects:** high-risk endeavors with the possibility of high returns. Example- 3D television

## Aggregate Project Plan



## Aggregate project plan can be used to:

- Views the mix of projects within each category
- Analyse and adjust mix of projects within each category
- Assess the resource demands
- Identify and adjust the gaps in categories, sizes and timing of projects
- To identify workforce requirement

### 3. Collect Project Data

- For existing and proposed project collect data appropriate to the category criteria
  - Timing, date, duration, expected benefits and resource needed
- Use project plan, schedule of project activities, past experience, expert opinion to get good estimate of the data
- Identify any projects that can be deferred to a later time period, those that must precede or follow other projects, those that support other projects or should be done in conjunction with them, those that can be outsourced, and other such special aspects of the projects.
- Use criteria score limits to screen out the weaker projects
  - Escalating costs
  - Changed organisational goals
  - Changed regulations or law

### 5. Reduce the Project and Criteria Set

- Whether the project support organisational goals
- Whether required competence exists in the organisation
- Profitability
- Risk
- Resources
- If the projects has slipped from its objectives
- If the project dominated by another existing or proposed project

### 4. Assess Resource Availability

- Assess the availability of both internal and external resources by type, department and timing.
- Council will be trying to balance aggregate project resource needs over future periods with resource availabilities

### 6. Prioritise the Projects within Categories

- Apply score and criterion weights to rank projects
- Reconsider the projects in terms of their benefits first and their resource costs second.
- Council summarizes return from the project to the organization by category.

### 7. Select the Projects to be funded and held reserve

- Determine the mix of projects across various categories
- Leave 20-25 % of the organisations resources for new opportunities, crisis in existing project, errors in estimate etc.
- Rank the projects in categories.
- Commit fewer projects but allocate sufficient fund for project selection.

### 8. Implement the Process

- First step is to make the results of PPP widely known.
- Document the reasons for project cancellation, non selection etc.
- Commitment of top management by supporting the process and the results.
- Process must be repeated on a regular basis, the process should be flexible and improved continuously.

## Role of Project Sponsor

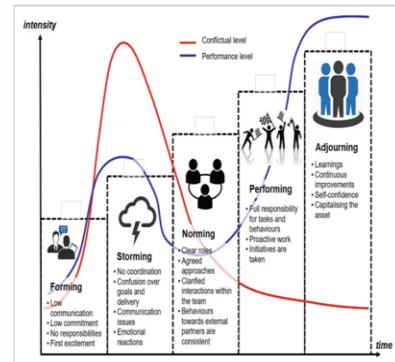
During the life of any project, business circumstances may change considerably, making it impossible for the Project Manager to carry out his/her job. Examples are such things as changes of policy, adverse business conditions, etc. In such cases the Project Sponsor is responsible for recognising and reacting to any such circumstances. The Project Sponsor acts as the representative of the organisation, and plays a vital leadership role through:

- providing 'championship' for the project, selling and marketing the project throughout the organisation
- providing business expertise and guidance to the Project Manager
- acting as the link between the project, the business community and perhaps most importantly, management decision making groups
- acting as an arbitrator and making decisions that may be beyond the authority of the Project Manager
- acting as a chairperson of the Steering Committee.

### Stages of team development

- **Forming.** This phase is where the team members meet and learn about the project and their formal roles and responsibilities. Team members tend to be independent and not as open in this phase.
- **Storming.** During this phase, the team begins to address the project work, technical decisions, and the project management approach. If team members are not collaborative or open to differing ideas and perspectives, the environment can become counterproductive.
- **Norming.** In this phase, team members begin to work together and adjust their work habits and behaviors to support the team. The team members learn to trust each other.
- **Performing.** Teams that reach the performing stage function as a well-organized unit. They are interdependent and work through issues smoothly and effectively.
- **Adjourning.** In this phase, the team completes the work and moves on from the project. This typically occurs when staff is released from the project as deliverables are completed or as part of the Close Project or Phase process.

**Level of Conflict & Performance during team development**



### Team Dynamics

- Team dynamics are the unconscious, psychological forces that influence the direction of a team's behaviour and performance.
- Team dynamics are created by the nature of the team's work, the personalities within the team, their working relationships with other people, and the environment in which the team works.
- Team dynamics can be good - for example, when they improve overall team performance and/or get the best out of individual team members.
- They can also be bad - for example, when they cause unproductive conflict, demotivation, and prevent the team from achieving its goals.

**Better Results-** Establishing an effective team involves defining a clear purpose, goals, dependencies and accountability

**More Commitment-** When a team member feels valued by the project manager and other team members, her morale and confidence go up. She tends to feel more commitment to the project and is likely to contribute more discussions, task completion and other project activities.

**Less Conflict-** Team members who disrespect each other tend to focus on their differences, not their commonalities. Varying cultural backgrounds and experiences may lead team members to make judgments and jump to erroneous conclusions

**More Trust-** Establishing trust takes time. Team members may resist exposing their weaknesses and hide deficiencies. An effective project manager works to assess the team's strengths and limitations.

### The Importance of Team Dynamics in PM

**Communication-** Communication is vital for a successful project. The project leader must give directions and advice clearly to ensure the team understands its task, and the team must feel comfortable relaying problems and inquiries to each other and the manager.

**Motivation-** Motivated workers are excited to contribute. Unmotivated workers, at best, do just enough to avoid criticism. Use incentives to motivate your team to work together well.

**Innovation-** Innovation can be an emergent group phenomenon, meaning it arises from the communication dynamics of the entire team, not just from the rare brilliant individual.

**Efficiency-** Effective team dynamics allow each participant to serve in her best capacity. The various skills of the team members complement one another, leading to speedy, efficient work.

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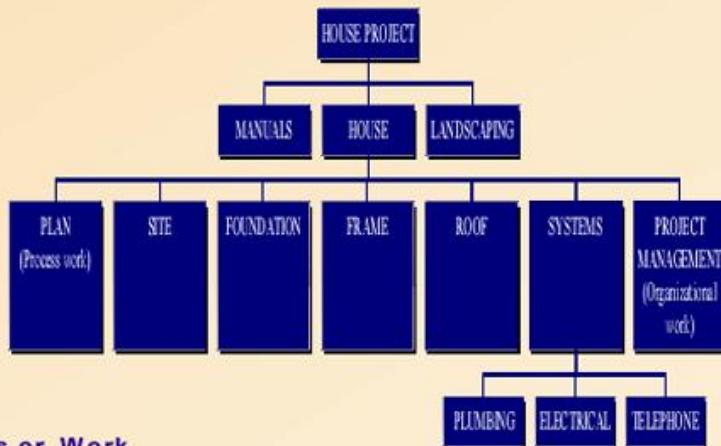
### STRATEGIES FOR IMPROVING TEAM DYNAMICS:

- Know Your Team
- Tackle Problems Quickly
- Define Roles and Responsibilities
- Break Down Barriers
- Focus on Communication
- Pay Attention



## House Project - Work Breakdown Structure (WBS)

<u>Level</u>	<u>Label</u>
0	Project
1	Deliverables or Subprojects
2	Components or Work packages
3	Sub-components or Work packages



## Difference between PERT & CPM

PERT (Programme Evaluation Review Technique)	CPM (Critical Path Method)
<ul style="list-style-type: none"> <li>1. PERT is event oriented.</li> <li>2. PERT is probabilistic.</li> <li>3. PERT is primarily concerned with time only.</li> <li>4. PERT is generally used for projects where time required to complete the activities is not known a priori. Thus PERT is used for large, R&amp;D type of projects.</li> <li>5. Three time estimates are possible for activities linking up two events.</li> </ul>	<ul style="list-style-type: none"> <li>1. CPM is activity oriented.</li> <li>2. CPM is deterministic.</li> <li>3. CPM places dual emphasis on project time as well cost.</li> <li>4. CPM is used for projects which are repetitive in nature and comparatively small in size.</li> <li>5. One time estimate is possible for activities (No allowance is made for uncertainty)</li> </ul>

## Critical Path Analysis

1. Calculate the time schedule for each activity
2. Calculate the time schedule for the completion of the entire project
3. Identify the critical activities and find the critical path

Activity	1-2	1-3	2-3	2-5	3-4	3-6	4-5	4-6	5-6	6-7
Duration (weeks)	15	15	3	5	8	12	1	14	3	14

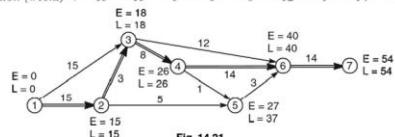


Fig. 14.21

- **Early Start Time:** The earliest point in the schedule at which a activity can begin.

EST of activities with no predecessors = First logical starting point.

EST of activities with predecessors = Predecessor EFT (Earliest Finish Time).

- **Early Finish Time:** The earliest point in the schedule at which a activity can finish.

EFT of activity with no predecessors = Estimated activity duration.

EFT of activity with predecessors = (Activity EST + Estimated activity duration).

- **Latest Start Time:** The latest point in the schedule at which a activity can start without causing a delay.

Activity LST = (LFT – Task duration).

- **Latest Finish Time:** The latest point in the schedule at which a activity can finish without causing a delay.

Activity LFT = EST of the next dependent task.

- **Float :** There are many activities where the maximum time available to finish the activity is more than the time required to complete the activity. The difference between the two times is known as float available for the activity.
- **Slack:** The difference between the latest event times and the earliest event time. i.e. Slack = TL - TE.

There are four types of float:

- **Total float :** It is the spare time available when all preceding activities occur at earliest possible times & all succeeding activities occur at latest possible times.

$$TF = LFT - EFT \quad (\text{or})$$

$$TF = LST - EST$$

- **Free float (FF) :** The maximum number of days the activity can be delayed without delaying any succeeding activity.

$$\begin{aligned} \text{Free float} &= \text{Total float} - \text{head event slack} \\ &= \text{EST of successor} - \text{EFT of current} \end{aligned}$$

- **Independent Float (IF) :** It may be defined as the amount of time by which the start of an activity can be delayed without affecting the earliest start time of any successor activity, assuming that preceding activity has finished at its latest finish time.

$$\text{Independent Float} = \text{Free float} - \text{tail event slack}$$

**Interfering Float:** It is that part of the total float which causes a reduction in the floats of the succeeding activities.

It can be defined as the difference between the latest finish time of the activity under consideration and the earliest start time of the following activity, or zero, whichever is larger. i.e.  $(LFT - EST) = TF - FF = \text{head event slack}$ .

$$\text{Interfering Float} = \text{Total Float} - \text{Free Float}$$

Activity ( $i - j$ )	Duration (D)	Start time		Finish time		Total Float
		(3)	(4)	(5)	(6)	
(1)	(2)					(7)
1-2	15	0	0	15	15	0
1-3	15	0	3	15	18	3
2-3	3	15	15	18	18	0
2-5	5	15	32	20	37	17
3-4	8	18	18	26	26	0
3-6	12	18	28	30	40	10
4-5	1	26	36	27	37	10
4-6	14	26	26	40	40	0
5-6	3	27	37	30	40	10
6-7	14	40	40	54	54	0

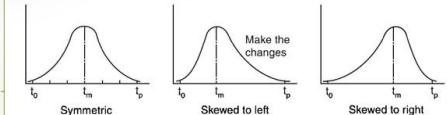
Critical Path = 1-2-3-4-6-7 = 54 weeks

## PERT

### ESTIMATING ACTIVITY TIMES

- Optimistic time ( $t_o$ )**: is that time estimate of an activity when everything is assumed to go as per plan. In other words it is the estimate of **minimum possible time** which an activity takes in completion under ideal conditions.
- Most likely time ( $t_m$ )**: the time which the activity will take most frequently if **repeated number of times**.
- Pessimistic time ( $t_p$ )**: the unlikely but possible performance time if whatever could go wrong, goes wrong in series. In other words it is the **longest time** the activity can take.

### EXPECTED TIME



- The times are combined statically to develop the expected time  $t_e$

$$t_e = \mu = \frac{t_o + 4t_m + t_p}{6}$$

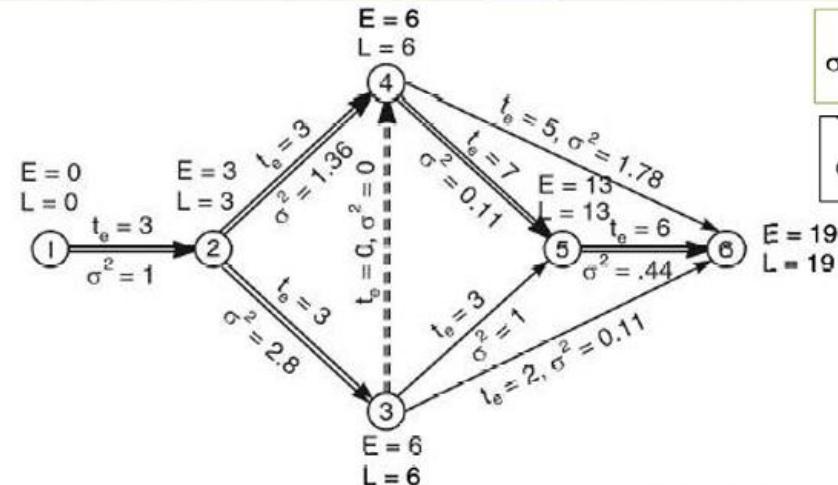
- Standard deviation

$$\sigma = \frac{t_p - t_o}{6}$$

- Variance

$$V = \sigma^2 = \left( \frac{t_p - t_o}{6} \right)^2$$

*The expected time is then used as the activity duration and the critical path is obtained by the analytical method explained earlier.*



$$\sigma = \frac{t_p - t_o}{6}$$

$$\sigma = \sqrt{\sum \sigma_{ij}^2}$$

$$\therefore \sigma \text{ for path } 1-2-4-5-6 = \sqrt{1+1.36+0.11+0.44} = 1.70,$$

$$\sigma \text{ for path } 1-2-3-4-5-6 = \sqrt{1+2.8+0+0.11+0.44} = 2.08.$$

$\therefore \sigma = 2.08$  is chosen as it is higher of the two values.

$$\therefore \text{Normal deviate, } Z = \frac{T - T_{cp}}{\sigma} = \frac{20 - 19}{2.08} = 0.48.$$

From table C-2, probability = 68.44%.

1-2-3-4-5-6 and 1-2-4-5-6 are the two critical paths.

## 1. What is a Gantt Chart? Explain with an Example.

### Definition:

A Gantt Chart is a visual project management tool used for scheduling and tracking tasks over time. It represents tasks as horizontal bars on a timeline, showing their start and end dates, dependencies, and progress.

### Key Components of a Gantt Chart:

- Tasks – The work to be done in the project.
- Timeline – The schedule of the project (days, weeks, or months).
- Bars – Represent the duration of each task.
- Dependencies – Show the relationship between tasks (e.g., Task B starts only after Task A is completed).
- Milestones – Important checkpoints in the project.

### Example:

A software company is developing a new mobile app. The Gantt chart would look like this:

Task	Start Date	End Date	Duration	Dependency
Project Planning	Day 1	Day 5	5 days	-
UI/UX Design	Day 6	Day 15	10 days	Planning
Backend Development	Day 16	Day 30	15 days	UI/UX Design
Testing	Day 31	Day 40	10 days	Development
Deployment	Day 41	Day 45	5 days	Testing

### Graphical View:



👉 This shows which tasks overlap and how long each takes.

### ⭐ Use Case:

Gantt charts help project managers track progress, manage deadlines, and allocate resources effectively.