



PROJECT MANAGEMENT (934E913A) – COURSE MATERIAL

VISION & MISSION STATEMENT

Vision: To be an oasis of knowledge to the seeker, to nurture one's creativity and research acumen, and to instill a unique blend of leadership, innovative spirit, and empathy in response to the ever-evolving business ecosystem.

Mission:

- Provide a pedagogy that blends academic rigor and experiential learning.
- Inculcate an entrepreneurial mindset through curated activities.
- Establish a conducive environment for research.
- Foster a culture of innovation and collaboration to progress in a dynamic business landscape.
- Promote humanistic values to produce socially responsible leaders.

Program Educational Objectives (PEOs)

PEO 1 – Employability:

To develop students with industry-specific knowledge & skills to meet the industry requirements, and also join a public sector undertaking through competitive examinations.

PEO 2 – Entrepreneur:

To create effective business service owners with a growth mindset by enhancing their critical thinking, problem-solving, and decision-making skills

PEO3 – Research and Development:

To instil and grow a mindset that focuses efforts towards inculcating and encouraging the students in the field of research and development



PEO 4 – Contribution to Business World

To produce ethical and innovative business professionals to enhance the growth of the business

PEO 5 – Contribution to the Society:

To work and contribute towards the holistic development of society by producing competent MBA professionals

Program Outcomes

PO1: Problem Solving Skill

Application of tools & techniques relevant to management theories and practices in analysing & solving business problems

PO2: Decision-Making Skill

Fostering analytical and critical thinking abilities for data-based decision making

PO3: Ethical Value

Ability to develop value-based leadership attributes

PO4: Communication Skill

Ability to understand, analyse, and effectively communicate global, economic, legal, and ethical aspects of business

PO5: Individual and Team Leadership Skill

Ability to be self-motivated in leading & driving a team towards the achievement of organizational goals and contributing effectively to establish industrial harmony

PO6: Employability Skill

Foster and enhance employability skills through relevant industry subject

knowledge **PO7: Entrepreneurial Skill**



Equipped with skills and competencies to become a global entrepreneur

PO8: Contribution to Society

Strive towards becoming a global influencer and motivating future generations towards building a legacy that contributes to the overall growth of humankind

SYLLABUS

Unit 1: Project management overview: Definition and examples of projects, Key features of projects, Life cycle of projects, Typical project problems, Human issues in Projects, Role of Computers in Projects - Project identification and screening: (Brainstorming, Strength, and weaknesses in the system, environmental opportunities and threats, Identification and screening) – Project Appraisal and Selection

Unit 2: Scope, Time and Cost Management: Project Organization Structure, Culture – Scope Management – Defining the Project – SOW - WBS and PBS – Time Management – Network Diagram – Forward Pass and Backward Pass Critical path – PERT and CPM - AOA and AON methods – tools for Project Network – Estimation Techniques - Cost Management – Earned Value Method.

Unit 3: Quality, Resource, Stakeholder and Procurement Management: Quality assurance and quality control, project audit and quality audit - Methods of enhancing quality: the different types of testing, inspections, reviews, standards. Management and control of testing - Human Resource Management - Scheduling Resources – Resource Allocation methods - Reducing Project duration: Project Crashing and resource-leveling methods - Leadership styles and skills – Problem-solving skills - Project Manager roles and responsibilities –Stakeholder Management: Identify Stakeholders - Plan Stakeholder Management – Manage Stakeholder Engagement - Control Stakeholder Engagement – Procurement Management.

Unit 4: Risk Management and Communication Management: Risk identification: types of risk, risk checklists-Risk prioritization -Risk management tactics, Including risk avoidance, risk transfer, risk reduction, risk mitigation and contingency planning- Risk registers –Communication Management

Unit 5: Performance Management: Project Integration - Progress and Performance measurement and evaluation – Project monitoring information system, developing a status report and other control issues - Project audit and closure – audit process, project closure, team, team member and project manager evaluations - International Projects – environmental factors, cross-cultural considerations, selection and training for international projects - Future likely trends in Project management – certain unresolved issues and project management career issues.

Unit 1: Project management Overview:

What is a Project?

The Project Management Institute (PMI, 2013b) defines a project as "a transitory undertaking intended to generate a distinctive product, service or outcome." The transient nature of projects indicates that they have a defined beginning and end. The project ends when its goals are achieved or it is no longer feasible.

According to the (Commerce, 2009), a Project is a brief organization that is created for the motive of handing over one or extra enterprise products in accordance to an agreed Business Case.

According to the (Management, 2006) "A project is a one-of-a-kind, temporary endeavour undertaken to achieve a specific goal."

The Software Engineering Institute defines a Project as a controlled group of interconnected resources that provide one or more products to a client. The set of sources has a start and finish and follows rules.

As per ISO 10006:2003 standard a "A project is a unique collection of coordinated and controlled activities with start and end dates that are undertaken to achieve a specific objective within time, money, and resource constraints."

An IT project does have a start and finish date, as well as milestones and goals that must be met along the development cycle. Some examples of short-term activities include retiring obsolete servers, redesigning an ecommerce site, taking fresh laptop photos, or combining databases. (Phillips, 2014)

Who is a Stakeholder?

The stakeholder can be anyone who has interest and who will be impacted by the outcome of a project. They can be those within a company like owners and employees. They could be external stakeholders like customers, suppliers, investors, the public, the government etc.

According to the Project Management Institute (PMI), the term project stakeholder refers to "an individual, group, or organization, who may affect, be affected by, or perceive itself to be affected by a decision, activity, or outcome of a project".

Project Management is the application of knowledge, skills, tools and techniques to project activities to meet project requirements.

Effective project management helps in:

- Meeting project objectives
- Satisfy stakeholder expectations
- Enhance predictability
- Conflict management
- Proactive risk management
- Better change management

Consider the reasons why a project is created:

- **Market Demand** : Your company is growing so quickly a project is launched to create a sales- and order-fulfilment application.



- **An organizational need:** Special needs within your company. All of the computers are old, so a project is launched to replace all of the computers and standardize office applications.
- **Social Need:** To provide drinking water to villages through borewells.
- **A Customer request :** Many organizations, such as IT integrators, construction companies, architects, and dozens more, complete projects for other people. For example, to create a new flyover for PWD department.
- **Environmental Consideration:** Project to create awareness of Solar Panel to reduce fossil fuel consumption.
- **A Technology Advance:** Technology changes so quickly that there are constantly new technical projects within an organization.
- **A Legal requirement :** Laws can cause a new project to launch. Consider the recent Sarbanes-Oxley requirements, for example. This new law spurred many projects to adhere to the new privacy requirements. Laws and regulations within different industries can also spur new projects—consider pharmaceutical, insurance, health care, and on and on. Regulations are required, but standards are guidelines

1.4 Key Characteristics of projects

Major Characteristics of a Project include

- Has an established objective.
- Has a defined life span with a beginning and an end.
- Requires across-the-organizational participation.
- Involves doing something never been done before.
- Has specific time, cost, and performance requirements.

According to the (PMI, 2013b), a project has three important characteristics namely:

- Temporary
- Unique
- Progressive elaboration

Temporary: Projects have a definitive starting and a definitive end. Projects normally come to an end when the project's scope is met. When a project runs out of time, money, or it becomes evident that the project will not be able to achieve the scope objectives, it may come to an end, hence a project is scrapped. So temporary normally means that the assignment is temporary but not the deliverable.

Unique: Projects are unique. This skill that each assignment one ever does is different than all the other projects one has in the past. Even if it is the same basic method to get to the same end result, there are special elements within each assignment such as the time it takes, the stakeholders involved, the surroundings the assignment takes place in, and so on.

Progressive Elaboration: All projects commence as a concept. A project idea to create a new product or service generally consists of a broad vision of what the end result of the challenge will be. The temporary



assignment outcomes in the unique product or service through innovative elaboration. Progress elaboration is virtually growing in steps and persevering with through increments.

Program is a group of related projects managed in a coordinated way to obtain benefits and controls not available from managing them individually.

Portfolio is a collection of projects/ programs that are grouped together to facilitate effective management of that work to meet strategic business objectives.

1.5 Project Life Cycle

The purpose of the project life cycle is to create an easy-to-follow framework to guide projects.

There are five phases to a project lifecycle; known as process groups. Each process group represents a series of inter-related processes to manage the work through a series of distinct steps to be completed. This type of project approach is often referred to as "traditional"[29] or "waterfall" .[30]

Phases of the Project Management Lifecycle

A project life cycle provides a high-level view of the project and the phases are tailored to fit a project's needs providing a roadmap to accomplish it. The project management life cycle is divided into 5 phases: project initiation, planning, execution, monitoring & control, and closure.

1. **The Project Initiation stage:** Define project goals, evaluate feasibility and establish the project's purpose and stakeholders.
2. **The Project Planning stage:** Create a comprehensive project blueprint outlining tasks, timelines and [resource allocation](#).
3. **The Project Execution stage:** Put the project plan into action, ensuring effective communication and coordination among team members.
4. **The Project Monitoring & controlling stage:** Track project progress, identify any deviations and make necessary adjustments to keep the project on course.
5. **The Project Closure stage:** Complete all project tasks, obtain client approval and conduct a thorough review to capture valuable insights for future projects.

Projects can be executed using a "traditional methodology" such as the "Waterfall methodology" or an Agile method or a mix of the two, which is referred to by many as the "Hybrid Agile" method. Irrespective of the "execution methodology", all projects typically go through these 5 phases from identification/ approval to completion. This article describes these phases in some detail:

1. Project Initiation

The goal of the initiation phase is to define the project at a broad level in terms of what needs to be done and achieved in order for it to be successful.

This is where the stakeholders (the people or business unit who will fund the project), the goals, objectives and deliverables are identified and the resources and the money needed to do the project are determined at a high level. A high-level determination is made whether the project is "feasible or not" based on these. The key deliverable of this phase is the Project Charter.

Key project management steps involved in the Initiation phase

- Conduct a feasibility study to identify the primary problem the project will solve and whether the project can deliver a solution to that problem



- Create a business case and define the project at a high level
- Create a Project Charter or project initiation document that outlines the vision, objectives and goals of the project
- Identify the high-level scope of the project and define the product or service the project will deliver
- Identify key project stakeholders
- Once the project gets a go-ahead, assemble the project team and establish a project office

A business case, a feasibility study and a Project Charter together fulfil the requirement of the Initiation phase to determine if the project is to be approved or not. Once the project is approved, one or more project initiation meetings are held to finalize the project. This is where the project initiation phase ends and the planning phase begins.

2. Project Planning

This phase begins after the project receives a green light in the Initiation phase. The Project Planning phase is most critical and requires complete diligence as it lays out the project's roadmap.

It involves defining the work to be done and figuring out how to accomplish it. This is especially true for large and/or complex projects, which are typically executed using traditional methodologies. Projects that are executed using Agile methods of execution also go through a planning phase, but the plans may be defined at a high level; with the detailed execution being left to the team to plan in short iterations or sprints.

The project manager begins setting goals with a project plan. A well-crafted project plan outlines a detailed project schedule, communication plan to give direction to the team for producing quality output and handling risks.

During the planning stage, the Project Manager defines the scope of the project and project management plan that involves the cost, quality, resources and project timeline. The scope is defined by the project manager with a scope statement and Work Breakdown Structure (WBS) (the deliverables for the project).

Another crucial activity during this phase is the effort and resource estimation for the project. The Project Manager, usually working with a team of experts, provides "rough order of magnitude" (ROM) estimates of all the essential elements of the project, such as effort on various phases and high-level tasks, other non-labour resources and overall budgets based on that. All of these inputs go into putting together the high-level plan for the project.

Key project management steps involved in the Planning phase:

- Create a Statement of Work document to flesh out the details of project deliverables
- Develop a Work Breakdown Structure
- Create a project plan, assign team members (and other resources) to the various tasks and build a detailed project timeline
- Identify the Project Team roles and other resources for the project. At this stage, the Project Manager – working with a project staffing function – will most likely identify specific people for some of the key roles needed for the success of the project.
- Create a risk mitigation plan to identify potential risks and develop a strategy to minimize them
- Incorporate an effective change management plan for necessary changes in the project and to avoid bottlenecks
- Create a communication plan to schedule interactions with relevant stakeholders

3. Project Execution

The execution phase involved actually carrying out the activities that are identified in the project plan. This is where the rubber hits the road and the project ultimately comes to reality!



This is the stage where planning is turned into action. The project team is built. Specific people and other resources are assigned to the tasks identified in the project plan. The project work is carried out in the required sequence in order to complete all of the work in the most efficient manner possible.

The key outcome of the Execution phase are the various deliverables that are produced in line with the defined project plan.

The project manager organizes the team members, establishes workflow and constantly monitors progress, ensuring that work is done as per plan, while maintaining effective collaboration between the project team and various stakeholders.

Key project management steps involved in the Execution phase:

- Identify and assign the project team Assign the team and other resources to the project tasks and begin work in the planned manner
- Provide necessary guidance to the team on how tasks should be completed
- Monitor progress of the team
- Communicate with the stakeholders on a regular basis to ensure that the project deliverables are acceptable

4. Project Monitoring & Control

This phase typically runs in parallel with the Project Execution phase and involves keeping the project on track and ensuring that objectives and project deliverables are met.

The project manager reports on the performance of the project and makes sure the project is going according to plan. This helps track any deviations from the planned budget, timeline and quality goals of the project.

Any necessary changes to the project goals are implemented after formal evaluation of the potential impact to the project goals and acceptance/ approval of the impact by the project stakeholders.

This phase also involves continuously monitoring the project environment for any risks or issues that are likely to impact the project performance, and taking the necessary steps to prevent or mitigate them as proactively as possible, to minimize impact to any of the project goals.

Key project management steps involved in the Monitoring and Control phase:

- Tracking the progress of various project tasks
- Measure budget, timeline and quality performance of the project
- Conduct user reviews and collect feedback, and take any corrective actions needed
- Track all changes to the project scope (whether from team members or the stakeholders) and report on their impact to project goals.
- Monitor overall project performance, including all project plan changes, and ensure that all stakeholders and the project team are on the same page about the project status and its expected outcomes.

5. Project Closure

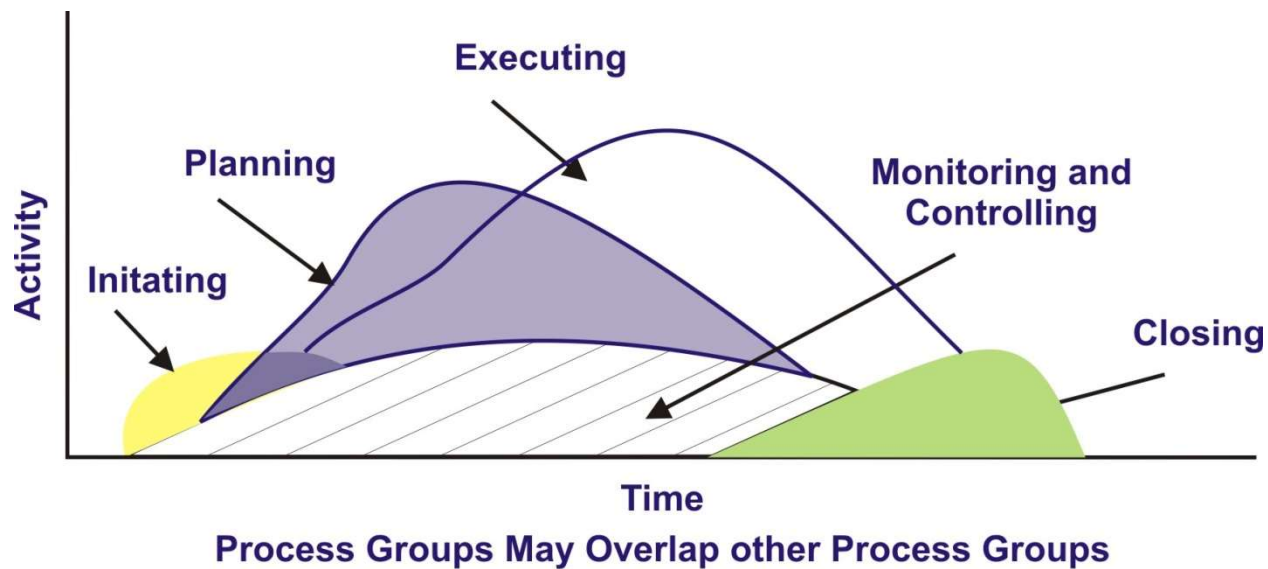
Project Closure is the final phase of the project management life cycle, which indicates the end of the project and the final delivery of the project deliverables.

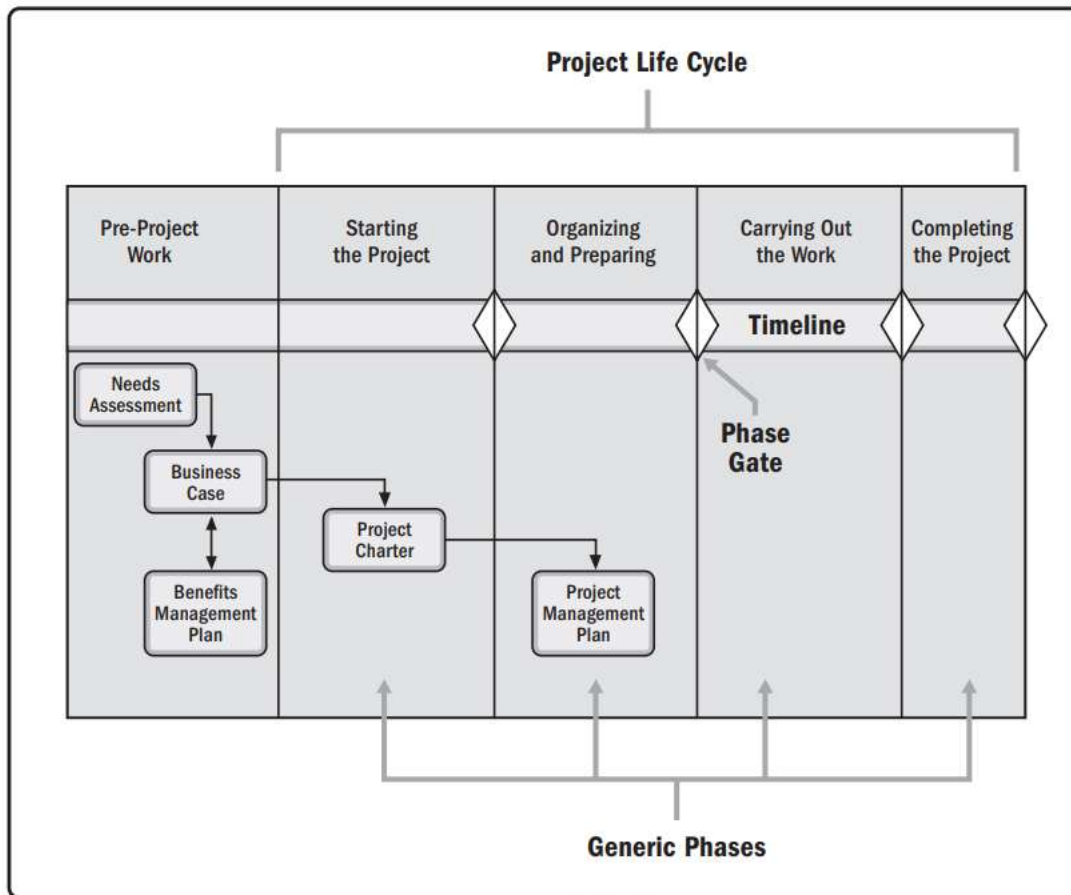


Project Closure involves completion of the final delivery of a project and its approval by the stakeholders. Once the project's closure is formally approved, other aspects of the closure can be carried out.

The project manager conducts a "post-project review" meeting, or commonly referred to as a retrospective- to review the lessons from the project, and the challenges that were faced during the project. It gives an opportunity to comprehend lessons learned to improve productivity in the future.

Once the above activities are completed, the project team members are released to other projects





(Source: PMBOK 6th Edition)

1.6 Project Challenges



There are many qualities a good project manager must have, including the ability to plan projects in detail and assemble the right team for each job. However, many will argue that the most important trait is the ability to anticipate challenges and proactively and quickly find solutions to problems as they arise. Few project management challenges, along with suggested solution ideas to help overcome those challenges:

Unrealistic deadlines – The challenge of many managers becomes to find alternate approaches to the tasks and schedules in order to complete a project “on time”, or to get approval for slipping dates out. An “absolute” time-based deadline such as a government election, externally scheduled event, or public holiday forces a on-time completion. But most project timelines do eventually slip due to faulty initial deadlines.

Solution: Manage the stress of the project deadline and the project issues with creative planning, alternatives analysis, and communication of reality to the project participants. Also determine what deadlines are tied to higher-level objectives, or have critical links into schedules of other projects in the organization’s portfolio.

Resource competition – Projects usually compete for resources (people, money, time) against other projects and initiatives, putting the project manager in the position of being in competition.

Solution: Portfolio Management – ask upper-level management to define and set project priority across all projects. Also realize that some projects seemingly are more important only due to the importance and political clout of the project manager, and these may not be aligned with the organization’s goals and objectives.

Insufficient team skills – The team members for many projects are assigned based on their availability, and some people assigned may be too proud or simply not knowledgeable enough to tell the manager that they are not trained for all of their assigned work.

Solution: Starting with the project manager role, document the core set of skills needed to accomplish the expected workload, and honestly bounce each person’s skills against the list or matrix. Using this assessment of the team, guide the team towards competency with training, cross-training, additional resources, external advisors, and other methods to close the skills gap.



Lack of accountability – The project participants and related players are not held accountable for their results – or lack of achieving all of them.

Solution: Determine and use accountability as part of the project risk profile. These accountability risks will be then identified and managed in a more visible manner.

Share this:

1.7 Role of Computers in Projects

In virtually every business, a computer is an essential tool for running the day-to-day operations, enhancing productivity and communicating with customers, suppliers and the public. Managers use computers for a variety of reasons, including keeping their teams on track, budgeting and planning projects, monitoring inventory and preparing documents, proposals and presentations. Managers need to understand not only the basic functions of the corporate software tools used in the office but also the Internet and other external computing tools that can improve the way they manage their respective projects in their departments. Project managers can get a helping hand in ensuring project success with workflow automation tools and machine learning-driven analytics. IT project managers may work in a variety of industries, as nearly all organizations rely on computing technologies.

1.8 Global Project Management Standards

APM Project Management

APM, The Association for Project Management approach is based on their *Body of Knowledge* (BoK). APM Body of knowledge includes:

- Project Context,
- Project people (Team & Stakeholders)
- Project delivery

In addition to *Body of Knowledge* (BoK), APM further includes, Competence Framework, which is based on detailed research done by Project Management Practitioners.

APM also emphasize on following project domains:

- Technical Domain
- Behavioural Domain (Soft Skills side of Project Manager Interpersonal Skills, Emotional Intelligence) and
- Contextual Domain (Which suggests Project Management Tailoring according to context)

In order to deliver results these three key domains, APM suggests 47 individual competences.

Last but not the least, Association for Project Management (APM) is the only chartered body for the project profession, with over 30,000 individual members and more than 500 partner organizations.

APM project delivery approach is mostly being commonly used in the UK in the rail industry, construction, defence and local government but is also recognized globally through its alignment with the International Project Management Institute (IPMA).



PMI Project Management based on Project Management Body of Knowledge, PMP

PMBOK 7th edition is divided into two components.

PM standard

This part includes:

12 Project Management Principles, similar to PRINCE2

Systems for Value Delivery, for strategic alignment of strategy and projects.

PMBOK Guide

This part includes 8 performance domains, almost similar to Knowledge areas.

- Stakeholders
- Team
- Development approaches and lifecycles
- Planning
- Project work
- Delivery
- Measurement
- Uncertainty

PMP is considered as globally recognized Gold Standard of project management ANSI standard which is continually evolving to suggest best project management approaches globally and cross-functional industries.

1.9 Project Appraisal and Selection

Selection Criteria for projects comprise two models namely:

- **Financial models:** payback, net present value (NPV)
- **Non-financial models:** projects of strategic importance to the firm.
- Multi-Weighted Scoring Models
 - Use several weighted selection criteria to evaluate project proposals.

Project appraisal is the structured process of assessing the viability of a project or proposal. It involves calculating the feasibility of the project before committing resources to it. It is a tool that company's use for choosing the best project that would help them to attain their goal. Project appraisal often involves making comparison between various options and this is done by making use of any decision technique or economic appraisal technique.

Project appraisal is a tool which is also used by companies to review the projects completed by it. This is done to know the effect of each project on the company. This means that the project appraisal is done to know, how much the company has invested on the project and in return how much it is gaining from it.



Steps of Project Appraisal

Project appraisal is the process of assessing the feasibility, viability, and potential impact of a proposed project. It involves a systematic analysis of various aspects of the project, such as its objectives, scope, benefits, costs, risks, and potential outcomes. The following are the steps involved in project appraisal:

1. **Project Identification:** This involves identifying and defining the project, including its objectives, scope, and key stakeholders.
2. **Project Screening:** This step involves assessing the project's alignment with the organization's strategic goals, resource availability, and overall feasibility.
3. **Project Scoping:** This step involves defining the project's boundaries, deliverables, timelines, and resource requirements.
4. **Market and Demand analysis:** This step involves analysing the market and demand for the project's output or services, including potential customers, competitors, and market trends.
5. **Technical analysis:** This step involves assessing the project's technical feasibility, including the availability of technology, expertise, and other resources required for the project.
6. **Financial analysis:** This step involves assessing the project's financial viability, including the costs, revenues, profits, and cash flows associated with the project.
7. **Economic analysis:** This step involves assessing the project's economic impact, including its contribution to economic growth, employment, and social welfare.
8. **Risk analysis:** This step involves assessing the project's risks, including its vulnerability to external factors, such as market fluctuations, natural disasters, and political instability.
9. **Environmental and social impact analysis:** This step involves assessing the project's potential impact on the environment and society, including the potential risks and benefits associated with the project.
10. **Project appraisal report:** This step involves compiling all the information gathered from the above steps and presenting it in a comprehensive project appraisal report. The report should provide a clear recommendation on whether the project should be approved, modified, or rejected.

The process of project appraisal consists of five steps and they are – initial assessment, defining problem and long-list, consulting and short-list, developing options, and comparing and selecting project. The process of appraisal generally starts from the initial phase of the project. If the appraisal process starts from an early stage, then the company will be in a better position to decide how capital should be spend in the project and also it will help them to make the decision of not spending too much or stopping a project that is not economically viable.

Types of Project Appraisal

Appraisal of projects can be done by many ways, but the most common of them are financial and economic appraisal. In case of financial project appraisal, the company reviews the cost of the project and the expected revenues that will be generated by the project. This type of appraisal helps the company to prevent overspending on a project. It also helps in finding certain areas where alterations can be done for generating higher revenues. Under economic



appraisal, the company mainly focuses on the total benefit of the project and less on the costs spent on the project. Other than these two types of appraisals, there are also other types of project appraisal which include technical appraisal, management or organizational appraisal and marketing and commercial appraisal.

What period of the future should be chosen for a better project evaluation?

The time period for project appraisal depends on the project's nature, scope, and expected lifespan. Generally, a project's appraisal period should cover the entire project lifecycle, including the planning, implementation, and post-implementation stages.

For short-term projects, the appraisal period may be one to three years. In contrast, for long-term projects, the appraisal period may be 10 to 20 years or even longer. The appraisal period should be long enough to capture the project's expected benefits and costs, including the initial investment, ongoing operational costs, and expected benefits over the project's lifespan.

It's also critical to keep in mind that the length of the project appraisal period can change based on the goals of the project and the organization's policies and processes. For instance, if the project's goal is to make quick money, the appraisal time can be shorter than if the goal is to benefit stakeholders over the long term.

In conclusion, the term for project evaluation should include the full project lifecycle and be extensive enough to include all of the estimated costs and benefits, including the initial investment, continuous [operating expenses](#), and anticipated benefits during the project's duration.

Specialists carry out project appraisals

Project appraisal involves a wide range of specialists from different fields, depending on the nature, scope, and complexity of the project. The following are some of the specialists who may be involved in project appraisal:

- *Project manager*: The project manager is responsible for overseeing the entire project appraisal process, including the coordination of all the specialists involved.
- *Financial analyst*: A financial analyst assesses the financial viability of the project, including the cost-benefit analysis, cash flow projections, and other financial metrics.
- *Economist*: An economist assesses the economic impact of the project, including its contribution to economic growth, employment, and social welfare.
- *Market analyst*: A market analyst assesses the demand and supply factors related to the project, including market trends, customer preferences, and competition.
- *Technical specialist*: A technical specialist assesses the technical feasibility of the project, including the availability of technology, expertise, and other resources required for the project.
- *Environmental specialist*: An environmental specialist assesses the potential environmental impact of the project, including its impact on air, water, and land.
- *Social specialist*: A social specialist assesses the potential social impact of the project, including its impact on the community, culture, and social norms.



- *Legal specialist*: A legal specialist assesses the legal aspects of the project, including compliance with laws and regulations, contractual agreements, and liability issues.
- *Risk analyst*: A risk analyst assesses the potential risks associated with the project, including market risks, operational risks, financial risks, and other types of risks.

The specific specialists involved in project appraisal may vary depending on the type and scale of the project, as well as the organization's policies and procedures.

Software Used for Projects Appraisal

There are several software tools that can be used for project appraisal, including:

1. **Microsoft Excel**: This is a spreadsheet software that can be used for financial analysis, cost-benefit analysis, and other types of [quantitative analysis](#).
2. **Project management software**: There are several project management software tools available in the market, such as Microsoft Project, Primavera P6, and JIRA. These tools can be used for project scoping, scheduling, resource allocation, and other project management activities.
3. **Decision-making software**: There are several decision-making software tools available, such as Decision Tools Suite, Expert Choice, and Analytica. These tools can be used for cost-benefit analysis, risk analysis, and other types of decision-making analysis.
4. **Mind mapping software**: There are several mind mapping software tools available, such as MindManager, XMind, and FreeMind. These tools can be used for brainstorming, SWOT analysis, and other types of visual analysis.
5. **Environmental and social impact assessment software**: There are several environmental and social impact assessment software tools available, such as ESRI ArcGIS, IMPACT, and OpenLCA. These tools can be used for environmental and social impact analysis, including the analysis of land use, water use, energy consumption, and carbon footprint.

Depending on the organization's rules and processes, as well as the project's type, scale, and complexity, the specific software tools utilized for project assessment may change.

Financial Models

- The Payback Model
 - Measures the time the project will take to recover the project investment.
 - Uses more desirable shorter paybacks.
 - Emphasizes cash flows, a key factor in business.



• **Limitations of Payback:**

- Ignores the time value of money.
- Assumes cash inflows for the investment period (and not beyond).
- Does not consider profitability.

The Net Present Value (NPV) model

- Uses management’s minimum desired rate-of-return (discount rate) to compute the present value of all net cash inflows.
 - Positive NPV: project meets minimum desired rate of return and is eligible for further consideration.
 - Negative NPV: project is rejected

NONFINANCIAL STRATEGIC CRITERIA include the following:

- To capture larger market share
- To make it difficult for competitors to enter the market
- To develop an enabler product, which by its introduction will increase sales in more profitable products
- To develop core technology that will be used in next-generation products
- To reduce dependency on unreliable suppliers
- To prevent government intervention and regulation
- To restore corporate image or enhance brand recognition
- To demonstrate its commitment to corporate citizenship and support for community development.

Topic	Question
Strategy/alignment	What specific strategy does this project align with?
Driver	What business problem does the project solve?
Success metrics	How will we measure success?
Sponsorship	Who is the project sponsor?
Risk	What is the impact of not doing this project?



Risk	What is the project risk to our organization?
Risk	Where does the proposed project fit in our risk profile?
Benefits, value, ROI	What is the value of the project to this organization?
Benefits, value, ROI	When will the project show results?
Objectives	What are the project objectives?

· Unit 2: Scope, Time and Cost Management:

Project Organization

Structure

Projects operate within the constraints imposed by the organizations. To operate effectively and efficiently, the project manager needs to understand where responsibility, accountability, and authority reside within an organization. This understanding will help the project manager effectively use his/her power, influence, competence, leadership, and political capabilities to successfully complete the project.

Organization structure consists of three key elements

1. Organizational structure (OS) designates formal reporting relationship, including no of levels, span of control of managers and supervisors.
2. OS identifies the grouping together of individuals into departments and departments into total origination.
3. OS includes the design of systems to ensure effective communication, coordination, and integration of efforts across departments.

Forms of organizational structure

Functional organization: Grouping people performing similar activities into departments

Project organization: grouping people into project teams on temporary assignments

Matrix organization: companies are structured by creating a dual hierarchy in which functions and project have equal prominence

Organization Structure Influences on Projects



Organization Structure Project Characteristics	Functional	Matrix			Projectized
		Weak Matrix	Balanced Matrix	Strong Matrix	
Project Manager's Authority	Little or None	Limited	Low to Moderate	Moderate to High	High to Almost Total
Resource Availability	Little or None	Limited	Low to Moderate	Moderate to High	High to Almost Total
Who controls 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

Figure 2:1 Types of Organization Structures

As can be seen in Figure 2:1, project managers exhibit high to total authority in Strong matrix and projectized organization structures, they also have a full-time role here, which creates a strong foundation for ensuring Project success.

Culture

A project culture represents the shared norms, beliefs, values, and assumptions of the project team. Understanding the unique aspects of a project culture and developing an appropriate culture to match the complexity profile of the project are important project management abilities.

Culture is potent. It can block an organization's (or project) strategy or catalyse it. Project leaders who lack cultural awareness can become restricted and handicapped by the values and beliefs of the base organization's culture.

2.4 Project Scope Management

Project Scope management includes the processes required to ensure that the project includes **all the work required** and **only the work required**, to complete the project successfully. Managing the project scope is primarily concerned with what is and what is not included in the project.

The main steps of Project Scope management include

- Defining the Scope
- Create a Work Breakdown structure
- Validate Scope
- Control Scope

In the project context, the term “scope” can refer to:

- Product Scope: The features and functions that characterize a product, service or result
- Project Scope: The work performed to deliver a product

Statement of Work

It is a narrative description of products, services or results to be delivered by the project. This is generally prepared by the customer to potential vendors who wish to bid for any project. This comprises, generally of the following information on the project

- Introduction/background
- Scope of work
- Period of performance
- Place of performance
- Work requirements
- Schedule/milestones
- Acceptance criteria
- Other requirements

Work Breakdown Structure

A work breakdown structure (WBS) is a visual, hierarchical and deliverable-oriented deconstruction of a project. It is a helpful diagram for project managers because it allows them to break down their project scope and visualize all the tasks required to complete their projects.

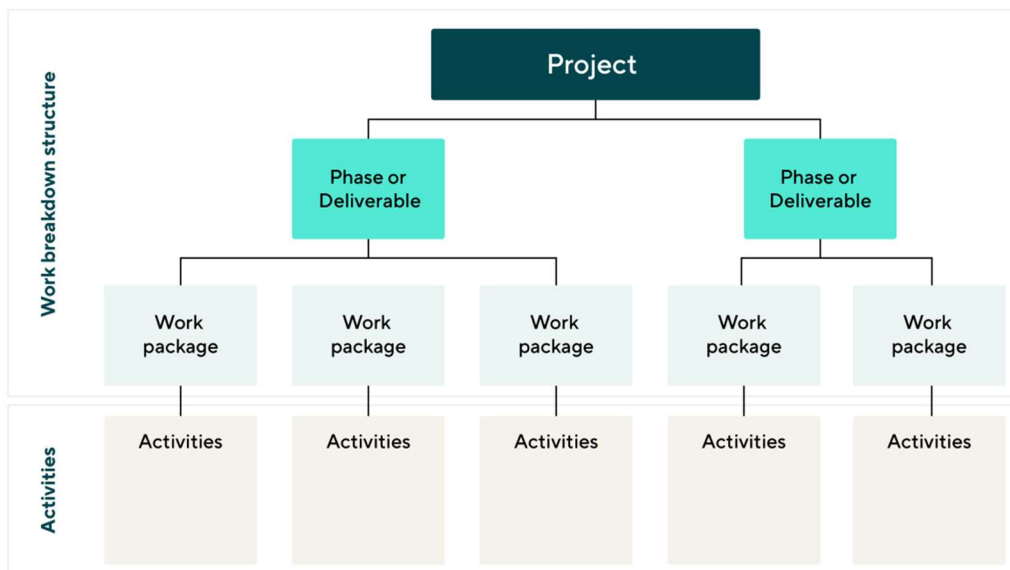


Figure 2:2 Work Breakdown Structure

Decomposition is the tool used for dividing and subdividing the project scope and project deliverables into smaller , more manageable parts.



A deliverable is a tangible or intangible good or service produced as a result of a project that is intended to be delivered to a customer.

An important design principle for work breakdown structures is called the 100% rule. The 100% rule states that the WBS includes 100% of the work defined by the project scope and captures all deliverables – internal, external, interim – in terms of the work to be completed, including project management.

The lowest level of a WBS is the work package. A work package is a sequence of activities that leads to a deliverable. A work package is at a higher level in the WBS hierarchy than an activity.

Product Breakdown Structure

A product breakdown structure is a hierarchical chart that captures a project's physical products that are necessary to deliver success. During the planning stage, it lists the products that'll be delivered over the project's life cycle to manage and organize everything that's needed to successfully complete the project.

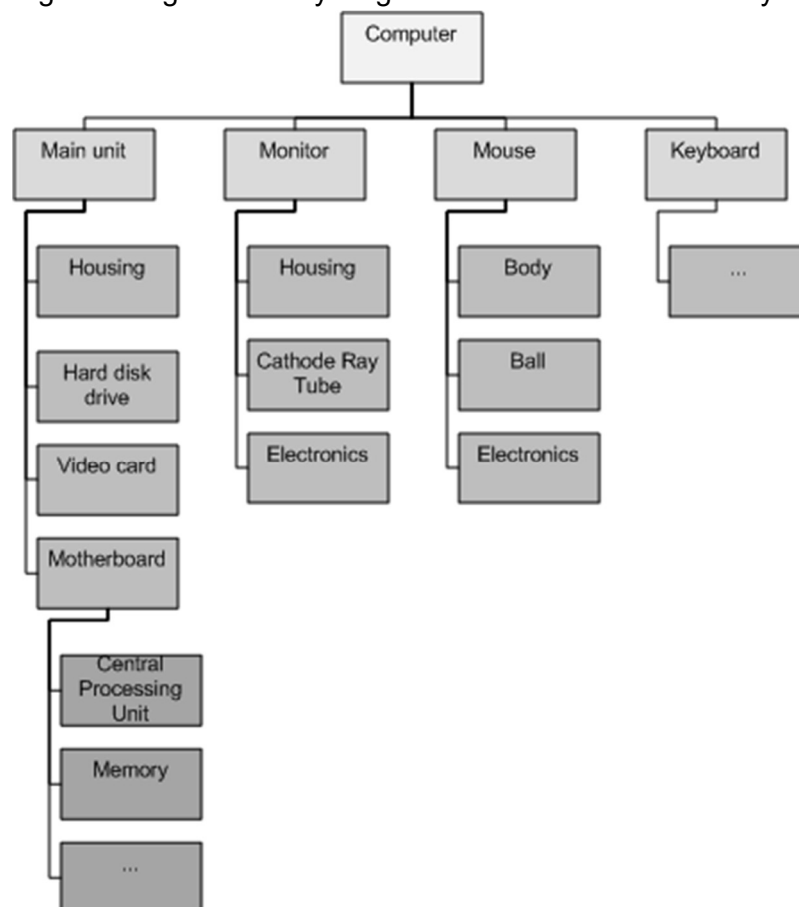


Figure 2:3 Product Breakdown Structure

2.5 Project Time Management

Time is one of the 3 pillars of project management. As an invaluable asset for project managers, time should be carefully planned.

Project time management refers to the way a project manager sets up a strategy in order to allocate the right amount of time to each task and decide on deadlines for project phases and delivery dates.



The aim of effective project time management is to stick to the schedule and bring projects to completion on time.

Since time doesn't wait for anyone and it just keeps going forward, time management takes on even more significance.

Why is project time management important?

If time is not properly handled within a project, both scope and cost — the 2 other pillars of project management — start to crack and shake.

Project managers are responsible for managing their own time and that of their team(s). Stakeholders, both internal and external, expect the schedule to be met and every task to run like clockwork (which is, to be honest, almost never the case).

Careful project time management enables realistic time planning and prevents tight deadlines. What's more, a precise timeline for every bit of the project life cycle reflects well on your team and their productivity.

Benefits of Project Time Management

Poor project time management is one of the most common obstacles to project success. It leads to missed deadlines — a common cause of project failure.

On the other hand, good project time management can be highly beneficial for both the project and team members.

Some of the benefits of proper time management include the following:

Reduced stress, Increased productivity, Improved work standards, Efficient budget and resource management, Firm reputation, and better work-life balance.

Now, let's briefly go over each of them.

Benefit #1: Reduced stress

Managing your time is a necessary skill if you want to decrease stress levels. When your working day is planned well and your daily goals are clear, you can do your job without pressure.

Benefit #2: Increased productivity

Knowing your deadlines helps you prioritize tasks and finish the urgent ones first. Also, if you invest the right amount of time in each task, you will soon notice a boost in your productivity. Some tasks will take less time, leaving enough room in your schedule for additional checks and/or research.

Benefit #3: Improved work quality

When you learn how to manage your time, you will notice a boost in the overall quality of your work. Finishing assignments on schedule will leave more room for testing, improving your skills, or upgrading your knowledge. Another way to improve work quality is to assign tasks to project team members who will know how to complete them within given time limits.

Benefit #4: Efficient budget and resource management

Efficient budget management relies heavily on project time management. Stakeholders are only satisfied if their money is spent on a project that has potential and when they can see project milestones are reached within time and budget.

Time is a vital aspect of efficient resource management because any delay might bring resources into question.

Benefit #5: Well-earned reputation

Project managers who effectively tackle project issues, keep track of deadlines, and consistently monitor progress are greatly appreciated. Their teammates trust them and know that the project is in good hands. A successful project earns a great reputation, not only for the manager but also for the whole company.

Benefit #6: Better work-life balance



We all like finishing our working day on time and going home satisfied with what we have accomplished. A well-organized work schedule allows us to fully unwind and enjoy our personal lives, unburdened by unfinished responsibilities at work.

Project time management processes

Before we start discussing time management processes within a project, let's imagine a simple real-life situation. For instance, you decide to refurbish your old kitchen. You consider buying new tiles, a new sink, and a built-in oven. The only time you can deal with this is at weekends, and therefore you don't determine an end date.

Procrastination knocks on your door. Without a clear plan of when to order the tiles, purchase the sink and oven, and make a call to professionals, this project has no end in sight.

The same can easily happen to any business project. Therefore, a project and a plan are inseparable, and time is a crucial link between the two.

Project time management includes 7 processes that are crucial for project success and these are:

1. Plan schedule management,
2. Define project activities,
3. Sequence project activities,
4. Estimate activity resources,
5. Estimate activity duration,
6. Develop project schedule, and
7. Control project schedule

We'll now go over each of them and talk about some project management tools that will help you with effective project scheduling.

Process #1: Plan schedule management

Before you start defining and sequencing, you need to plan how you are going to manage the schedule. This process lays the foundation for the steps that follow.

Throughout this process, project managers:

Establish rules and procedures,

- Specify objectives,
- Define deliverables,
- Set due dates, and
- Choose software for monitoring and controlling the schedule.

At this stage, it is important to negotiate a final deadline with stakeholders. A schedule isn't of much use if you don't stick to it. You can determine whether or not your project is veering off course (and by how much) by calculating schedule variance?

Process #2: Define project activities

Activity definition is based on the previous process. Its aim is to define project activities and tasks that must be completed in a timely manner. Major milestones should be settled at this point.

Since a simple to-do list doesn't get the job done for complex projects, it is recommended to organize tasks in the form of WBS (Work Breakdown Structure) — a graphic representation of a project. The graph displays all the activities which are divided into tasks and subtasks of high and low priority.

Process #3: Sequence project activities



This process is about putting tasks and deliverables in order of performance. Some tasks will possibly overlap, so you have to pay attention to due dates. The aim of this process is to order the activities in a way that enables the most efficient workflow. It is essential to take care of the order of tasks allocated to the same team member. Adjustments need to be made with the aim of avoiding unnecessary delays.

Process #4: Estimate activity resources

The term 'resources' is usually used for people who work on a project. But this term encompasses tools, finances, machines, materials, as well as time. The focus of this process is to ensure there are enough resources for each task or activity and that resources are allocated appropriately.

This process is said to be the most important one among the seven. Project managers should be well aware of the available resources, when they are needed, and for how long. Resources affect schedule to a great extent. The more accurate resource allocation is, the fewer schedule changes it causes.

When project managers delegate tasks, they have to consider the productivity level of each team member. Tracking time spent on tasks offers project managers insight into the tasks that take more time and effort to complete. It allows for immediate reaction and schedule adjustments when issues are detected.

Process #5: Estimate activity duration

This process deals with the estimation of the time needed to complete one or more tasks. Based on these estimates, project managers can set up deadlines, leave some time for troubleshooting, and decide when to close the project. It is advisable to look into the reports from previous similar projects as these might be helpful with making duration estimates.

When the time frame for tasks and deliverables is set, you are able to determine the critical path of the project.

Process #6: Develop project schedule

Based on the previous project time management processes, project managers are able to develop project schedules.

This process encompasses the analysis of:

- Start and end dates,
- Order of activities,
- Resources, and
- Potential obstacles to the project's timely completion.

Experienced project managers usually use project management software because it incorporates all documents, analyses, and reports in one place.

Process #7: Control project schedule

Schedule control and project monitoring on a regular basis are highly recommended. Since no project runs without a few stumbling blocks in its path, progress review is essential as it mitigates risks and provides chances for immediate adjustments. You can compare the actual progress with the original plan and see if there are any schedule delays.

Having covered all the processes, we'll now offer some tips and techniques that have proved useful in project time management.

Let's be honest — there is no magic wand to create an effective project plan and no spell to put a project back on track. What you can do is go through some of the tips we have picked for you and see if you can apply any of them to your project.

Tip #1: Use the Pareto principle

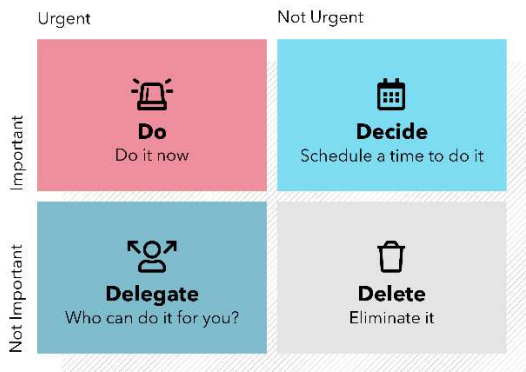
Also known as the 80/20 rule, this principle implies that 80% of your results should be derived from 20% of your activities. Using this rule, you can learn to optimize your time at work and improve your productivity.



Tip #2: Prioritize

Being snowed under with work is a familiar situation to many of us. Setting clear priorities might be difficult at first, but it becomes easier as time goes by. The Eisenhower Matrix is a technique often used to differentiate between important and urgent tasks. It has proven very effective, and it includes four categories:

The Eisenhower decision matrix



Each quadrant represents a group of tasks:

- Important and urgent tasks — those that you should do first
- Important but not urgent — tasks you can do a bit later
- Not important but urgent — these tasks should be delegated if possible
- Not important and not urgent — tasks that can be eliminated

The matrix is a great prioritization tool, but bear in mind that priorities differ from person to person. You should try to divide tasks into these categories and focus on what is really important for your work.

Tip #3: Break large tasks into smaller

The feeling of where should I begin is well known to everybody dealing with complex tasks or projects. That is why a good piece of advice is to break your tasks into smaller ones. This way, you can stay on track and reduce the risk of missing deadlines.

Tip #4: Delegate tasks

The main goal of any project is to finish it on time and within budget. So, if there are any tasks that you are not sure how to deal with or you have no time to finish, don't hesitate to ask your co-workers for help and delegate tasks.

Tip #5: Make a proper project plan

We have discussed the importance of an effective plan throughout this article. A well-defined plan prevents delays and allows a buffer for schedule changes. Only when you set up a strategy, allocate tasks, provide resources and determine deadlines, can you move on to the execution phase.

Tip #6: Improve communication with stakeholders

Stakeholders should always be informed about the project's progress. To keep them up to date, you can send weekly or monthly emails and reports on the progress or organize regular meetings to share relevant information.

Tip #7: Minimize interruptions



A working day is full of interruptions such as:

Phone calls,
Emails,
Colleagues,
Chats, and more.

They prevent you from focusing on important tasks and are often successful in diverting attention from priorities. By snoozing notifications and setting your phone aside, you can resist the urge to constantly check your messages. Another good suggestion is to try to specify the time for checking and answering emails. When it comes to interruptions by your colleagues, you can find a way to show that they should not disturb you. For example, you can put your headphones on or mark that you are in a meeting on your internal chat channel.

Tip #8: Learn to say no

This tip might be applied to both your personal and professional life. It is never easy to say no to your superiors, but there are polite ways to do it. Be honest and explain the reasons why you can't cope with more tasks. Check if any of the tasks can be postponed or delegated. You can also point out your priorities and let your superiors decide what is best for a project.

Tip #9: Focus on one task at a time

Although many people support multitasking, this method has proved inefficient. Our brain needs time to switch from one task to another. The Pomodoro technique suggests dividing your tasks into shorter sessions — 25 minutes of work, followed by a short break.

Tip #10: Use the Right Project Management tool

The project time management process is very often supported by various software tools and solutions. These might be easy or complicated to use, but they are all made with the aim of helping managers organize their work and their teams. Kanban boards, time trackers, project management software, and communication tools are there to help and ease management procedures. They contribute to resources' organization and overall performance.

Using the project management software that suits your needs can contribute enormously to project planning and overseeing processes. In the end, we have to agree with John C. Maxwell's quote: "Time management is an oxymoron. Time is beyond our control, and the clock keeps ticking regardless of how we lead our lives. Priority management is the answer to maximizing the time we have."

The point is that you should take good care of your time, prioritize tasks, and minimize time wasters that might jeopardize your project's success.

Project Evaluation and Review Technique (PERT)

Project Work packages (last element of WBS) is broken into smaller elements called Activities. An activity is an element of the project that requires time.

Merge Activity: an activity that has two or more preceding activities on which it depends.

Parallel (Concurrent) Activities: Activities that can occur independently and, if desired, not at the same time.

Project Evaluation and Review Technique (PERT) is a procedure through which activities of a project are represented in its appropriate sequence and timing. It is a scheduling technique used to schedule, organize and integrate tasks with. Pert uses arrow diagram to create a schedule. There are two different types of arrow diagrams: the arrow network (also called activity on arrow (AoA)) and the node network or activity on node (AoN), also known as a precedence diagram.



Project Schedule Network Diagram

Project schedule network diagram is a graphical representation of the logical relationships, also referred to as dependencies

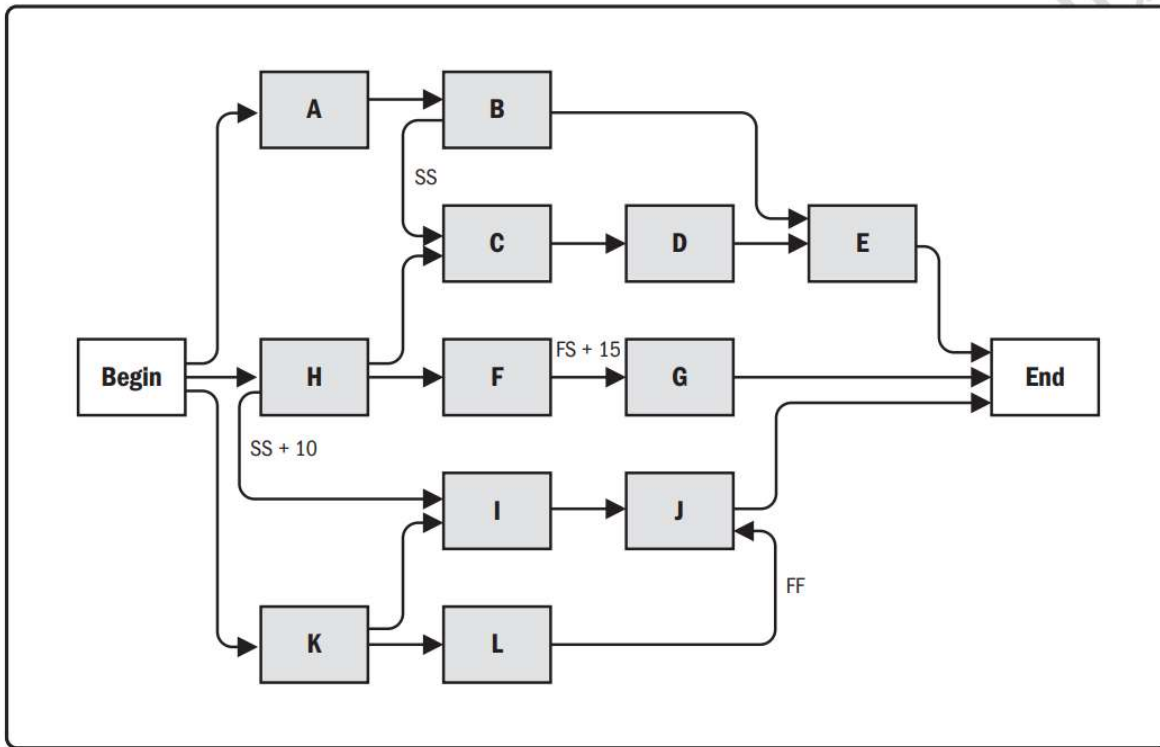


Figure 2:4 Project Schedule Network Diagram

Activities that have multiple predecessor activities indicate a path convergence. Activities that have multiple successor activities include a path divergence

BASIC RULES TO FOLLOW IN DEVELOPING PROJECT NETWORKS

1. Networks typically flow from left to right.
2. An activity cannot begin until all preceding connected activities are complete.
3. Arrows indicate precedence and flow and can cross over each other.
4. Each activity must have a unique identify number that is greater than any of its predecessor activities.
5. Looping is not allowed.
6. Conditional statements are not allowed.
7. Use common start and stop nodes.

AoA Diagram

This is the diagram we've been talking about, one in which the activities are represented by arrows. These arrows are then connected by nodes, with the back of the arrow indicating the start of the activity and the front



point the end. The length of the arrow is the duration of that activity, drawn in scale to fit on the diagram. This type of diagram only shows finish-to-start dependencies between activities.

Activity on Arrow

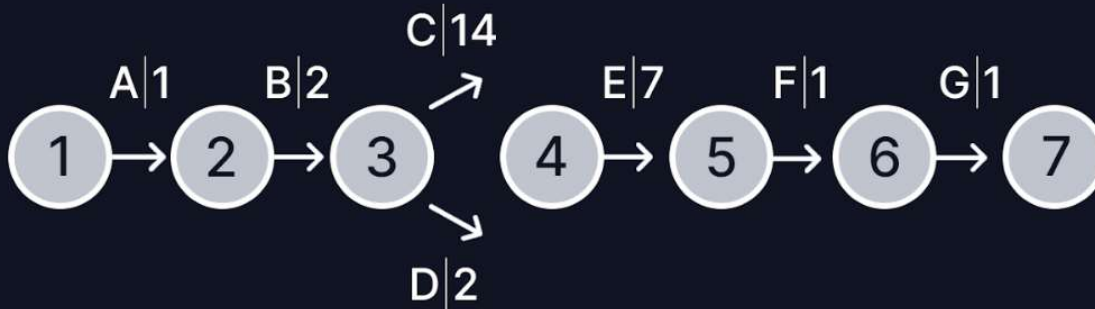


Figure 2:5 Activity on Arrow

Precedence Diagram Method

The precedence diagram method (PDM) is a tool for scheduling activities in a project plan. It is a method of constructing a project schedule network diagram that uses boxes, referred to as nodes, to represent activities and connects them with arrows that show the dependencies. It is also called the activity-on-node (AON) method.

Unlike the above diagramming, all four types of dependencies can be shown—finish to start, start to start, finish to finish and start to finish.

Activity on Node

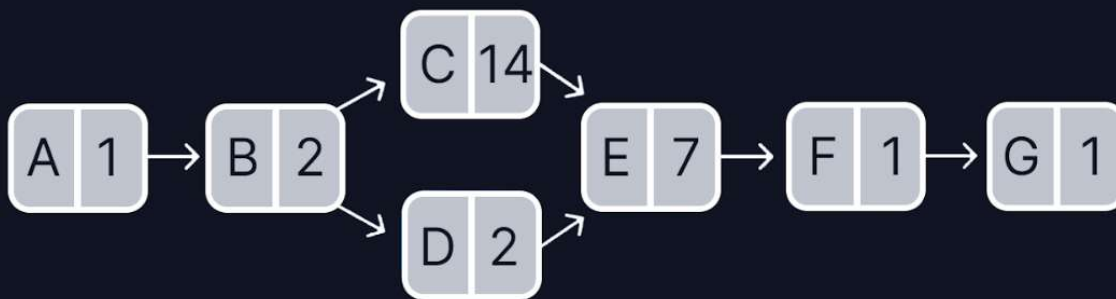
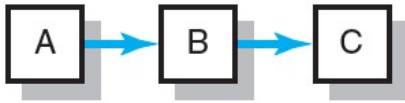


Figure 2:5 Activity on Node

Activity on Node is more popular technique in creating network diagram and it uses the following conventions when creating network diagrams. There are three basic relationships which must be established for activities included in the project network:

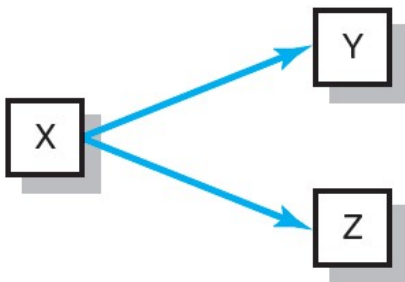


1. Which activities must be completed immediately before any activity. These activities are called as predecessor activities.
2. Which activities must immediately follow this activity. These activities are called as successor activities.
3. Which activities can occur while this activity is taking place. These activities are called as concurrent or parallel activities.



A is preceded by nothing
B is preceded by A
C is preceded by B

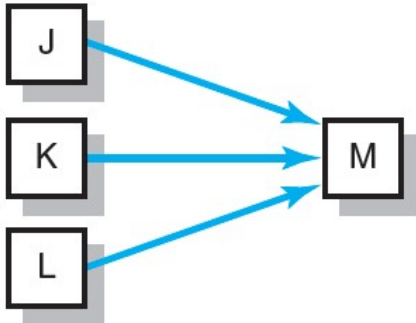
(A)



Y and Z are preceded by X

Y and Z can begin at the same time, if you wish

(B) X is a burst activity

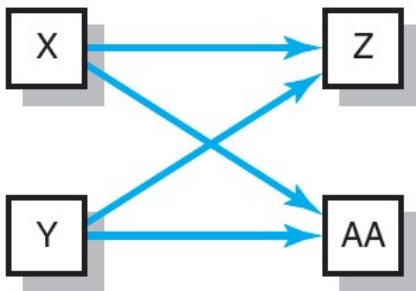


J, K, & L can all begin at the same time, if you wish (they need not occur simultaneously)

but

All (J, K, L) must be completed before M can begin

(C) M is a merge activity



Z is preceded by X and Y

AA is preceded by X and Y

(D)

Forward Pass and Backward Pass

Let's consider an example to estimate schedule for an order picking system for an automated warehouse.

AUTOMATED WAREHOUSE Order Picking System

Activity	Description	Preceding Activity	Activity Time
A	Define Requirements	None	10 workdays
B	Assign Team	A	5
C	Design Hardware	A	25
D	Code Software	B	20
E	Build & Test Hardware	C	50
F	Develop Patent Request	C	15
G	Test Software	D	35
H	Integrate Systems	E, F, G	15

Based on above information a simple network diagram can be created as below

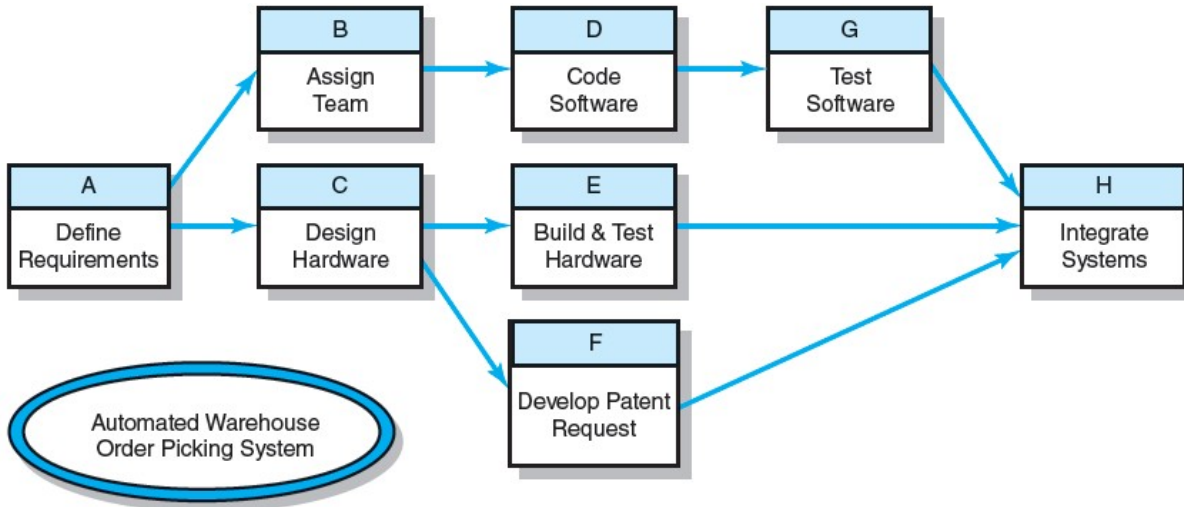


Figure 2:6 Network Diagram for Software System

Critical Path Method

The critical path method is used to estimate the minimum project duration and determine the amount of schedule flexibility on the logical network paths within the schedule model. This schedule network analysis technique calculates the early start, early finish, late start and late finish dates for all activities without regard for any resource limitations by performing a forward and backward pass analysis through the schedule network as described below.

The Forward Pass

It helps in calculating the earliest times for each activity and answers the following questions:

- How soon can the activity start? (early start:ES)
- How soon can the activity finish? (early finish:EF)
- How soon can the project finish? (expected time:ET)

The Backward Pass

It helps in calculating the latest times for each activity and answers the following questions:

- How late can the activity start? (late start:LS)
- How late can the activity finish? (late finish:LF)
- Which activities represent the critical path?
- How long can activity be delayed? (slack or float:SL)

For computing ES and EF (Forward Pass), do the following

- Add activity times along each path in the network ($ES + \text{Duration} = EF$).
- Carry the early finish (EF) to the next activity where it becomes its early start (ES) **unless...**
- The next succeeding activity is a merge activity, in which case the largest EF of all preceding activities is selected.

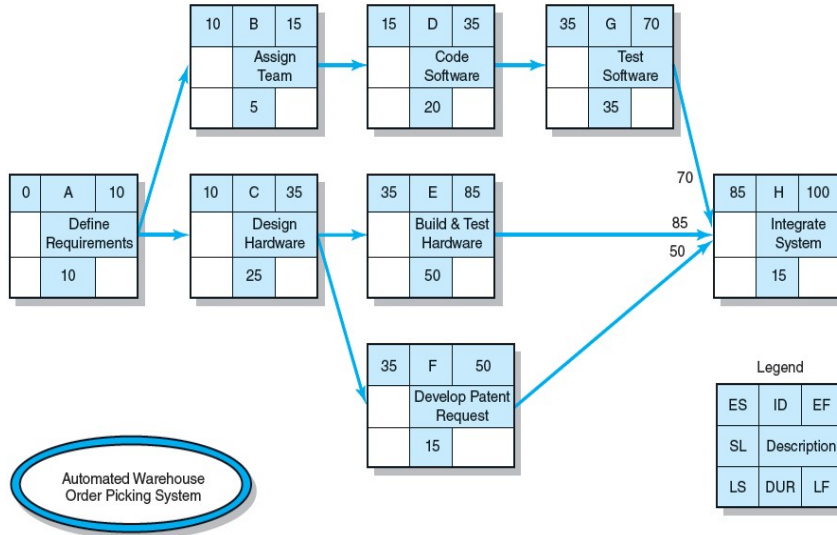


Figure 2:7 Forward Pass

For computing LS and LF (Backward Pass), do the following:

- Subtract activity times along each path in the network ($LF - \text{Duration} = LS$).
- Carry the late start (LS) to the next activity where it becomes its late finish (LF) **unless**
- The next succeeding activity is a burst activity, in which case the smallest LF of all preceding activities is selected.

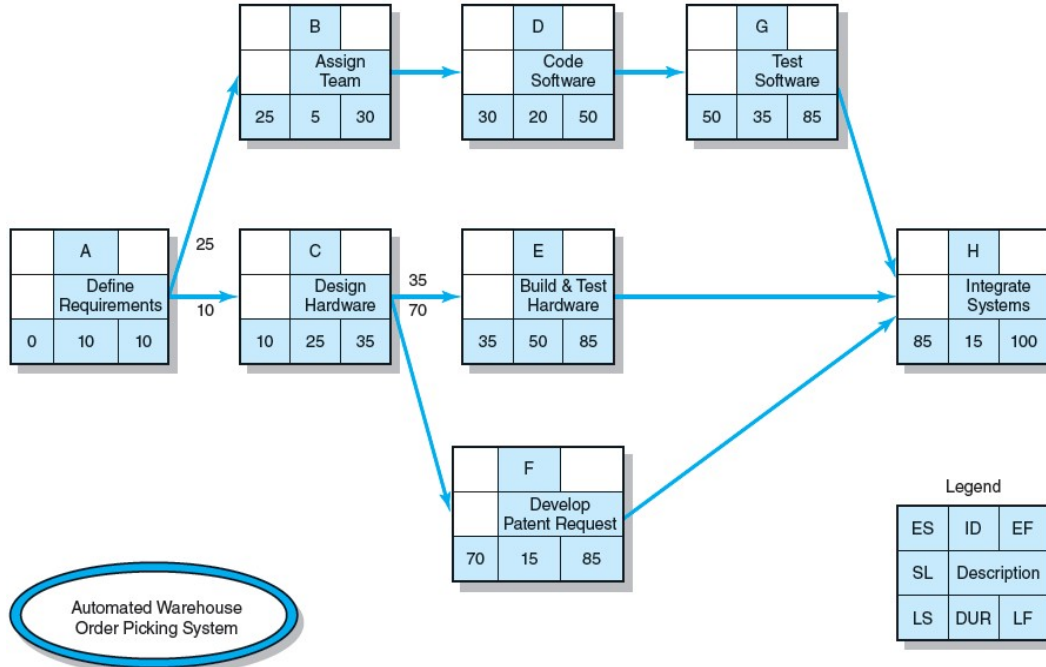


Figure 2:8 Backward Pass

Free Slack (or Float)

Is the amount of time an activity can be delayed after the start of a longer parallel activity or activities. Slack is how long an activity can exceed its early finish date without affecting early start dates of any successor(s). This allows flexibility in scheduling scarce resources. The slack is calculated and shown in the diagram as below:

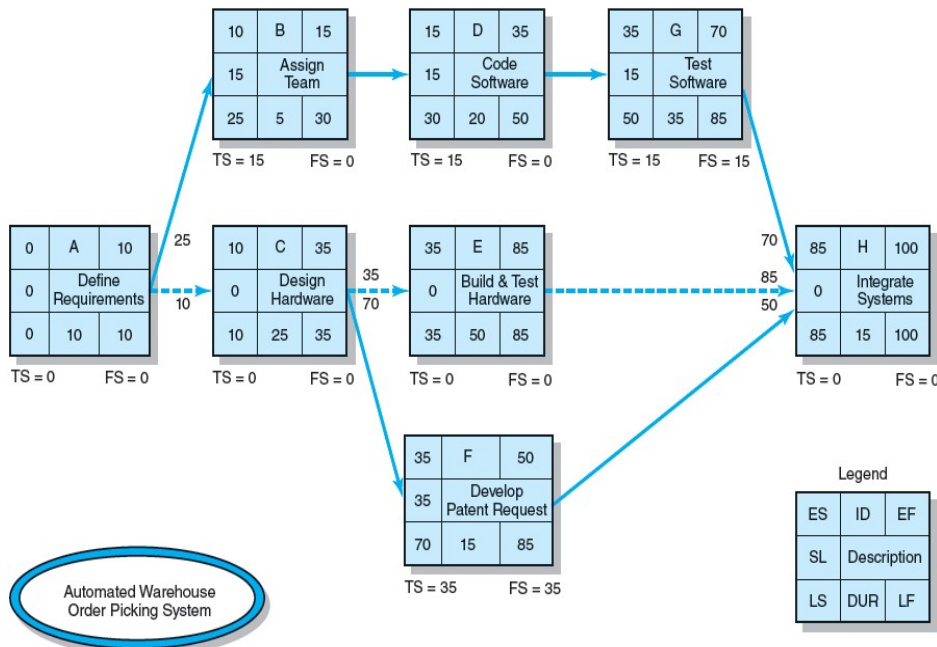


Figure 2:9 Calculation of Slack

- A critical path is characterized by zero float/slack. Hence in above example A>C>E>H is the critical path. Few characteristics of critical path are:
 - It is the longest path through the activity network that allows for the completion of all project-related activities;
 - It is the shortest expected time in which the entire project can be completed.
 - Delays on the critical path will delay completion of the entire project.

Tools for Project Network – Estimation Techniques

There are various tools to estimate the time for each of the network activities. Depending on available details and accuracy of estimates required:

Expert Judgment :The project manager and the project team should utilize expert judgment, if possible, to predict the duration of project activities. Expert judgment can come from subject matter experts, project team members, and other resources, internal or external to the performing organization, who are familiar with the activities the project demands. Estimating durations is not easy as there are many variables that can influence an activity's duration. Consider the amount of resources that can be applied to the resources, the experience of the resources completing this type of work, and their competence with the work packages.



Analogous estimating : Relies on historical information to predict what current activity durations should be. Analogous estimating is also known as Top-Down Estimating and is a form of expert judgment. To use analogous estimating, the activities from the historical project are similar in nature and are used to predict what similar activities in the current project will take.

Parametric Estimating : Activity durations can be quantitatively determined by multiplying the quantity of work to be performed by the productivity rate. There are two ways to create parametric estimates:

- Regression Analysis (Scatter Diagram): This diagram tracks two variables to see if they are related and creates a mathematical formula to be used in future parametric estimating.
- Learning Curve: The 100th stretch of road to be laid will take less time than 1st stretch because of improved efficiency.

Three-Point Estimates: A three-point estimate requires that for each activity an optimistic, most likely, and pessimistic estimate be created. Based on these three estimates, an average can be created to predict how long the activity should take. Weighted Mean= $(P+4M+O)/6$; Triangular Distribution ($tE=(tO+tM+tP)/3$)

2.6 Project Cost Management

Project Cost Management includes the processes involved in planning, estimating, budgeting, and controlling costs so that the project can be completed within the approved budget. It includes the following activities:

- Estimating the monetary resources needed for the project
- Establishing a cost baseline
- Managing changes to the cost baseline

Types of Costs

Variable Costs: Project costs that change with the amount of work. Examples include cost of wages/ materials etc.

Fixed Costs: Project costs that do not change as production changes. Examples include set-up, rental etc.

Direct Costs: Costs that are directly attributable to the work on the project. Examples are team travel, team wages and cost of material used on the project.

Indirect Costs: Overhead items or costs incurred for the benefit of more than one project. Examples include taxes and fringe benefits.

Tools of Cost Estimation

Analogous Estimating : Analogous estimating relies on historical information to predict the cost of the current project. It is also known as Top-Down estimating. The process of analogous estimating takes the Actual cost of a historical project as a basis for the current project. The cost of the historical project is applied to the cost of the current project, taking into account the scope and size of the current project as well as other known variables. Analogous estimating is a form of expert judgment. This estimating approach takes less time, but is also less accurate. This top-down approach is good for Fast estimates to get a general idea of what the project may cost and is generally less costly than other techniques.

Parametric Estimating: Parametric modelling uses a mathematical model based on known parameters to predict the cost of a project. The parameters in the model can vary based on the type of work being completed and can be measured by cost per cubic yard, cost per unit, and so on. A complex parameter can be cost per



unit with adjustment factors based on the conditions of the project. In addition, the adjustment factors may have additional modifying factors depending on additional conditions. To use parametric modelling, the factors the model is based on must be accurate. The factors within the model are quantifiable and don't vary much based on the effort applied to the activity. And finally, the model must be scalable between project sizes.

Three-Point Estimates: This concept originated with the program evaluation and review technique (PERT). PERT uses three estimates to define an approximate range for an activity's cost:

- Most Likely (Cm-Realistic Effort)
- Optimistic (Co-Best-Case Scenario)
- Pessimistic (Cp-Worst Scenario)
- Expected cost, $C_e = (C_o + 4C_m + C_p) / 6$

Bottom-Up Estimating: Bottom-up estimating starts from zero, accounts for each component of the WBS, and arrives at a sum for the project. It is completed with the project team and can be one of the most time-consuming methods used to predict project costs. At the same time, it is one of the most accurate methods.

Project Management Estimating Software : Project management cost Estimating software applications can simplify the use of some cost Estimating techniques and thereby facilitate rapid consideration of cost estimate alternatives.

Vendor Bid Analysis : Occasionally it's just more cost effective to hire someone else to do the work. Other times, the project manager has no choice because the needed skill set doesn't exist within the organization.

Expert Judgment: Cost estimates are influenced by numerous variables such as labour rates, material costs, inflation etc. Expert judgment, guided by historical information, provides valuable insight about the environment and information from prior similar projects.

Cost of Quality : Assumptions about cost of quality which include both conformance and non-conformance costs are used to prepare the activity cost estimate.

Components of Project Budget

Activity Cost Estimates: An activity cost estimate is a quantitative assessment of the likely costs of the resources required to complete schedule activities. Each resource in the project must be accounted for and assigned to a cost category. Categories include Labor costs, Material costs, Travel costs, Supplies, Hardware costs, Software costs, Special categories (inflation, cost reserve, and so on)

Basis of Estimates: Includes:

- Description of schedule of activity's scope of work
- Documentation of the basis for the estimate
- Documentation of any assumptions made
- Documentation of any constraints

Information on the range of variance in the estimate: For example, based on the estimating method used, the project cost may be \$220,000 ± \$15,000. This project cost may be as low as \$205,000 or as high as \$235,000

Control Account : A management control point where the integration of scope, budget, actual cost and schedule takes place, and where the measurement of performance will occur. Each control account is associated with a specific single organizational component in the organizational breakdown structure (OBS)

Management Reserve: An amount of the total contract budget withheld for management control purposes by the contractor. This is used for project "Unknown Unknowns"



Contingency Reserve: This refers to an allocation of the budget at a high level that is specifically reserved for Project “Known unknowns”. This contingency reserve is allocated following the identification of project risks and uncertain events.

Cost Baseline: A cost baseline is the budget that has been approved for the project, broken down into a list of salaries, materials, equipment and more. It’s the sum of the cost estimates for all the tasks on your project schedule. This also includes any contingency reserves for identified risks.

Cost Budget is depicted in the figure below which includes the cost baseline and management reserves.

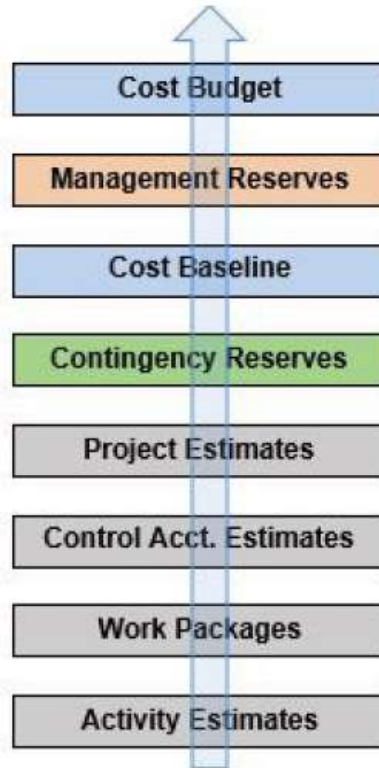


Figure 2:9 Components of Project Budget

Earned Value Method

Earned Value Management System is a project management technique for estimating how a project is doing in terms of its budget and schedule. Earned value compares the work finished so far with the estimates made in the beginning of the project. This gives a measure of how far the project is from completion. By extrapolating from the amount of work already put into the project, the project manager can get an estimate on how much resources the project will have used at completion.

To measure progress, there must be a standard against which the forward movement may be compared. EVMS establishes a baseline to measure progress.

The basic premise of earned value management (EVM) is that the value of a piece of work is equal to the amount of funds budgeted to complete it. As part of EVM, you use the following information to assess your schedule and cost performance throughout your project.

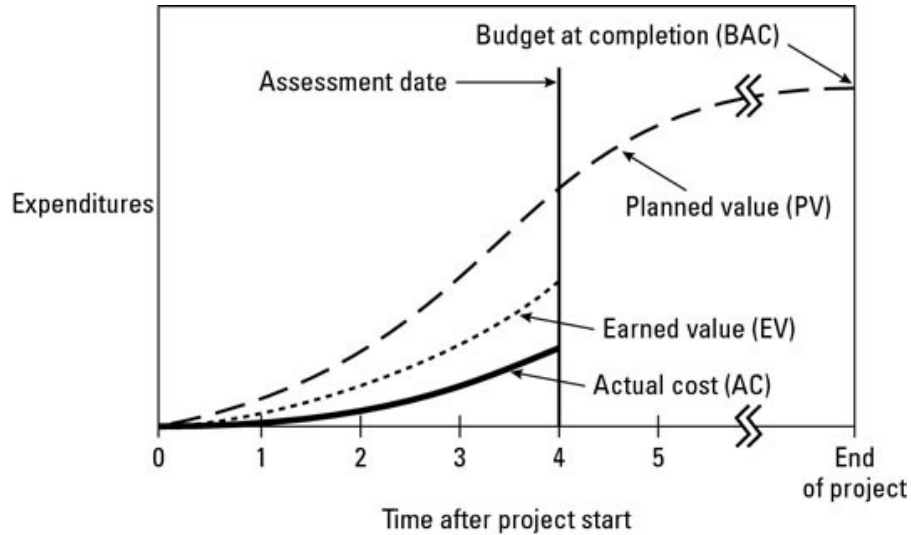


Figure 2:10 Earned Value Management

Planned value (PV): The approved budget for **the work scheduled to be completed** by a specified date; also referred to as the budgeted cost of work scheduled (BCWS). The total PV of a task is equal to the task's budget at completion (BAC) — the total amount budgeted for the task.

Earned value (EV): The approved budget for the **work actually completed(%completed)** by the specified date; also referred to as the budgeted cost of work performed (BCWP).

Actual cost (AC): The **costs actually incurred** for the work completed by the specified date; also referred to as the actual cost of work performed (ACWP).

To describe your project's schedule and cost performance with EVM, you use the following indicators:

Schedule variance (SV): The difference between the amounts budgeted for the work you actually did and for the work you planned to do. The SV shows whether and by how much your work is ahead of or behind your approved schedule.

Schedule variance (SV) = Earned value (EV) – Planned value (PV)

Cost variance (CV): The difference between the amount budgeted and the amount actually spent for the work performed. The CV shows whether and by how much you're under or over your approved budget.

Cost variance (CV) = Earned value (EV) – Actual cost (AC)

Schedule performance index (SPI): The ratio of the approved budget for the work performed to the approved budget for the work planned. The SPI reflects the relative amount the project is ahead of or behind schedule, sometimes referred to as the project's schedule efficiency. You can use the SPI to date to project the schedule performance for the remainder of the task.

Schedule performance index (SPI) = Earned value (EV) / Planned value (PV)

Cost performance index (CPI): The ratio of the approved budget for work performed to what you actually spent for the work. The CPI reflects the relative value of work done compared to the amount paid for it, sometimes referred to as the project's cost efficiency. You can use the CPI to date to project the cost performance for the remainder of the task.

Cost performance index (CPI) = Earned value (EV) / Actual cost (AC)

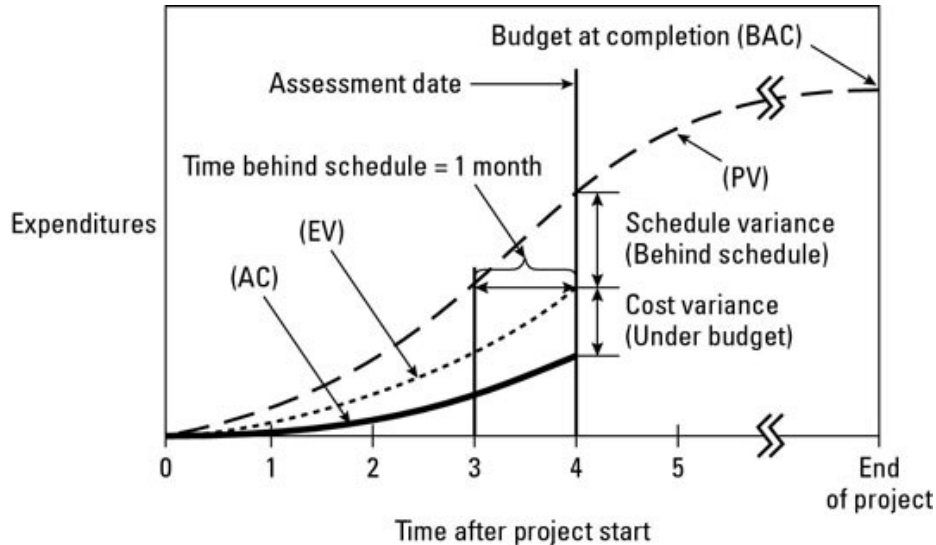


Figure 2:12 Earned Value Management

The final step when assessing task performance to date is to update what you expect your total expenditures will be upon task completion. Specifically, you want to determine the following:

Estimate at completion (EAC): Your estimate today of the total cost of the task

Estimate to complete (ETC): Your estimate of the amount of funds required to complete all work still remaining to be done on the task

You can use the following two approaches to calculate the EAC:

Method 1: Assume that the cost performance for the remainder of the task will revert to what was originally budgeted.

$$EAC = \text{Approved budget for the entire task} - \text{Cost variance for the work done to date on the task}$$
$$= \text{Budget at completion (BAC)} + \text{Actual cost (AC)} - \text{Earned value (EV)}$$

Method 2: Assume that the cost performance for the remainder of the task will be the same as what it has been for the work done to date.

$$EAC = \text{Budget at completion (BAC)} / \text{Cumulative cost performance index (CPI)}$$

Whether you use Method 1 or Method 2 to calculate EAC, ETC is determined as follows:

$$ETC = \text{Budget at completion (BAC)} - \text{Actual costs to date (AC)}$$



Unit 3: Quality, Resource, Stakeholder and Procurement Management:

In common usage, quality can have two meanings:

- 1) The characteristic of a product or service that bear on its ability to satisfy stated or implied needs;
- 2) A product or service free of deficiencies.

According to Joseph Juran, quality means “Fitness for use.” According to Philip Crosby, it means “conformance to requirements.”

Project Quality Management includes all the activities of the Performing organization that determine quality policies, objectives, and responsibilities so that the project will satisfy the needs for which it was undertaken. It includes various tools to undertake the following activities:

- Identifying Quality standards
- Performing Quality Assurance
- Performing Quality Control

Quality Management and Project Management have similar characteristics:

- **Customer satisfaction:** The project must satisfy the customer requirements by delivering what it promised in order to satisfy the needs of the customer. The PMBOK© states it as “conformance to requirements” and “fitness for use.”
- **Prevention :** Quality is planned into a project, not inspected in. It is always more cost-effective to prevent mistakes than to correct them.
- **Management responsibility:** The project team must work towards the quality goal, but management must provide the needed resources to deliver on the quality promises.
- **Continuous Improvement:** The plan-do-check-act cycle is the basis for quality improvement. Process improvement models include Malcolm Baldrige, Organizational Project Management Maturity Model (OPM3), and capability Maturity Model Integrated (CMMI).

Cost of Quality (COQ)

Cost of quality (COQ) is defined as a methodology that allows an organization to determine the extent to which its resources are used for activities that prevent poor quality, that appraise the quality of the organization’s products or services, and that result from internal and external failures. Having such information allows an organization to determine the potential savings to be gained by implementing process improvements.(Source: American Source of Quality)

There are three categories of cost involved

- Appraisal costs are costs incurred to determine the degree of conformance to quality requirements.
- Internal failure costs are costs associated with defects found before the customer receives the product or service.
- External failure costs are costs associated with defects found after the customer receives the product or service.

Appraisal costs



Appraisal costs are associated with measuring and monitoring activities related to quality. These costs are associated with the suppliers' and customers' evaluation of purchased materials, processes, products, and services to ensure that they conform to specifications. They could include:

- Verification: Checking of incoming material, process setup, and products against agreed specifications
- Quality audits: Confirmation that the quality system is functioning correctly
- Supplier rating: Assessment and approval of suppliers of products and services

Internal failure costs

Internal failure costs are incurred to remedy defects discovered before the product or service is delivered to the customer. These costs occur when the results of work fail to reach design quality standards and are detected before they are transferred to the customer. They could include:

- Waste: Performance of unnecessary work or holding of stock as a result of errors, poor organization, or communication
- Scrap: Defective product or material that cannot be repaired, used, or sold
- Rework or rectification: Correction of defective material or errors
- Failure analysis: Activity required to establish the causes of internal product or service failure

External failure costs

External failure costs are incurred to remedy defects discovered by customers. These costs occur when products or services that fail to reach design quality standards are not detected until after transfer to the customer. They could include:

- Repairs and servicing: Of both returned products and those in the field
- Warranty claims: Failed products that are replaced or services that are re-performed under a guarantee
- Complaints: All work and costs associated with handling and servicing customers' complaints
- Returns: Handling and investigation of rejected or recalled products, including transport costs

Prevention costs are incurred to prevent or avoid quality problems. These costs are associated with the design, implementation, and maintenance of the quality management system. They are planned and incurred before actual operation, and they could include:

- Product or service requirements: Establishment of specifications for incoming materials, processes, finished products, and services
- Quality planning: Creation of plans for quality, reliability, operations, production, and inspection
- Quality assurance: Creation and maintenance of the quality system
- Training: Development, preparation, and maintenance of programs

3.3 Quality Assurance

Quality assurance can be defined as "part of quality management focused on providing confidence that quality requirements will be fulfilled." The confidence provided by quality assurance is twofold—internally to management and externally to customers, government agencies, regulators, certifiers, and third parties. An alternate definition is "all the planned and systematic activities implemented within the quality system that can be demonstrated to provide confidence that a product or service will fulfil requirements for quality."



Figure 3.1 Quality Relationships

[Auditing](#) is part of the quality assurance function. It is important to ensure quality because it is used to compare actual conditions with requirements and to report those results to management.

Quality Audits: A quality audit is a structured, independent review to determine whether project activities comply with Organizational and project policies, processes, and procedures. The objectives of quality audit are:

- Identify all the good/ best practices being implemented,
- Identify all the gaps/shortcomings,
- Share the good practices introduced or implemented in similar projects in the organization/ industry,
- Improve implementation of processes
- Contribute to lessons learned repository of the organization

3.4 Quality Control

Quality control can be defined as "part of quality management focused on fulfilling quality requirements." While quality assurance relates to how a process is performed or how a product is made, quality control is more the inspection aspect of quality management. An alternate definition is "the operational techniques and activities used to fulfil requirements for quality.

Inspection is the process of measuring, examining, and testing to gauge one or more characteristics of a product or service and the comparison of these with specified requirements to determine conformity. Products, processes, and various other results can be inspected to make sure that the object coming off a production line, or the service being provided, is correct and meets specifications.

Quality Assurance	Quality Control
Focus on Prevention of Defects	Focus on Identification of Defects
Proactive Process	Reactive Process
Process Based Approach	Product Based Approach



Manages Quality	Verifies the Quality
-----------------	----------------------

Table 3:1 QA vs QC

3.5 Quality Methods

Quality professionals have many names for these seven basic tools of quality, first emphasized by Kaoru Ishikawa, a professor of engineering at Tokyo University and the father of "quality circles."

Cause-and-effect diagrams (Ishikawa Diagrams) : These diagrams show the relation between the variables within a process and how those relations may contribute to inadequate quality. This diagram can help organize both the process and team opinions, as well as generate discussion on finding a solution to ensure quality.

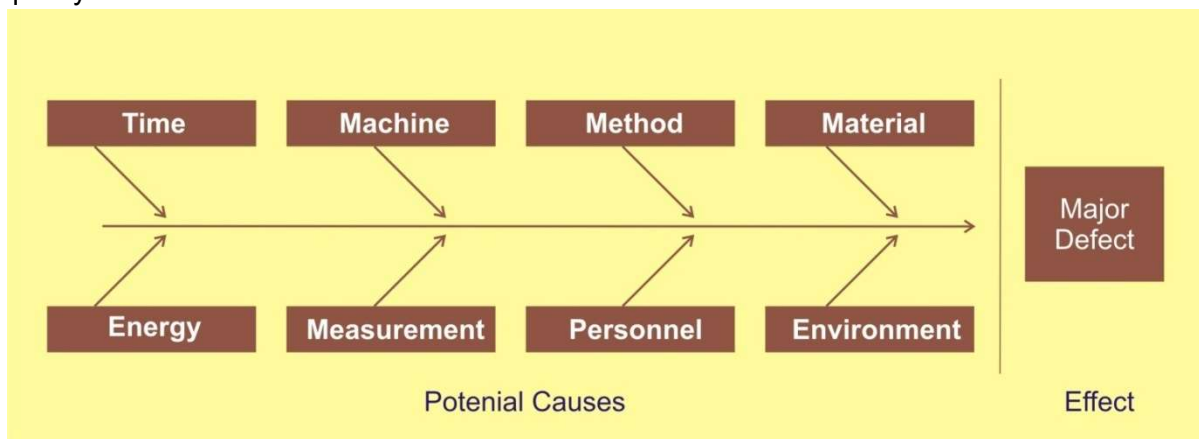


Figure 3.2 Cause and Effect Diagrams

Control Charts :

Graph used to study how a process changes over time. Comparing current data to historical control limits leads to conclusions about whether the process variation is consistent (in control) or is unpredictable (out of control, affected by special causes of variation). It also illustrates how a process behaves over time. The upper control limit and lower control limit are usually set at ± 3 sigma (Standard deviation).

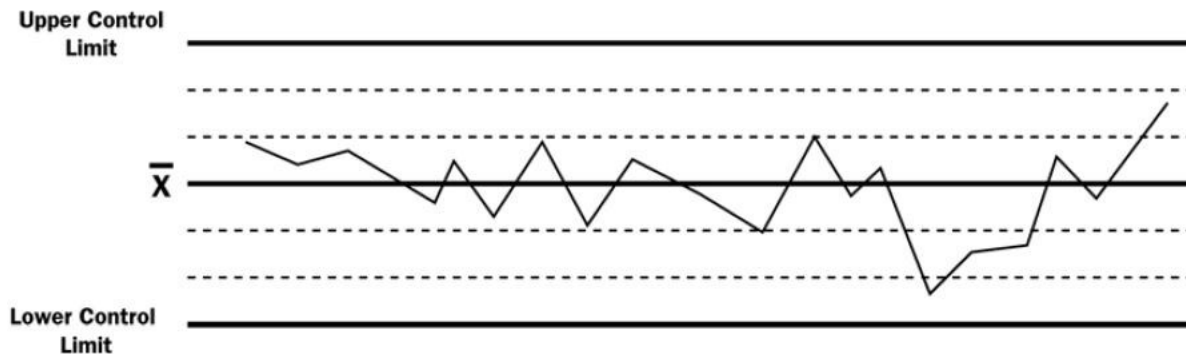


Figure 3.3 Control Charts



Histogram:

The most commonly used graph for showing frequency distributions, or how often each different value in a set of data occurs. Within project management a common histogram is a resource histogram that shows the frequency of resources used on project work. It's nothing more than a bar chart. Unlike control chart, the histogram does not consider the influence of time on the variation that exists within a distribution

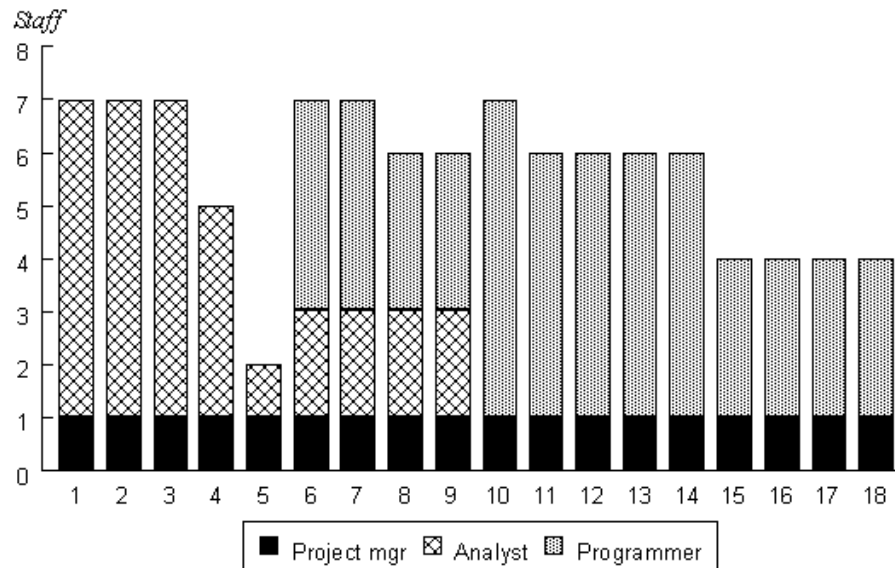


Figure 3.4 Histogram

Pareto chart:

A bar graph that shows which factors are more significant. A Pareto diagram is somewhat related to Pareto's Law: 80 percent of the problems come from 20 percent of the issues.

This is also known as the 80/20 rule. The Pareto Chart:

- Help focus attention on the most critical issues
- Prioritizes potential "causes" of the problems
- Separates the critical few from the uncritical many.

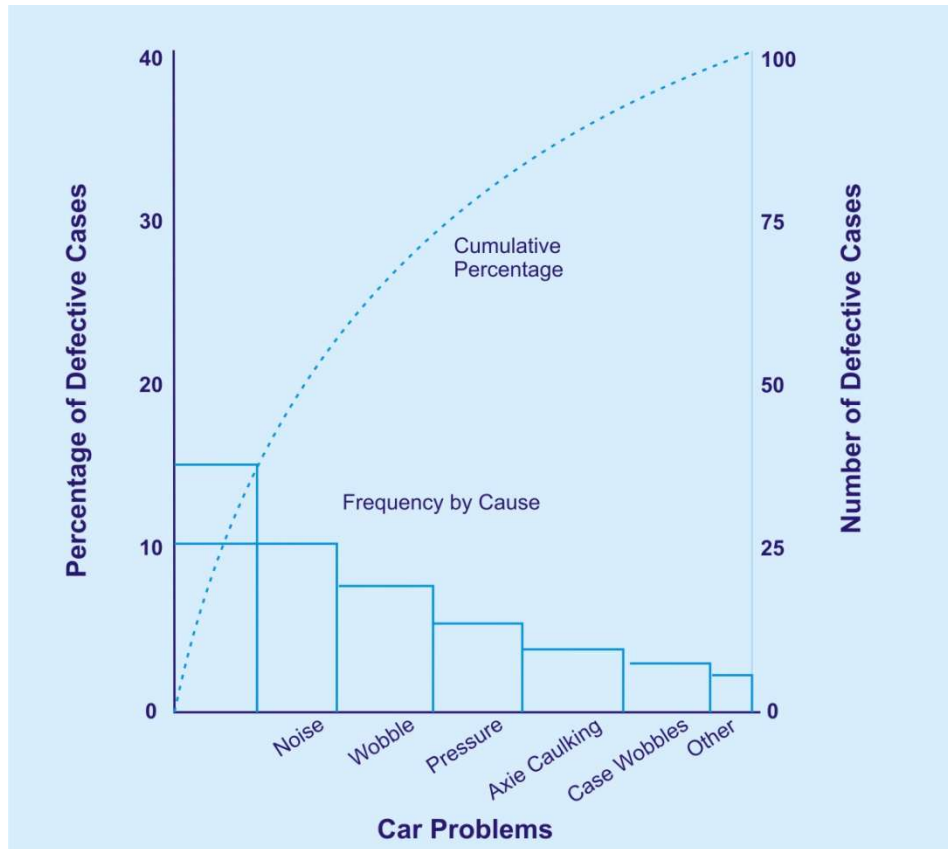


Figure 3.5 Pareto Chart

Scatter diagram:

Graphs pairs of numerical data, one variable on each axis, to look for a relationship. A scatter diagram is like a run chart, but it instead Tracks the relationship between two variables. The two variables are Considered related the closer they track against a diagonal line. For example, a project manager could track the performance of two team members, the time and cost, or even changes between functional managers and the project's schedule.

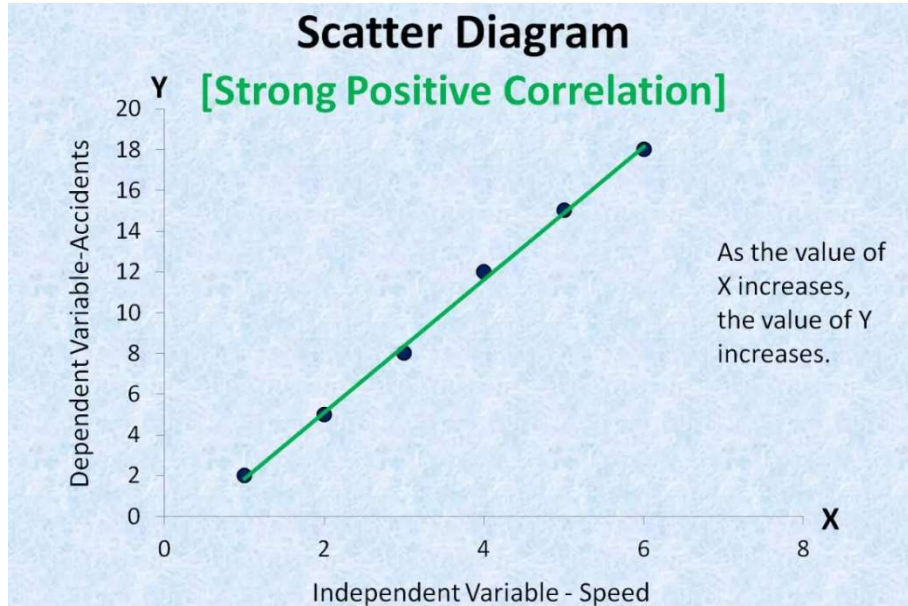


Figure 3.6 Scatter Diagram

Flow Charts:

A flowchart is a graphical representation of a process. Flowcharting can help the project team anticipate what and where quality problems might occur and, thus, can develop approaches for developing with them.

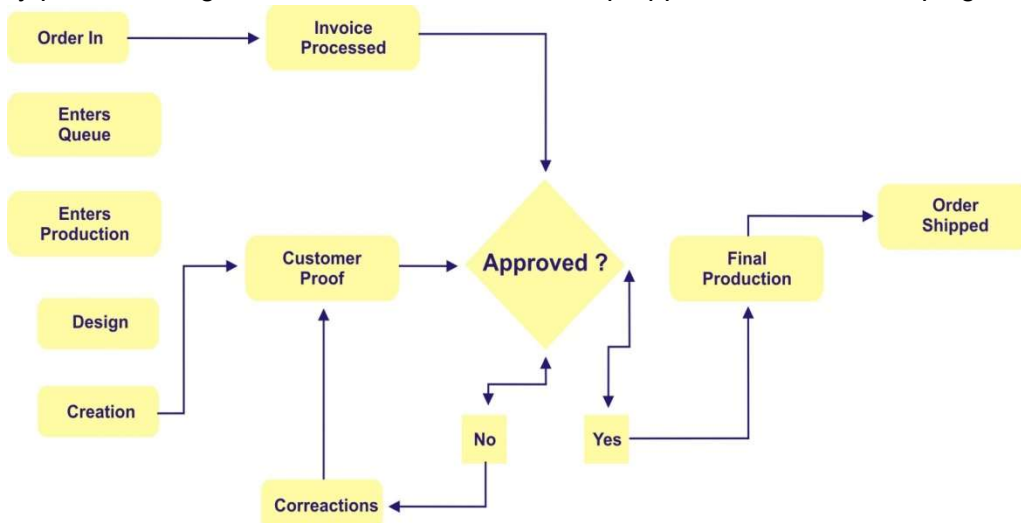


Figure 3.7 Flow Chart

Check Sheets:

The check sheet is a form (document) used to collect data in real time at the location where the data is generated. The data it captures can be quantitative or qualitative. When the information is quantitative, the check sheet is sometimes called a tally sheet.



Defect Types/ Event Occurrence	Dates							TOTAL
	Sunday	Monday	Tuesday	Wednesday	Thursday	Friday	Saturday	
Defect 1								
Defect 2								
Defect 3								
Defect 4								
Defect 5								
Defect 6								
Defect 7								
Defect 8								
Defect 9								
Defect 10								
TOTAL								

Figure 3.8 Check Sheet

3.6 Six Sigma

Six Sigma (6σ) is a set of techniques and tools for process improvement. It was introduced by American engineer [Bill Smith](#) while working at [Motorola](#) in 1986.^{[1][2]}

Six Sigma strategies seek to improve [manufacturing](#) quality by identifying and removing the causes of defects and minimizing [variability](#) in manufacturing and [business processes](#). This is done by using empirical and statistical [quality management](#) methods and by hiring people who serve as Six Sigma experts. Each Six Sigma project follows a defined methodology and has specific value targets, such as reducing pollution or increasing [customer satisfaction](#).

Six Sigma asserts that:

- Continuous efforts to achieve stable and predictable process results (e.g., by reducing process [variation](#)) are of vital importance to business success.
- Manufacturing and business processes have characteristics that can be defined, measured, analysed, improved, and controlled.
- Achieving sustained quality improvement requires commitment from the entire organization, particularly from top-level management.

Features that set Six Sigma apart from previous quality-improvement initiatives include:

- Focus on achieving measurable and quantifiable financial returns
- Emphasis on management leadership and support
- Commitment to making decisions on the basis of verifiable data and statistical methods rather than assumptions and guesswork

Six Sigma projects follow two project methodologies, each with five phases.^[6]

- DMAIC is used for projects aimed at improving an existing business process
- DMADV is used for projects aimed at creating new product or process designs



The DMAIC project methodology has five phases:

Define the system, the voice of the customer and their requirements, and the project goals, specifically.

Measure key aspects of the current process and collect relevant data; calculate the "as-is" process capability

Analyze the data to investigate and verify cause and effect. Determine what the relationships are, and attempt to ensure that all factors have been considered. Seek out the root cause of the defect under investigation.

Improve or optimize the current process based upon data analysis using techniques such as [design of experiments](#), [poka yoke](#) or mistake proofing, and standard work to create a new, future state process. Set up pilot runs to establish [process capability](#).

Control the future state process to ensure that any deviations from the target are corrected before they result in defects. Implement [control systems](#) such as [statistical process control](#), production boards, visual workplaces, and continuously monitor the process. This process is repeated until the desired quality level is obtained.

DMADV's five steps

Also known as DFSS ("Design for Six Sigma"), the DMADV methodology's five phases are:[6]

- Define design goals that are consistent with customer demands and the enterprise strategy.
- Measure and identify CTQs (characteristics that are Critical to Quality), measure product capabilities, production process capability, and measure risks.
- Analyze to develop and design alternatives
- Design an improved alternative, best suited per analysis in the previous step
- Verify the design, set up pilot runs, implement the production process and hand it over to the process owner(s).

In process improvement efforts, **defects per million opportunities** or **DPMO** (or **nonconformities per million opportunities (NPMO)**) is a measure of process performance. It is defined as

$$DPMO = \frac{1,000,000 \times \text{number of defects}}{\text{number of units} \times \text{number of Defects opportunities per unit}}$$

A defect can be defined as a nonconformance of a quality characteristic (e.g. strength, width, response time) to its specification. DPMO is stated in opportunities per million units for convenience: Processes that are considered highly capable (e.g., processes of [Six Sigma](#) quality) are those that experience fewer than 3.4 defects per million opportunities (or services provided).

3.6.1 Lean Six Sigma

Lean Six Sigma is a process improvement approach that uses a collaborative team effort to improve performance by systematically removing operational waste^[1] and reducing process variation. It combines [Lean Management](#) and [Six Sigma](#) to increase the velocity of value creation in business processes.



Unit 4: Risk Management and Communication Management:

Risk is an **uncertain event** which may or may not happen. If it does happen, it can have **positive or negative impact** on one or more project objectives such as scope, schedule, cost, and quality. The positive impacts are called as **opportunities** and can include such things as:

- The equipment is cheaper
- Work package is completed faster than expected
- Work can move faster since we are able to acquire a resource with a higher productivity level.

Negative impact are Threats and can include such things as:

- Key Team members leaving
- Work is moving slower due resources with low productivity rates
- Delay in approvals from stakeholders

Risk Category includes a list of causes of risk. To relate the risk categories to the levels of project objectives, the three categories are defined as follows:

1. Operational risks: This term refers to risks related to operational objectives of the project. This means risks restricted to the direct results from the project—that is, its products.
2. Short-term strategic risks: This term refers to risks related to the short-term strategic objectives of the project. In other words, short-term strategic risks are risks related to the objectives for project owner's use of the project results after the project has been completed. It may also mean the risk for first-order effects of the project—that is, risk for the effects that should be achieved for the target group or users.
3. Long-term strategic risks: This term refers to risks related to long-term strategic objectives of the project—in other words, risks related to the project purpose, or, the long-term objective that the project is meant to contribute to.

5.3 Risk Management Phases

Risk Identification: Determining which risks might affect the project and documenting their characteristics.

Risk Analysis: Includes methods for prioritizing the identified risks for further action

Plan Risk Response: Developing options and actions to enhance opportunities, and to reduce threats to project objectives.

Control and Monitor Risks: Process of implementing risk response plans, tracking identified risks, monitoring residual risks, identifying new risks, and evaluating risk process effectiveness throughout the project.

5.3 Risk Identification

Risk identification is the process of identifying individual project risks and documenting their characteristics. Some of the popular techniques used to identify risks early in the project are:

- a) **Information Gathering Techniques**: Used in identifying risk can include:



- **Brainstorming:** The project team usually performs brainstorming, often with a multidisciplinary set of experts not on the team. Ideas about project risk generated under the leadership of a facilitator.
 - **Delphi Technique:** Is a way to reach consensus of experts. Project risk experts participate in this technique anonymously. This technique helps reduce bias in the data and keeps any one person from having undue influence on the outcome.
- b) **Interviewing: One** of the main sources of risk identification data gathering. The interviewee, through questions and discussion, shares his insight on what risks he perceives within the project. The goal of the process is to learn from the expert what risks may be hidden within the project, what risks this person has encountered on similar work, and what insight the person has into the project work.
- c) **SWOT Analysis:** Can be developed based on historical information and knowledge that has been accumulated from previous similar projects and from other sources of information. This technique examines the project from each of the SWOT (strengths, weaknesses, Opportunities, and threats)
- a) **Expert Judgment:** Risks can be identified directly by experts with relevant experience of similar projects or business areas. Such experts should be identified by the project manager and invited to consider all aspects of the project and suggest possible risks based on their previous experience and areas of expertise

5.3 Risk Analysis

Risk analysis includes methods for prioritizing the identified risks for further action. This includes quantitative techniques which include:

1. **Risk Probability and Impact Assessment:** The project risks are rated according to their probability and impact. Risk probability is the likelihood that a risk event may happen, while risk impact is the consequence that the result of the event will have on the project objectives
2. **Expert Judgment:** Is required to assess the probability and impact of each risk and its location in the matrix.
3. **SWOT Analysis:** Can be developed based on historical information and knowledge that has been accumulated from previous similar projects and from other sources of information. This technique examines the project from each of the SWOT (strengths, weaknesses, Opportunities, and threats)
4. **Checklist Analysis:** Can be developed based on historical information and knowledge that has been accumulated from previous similar projects and from other sources of information.
5. **Assumption Analysis:** Identifies risks to the project from inaccuracy, inconsistency, or incompleteness of assumptions.

The risk register is a major output of the risk analysis process. It contains all of the information related to the risk management activities. It's updated as risk management activities are conducted to reflect the status, progress, and nature of the project risks. The risk register includes the following:

Risk	Risk Category	Probability (0-1)	Impact (1-10)	Risk Score (P X I)	Risk Ranking	Risk Response	Trigger	Risk Owner
					1			

1. Risk Name
2. Risk Category



3. Probability: A number from 0 to 1
4. Risk Impact: The Impact a risk will have on any (one or more) of project objectives if it occurs
5. Risk Score: Is calculated by multiplying risk probability and risk impact. This value helps in prioritizing risks.
6. Risk Ranking: Based on the risk score, the risks are ranked for action for appropriate team members.
7. Risk Response: Three strategies typically deal with threats or risks that may have negative impacts on project objectives if they occur. The fifth “Accept” can be used for both negative as well as positive risks or opportunities.
 - a. **Escalate:** This is simply escalating it at the higher level since it is above the Project Managers authority. Escalated risks are not monitored by the Project Team, though they may be recorded in the risk register.
 - b. **Avoid: Avoidance** is simply avoiding the risk. This can be accomplished many different ways and generally happens early in the project when any change will result in fewer consequences than later in the project plan.
 - c. **Transfer: Transference** is the process of transferring the risk (and the ownership of the risk) to a third party. The risk doesn’t disappear, it’s just someone else’s problem. Transference of a risk usually costs a premium for the third party to own and manage that risk
 - d. **Mitigate:** Mitigating risks is an effort to reduce the probability and/or impact of an identified risk in the project. Mitigation is done—based on the logic—before the risk happens. Taking early action to reduce the probability and/or impact of a risk occurring on the project is often more effective than trying to repair the damage after the risk has occurred.
 - e. **Acceptance:** Risk acceptance is the process of simply accepting the risks because no other action is feasible; or the risks are deemed to be of small probability, impact, or both and that a formal response is not warranted. Passive acceptance requires no action; the project team deals with the risks as they happen.
8. **Risk Trigger:** Events or conditions which indicate that a risk is about to occur
9. **Risk Owner:** The team member who is accountable for the risk and monitors it on a weekly basis.

In the project budget, a contingency reserve is allocated for known risks to make available any additional funds if the need arises. Residual risks are risks that are expected to remain after planned responses have been taken. While secondary risks arise as a direct outcome of implementing a risk response

5.5 Risk Responses

Five alternative strategies may be considered for dealing with threats or negative risks, as follows:

1. **Escalate.** Escalation is appropriate when the project team or the project sponsor agrees that a threat is outside the scope of the project or that the proposed response would exceed the project manager’s authority. Escalated risks are managed at the program level, portfolio level, or other relevant part of the organization, and not on the project level.
2. **Avoid.** Risk avoidance is when the project team acts to eliminate the threat or protect the project from its impact. It may be appropriate for high-priority threats with a high probability of occurrence and a large negative impact. Avoidance may involve changing some aspect of the project management plan or changing the objective that is in jeopardy in order to eliminate the threat entirely, reducing its probability of occurrence to zero. Examples



of avoidance actions may include removing the cause of a threat, extending the schedule, changing the project strategy, or reducing scope. Some risks can be avoided by clarifying requirements, obtaining information, improving communication, or acquiring expertise.

3. **Transfer.** Transfer involves shifting ownership of a threat to a third party to manage the risk and to bear the impact if the threat occurs. Risk transfer often involves payment of a risk premium to the party taking on the threat. Transfer can be achieved by a range of actions, which include but are not limited to the use of insurance, performance bonds, warranties, guarantees, etc. Agreements may be used to transfer ownership and liability for specified risks to another party.

4. **Mitigate.** In risk mitigation, action is taken to reduce the probability of occurrence and/or impact of a threat. Early mitigation action is often more effective than trying to repair the damage after the threat has occurred. Adopting fewer complex processes, conducting more tests, or choosing a more stable seller are examples of mitigation actions. Mitigation may involve prototype development to reduce the risk of scaling up from a bench-scale model of a process or product. Where it is not possible to reduce probability, a mitigation response might reduce the impact by targeting factors that drive the severity. For example, designing redundancy (Safety concept) into a system may reduce the impact from a failure of the original component.

5. **Accept.** Risk acceptance acknowledges the existence of a threat, but no proactive action is taken. This strategy may be appropriate for low-priority threats, and it may also be adopted where it is not possible or cost-effective to address a threat in any other way. Acceptance can be either active or passive. The most common active acceptance strategy is to establish a contingency reserve, including amounts of time, money, or resources to handle the threat if it occurs. Passive acceptance involves no proactive action apart from periodic review of the threat to ensure that it does not change significantly.

Risk Mitigation

The risk mitigation procedures included in the risk management methods utilized by companies enable them to foresee all project-related hazards' possible implications in advance. To readily recognize, monitor, and analyze all potential risks and their effects as they work to accomplish their project, the team members employ a variety of mitigation measures throughout the project's lifespan.

Risk mitigation is minimizing the effects of probable hazards by creating a strategy to manage, erase, or substantially limit setbacks. Management will monitor progress after developing and implementing the plan and evaluate whether to adjust any measures as needed. Although copying a risk management approach from another organization could be tempting, your project will be based on your business strategy. The effort to establish a unique risk mitigation strategy could mean the difference between keeping a positive client connection and losing out on business.



Likelihood	Consequences				
	Insignificant <i>Risk is easily mitigated by normal day to day process</i>	Minor <i>Delays up to 10% of Schedule Additional cost up to 10% of Budget</i>	Moderate <i>Delays up to 30% of Schedule Additional cost up to 30% of Budget</i>	Major <i>Delays up to 50% of Schedule Additional cost up to 50% of Budget</i>	Catastrophic <i>Project abandoned</i>
Certain <i>>90% chance</i>	High	High	Extreme	Extreme	Extreme
Likely <i>50% - 90% chance</i>	Moderate	High	High	Extreme	Extreme
Moderate <i>10% - 50% chance</i>	Low	Moderate	High	Extreme	Extreme
Unlikely <i>3% - 10% chance</i>	Low	Low	Moderate	High	Extreme
Rare <i><3% chance</i>	Low	Low	Moderate	High	High

You can be exposed to various risks than a company in a different industry with a diverse clientele or clientele. However, a few fundamental dangers apply to all companies and industries, including:

1. Compliance Danger

A threat to business earnings or reputation when it breaks external or internal laws, rules, or standards. Companies that violate compliance regulations risk losing clients or incurring fines.

2. Legal Danger

Compliance risk arises when a business violates the laws and regulations that apply to businesses. Companies may become involved in costly litigation when they face legal dangers.

3. Strategic Hazard

The consequence of a company's poor or lack of business strategy.

4. Continuity Risk

A risk might harm the company's reputation or the public's perception of it. Reputational risks can cause economic losses and a reduction in shareholder trust.

5. Operational Hazard

Current activities might potentially eat away at a company's profitability. Operational hazards can be relied on by both internal systems as well as outside variables.

The chances of finishing a project from top to bottom in one go are always close to zero, according to project managers. Roadblocks come in both expected and unanticipated types; therefore, both need to be anticipated. The most prepared optimists are those who have a backup plan in place for every conceivable scenario. Risk mitigation planning is crucial to ensure control over the project development process and its success. Project managers are given the most appropriate strategy, resources, and tools to deal with the worst-case event via risk mitigation, which might slow down project progress if not considered.



One might ask why one should spend money and time on something that may or may not happen. While this may be a credible reason for little projects, thorough risk mitigation is not an alternative but a need for corporate projects where expenditures might reach millions. Here are some further reasonings:

1. Prompt Crisis Management

Planning for risk mitigation provides a view into all potential future problems. As a reason, project managers and leaders may make the most informed choices to not only lessen the impact on the project scope when they occur but, in the best circumstances, to avoid them through the use of the best contingency plans.

2. Close Gaps More Efficiently and Quickly

Planning for risk mitigation typically focuses on the project's weak point. Project managers can develop workable solutions along the lines of trigger points if they are aware of any potential dangers, saving time and money.

3. Budgeting in Realistic Terms

Planning for risk mitigation gives project managers the perfect insight to deploy resources in advance for known and unknown risk events. Project managers can offer resource and budget estimations to stakeholders based on the real conditions on the ground. This helps lessen conflict during risky situations and frees project teams and other stakeholders to focus on what matters.

4. Simple Cooperation and Escalation

Last but not least, a thorough risk mitigation strategy creates the foundation for future partnerships that are frictionless, and goal driven. The sub-teams are fully conscious of their responsibilities and have the necessary **escalation matrix** to refer to incidents that fall outside their purview to the appropriate stakeholders.

5.7 Managing and Controlling Risks

Risk monitoring and management are done throughout the project life cycle. This process uses information generated during project execution to determine if:

1. Implemented Risk Response is effective
2. New individual project risks have arisen
3. Contingency Reserves are adequate for the risk
4. Project Assumptions are valid

Some of the tools to manage and control risks include

1. **Risk Audits:** A risk response audit examines the planned risk response, how well the planned actions work, and the effectiveness of the risk owner in implementing the risk response. The audits happen throughout the project to measure the effectiveness of mitigating, transferring, and avoiding risks. The risk response audit should measure the effectiveness of the decision and its impact on time and cost.
2. **Technical Performance Measurement:** The level of technical achievement should be in proportion to the expected level of technical performance within the project. If the project team is not performing at a level of expected technical expertise, the project may suffer additional risks due to the discrepancy.
3. **Reserve Analysis:** Reserve Analysis compares the amount of the contingency reserves remaining to the amount of risk remaining at any time in the project, in order to determine if the remaining reserve is adequate.
4. **Status Meetings:** Project risk management can be an agenda item at periodic status meetings. Risk management becomes easier the more often it is practiced, and frequent discussions about risk make talking about risks, particularly threats, easier and more accurate.

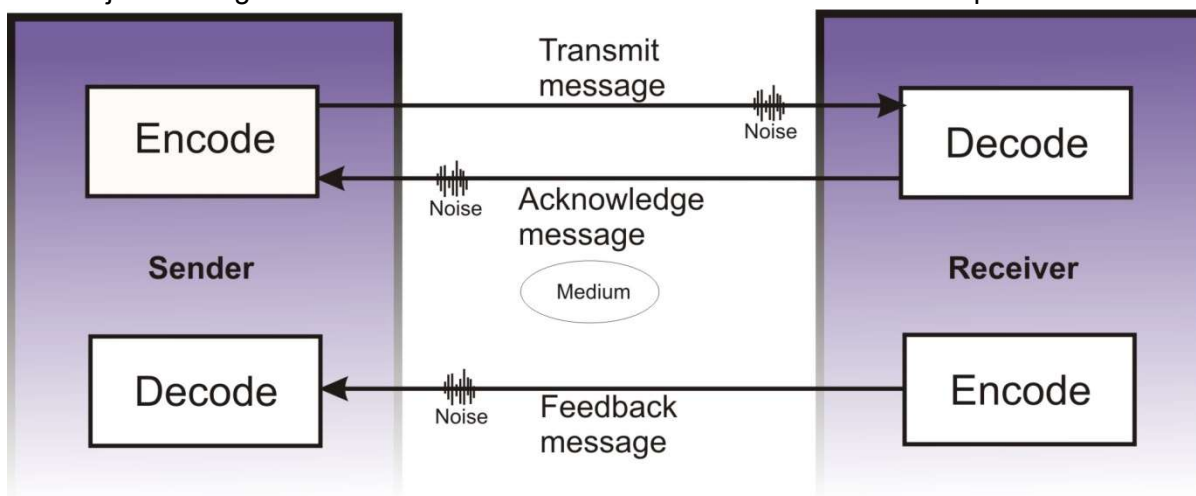


5.5 Communication Management

Project Communications Management centres on determining who needs what information and when and then producing a plan to provide that needed information. It includes generating, collecting, disseminating, and storing communication. Successful projects require successful communication; thus, communication is the key link between people, ideas, and information. The art of communication involves:

- Sender Receiver Models
- Choice of Media (Writing/Oral/Email/Face to face)
- Writing style (Active versus Passive, Choice of words)
- Presentation techniques (Visual aids)
- Meeting Management techniques (Prepare agenda and conflict management)

The Project Manager needs to understand the communication model as depicted below:



Here's a summary of all the different parts of a communication model:

- **Encode:** To translate thoughts or ideas into a language that is understood by others.
- **Message and feedback-message:** The information is then sent by the sender using communication channel. The transmission of this message may be compromised by various factors, which are collectively called as Noise.
- **Noise:** Anything that interferes with the transmission and understanding of the message.
- **Decode:** To translate the message back into meaningful thoughts or ideas.
- **Acknowledge:** Upon receipt of a message, the receiver may signal (acknowledge) receipt of the message but this does not necessarily mean agreement with or comprehension of the message.
- **Feedback/ Response:** When the received message has been decoded and understood, the receiver encodes thoughts and ideas into a message and then transmits this message to the original sender.
- **Medium:** The method used to convey the message



Avoiding Noise in Communication

Communication Methods

As part of the communication process, the sender is responsible for making the information clear and complete so that the receiver can receive it correctly, and for confirming that it is properly understood. The receiver is responsible for making sure that the information received in its entirety, understood correctly, and acknowledged.

Communication Methods: These can be classified into:

Interactive communication : Between two or more parties performing a multidirectional exchange of information. It includes meetings, phone calls, video conferencing etc.

Push communication : Sent to specific recipients who need to know the information. It includes letters, memos, reports, emails, faxes, voice mails, press releases etc.

Pull communication : Used for large audiences and large volumes of data. It includes intranet sites, e-learning, and knowledge repositories etc.

Unit 5: Performance Management: Project Integration

Projects that start need to be tracked to ensure they remain compliant with business objectives, market needs, and stipulated baselines. All of this evaluation, monitoring, and control is what primarily formulates the important function of project performance management for a project manager. In this article, we aim to establish a foundational understanding of what performance management is in project management, what it encompasses, what is the modus operandi of it, how project managers achieve it, its goals, benefits, and more.

Project performance management is the process of keeping track and evaluating the viability and desirability of continuing projects as well as monitoring their efficiency and congruency to outlined organizational goals and objectives. The performance [management process](#) goes beyond just tracking tasks/activities and involves supervision of the overall project from initiation to completion. Components of performance management in this context would include managing budgets, schedules, resources, communications, procurements, etc., for a project while overlooking the organization's systems.

Performance management for a project is essentially applying processes and compliance in a project set up in addition to the ones already laid out at the organizational level. When evaluating performance management strategies to plan or strategize performance management in real-time, project managers need to account for several factors, such as:

- Type of project in consideration
- Team members involved in the project
- Organization Processes, hierarchy, and governance model
- Tailored requirements (from client/organization in certain cases)

How Does Project Performance Management Benefit a Business?

In today's competitive environment in which projects are forced to operate, no project manager can undermine the importance of performance management in the project. This is due to several reasons, which may be noted as follows:



- Ever-changing market conditions and consumer behaviours
- Growing technology and marketable platforms
- Cut-throat competition across industries
- Unique and more-challenging project risks
- Changes in hiring trends, ways of working

Due to one or more of the above factors, project managers need to keep an active track of performance management which is also a harbinger of other benefits such as:

- Keeps an active check on project path to ensure it does stray away from organization changes
- Helps establish project change control is within acceptable thresholds
- Ensures effective allocation and management of resources in the project
- Gives room for adjustment in case of deviations with guidance to limit impacts
- Strengthens the governance model of the organization
- Improvises communication and ways of working across project teams with a constant customer and objective focus
- Abets project manager performance
- Creates competitive culture among and within teams
- Promotes measures for overall team performance and success
- Helps solidify project activities and link them to KPIs/goals
- Improves transparency in the team with measures for corrective action where necessary

.How Does Project Performance Management Work?

So now that you have understood what is performance management and what its benefits are, the next question you may have is how does it work or how project managers can establish the performance management framework in the organization?

Getting started with performance management includes setting up a framework for the evaluation of project performance involving taking certain steps, viz:

- Creating a clear hierarchical structure across the organization
- Adding measures and criteria to the existing governance model (to avoid reinventing the wheel)
- Centralizing data and tracking of projects to form a single focal point
- Utilizing a commercial or indigenous software tool to create workflows for two-way communication
- Driving reporting uniformity and standardizing KPIs and metrics across the organization
- Creating dashboards and reports to track performance, variances, and risks
- Enabling stakeholder communication and satisfaction by providing self-service dashboards/reports

To summarize, creating a performance management process involves addressing all touchpoints in the Plan, Do, Check, Act (PDCA) cycle to create a feedback loop and strengthen the governance process to solidify both project performance management as well as organization performance management.

While organizations may address it by different nomenclature, any performance management life cycle must have the five phases of planning, monitoring, learning, feedback, and rewarding to be complete and contribute to successful evaluations and results.



Project Performance Management Goals

Project performance management is an important discipline that helps project managers stay current on the project's progress and also keep track of variations from what was planned or baseline to measure project success. Having a well-defined and structured project performance management plan helps outline goals that project managers aim to achieve with the implementation of the performance management strategies or goals outlined. Some of the common goals include:

- Brings awareness of the bigger picture in executing projects
- Bolsters portfolio efforts in linking project activities to overall organization goals
- Creating a culture of transparency and competition driven by results
- Defining measures for performance evaluation of individual members and teams
- Outlining measures for evaluating the completion of the project's goals and objectives
- Driving engagement across the organization positively impacts success metrics and KPIs
- Reducing wastage, rework, and sunk costs which can be avoided

Stages of Project Performance Management

Project performance management involves creating a plan that bounds within the outlined governance model for the organization yet does not overlap with its performance management strategies. This involves undertaking a series of steps or stages viz:

Stage 1: Understanding the Business Case

Understanding the project business case or business needs behind project selection is the first and foremost step that lays the foundation for the determination of a successful measurement criterion. This understanding and know-how also help in creating specific, measurable indicators of performance tailored to the needs of the project under the organization's standard operating procedures.

Stage 2: Define the Project Goals

Having definitive project goals, which are in turn linked with overall organizational strategies and KPIs, helps maintain transparency and also justifies the viability and desirability of the project in the overall landscape. The presence of structured project goals helps ease governance, funding, communication, and workflows in the organization, thereby enabling proper performance evaluations and transparency.

Stage 3: Data Points Establishment for Result Measurement

There can be multiple types of performance management systems that project, program, or portfolio managers can use to perform performance management across the organization, but none of them can be effective if not backed with objective data points. Establishing data points and defining objective criteria helps get rid of open-ended goals or statements and brings in the required dependencies as well as clarity on the means or measures to achieve the goals.

Stage 4: Settling Milestones, Deadlines, and Action Items

Regular project reviews set up by way of milestones, deadlines, and open action item reviews not only help projects move forward appropriately but also ensure team members are motivated with smaller achievements to reach and meet larger goals or deadlines. Having clear entry and exit criteria for the projects at the operational level increases visibility and efficient tracking and helps avoid bottlenecks by addressing items as they happen rather than going backward or dwelling on them.

Stage 5: Mid-point Checkpoints



Creating a culture of constantly reviewing project progress helps avoid surprises affecting project baselines or milestones, especially with so much uncertainty, socio-economic challenges, and technological and related risks in which projects operate. Checkpoints and regular reviews ensure nothing strays too far to result in a scope creep or raise new issues to the overall progress.

Stage 6: Final Report Assessment

To be effective and economical, projects should start with an end in mind and this is the primary objective of measuring or managing project performance. The final report assessments being shared with leadership and stakeholders act as a formal closure communication for the project and move the project to the much-awaited benefit realization phase. This also covers the important piece of the puzzle for project performance management by evaluating what was planned vs what was completed and what's left to derive a logical conclusion on the project.

How to Measure Project Performance Management?

Project performance management is an important discipline that seeks to help project and program managers run projects effectively. To be effective, it is important to evaluate performance management against one or more of the following criteria:

- Variance metrics - planned vs actual variances
- Portfolio metrics on project completions
- Return on Investment data
- Net Promoter score
- Number of project escalations
- Resource allocation data

Whilst the list may not be exhaustive, it is important to gauge process efficiencies and effectiveness of performance management as a whole to ensure it orchestrates the project landscape of the organization towards the achievement of outlined goals, strategies, and objectives & deriving the resultant benefits.

Using Software to Execute Performance Management

Performance management is closely tied to the organization's governance model and, unless supported by a tool, is very tedious to accomplish as it involves having a bird's eye view of the way tasks are planned, executed, monitored, and closed. Managing these aspects without the support of a software tool is neither practically possible nor advisable, considering the criticality of this discipline. Utilizing or implementing performance management via a tool helps the organization by:

- Centralizing all information on projects,
- Ensuring transparency and linkage of strategies to projects and vice-versa,
- Aiding the downward flow of information, ensuring full communication,
- Supporting portfolio objectives and fulfilment of planned initiatives,
- Providing real-time data related to projects which helps monitor variances effectively,
- Allowing leadership to focus on optimizations and critical decision-making without worrying about the granularity of tracking items
- Providing calculations and reports over time to monitor progress,
- Ensuring more productive and engaging discussions across all levels

A few popular project performance management software are:

- Microsoft Project



- JIRA
- Smartsheet
- Asana
- Wrike
- Monday.com

Many tools even provide ready-to-use performance management templates or even out-of-the-box performance management examples for organizations to merely update with basic data and start monitoring projects, tracking progress, and reporting performance statistics with advanced capabilities and configurations.

6.4 Progress and Performance measurement and evaluation

Project monitoring information system, developing a status report and other control issues . Once a project is rolled out, it requires continuous monitoring to ensure project is on track and adhering to Project baselines.

Project Management Information Systems

A project management information system (PMIS) is how a project's information is organized. It collects and uses project information through one or more software applications. These programs help project managers plan, execute and close their projects and allow them to organize the flood of information so they can take effective decisions on the project.

Project Status Report

Work Performance Reports: Are representation of work performance information compiled in project documents, intended to generate decisions, actions, or awareness. Examples include status reports, memos, justifications, information notes, recommendations, and updates.

A project status report is a document that describes the progress of a project within a specific time period and compares it against the project plan. Project managers use status reports to keep stakeholders informed of progress and monitor costs, risks, time and work. Project status reports allow project managers and stakeholders to visualize project data through charts and graphs.

Project status reports are taken repeatedly throughout every phase of the project's execution as a means to maintain your schedule and keep everyone on the same page. The status report for a project generally includes the following:

- The work that's been completed
- The plan for what will follow
- The summary of the project budget and schedule
- A list of action items
- Any issues and risks, and what's being done about them

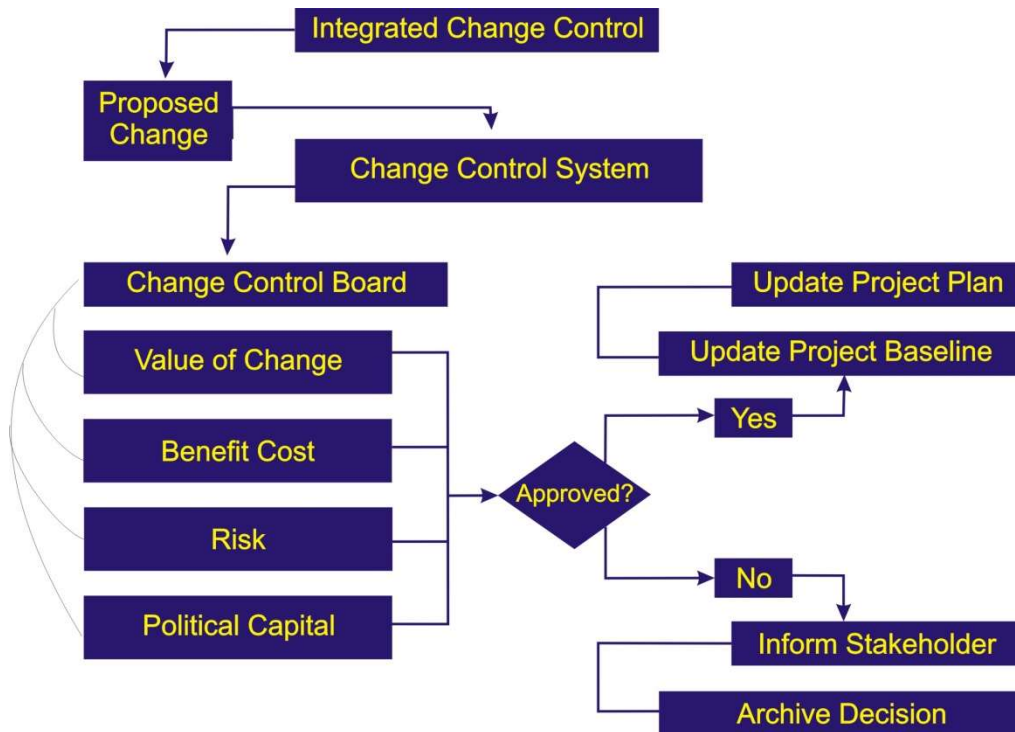
Change Requests

During project execution and monitoring, some change requests are encountered by Project team. **Change requests can be defined as any change to document, deliverable or baseline.** Change requests are of 3 types:



1. Corrective Action : Corrective actions are documented recommendations required to bring expected future project performance into conformance with the project management plan.
2. Preventive Action : Preventive actions are documented recommendations that reduce the probability of negative consequences associated with Project Risks.
3. Defect Repair : Some defects which are found during audit are recommended for correction.

To handle any change requests in a project, the Project Manager authorizes the change management process. Most changes have time and cost implications on a project. Hence, they have to be evaluated through an Integrated Change Management Process as described below:



As per process, all change requests decision by change board are archived irrespective of outcome.

6.5 Project Integration –

Project Integration Management includes the processes and activities needed to identify, define, combine, unify, and coordinate the various processes and project management activities within the Project. Within any project there are many moving parts: time management, cost management, schedule conflicts, human resource issues, iterative planning, and much, much more. Project Integration Management is the Art and Science of ensuring that your project moves forward, and that your plan is fully developed and properly implemented. Project Integration Management requires that your project, regardless of its size and impact meshes with the **existing operations** of your organization.



Project Management Plan

A project plan, according to the Project Management Body of Knowledge (PMBOK), is: "...a formal, approved document used to guide both project execution and project control. The primary uses of the project plan are to document planning assumptions and decisions, facilitate communication among project stakeholders, and document approved scope, cost, and schedule baselines. A project plan may be summarized or detailed. The project management plan includes:

1. The project management processes selected by Project Management Team that will be applied to each phase
2. The level of implementation of each selected process
3. The description of tools and techniques to be used for accomplishing those processes.
4. How work will be executed to accomplish the project objectives
5. How changes will be monitored and controlled
6. How configuration management will be performed
7. The need and techniques for communication among stakeholders
8. How integrity of the performance measurement baselines will be maintained.
9. Key management reviews for content, extent, and timing to facilitate addressing open issues and pending decisions.

During execution of a Project, the following are outputs generation

1. **Deliverables:** Is any unique and verifiable product, result or capability to perform a service that is required to be produced to complete a process, phase, or project. Examples include tangible outputs like building floor, prototype or intangible services like documents and software.
2. **Work Performance Data :** Work Performance data are the raw observations and measurements identified during activities being performed to carry out the project work. Examples include reported percent of work physically completed, quality and technical performance measures, start and finish dates of scheduled activities, number of change requests, number of defects, actual costs, actual duration, etc.

6.6 Project audit and closure

The (PMBOK® Guide) defines audit as, "a structured independent review to determine whether project activities comply with organisational and project policies, and procedures. In short, it is a quality management tool.

There are several variations of a project audit:

- In-process quality assurance review,
- Gateway review,
- Project management audit and
- Post-implementation audit.



The project manager should realise that each can have a different set of objectives. By ascertaining what these objectives are, the project manager will better understand the direction in which the auditors are headed – and better anticipate the types of questions the auditors will ask. We'll discuss two methods of determining the audit focus, the announcement letter and the audit programme, later in this paper.

To ensure the audit is unbiased, the reviewers should have no conflict of interest and be independent, i.e. not related to or controlled by the party being audited. Organisations may use a combination of project management office staff, internal audit staff, external auditors and/or external third-party experts. The audit team should include functional as well as subject matter experts, e.g. if the project is information systems related, the business viewpoint must be represented as well as information technology. For post-implementation reviews, some businesses include team members from the project implementation team, but then ensure the audit team lead is independent.

A third-party firm may be used when the internal audit function lacks bandwidth or expertise in a particular subject matter area. Some prescient organisations even plan for such possibilities as part of their procurement – see the case study for details.

Gateway reviews are conducted at the end of a project phase and prior to progressing on to the next phase.

A project audit may be conducted at any time, but is often timed so that sufficient deliverables are available for review, or when a project sponsor seeks an independent assessment of project progress.

Post-implementation reviews occur after the end of a project, but the exact timing could be from a few weeks to a year, depending on what is to be examined. It can be difficult to assess benefits unless enough sufficient time has elapsed and the proper benefits realisation processes built. Ideally, the auditors should be able to examine the already implemented benefits measurement procedures and compare initial benchmarks with ongoing results.

How to conduct a Project audit in Project management?

A project management audit requires a methodical approach and clear communication throughout the process. Here's a practical guide on how to perform a project audit:

- Preparation is key. Start by defining the audit scope, objectives, and criteria. Gather all necessary documentation, resources, and tools needed for the audit. Assign roles and responsibilities within the audit team to ensure everyone understands their tasks and contributions.
- Once the groundwork is laid, it's time to dive into data collection. Collect relevant data and information through various methods such as document reviews, interviews, surveys, and observations. Ensure the data collected is accurate, comprehensive, and aligned with the audit objectives.
- With the data in hand, move on to the analysis phase. Analyze the collected data thoroughly to assess the project's performance against the established audit criteria. Identify both the strengths and weaknesses of the project, as well as any potential opportunities or threats. Utilize both quantitative and qualitative analysis techniques to derive meaningful insights.
- After completing the analysis, it's time to consolidate your findings. Compile the audit findings into a clear and concise project report, summarizing key observations, trends, and recommendations. Present your findings objectively, supported by evidence and data.
- Effective communication is crucial throughout the audit process. Communicate your findings to project sponsors, managers, and team members. Engage in discussions about the implications of the findings, potential risks, and opportunities for improvement. Solicit feedback and input from stakeholders to ensure alignment and understanding.



Project Team Evaluations

Team performance is the process of evaluating the performance of an entire team, not just an individual. Team performance evaluation is done to get a clear idea of how well the team's skills are working together. It includes managing team members, motivating them and providing feedback on their performance. The purpose of this evaluation is to find out if the team can work together efficiently. The process starts with setting individual goals for each member and then assigning tasks within that goal. There should also be constant communication between management and their employees during this process.

The evaluation can be done either by using a formal framework or informal assessment methods like checklists, self-evaluation questionnaires and interviews with employees about their opinion on the team's effectiveness.

There are many ways you could go about measuring your team's performance. Here are two examples:

1) How often did the team meet its deadlines?

2) What was the quality of the final product?

For individual Performance, managers solicit feedback concerning team members' performance from all of the people that their work affects. This includes project managers, area managers, peers, subordinates, and customers.

The Project managers are evaluated on the basis of the following parameters:

- % of Projects completed on time
- % of Projects completed without cost slippage
- % of Projects completed without scope creep (Increase)
- % of Projects having zero post-delivery defects (Some managers might not directly use this metric for Project Managers, but can relate it to the fact that did the Project Manager raise a risk or take the right steps to avoid post-delivery defects)
- Effective usage of Project Management tools like JIRA/MS Project for project-related tasks
- Domain/Technical Knowledge

Project Closure

The process of finalizing all activities for the project, phase or contract is known as Project Closure.

Once a project is closed, following activities are done:

- Getting delivery acceptance from the customer.
- Shutting down resources and releasing them to new uses.
- Evaluating the team, team members and the project manager; and reassigning project team members.
- Closing accounts and paying all bills.
- Delivering the project to the customer.
- Creating a final report.



Project Closure checklist can include below items:

	Task	Completed? Yes/No
	<i>Team</i>	
1	Has a schedule for reducing project staff been developed and accepted?	
2	Has staff been released or notified of new assignments?	
3	Have performance reviews for team members been conducted?	
4	Has staff been offered outplacement services and career counseling activities?	
	<i>Vendors/contractors</i>	
5	Have performance reviews for all vendors been conducted?	
6	Have project accounts been finalized and all billing closed?	
	<i>Customer/Users</i>	
7	Has the customer signed-off on the delivered product?	
8	Has an in-depth project review and evaluation interview with the customer been conducted?	
9	Have the users been interviewed to assess their satisfaction with the deliverables? With the project team? With vendors? With training? With support? With maintenance?	
	<i>Equipment and facilities</i>	
10	Have project resources been transferred to other projects?	
11	Have rental or lease equipment agreements been closed out?	
12	Has the date for the closure review been set and stakeholders notified?	
	<i>Attach comments or links on any tasks you feel need explanation.</i>	