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T.E. (Computer Engineering) Semester - V (Elective - I)

SOFTWARE PROJECT MANAGEMENT

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PREFACE

The importance of **Software Project Management** is well known in various engineering fields. Overwhelming response to our books on various subjects inspired us to write this book. The book is structured to cover the key aspects of the subject **Software Project Management**.

The book uses plain, lucid language to explain fundamentals of this subject. The book provides logical method of explaining various complicated concepts and stepwise methods to explain the important topics. Each chapter is well supported with necessary illustrations, practical examples and solved problems. All chapters in this book are arranged in a proper sequence that permits each topic to build upon earlier studies. All care has been taken to make students comfortable in understanding the basic concepts of this subject.

Representative questions have been added at the end of each section to help the students in picking important points from that section.

The book not only covers the entire scope of the subject but explains the philosophy of the subject. This makes the understanding of this subject more clear and makes it more interesting. The book will be very useful not only to the students but also to the subject teachers. The students have to omit nothing and possibly have to cover nothing more.

We wish to express our profound thanks to all those who helped in making this book a reality. Much needed moral support and encouragement is provided on numerous occasions by our whole family. We wish to thank the **Publisher** and the entire team of **Technical Publications** who have taken immense pain to get this book in time with quality printing.

Any suggestion for the improvement of the book will be acknowledged and well appreciated.

Authors
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Ashwini Dhoke
Dr. Yogeshri D. Choudhari

Dedicated to the Universe and My Loved ones...

The wonderful and best things in life can't be seen or touched. They must be sensed from the heart. One of these prayers is "Thank You."

I would like to take this opportunity to thank everyone who has motivated me in the preparation of this book.

I'd want to thank our Principal, Dr. Pramod Patil, for his constant encouragement and support.

I'd also like to express my gratitude to the Technical Publication team for providing me with the opportunity to write the book.

With all my Heart, I am grateful to my son Dushyant, family members, and friends for their cooperation and support throughout the writing of this book.

I am confident that this book will assist students in comprehending all aspects of this subject.

Thank You! Thank You! Thank You!

Dr. Rachna K. Somkunwar

SYLLABUS

Software Project Management - (310245(D))

Credit :	Examination Scheme :
03	Mid-Semester (TH) : 30 Marks End-Semester (Paper): 70 Marks

Unit I Introduction to Software Project Management

Project Definition, Project versus Flow type work, Project Lifecycle, Processes and Knowledge Areas in Project Management (PM), Build or Buy decision, Work Breakdown Structure (WBS) and its types, Introduction to PMBOK, Program and Portfolio Management. **(Chapter - 1)**

Unit II Project Planning and Project Management Tools

Project Planning : Steps for Project Planning, PERT and Gantt Charts, Gantt Project, Microsoft Project and Primavera Project Management Software, Objectives of Activity planning, Project Schedules, Activities, Sequencing and Scheduling, Network Planning Models, Formulating Network Model. **(Chapter - 2)**

Unit III Activity based Scheduling

Introduction, Objectives of Activity Planning, Project Schedules. **Activities** : Sequencing and Scheduling, Network Planning Models, Formulating Network Model, Activity relationships (FS,SF,SS,FF), Forward Pass and Backward Pass techniques, Critical Path concept and remedies. **(Chapter - 3)**

Unit IV Project Tracking and Control

Introduction, Collection of Project data, Visualizing progress, Cost monitoring, Earned Value Analysis, Project tracking, Change Control, Software Configuration Management, Managing contracts, Contract Management. **(Chapter - 4)**

Unit V Agile Project Management

Predictive versus Empirical Management, Comparison between Non-Agile and Agile Project, Three stages of Agile Project, Estimation, Scope Management, Roles and Responsibilities, Scheduling and Tracking. **(Chapter - 5)**

Unit VI Staffing in Software Projects

Managing People, Organizational behaviour, Best methods of Staff Selection, Motivation, The Oldham, Hackman job characteristic Model, Stress, Health and Safety, Ethical and Professional concerns, Working in Teams, Decision Making, Organizational structures, Dispersed and Virtual Teams, Communications Genres, Communication Plans. **(Chapter - 6)**

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UNIT- I

1

Introduction to Software Project Management

Syllabus

Project Definition, Project versus Flow type work, Project Lifecycle, Processes and Knowledge Areas in Project Management (PM), Build or Buy decision, Work Breakdown Structure (WBS) and its types, Introduction to PMBOK, Program and Portfolio Management.

Contents

- 1.1 *Software Project*
- 1.2 *Software Projects Versus Other Types of Project*
- 1.3 *Project Life Cycle*
- 1.4 *Processes and Knowledge Areas in Project Management*
- 1.5 *Build or Buy Decision*
- 1.6 *Work Breakdown Structure*
- 1.7 *Project Management Body of Knowledge*
- 1.8 *Program and Portfolio Management*
- 1.9 *Multiple Choice Questions*

1.1 Software Project

A software project is the entire process of software development, from requirement collecting to testing and maintenance, that is carried out in a specific time frame to produce the desired software product, according to the execution techniques.

1.1.1 Need of Software Project Management

Software is often referred to as an intangible asset. Software development is a relatively young field in the world of business, with little expertise in the creation of software products. The majority of software solutions are developed to order in order to meet the specific needs of the client.

The most crucial is that the underlying technology evolves and changes at such a rapid pace that experience gained from one product may not be applicable to another. All of these commercial and environmental restrictions put software development at risk, thus it's critical to manage software projects effectively.

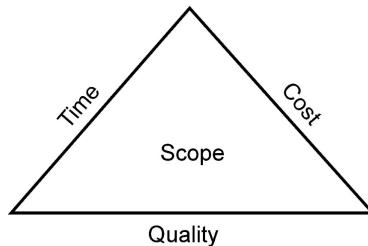


Fig. 1.1.1 Software project constraints

For software projects, the Fig. 1.1.1 depicts triple limitations. It is an important component of software development to create a high-quality product while staying within the price constraints of the client and completing the project on time. This triple constraint triangle may be influenced by a number of internal and external factors. Any one of three factors can have a significant impact on the other two. As a result, software project management is critical for incorporating user needs as well as budget and time restrictions.

1.1.2 Project

Project is a precise design or plan, a well-planned project, a significant undertaking .

The focus on planning suggests that we can figure out how to complete a task before we begin. However, this may be challenging in exploratory projects. Even with uncertain tasks, planning entails thinking hard about something before doing it, and as long as the

resulting plans are viewed as provisional, this is worthwhile. Other tasks, such as routine maintenance, will have been completed so many times that everyone is familiar with the procedure. Planning appears to be unnecessary in these situations, while processes may be written to guarantee consistency and to assist newcomers.

The activities that gain the most from traditional project management are likely to fall somewhere in the middle shown in the Fig. 1.1.2.

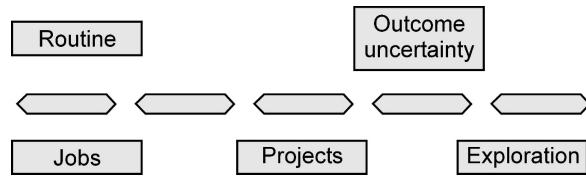


Fig. 1.1.2 Project management activities that are most likely to benefit

The line between a non-routine project and a routine job is blurry. It will feel like a project the first time we conduct a routine task. A project to construct a system similar to past ones that we have developed, on the other hand, will include a significant element of routine. The characteristics listed below distinguish projects.

1. Tasks that are not routine are involved.
2. Preparation is required
3. Certain goals must be accomplished or a specific product must be generated
4. The project has a deadline
5. Work is performed for someone other than yourself
6. Work entails multiple specialties
7. To complete the assignment, people are organized into a temporary work group.
8. The work is carried out in stages.
9. The amount of resources accessible for usage on the project is limited.
10. It's a big or complicated project.

The more of these elements that apply to an activity, the more complex it becomes. The magnitude of the project is extremely essential. Because of the requirement for additional coordination, a project with 20 developers is likely to be disproportionately more challenging than one with only ten.

Review Questions

1. *What is project?*
2. *What is the need for software project management?*

1.2 Software Projects versus other Types of Project

Any project management principles that apply to general projects also apply to software projects, however Fred Brooks recognized specific peculiarities of software projects that make them particularly challenging.

Invisibility : The progress of a physical item, such as a bridge, can be observed. Progress in software isn't always apparent. The process of making the unseen visible can be viewed as software project management.

Complexity : Software goods are more sophisticated than other constructed artefacts for every dollar, pound, or euro spent.

Conformity : Any project management principles that apply to general projects also apply to software projects, however Fred Brooks recognized specific peculiarities of software projects that make them particularly challenging. Individuals aren't the only ones who can be unreliable. Organizations can display significant organizational stupidity as a result of gaps in collective memory, internal communication, or effective decision making.

Flexibility : It is considered a strength that software is simple to change. When a software system interacts with a physical or organizational system, the software is expected to adjust to accommodate the other components rather than the other way around. As a result, software systems are especially vulnerable to change.

1.2.1 Project Versus Flow Type Work

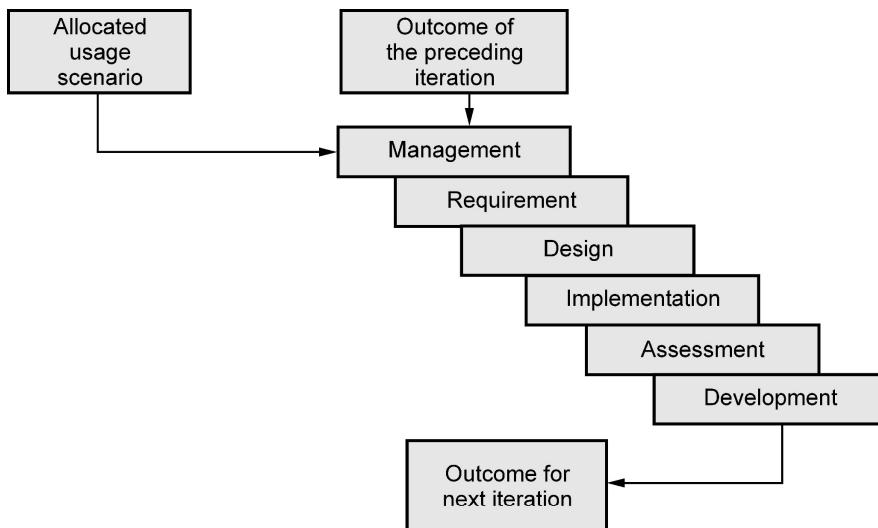
Workflow : In general, workflow refers to a set of tasks that are completed in a specific order to reach a specific purpose. Input, transformation, and output are the three parameters that define each process phase. A set of actions are carried out in a workflow process in order to attain a business goal.

Software process workflows : The software process workflows lead the software development in a linear method by completing a series of sequential tasks, and the software process workflows are the set of connected actions that are completed to get a software product as an end shown in Fig. 1.2.1.

In software project management, there are top 7 software process workflows :

1. **Management workflow :** In the management workflow, several of the critical steps of the controlling process are completed. Software Development Plan (SDP), business case, vision, and other artefacts are among them.

In terms of developing, executing, and deploying software projects, ensuring a win-win situation for all stakeholders.

**Fig. 1.2.1 Iteration workflows**

2. **Environment workflow :** Using workflow to automate the process of coordinating and integrating tools and people with the process, which lowers human errors and allows for faster development, resource allocation, and response to concerns. The environment for maintaining and updating software is changing.
3. **Requirements workflow :** Analyzing the problem space in order to discover a solution and identify/understand the challenges. Evolving requirement artefacts such as use cases, requirements, and design documents/specifications that aid in the description of software's purpose, architecture, and design.
4. **Design workflow :** Software modeling is used to express the software design, with program modeling covering the complete software design. Architecture and design artefacts are evolving.
5. **Implementation workflow :** The components are programmed in this procedure to put the designs and architectures into action. Artifacts for implantation and deployment are also evolving.
6. **Assessment workflow :** Observing and evaluating process trends. Here, product quality is assessed by looking at the product's quality attributes as well as defect management.
7. **Deployment workflow :** The process of delivering final products to users or preparing the software application/product to run and operate in a certain environment is carried out in this workflow.

Project versus flow type work :

Project	Workflow project
A project is a collection of tasks that must be completed in order to achieve a specific outcome.	The term “workflow” refers to the sequence of steps required to perform a task, as well as how you move between them.
Software projects are planned, implemented, monitored and controlled as part of project management.	The practice of organizing tasks and activities between critical milestones into an efficient and meaningful sequence is known as project management workflow.
Examples : <ol style="list-style-type: none"> 1. Monitoring of Android tasks. 2. Sentiment analysis is used to rate products. 3. ATM system based on fingerprints. 4. Employee management system with advanced features. 5. The AES algorithm is used to encrypt images. 6. Voting system based on fingerprints. 7. System for predicting the weather. 8. Local train ticketing system for Android. 	Examples : <ol style="list-style-type: none"> 1. Workflows for Vacation Requests. 2. Workflow for Document Approvals. 3. Workflow for Purchases Orders. 4. Workflows for Expense Claim Requests.

Review Questions

1. *What is software process workflows?*
2. *Differentiate between software projects versus other types of project.*

1.3 Project Life Cycle

The project life cycle is a set of activities that must be completed in order for project objectives or targets to be met. Projects may differ in size and difficulty, but regardless of size, whether huge or small, all projects may be mapped to the specified lifecycle framework.

A project's origin and end are defined by the project life cycle. When a company discovers a business opportunity to which it wants to respond, it may frequently commission a requirements assessment and/or a feasibility study to determine whether or not to proceed with a project. The feasibility study will be handled as the initial project phase or as a separate, standalone project, depending on the project life-cycle definition.

The project life-cycle definition will also determine which transitional actions are included and which are excluded at the start and end of the project. In this way, the project life-cycle definition can be utilized to connect the project to the performing organization's ongoing operations. A project's origin and end are defined by the project life cycle. When a company discovers a business opportunity to which it wants to respond, it may frequently commission a requirements assessment and/or a feasibility study to determine whether or not to proceed with a project. When the risks involved are deemed acceptable, a future phase is occasionally started prior to acceptance of the previous phase deliverables. Fast tracking is a term used to describe the practice of overlapping phases.

In general, project life cycles are defined as follows :

- What technical work should be completed in each step (for example, is the architect's work part of the definition phase or the execution phase?).
- Who should be involved in each phase (for example, implementers who need to know about requirements and design).

The descriptions of the project life cycle might be very vague or very specific. To give organization and uniformity, highly thorough explanations may include several forms, charts, and checklists. Project management methodologies are typically used to describe such specific approaches.

The majority of project life-cycle descriptions have a few elements in common :

- Costs and staffing levels are modest at the beginning, rise toward the end, and then rapidly decline as the project progresses. Fig. 1.3.1 illustrates this arrangement.
- At the outset of the project, the probability of successfully finishing the project is lowest, and hence risk and uncertainty are highest. As the project progresses, the chances of it being completed successfully tend to increase.

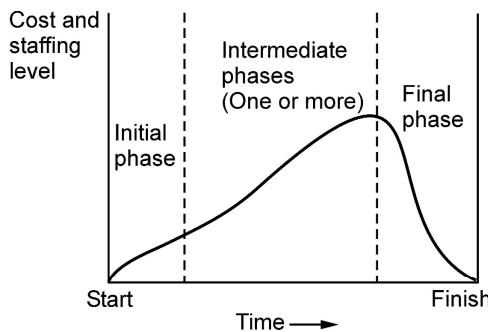


Fig. 1.3.1 Generic life cycle

- The ability of stakeholders to affect the final qualities of the project's product and the project's final cost is greatest at the beginning and decreases as the project progresses. The cost of adjustments and error correction often rises as the project progresses, which contributes to this occurrence.
- It's important to keep the project life cycle separate from the product life cycle. A project to bring a new desktop computer to market, for example, is only one phase or stage of the product life cycle.
- Despite the fact that many project life cycles have similar phase names and demand similar deliverables, few are exactly the same. The majority of them contain four or five phases, but some have as many as nine. There can be substantial differences even within a same application area—one organization's software development life cycle may have a single design phase, while another's has separate functional and detail design phases.
- Within a project, subprojects may have their own project life cycles. When an architectural firm is engaged to design a new office building, for example, it is first involved in the owner's definition phase when doing the design and then in the owner's implementation phase when assisting with the construction effort.
- The architect's design project, on the other hand, will go through its own set of stages, from conceptualization through definition and implementation to completion. The architect may even approach the facility design and construction support as different projects with discrete phases.

The project life cycle is made up of five project management stages : initiation, planning, execution, monitoring and control and closure.

1. **Initiation** : This is the first stage of the project, and the project manager must demonstrate that the project is worthwhile and practicable. This comprises developing a business case to justify the project's need and a feasibility study to show that it can be completed in a fair amount of time and money.

After that, a project charter is prepared, which is a document that explains what the project will deliver. A project brief accomplishes the same thing. The fundamental distinction is that a project charter adheres to the PMBOK framework, but a project brief adheres to the PRINCE2 methodology.

This stage of project management culminates in a project launch meeting, where the team, stakeholders, and other interested parties gather to lay out the project's goals, timetable, methods, and communication chain.

2. **Project planning** : Following project approval, the project enters the second phase

of project management : project planning. The purpose of this phase is to create a project plan that will serve as a guide for the following two phases. Every aspect of the project's execution, including expenses, risks, resources, and deadline, must be included in the project plan.

Using a work breakdown structure, the project scope (the work required to accomplish the project) is established during this phase (WBS). The WBS divides the project into activities, milestones, and deliverables, allowing project managers to construct timetables and assign work to their team members with ease.

Gantt chart software, which provides a visual depiction of the complete project, is frequently used by project managers to put out their project plan. This serves as a road map for the work till the project is completed.

3. **Project execution :** The third project management phase is project execution, which involves completing the tasks and milestones indicated in the plan to generate the deliverable to the satisfaction of the customer or stakeholder.

The project manager will reallocate resources as needed along the route to keep the team operating. They will also identify and reduce risks, resolve issues, and incorporate any modifications.

4. **Project monitoring and control :** Project monitoring and control, the fourth project management phase, occurs concurrently with the project execution phase. It entails keeping track of the project's development and performance to guarantee that it stays on track and within budget. To ensure quality assurance, quality control processes are used.

The three most important constraints in a project are time, money, and scope, which are generally referred to as the triple constraint. The main purpose of this phase is to establish tight project controls to ensure that those three criteria do not deviate from the original plan.

5. **Project closure :** Project closure is the fifth project management phase, which involves presenting the final deliverables to the client or stakeholder. Resources are released, documentation is done, and everything is signed off on once they have been approved. The project manager and team can now hold a post-mortem to review the project's lessons learnt.

The closure phase may include passing over control to a different team, such as an operations management team, depending on the project. In this instance, it is the project manager's responsibility to guarantee a smooth handover.

Project monitoring and control, the fourth project management phase, occurs

concurrently with the project execution phase. It entails keeping track of the project's development and performance to guarantee that it stays on track and within budget. To ensure quality assurance, quality control processes are used. Then, in the format that works best for us, whether it's a Gantt chart, a Sheet, or a kanban board, make a schedule. After created our plan and established a baseline, use our customized project dashboard to track variations in real time. Create filtered reports to show exactly what we need in just a few clicks when we are ready to share information with stakeholders.

Review Questions

1. *What challenges do you believe the project manager will face at each stage of the project life cycle?*
2. *What are the different phases of project cycle?*

1.4 Processes and Knowledge Areas in Project Management

The project management process groups are concerned with the scope of the project's definition, organisation, and management.

Project Management Processes (Process Groups)

Project management process groups are a logical classification of tasks that are organized in a system to carry out projects. Project management process groups and knowledge domains are terminologies and recommendations developed by the Project Management Institute to assist us in successfully managing our project.

Project Management Processes	Project Management Knowledge
Initiating	Integration Management
Planning	Scope Management
Executing	Schedule Management
Monitoring and Controlling	Cost Management
Closing	Quality Management
	Resource Management
	Communications Management

	Risk Management
	Procurement Management
	Stakeholder Management

Table 1.4.1 Processes and knowledge

Project management is divided into five processes, according to the PMBOK Guide.

1. Initiating
2. Planning
3. Executing
4. Monitoring and Controlling
5. Closing

During the planning stage, a project proposal will be evaluated in terms of its benefits and revenues for the stakeholders. The project charter must be developed and approved as part of the starting procedure.

The project management plan, which aids in the execution of project activities, is created as part of the planning phase. During the planning phase, the project's timeline, budget, and resources are defined.

The physical project deliverables will be constructed and provided to the client during the executing phase, which is usually the longest in the project life cycle. Do the actual work and spend the majority of our time and money during the execution process.

Project management teams will compare and report the planned and actual status of the project during the monitoring and controlling phase. Project managers will make adjustments during this phase to keep the project on track. It's a never-ending process that occurs throughout the project's life cycle.

After all of the scope of work and project management processes have been completed, the closure phase begins. The closure process is a formal procedure that includes the parties' formal agreement on the project's completion. Complete all procurement contracts and keep track of the lessons learnt throughout the process.

As we can see in the diagram above, all of the process groups are arranged in a logical manner. To complete the project successfully, all five process groups are required: initiating, planning, executing, monitoring and controlling, and closing.

Despite the fact that project types and project management techniques differ by industry, the aforementioned project management phases are common to practically all projects.

Project management knowledge areas :

For successful project management, the PMBOK Guide defines ten knowledge domains. These project management knowledge domains breathe life into the project and ensure that it achieves its goals.

1. Integration Management
2. Scope Management
3. Schedule Management
4. Cost Management
5. Quality Management
6. Resource Management
7. Communications Management
8. Risk Management
9. Procurement Management
10. Stakeholder Management

- **Integration management :** By adding crucial papers such as a project charter, project integration management seeks to keep the entire project together. The project charter establishes the project and names the project manager.
- A project management plan, which is one of the most significant documents in this field, establishes the project's roadmap to guide all parties involved. The goal of project integration management is to run and manage the project work.
- **Scope management :** The scope refers to the work that needs to be done in order to accomplish the project. In order to establish the scope, gather the requirements and specify the final product's features in a scope statement. A crucial step in this area is to create the WBS (Work Breakdown Structure), which divides the project work into smaller, more manageable portions.
- Accepting deliverables and validating the scope during the project are examples of monitoring and regulating the scope process.
- **Project time management :** Each project has a start and finish date. Any process requires time as an input. Activities are detailed under each WBS level once the WBS (Work Breakdown Structure) is constructed. There are start and finish dates

for each activity, as well as resources and a budget.

- The plan schedule management process entails determining the activities and task lists for the project schedule. To describe the workflow, logical links and relationships between the operations are defined.
- Following the creation of the timetable, the following stage is to estimate and assign resources. At this point, each resource's working calendar should be specified.
- Finally, the critical route should be determined, and the float for each task should be examined to ensure that the schedule is well-constructed.

Following the creation of the schedule, the monitoring and controlling phase begins, during which we calculate earned value to understand the schedule's success.

- **Cost management :** To ensure that the finances cover the scope of the project, the project cost management area comprises developing, monitoring, managing, and reporting the project budget. It's critical to keep stakeholders and the project sponsor informed about the budget in order to get their support when it's needed.

Determine how to set the project budget and how to regulate it during the plan cost management process. The cost of each task should be assessed in detail for an effective budget by estimating the quantities of resources such as material, manpower, and equipment.

- Once we have added up all of the task prices, we will arrive at the project budget. Then there's the need to keep those costs under control via an earned value analysis. This is done on a frequent basis throughout the project to ensure that the predicted costs match the actual costs. After we have finished the project budget, move on to the monitoring and controlling phase, where we will use earned value calculations to determine cost overruns.
- **Quality management :** A project cannot be completed until the quality requirements are met. Plan quality management plays a significant role in the overall project management strategy.

Quality assurance activity is included in Project Quality Management to guarantee that quality standards are met. The project's deliverables should be inspected to verify that the quality is maintained.

As a result, in order to maintain quality, the deliverables must be examined to ensure that the quality management plan's standards are being followed.

- **Resource management :** A project cannot be completed without efficiently managing the project's resources. Human resources management is in charge of forming the project team and overseeing their progress. A human resource

management strategy that describes the duties and responsibilities of the positions is prepared to help with the processes.

We begin by hiring team members after establishing the role of each position. We can assemble a team from different initiatives both inside and outside the company.

Managing a team is a continuous activity that involves monitoring and controlling their performance as well as resolving inter-team disagreements.

Communications management : Project communications management is one of the most crucial aspects of any project's success. Within a project, communication refers to the exchange of information in various formats between the team and stakeholders.

The requirement to plan communications management is a vital phase in any project because it informs the team and stakeholders.

The communications management plan, which is the result of the planning communications process, determines how the parties will communicate. The goal of communication monitoring and control is to evaluate the process and make improvements as needed.

- **Risk management :** The goal of developing a risk management plan is to identify, categorise, and prioritise project risks that may exist during the project's life cycle.

Following the identification and classification of project risks, risk analysis is carried out. It is carried out in order to build risk management strategies.

Analyzing the risk register and evaluating risks to determine their possible implications on the project are all part of risk monitoring and control.

- **Procurement management :** Project procurement management encompasses efforts to buy commodities, services, and subcontractors in order to complete the project successfully. Procurement activities have an impact on the project's budget and timeline.

Determine the project's outside requirements and subcontractor involvement during the planning procurement management phase.

While hiring subcontractors, project procurement management comprises defining the statement of work, terms of reference, and request for quotations.

- **Stakeholder management :** Projects are carried out in order to meet the needs of stakeholders. As a result, they must be delighted with the project's results. As a result, stakeholders must be actively identified, examined, and managed in order to comprehend their issues.

Plan stakeholder management, which includes prioritising and categorising stakeholders based on their impact in order to effectively engage them throughout the project's life cycle. Stakeholder participation and expectations are the emphasis of the control stakeholder management approach.

These 10 project management knowledge categories help to organise and classify the knowledge and abilities needed for a certain project management specialisation. Processes and tasks are categorised into categories. It's easier to understand and recognise many project management procedures and duties by classifying them into a few categories.

The knowledge categories are divided into process groups based on the subject's similarities. These ten knowledge topics are structured in the PMBOK Guide and in most of the reference materials for the PMP certification test.

We will have a better understanding of project management processes and knowledge domains if we read both of them.

Review Questions

1. Explain the different areas of knowledge in project management.
2. Write a short note on process groups.

1.5 Build or Buy Decision

The creation of software can be viewed from two perspectives : that of the developers and that of the clients or users. The developers and users are both in the same organisation with in-house development. They are in different organisations where development is outsourced. Various organisations could be on different continents in these days of global system development. These elements will have an impact on how a project is organised.

The creation of a new IT application within a company frequently necessitates the hiring of technical personnel who will be redundant once the project is completed. Because this is a brand-new initiative for the customer, there may be a shortage of executives competent to lead the effort. In these circumstances, outsourcing the project to an outside IT development firm may be appealing. The contracting firm will have technical and project experience that the client will not have. However, the client would still have to put in a significant amount of effort to set up and monitor the contract.

Software development is still involved, whether it is done in-house or outsourced. Obtaining a licence to operate off-the-shelf software, as in the case of the Brightmouth

College payroll situation, is an increasingly popular option. The following are some of the benefits of such an approach:

1. The provider or application can spread the development costs across a large number of customers, lowering the cost per customer.
2. The software is already in existence, so it may be reviewed and possibly even trialled prior to purchase.

There is no downtime while the software is being developed.

3. Where a large number of people have already used the software, the majority of defects will have been reported and fixed, resulting in more reliable software.

However, there are certain drawbacks, including the following:

1. There is no competitive advantage because we use the same programme as everyone else.
2. Modern off-the-shelf software is often highly adjustable, with many parameter tables allowing users to alter the application's properties. However, this flexibility has its limits, and we may need to alter our office operations to work with the computer system.
3. The software code will not be ours. This may preclude the application from being modified in response to changes in the organisation or its surroundings.
4. Once we've purchased an off-the-shelf system, our company may become overly reliant on it. This could be a significant impediment to switching to a different application. Because we are basically a captive customer, the supplier may be able to negotiate higher licence payments.

Review Question

1. *In software project management, is it better to build than buy?*

1.6 Work Breakdown Structure

The success of a software project depends on a suitable work breakdown structure and its alignment with the process framework. Despite the fact that the concept and practice of employing a WBS are widely established, the published literature typically avoids this topic.

This is due to the fact that the creation of a work breakdown structure is influenced by factors such as project management style, company culture, customer preferences, financial restrictions, and a variety of other difficult-to-define project-specific parameters.

Background material on software-oriented work breakdown structures can be found in Software Engineering Economics [Boehm, 1981].

A work breakdown structure (WBS) is a set of pieces that breaks down a project plan into distinct work assignments. The information structure of a WBS is as follows:

- A list of all notable projects
- A clear task breakdown for responsibility assignment
- A framework for planning, budgeting, and tracking expenditures

Whether the software is the entire project or only one component of a bigger system, this section focuses on software WBS aspects.

The Work Breakdown Structure (WBS) is a tree structure that depicts the division of effort needed to accomplish a goal, such as a program, project, or contract. Hardware, product, service, or process-oriented WBSs are all possibilities. Breakdown structures, often known as tree diagrams, are commonly employed in project management when displaying parent-child relationships is required. Work Breakdown Structure (WBS), Resource Breakdown Structure (RBS), Risk Breakdown Structure (RBS), and Organization Breakdown Structure (OBS), often known as Organization Chart, are all examples of breakdown structures used as project management tools.

Starting with the ultimate goal, a WBS can be created by breaking it down into manageable components based on size, length, and responsibility (e.g., systems, subsystems, components, tasks, subtasks, and work packages), which comprise all actions required to meet the goal. The Work Breakdown Structure is the foundation for dividing work into definable increments from which the statement of work can be developed and technical, schedule, cost, and labor hour reporting can be established. It is the basis for dividing work into definable increments from which the statement of work can be developed and technical, schedule, cost, and labor hour reporting can be established.

Here are some pointers for creating a Work Breakdown Structure that effectively expresses work :

- Always use verb form to express Work Breakdown Structure activities at the lowest levels of granularity.
- Examine the Work Breakdown Structure (WBS). Ascertain that the works outlined in the Work Breakdown Structure have fully covered all deliverables.
- Ascertain that testing and training have been considered.
- Ensure that non-IT work packages, such as documentation and review activities, are represented in the framework.

- Other supporting activities, such as product/service launch and implementation activities, should be scheduled.
- Make certain that delivery approval cycles are taken into consideration.
- On the project, include project management deliverables as well (e.g. production of Project Plan). Include any deliverables that the customer or any other parties must meet or deliver. Check the Work Breakdown Structure for any activities that need to be included in the Work Breakdown Structure against the project methodology provided in the Project Charter.

In general, there are three common approaches to structure works using a Work Breakdown Structure (WBS). Phase-based structures, deliverable-based structures, and responsibility-based structures are only a few examples.

Phase-based structures

Using the project phases as a guide, define and structure project activities.

Deliverable-based structures

Define and structure project activities in accordance with the agreed-upon deliverables.

Responsibility-based structure

Define and structure project activities in accordance with the agreed-upon deliverables.

Breakdown Structure in Other Situations

Resource Breakdown Structure

The Resource Breakdown Structure (RBS) is a project management tool that provides a hierarchical decomposition of resources, which can be organized by resource category, kind, or IT/business function.

Here are some resource kinds to consider.

- Customer Support : The type of customer and the type of project support required.
- Resources : The resources necessary for the project (e.g. conference room, data center)
- Describe the hardware that will be required for the project (e.g. printer, scanner).
- Software Tools : Describe the project's software requirements (e.g. Visual Paradigm)

Risk Breakdown Structure

In any IT project, risks are crucial. Risk has a detrimental impact on the project's time, price, and quality. In project management, the Project Manager is in charge of risk management and ensuring that the project is delivered on time, on budget, and to the standard user's expectations. The Risk Breakdown Structure is a prominent risk management technique.

Breakdown of the risk The hierarchical breakdown of risks begins with the root node element, which symbolizes the project, and moves down to the numerous risk categories, and then finer level risks.

It is feasible to combine the usage of a Color Legend in illustrating the impact of risk with the presentation of project risks in a Risk Breakdown Structure. In the Risk Breakdown Structure example below, a five-item Impact legend has been built up, indicating the five levels of affects that risks may have on the project with five different color codes.

We can structure risks using a variety of Risk Management Tools. We might also utilize the Cause and Effect Diagram in addition to the Risk Breakdown Structure (also known as Fishbone Diagram).

Organizational Breakdown Structure

Organizational Disintegration Structure, often known as an Organization Chart, is a common project management tool for displaying project organization. It usually starts with the project sponsor and includes all essential stakeholders. Consider the organization or group that is requesting the project, as well as their level of sponsorship and authority, when proposing the organization structure.

Tree Structure View

A breakdown structure is visualized in the tree structure view. It is the most popular and simple-to-understand of the numerous points of view.

Evolutionary Work Breakdown Structures

The planning elements in an evolving WBS should be organized around the process framework rather than the product framework. This method better accommodates projected changes in the evolving plan and provides for a more clear evolution of planning fidelity. The main suggestion for the WBS hierarchy is to organize it as follows :

- Workflows are the first-level WBS elements (management, environment, requirements, design, implementation, assessment, and deployment). These

components are normally assigned to a single team and serve as the project's anatomy for planning and comparison with other initiatives.

- Each phase of the life cycle contains its own set of second-level elements (inception, elaboration, construction, and transition). These features allow the plan's fidelity to grow in lockstep with the amount of understanding of the requirements and architecture, as well as the risks they entail.
- The emphasis of actions that produce each phase's artefacts is established at the third level. These elements may be the lowest level in the hierarchy, collecting the cost of a discrete artefact for a certain phase, or they may be further decomposed into numerous lower level activities that, when combined, generate a single artefact.

Different WBS Types

Deliverable-based and phase-based WBSs are the two most common forms. A deliverable-based WBS shows the project's deliverables and scope on top, while a phase-based WBS shows the project's five phases on the bottom (initiation, planning, execution, control and closeout).

There are a few sorts of work breakdown structures that aren't common :

- **Verb-oriented WBS:** The deliverables are defined in terms of actions in a verb-oriented WBS.
- **A noun-oriented WBS :** Work is defined in terms of components in a noun-oriented WBS (this is also called a product breakdown structure).
- **A time-phased WBS :** For long-term projects, a time-phased WBS divides the project into phases.

Clearly, a job breakdown structure is a versatile instrument. A simple numbered list (often known as an outline view), a rudimentary tree diagram, or even a Gantt chart can all be used. When a Gantt chart is part of a broader project management tool, the Work Breakdown Structure (WBS) can be used to plan, assign, monitor, and track our team's work.

Review Questions

1. *What are the different types of WBS?*
2. *Explain in detail work breakdown structure.*

1.7 Project Management Body of Knowledge

Introduction

We, as humans, demand direction and guidance for every new thing we plan or begin to accomplish, and we do not compromise on the authenticity of the material we select for our education. So, it's fantastic news for students, project managers, and anyone else who wants to learn about project management. They can get help from the Project Management Body of Knowledge (PMBOK). It's a broad term that refers to the body of knowledge in the field of project management. And one of the benefits of PMBOK is that the knowledge of proven, traditional, as well as advanced methods contained in it is now extensively used in the twenty-first century, whereas it was previously only used in a restricted capacity.

It is distinct from other professions like as accounting, law, and medicine, in which practitioners and academics both hold, advance, and apply relevant information. This may appear to be comparable to the structure of PRINCE 2, but such a comparison would be misleading, as the PMBOK covers process components at a far higher and abstract level.

Purpose of PMBOK

The overarching goal of this body of knowledge is to define the component of the PMBOK that is widely accepted and applicable to practically all projects in today's world, and there is general agreement on their utility and value. But it's important to realize that just because it's applicable to all projects doesn't mean the PMBOK's methods and knowledge can be used universally.

The project manager and the entire team are responsible for determining the best practices for each project.

Project managers and their teams, project customers and other stakeholders, higher managers of projects, other functional managers, instructors who teach project management, consultants, trainers, and practitioners of project management can use this body of knowledge as a reference because it is also designed to establish a unified language among the project management profession.

The PMBOK is divided into two components.

- 1. Project management framework :** This section lays out the foundation for a better understanding of project management.

2. Knowledge areas of project management : The project management knowledge domains define project management techniques and expertise in terms of the processes involved.

The Project Management Body of Knowledge (PMBOK) is an attempt to define such a body of knowledge for project managers roles and responsibilities. Clearly, this is a massive undertaking, and the PMI has attempted to make it more manageable by attempting only that subset of it that is widely accepted. However, even with this limitation, the potential scope is vast, and the fact that the document cannot hope to be all-inclusive is reflected in the word 'guide' in the title.

The PMI set out to create the PMBOK with the following goals in mind :

- determine the most widely accepted project management practices;
- create a basic reference guide;
- create a glossary of terminology;
- serve as a foundation for training and certification.

As a result, the compilers of the body of knowledge had to draw the body of 'project management' with caution. On the one hand, there are broad management concepts and practices, some of which impact projects and others which do not. Other parts of project management, on the other hand, are exclusively applicable to certain technical applications. Software project management is an example of this, where certain content is unique to software development, such as the usage of function points for effort estimation.

The PMBOK starts with a definition of a project as "a temporary endeavor undertaken to create a unique product or service," and a definition of project management as "the application of knowledge, skills, tools, and techniques to project activities in order to meet or exceed stakeholder needs and expectations."

As indicated in Table 1.7.1, the PMBOK is divided into nine core knowledge areas, each of which has its own subdivisions.

Section	Subsection
Project integration management	Project plan development
	Project plan execution
	Overall change control

Project scope management	Initiation
	Scope planning
	Scope definition
	Scope verification
	Scope change control
Project time management	Activity definition
	Activity sequencing
	Activity duration estimating
	Schedule development
	Schedule control
Project cost management	Resource planning
	Cost estimating
	Cost budgeting
Project quality management	Quality planning
	Quality assurance
	Quality control
Project human resource management	Organizational planning
	Staff acquisition
	Team development
Project communication management	Communications planning
	Performance reporting

	Administrative cloture
Project risk management	Risk identification
	Solicitation planning
	Solicitation
	Source selection
	Contract administration
	Contract close-out

Table 1.7.1 Knowledge areas and its subdivisions

In the PMBOK, the problem is addressed by specifying a set of processes for each project phase. A 'process' is described as "a set of acts that results in a result." Initiating, planning, executing, controlling, and closing are the five process groups that have been identified.

There are core processes in each group. These are frequently interconnected, with the product of one process feeding into the input of others. There are a number of supporting activities (or facilitating processes in PMBOK terminology) such as quality planning and risk identification, which are similar to most of the methodologies covered in earlier appendices.

For each and every one of the steps. Inputs, techniques that can be employed, and outputs are all defined in the PMBOK.

This may appear to be comparable to the structure of PRINCE 2, but such a comparison would be misleading, as the PMBOK covers process components at a far higher and abstract level.

Review Questions

1. Briefly explain PMBOK.
2. What are the different PMBOK knowledge area? Explain its subdivisions in detail.

1.8 Program and Portfolio Management

Program managers are primarily in charge of budgeting and risk management, but solely at the program level. Project portfolio managers must consider the budget and risk of various initiatives, as well as future projects and corporate objectives.

The following is the best way to describe the relationship between project, program, and portfolio management:

A **project** is a short-term undertaking undertaken by a business or organization (such as the creation of a new product, service, or result).

A **program** is a collection of projects that are similar or related to one another and are frequently handled and coordinated as a group rather than individually.

A **portfolio** is a collection of initiatives and/or projects inside a single organization that may or may not be related to one another.

To put it another way, projects are part of broader programs, which are part of portfolios.

Program Management

- The Project Management Institute (PMI) defines program management as "a group of connected projects handled in a coordinated manner to obtain benefits not accessible when managed separately." "Effective program management provides a method for controlling the strategic, financial, and operational risks of significant endeavors," they go on to state.
- There are a few different ways to watch program. First and foremost, they are a collection of projects aimed at achieving the same or similar business goals. They are a collection of connected initiatives that must be brought together in order to reach a common aim.
- Although the projects within a program may be diverse, assigned to various teams, and supervised by different project managers, they all strive to achieve the same strategic goal. For example, there could be numerous projects running simultaneously but with interdependencies, all with the same aim of lowering customer churn.
- However, program management is much more than a collection of comparable tasks. The goal of program management is to facilitate strategy execution by bringing people and teams from different departments together to work towards a common goal.
- Effective program management balances and optimizes people and funds across

initiatives, allowing the organization to select and fund the most valuable activities.

- Program management is concerned with strategic planning, continuous improvement, and value realization, whereas project management is more concerned with individual project tasks and deadlines. Program management ensures that projects are better linked to company strategy and that resources are utilized across the organization with the least amount of conflicts that might create delays or budget concerns.
- Roadmaps are one of the most successful program management tools for converting vision into strategic strategies. Roadmaps provide a visual representation of program schedules, milestones, and releases, allowing managers to defend decisions and convey the strategy to the rest of the company.
- Programs may have transformational strategic business objectives that span departments or business entities. The translation of strategic objectives into measurable business outcomes, as well as the integration of numerous associated projects required for the outcome to be accomplished, is what program management is all about.

Portfolio Management

Project portfolio management is the process of managing a project portfolio in order to maximize the contribution of projects to the enterprise's overall well-being and success.

Now that businesses have recognized the value of projects and project management, the next natural step is for PPM to be recognized. However, thinking of PPM as solely an extension of project management is a huge mistake. These two crucial functions are not at all similar. As more companies embrace project management central office or project management office (PMO) approaches, I don't think it'll be long before the chief project officer is totally responsible for PPM (CPO). This, too, would be a miscalculation.

Portfolio management, according to PMI, "is a means of bridging the gap between strategy and implementation." Rather of focusing on a single project, portfolio management evaluates the potential of each project or future project to meet corporate objectives. Portfolio management's goal is to strike a good balance between the implementation of change initiatives and the potential return on investment. It focuses on issues such as:

1. Do I have the resources and funding in place to start a new project?
2. Can you think of any additional projects that could be modeled?
3. Do you have any ongoing projects that might conflict with this new project?

4. Do we need to change the expectations of stakeholders?
5. Is this project in line with our company's goals?

Organizations that use effective portfolio management are able to foresee outcomes and plan for projects that will yield the best results. Portfolio management produces a unified strategic plan that drives transformation projects and streamlines decision-making across technology, work, and resources.

Project Portfolio Management

A project portfolio is a collection of initiatives that an organization is working on.

Project Portfolio Management (PPM) is a systematic approach to coordinate, priorities, and assess the potential value from a set of projects that is normally a function of the PMO team. The discovery, prioritization, authorization, and management of projects within a portfolio are all centralized in a project portfolio management organization.

Review Questions

1. *What is the difference between project management and portfolio management?*
2. *What is portfolio management?*

1.9 Multiple Choice Questions

Q.1 Project management entails a variety of tasks _____.

- | | |
|--|--|
| <input type="checkbox"/> a) project planning | <input type="checkbox"/> b) project monitoring |
| <input type="checkbox"/> c) project control | <input type="checkbox"/> d) all of the above |

Q.2 After the feasibility study and before the requirement analysis and specification phase, which of the following activity is performed ?

- | | |
|--|--|
| <input type="checkbox"/> a) Project planning | <input type="checkbox"/> b) Project monitoring |
| <input type="checkbox"/> c) Project control | <input type="checkbox"/> d) Project scheduling |

Q.3 _____ an action that begins once the development activities begin.

- | | |
|---|--|
| <input type="checkbox"/> a) Project planning | <input type="checkbox"/> b) Project monitoring and control |
| <input type="checkbox"/> c) Project size estimation | <input type="checkbox"/> d) Project cost estimation |

Q.4 Which of the following activities does not fall within the project planning ?

- | | |
|--|--|
| <input type="checkbox"/> a) Project estimation | <input type="checkbox"/> b) Project scheduling |
| <input type="checkbox"/> c) Project monitoring | <input type="checkbox"/> d) Risk management |

Q.5 The application of information, skills, tools, and procedures to project activities in order to achieve project requirements is known as project management.

- a True b False

Q.6 A _____ is the entire process of software development

- a Software project b Planning
 c Monitoring d Management

Q.7 The objective of effective software project management is _____

- a people, performance, payoff, product
 b people, product, performance, payoff
 c people, performance, process, project
 d people, process, payoff, product

Q.8 _____ refers to a set of tasks that are completed in a specific order to reach a specific purpose.

- a Project b Workflow
 c Process d Actions

Q.9 In software project management, there are top _____ software process workflows

- a 8 b 9
 c 7 d 5

Q.10 What is the first stage in developing a project plan ?

- a Establish the objectives and scope. b Determine the budget.
 c Select the team organizational model. d Determine project constraints.

Q.11 The sequence of activities required to finish the project is represented by a _____

- a work break down structure b scope of work
 c step change d project logic diagram

Q.12 What occurs next in the project life cycle after the project is approved and advances into the planning stage ?

- a A risk response plan can be used to identify increasing levels of detailed risk analysis
 b Risks are identified with each major group of activities.
 c Agreements for risk sharing need to be concluded.
 d The total risk on the project typically reduces as activities are performed without loss.

Q.13 During the course of a project, each management follows a process termed as _____.

- a project management Life Cycle
 c manager life cycle

- b project management
 d all of the mentioned

Q.14 Which of the statements below is correct ?

- a The business case is owned by the project manager and is created during the concept phase of the project life cycle.
 b The business case is owned by the sponsor and is created during definition phase of the project life cycle.
 c The business case is owned by the project manager and is created during the definition phase of the project life cycle.
 d The business case is owned by the sponsor and is created during the concept phase of the project life cycle.

Q.15 The project life cycle is made up of _____ project management stages.

- a initiation and closure
 c planning and execution

- b monitoring and control
 d all of the above

Q.16 The probability of successfully finishing the project is _____, and hence risk and uncertainty are _____.

- a highest, lowest
 c lowest, lowest

- b lowest, highest
 d highest, highest

Q.17 The third project management phase is _____.

- a project execution
 c monitoring and control

- b initiation
 d closure

Q.18 A project's scope, time, cost and which additional parameter are normally defined ?

- a Benefits
 c Controls

- b Tolerance
 d Quality

Q.19 Which of the following risk statements is correct ?

- a Project risk focuses on identifying, assessing and eliminating the risks on the project.
 b Risk management is all about eliminating risk.
 c There are no risk-free projects.
 d Project risk is an uncertain event that, even if it occurs, has no effect on project objectives.

Q.20 The developers and users are both in the _____ with in-house development.

- | | |
|---|---|
| <input type="checkbox"/> a same organisation | <input type="checkbox"/> b different Organization |
| <input type="checkbox"/> c independent sections | <input type="checkbox"/> d unrelated divisions |

Q.21 The work breakdown for acquiring a certain defence material item that is tied to contractual effort is known as _____

- | | |
|---|---|
| <input type="checkbox"/> a program WBS | <input type="checkbox"/> b contract program WBS |
| <input type="checkbox"/> c contract WBS | <input type="checkbox"/> d none of these |

Q.22 How many different types of work breakdown structures are there ?

- | | |
|------------------------------|------------------------------|
| <input type="checkbox"/> a 3 | <input type="checkbox"/> b 5 |
| <input type="checkbox"/> c 2 | <input type="checkbox"/> d 4 |

Q.23 _____ is the least flexible and most obsolete of the life cycle models.

- | | |
|--|--|
| <input type="checkbox"/> a Spiral model | <input type="checkbox"/> b Waterfall model |
| <input type="checkbox"/> c Throwaway prototyping model | |
| <input type="checkbox"/> d Iterative / incremental development model | |

Q.24 The _____ is a semiformal method of breaking down the goal.

- | | |
|----------------------------------|--|
| <input type="checkbox"/> a PERT | <input type="checkbox"/> b WBS |
| <input type="checkbox"/> c PMBOK | <input type="checkbox"/> d None of these |

Q.25 Work Breakdown Structure must be _____ in software project planning.

- | | |
|--|--|
| <input type="checkbox"/> a a tree | <input type="checkbox"/> b a graph |
| <input type="checkbox"/> c a euler's graph | <input type="checkbox"/> d none of the above |

Q.26 A project document that describes all the work that must be done to complete the project, is known as _____.

- | | |
|---|--|
| <input type="checkbox"/> a work breakdown structure | <input type="checkbox"/> b work basic structure |
| <input type="checkbox"/> c work break structure | <input type="checkbox"/> d work boundary structure |

Q.27 In the Work Breakdown Structure (WBS), which of the following is captured ?

- | | |
|---|---|
| <input type="checkbox"/> a The life cycle phases | <input type="checkbox"/> b The logical order of tasks |
| <input type="checkbox"/> c The scope of the project | <input type="checkbox"/> d Project costs |

Q.28 Which step of the project management life cycle necessitates the longest completion time ?

- | | |
|--|--------------------------------------|
| <input type="checkbox"/> a Conceptualization | <input type="checkbox"/> b Planning |
| <input type="checkbox"/> c Estimation | <input type="checkbox"/> d Execution |

Q.29 On the X axis, the Risk Event Graph has the following :

- | | |
|--|--|
| <input type="checkbox"/> a Project life cycle | <input type="checkbox"/> b Gantt chart |
| <input type="checkbox"/> c Work break down structure | <input type="checkbox"/> d Splitting |

Q.30 Project management is described by the Project Management Institute (PMI) as "the application of knowledge, Methods _____, _____ and techniques to project operations in order to satisfy project requirements."

- | | |
|---|---|
| <input type="checkbox"/> a skills, analysis | <input type="checkbox"/> b tools, analysis |
| <input type="checkbox"/> c skills, tools | <input type="checkbox"/> d analysis, theories |

Q.31 Due to the rapid expansion of your company, your boss decides to establish a Project Management Office (PMO) within the company and asks you to take the lead. According to the PMBOK guide, to be the ideal PMO you can do which of the following ?

- a Speed up a specific ongoing project.
- b Find opportunities for collaborative project management.
- c Reassign the resources that have been assigned to ongoing projects.
- d Reduce the assigned resources to existing projects..

Q.32 PMBOK is an acronym for :

- a Project Management Book of Knowledge
- b Project Management Body of Knowledge
- c Project Management Box of Knowledge
- d None of the above

Q.33 Which of the following things does not fall under the purview of PRINCE2 ?

- | | |
|--|---|
| <input type="checkbox"/> a Leadership capability | <input type="checkbox"/> b Detailed technique |
| <input type="checkbox"/> c Specialist aspects | <input type="checkbox"/> d All of the above |

Q.34 Which team, according to PRINCE2, works independently of the project management team if at all ?

- | | |
|--|--|
| <input type="checkbox"/> a Senior supplier | <input type="checkbox"/> b Project assurance |
| <input type="checkbox"/> c Project support | <input type="checkbox"/> d Quality assurance |

Q.35 A _____ is a collection of projects that are similar or related to one another.

- | | |
|--------------------------------------|--|
| <input type="checkbox"/> a program | <input type="checkbox"/> b project |
| <input type="checkbox"/> c portfolio | <input type="checkbox"/> d none of these |

Q.36 A portfolio is a collection of initiatives and/or projects inside a single organization that may or may not be related to one another :

- a Program
- c Portfolio

- b Project
- d None of these

Q.37 There is a commitment to the project portfolio's process, supporting process and results at :

- a Organizing the process
- c Collect project Data

- b Reserving the process
- d Implement the process

Q.38 Projects management is organized into _____ process categories.

- a 7
- c 5

- b 9
- d none of the above

Q.39 There are many different types of program, but the most common are :

- a Related projects
- c People and work

- b Plans
- d Unrelated projects

Q.40 This type of collection can include one or more of the following :

- a Portfolios, products, projects , sub-projects
- b Sub-portfolios, projects, sub-programs
- c Projects, program, sub-portfolios, operations
- d Projects, portfolios, operations, products

Q.41 The project management institute is a professional organization for project managers :

- a AMA
- c PMBOK

- b MIS
- d PMI

Q.42 _____ is the series of processing steps that completes a commercial transaction or consumer request.

- a Model
- c Prototype

- b Workflow
- d Mock-up

Answer Keys for Multiple Choice Questions :

Q.1	d	Q.2	a	Q.3	b	Q.4	c
Q.5	b	Q.6	a	Q.7	c	Q.8	b
Q.9	c	Q.10	a	Q.11	d	Q.12	b
Q.13	a	Q.14	d	Q.15	d	Q.16	b
Q.17	a	Q.18	d	Q.19	c	Q.20	a
Q.21	a	Q.22	c	Q.23	b	Q.24	b
Q.25	a	Q.26	a	Q.27	c	Q.28	d
Q.29	a	Q.30	c	Q.31	b	Q.32	b
Q.33	d	Q.34	d	Q.35	a	Q.36	c
Q.37	d	Q.38	c	Q.39	a	Q.40	c
Q.41	d	Q.42	b				



Notes

UNIT- II

2

Project Planning and Project Management Tools

Syllabus

Project Planning : Steps for Project Planning, PERT and Gantt Charts, Gantt Project, Microsoft Project and Primavera Project Management Software, Objectives of Activity planning, Project Schedules, Activities, Sequencing and Scheduling, Network Planning Models, Formulating Network Model.

Contents

- 2.1 *Project Planning*
- 2.2 *PERT and Gantt Chart*
- 2.3 *Microsoft Project and Primavera Project Management Software*
- 2.4 *Objectives of Project Planning*
- 2.5 *Project Schedules*
- 2.6 *Activities*
- 2.7 *Sequencing and Scheduling*
- 2.8 *Network Planning Models*
- 2.9 *Formulating a Network Model*
- 2.10 *Multiple Choice Questions*

2.1 Project Planning

One of the most important project planning principles is to plan in broad strokes first, then in greater detail as the time to complete an activity approaches. As a result, when the tasks associated with a particular phase of a project are examined in further detail, the lists of goods and activities generated in step 4 will be reviewed. Following that, a more detailed repeat of steps 5 to 8 for the phase in question will be performed.

2.1.1 Steps for Project Planning

- Step 0 : Choose project
- Step 1 : Classify scope of the project and objectives
- Step 2 : Classify project infrastructure
- Step 3 : Examine project characteristics
- Step 4 : Classify project products and activities
- Step 5 : Calculate effort for each activity
- Step 6 : Classify activity risks
- Step 7 : Allocate resources
- Step 8 : Review plan
- Step 9 : Execute plan
- Step 10 : Execute lower levels of planning

Step 0 : Choose project

This is referred to as step 0 since it is apart from the main project planning process in several ways. Proposed initiatives do not materialize out of nowhere; some procedure must choose to start this project over another.

While a feasibility study may indicate that the project has a business case, it must still be proven that it should be prioritized over other initiatives. This assessment of project merits could be part of project portfolio management.

- 1. Choosing whether or not to take on the project
- 2. Feasibility is assessed on a technical, organizational, and financial level.

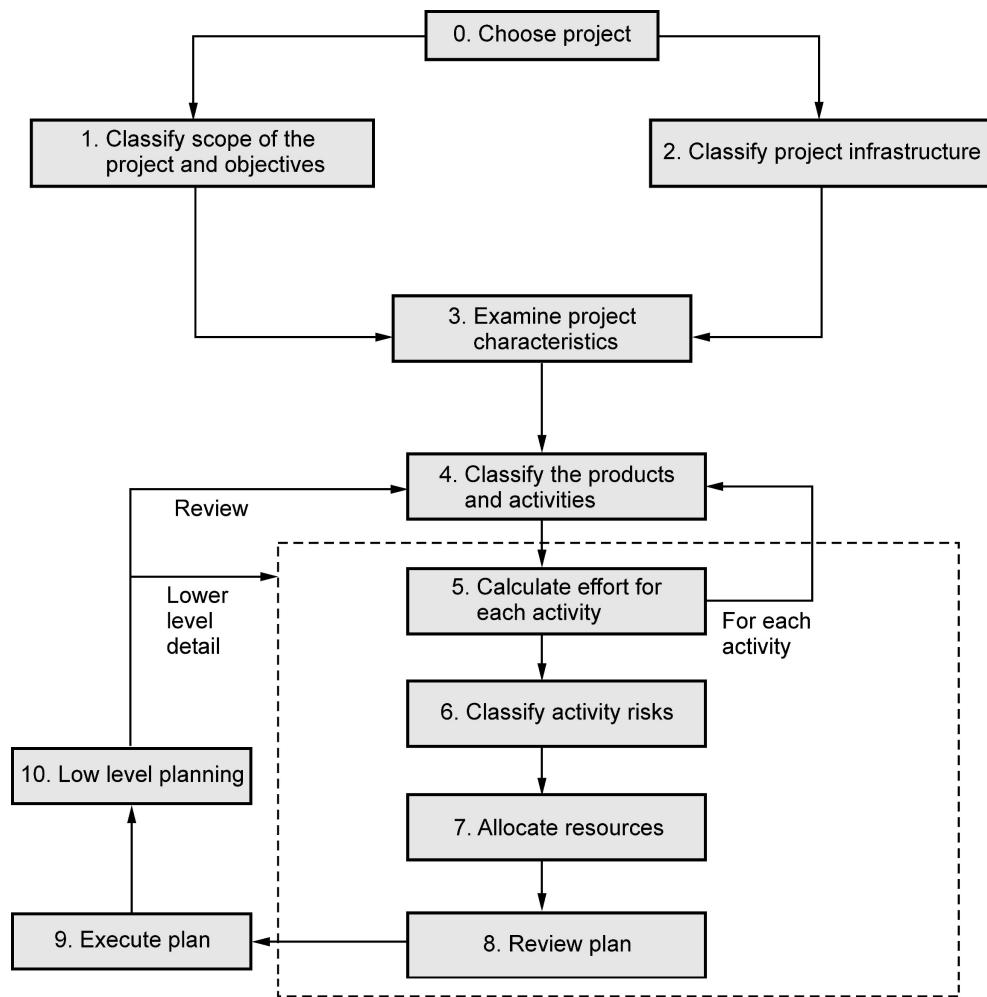


Fig. 2.1.1 Stepwise project planning

Step 1 : Classify scope of the project and objectives

The activities in this step guarantee that all project participants agree on the objectives and are dedicated to defining them correctly.

1. Determine objectives and practical metrics of effectiveness in achieving them.
2. Create a project authority - To ensure that everyone involved is working towards the same goal.
3. Determine who the project's stakeholders are and what their interests are.
4. Adjust goals in light of stakeholder analysis: It may be necessary to change the project objectives in order to achieve the full participation of all parties involved. This could entail providing new system features that benefit specific stakeholders

as a way of ensuring their commitment to the project. This is possibly problematic since the system's size will grow and the original goals will be concealed. Because of these risks, it is recommended that this procedure be carried out deliberately and in a regulated manner.

5. Establish communication channels for all stakeholders: Internal employees should find this pretty simple, but a project leader establishing a payroll system, for example, would need to find a contact point with BACS. This process may result in the first draught of a communications strategy.

Step 2 : Classify project infrastructure

Projects are never completed in isolation. Usually, there is some form of existing infrastructure that the project must work with. When project managers are new to a business, they must learn about the infrastructure in detail. This could be the case if the project manager works for a third-party company that does the client's work.

1. Determine the project's relevance to strategic planning.
 - To build a framework within which the system fits
 - To ensure that hardware and software standards are maintained
 - To decide the order in which related projects (in the organization) are being carried out
2. Identify installation standards and processes : Any software development company should have a set of practices in place. At the very least, the usual stages of the software life cycle should be documented, as well as the products developed at each level.

To ensure that modifications to requirements are implemented in a safe and orderly manner, change control and configuration management standards should be in place.

The quality checks that must be performed at each stage of the project life cycle may be outlined in the procedural standards, or they may be documented in a separate quality standards and procedures handbook.

As part of its monitoring and control policy, the company may have a measuring program in place that requires particular statistics to be collected at certain stages of a project.

Finally, any project planning and control standards should be known to the project manager. These will have to do with how the project is managed : Take, for example, how team members' hours spent on different tasks are reported on timesheets.

- A better title would be "Identify software project standards and procedures."

3. Determine the structure of the project team: Project managers, especially those in charge of major projects, may have some say in how their project team is organized. The organizational structure, on the other hand, is frequently prescribed to them. For example, a high-level administrative decision may have been made to separate software developers and business analysts, or to build business-to-consumer web apps in a separate group from traditional database programs.

Step 3 : Examine project characteristics

The overall goal of this phase of the planning process is to guarantee that the project's procedures are adequate.

1. Determine whether the project is goal-oriented or product-oriented.
2. Examine the project's other characteristics (including quality-based ones)
3. Identify project hazards at a high level : The hazards that could threaten the project's success must be taken into account. The majority of hazards are related to the operating or development environment, the project's technical character, or the sort of product being developed.
4. Take into account the needs of the users when it comes to implementation : Clients may have their own procedures in place. For instance, an organization may require the usage of a specific development approach.
5. In light of the foregoing, choose a generic lifecycle approach.
6. Examine the total resource estimations. Until this point : This would be a good time to re-estimate the effort and other resources required to implement the project once the principal risks have been recognized and the overall project approach has been determined. When there is enough information, a function [points] estimate may be suitable.
 - The project's primary risks are recognized
 - The project's general approach is decided

As a result, it's a good location to re-estimate the project's required effort and other resources.

Step 4 : Classify project products and activities

Individual activities are currently being planned in greater depth. The long-term planning is wide and sketchy, yet the more urgent duties are meticulously prepared.

1. Determine and explain the project's products: In general, no project product can exist without the actions that produce it. Whenever possible, we should also make sure that the opposite is true: that no activities do not result in a concrete outcome. We can verify that all of the tasks we need to do are accounted for by identifying all of the objects the project will create.

A huge number of technical products, such as training materials and operating instructions, will be included in these products. There will also be goods that have nothing to do with project management or quality. Planning materials, for example, would be considered management goods.

The items will be arranged in a hierarchy. The primary products will be accompanied by a series of component products, which may in turn be accompanied by sub-component products, and so on. A Product Breakdown Structure (PBS) - see Fig. 2.1.2 - can be used to document these linkages. In this case, the products have been divided into those that pertain to the entire system and those that pertain to specific modules. The third category, which has only one product, is management goods, which includes progress reports. The asterisk in the progress reports indicates that the entity progress report will be created multiple times throughout the project.

It's worth noting that the only boxes in the diagram that represent tangible things are those at the bottom of the hierarchy that aren't subdivided any deeper. As a result, the diagram only displays six different product types. Higher-level boxes, such as module products, are essentially names for sets of objects.

- Identify all project-related products.
- Keep track of all required actions.

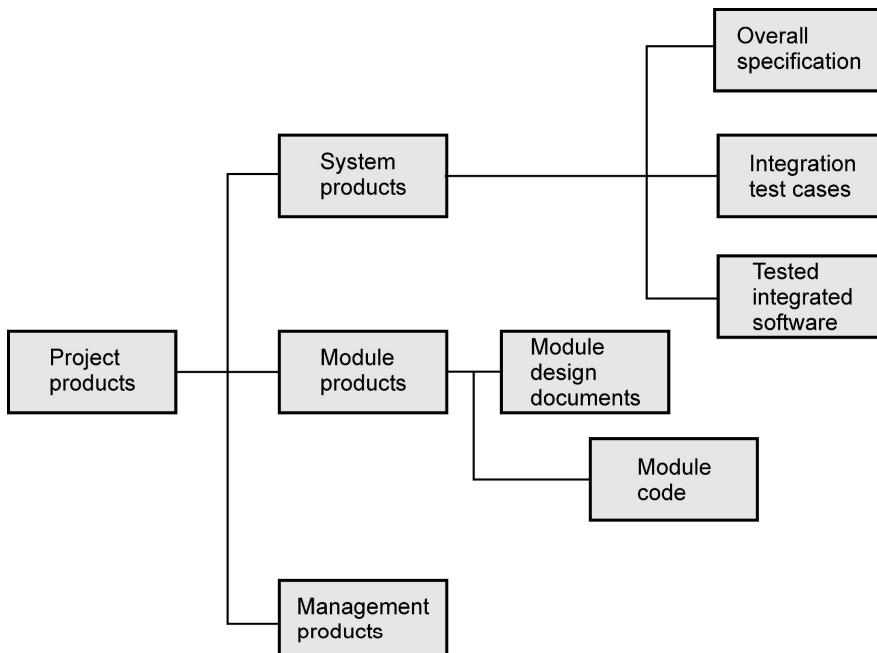
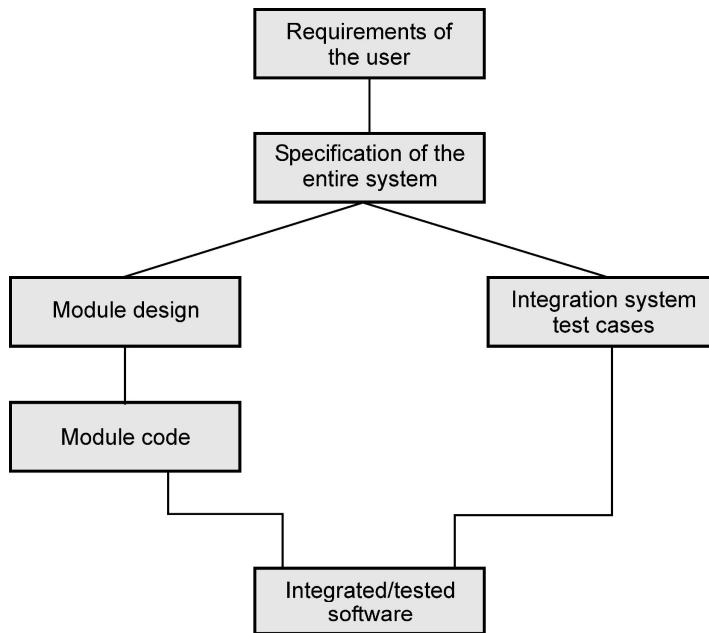


Fig. 2.1.2 A fragment of PBS

2. Generic product flows should be documented: Before a product can be formed, it must first exist as one or more existing products. For example, before a program can be developed, a program design must be constructed, and before the design can begin, the program specification must exist. In a Product Flow Diagram, these connections can be shown (PFD). A good example is shown in Fig. 2.1.3. It's worth noting that the flow in the figure is believed to be from left to right and from top to bottom. User needs are in an ellipse in the example in Fig. 2.1.3, indicating that they are used by the project but not developed by it. It's common to find one overall product at the bottom of the list, such as integrated/tested software, into which all the other items feed.
 - To keep track of the products' relative placement.
3. Recognize product variations :
When a generic PFD fragment is associated with many instances of the same product type, an attempt should be made to identify each of those instances. It's possible that the software to be produced in the example in Fig. 2.1.3 just has two component software modules.
 - An activity network depicts the tasks that must be completed as well as the order in which they must be completed in order to create a product from another.
4. Create a perfect activity network: There must be one or more operations that carry out the transformation in order to generate one product from another. We may develop an activity network by identifying these activities, which illustrates the tasks that must be completed and in what order they must be completed.
5. Make changes to the ideal to account for the necessity for stages and checkpoints: The method to activity sequencing outlined above encourages the creation of a plan that will reduce the project's overall duration or elapsed time. It is assumed that an action will begin once the preceding activities on which it is dependent have been performed.
 - To ensure that goods from prior initiatives are compatible with one other.

**Fig. 2.1.3 A fragment of PWD****Step 5 : Calculate effort for each activity**

1. Make bottom-up estimations : Estimates of the staff effort required, the likely elapsed time, and the non-staff resource required for each task will be required at this phase. Depending on the sort of activity, the process for arriving at each of these estimates will differ.

It's important to note the difference between elapsed time and effort. The amount of work that needs to be done is referred to as effort. The effort expended is 6 days if three members of staff labor for two full days each on a task. Elapsed time is the time between the start and finish of a task.

2. Revise the plan to include activities that can be controlled : Individual activity estimations may suggest that some will take a long time to complete. Long activities make it harder to keep track of a project. If a system testing activity is expected to take 12 weeks, determining whether 50 percent of the work has been accomplished after 6 weeks will be difficult. Breaking this down into a series of smaller subtasks might be preferable.

Step 6 : Classify activity risks

1. Activity-based risks should be identified and quantified : Step 3 took into account risks that are inherent in the project's general character. Now we'll take a look at each action individually and examine the dangers to its performance. Any strategy is built on a set of assumptions.
2. Plan for risk reduction and contingency actions as needed : Some of the listed dangers may be avoidable or at least reduced. Contingency plans, on the other hand, define what should be done if a danger occurs. For example, if a member of the project team is unavailable at a critical moment due to significant illness, a contingency plan could be to deploy contact personnel.
3. Risks should be factored into overall plans and estimations : We could alter our plans, perhaps by incorporating additional activities that lower hazards. For example, learning a new programming language may necessitate scheduling training sessions and time for programmers to practice their new skills on non-essential work.

Step 7 : Allocate resources

1. Determine and allot resources: Each activity's staffing requirements are noted. The project's available personnel are identified and assigned to tasks on a preliminary basis.
2. Revise and estimate plans to account for resource constraints: Some employees may be required to perform more than one duty at the same time, in which case a priority list is established. When some tasks are delayed while waiting for staff to become available, the decision made here may have an impact on the overall duration of the project.

Assuring that someone is ready to begin an activity as soon as the previous tasks are completed may result in them being inactive while waiting for the job to begin, and therefore being used inefficiently.

Step 8 : Review plan

1. Examine the project's quality aspects : When it comes to project management, there's always the risk that an activity would disclose that it wasn't finished effectively and needs to be modified. This can turn a project that appears to be developing smoothly into one that is badly out of control in a single stroke. It's critical to understand that when a work is marked as completed, it really is hence the value of quality assurance. Each task should have its own set of quality standards. These are quality assurance checks that must be passed before the activity can be deemed complete.

2. Plan ahead of time and get approval: It's critical that the plans are well-documented and that all project participants understand and adhere to the commitments outlined in the plan. This may seem self-evident, yet it's remarkable how often it's not done.

Step 9 : Execute plan and Step 10 : Execute lower levels of planning

When it comes to project management, there's always the risk that an activity would disclose that it wasn't finished effectively and needs to be modified. This can turn a project that appears to be developing smoothly into one that is badly out of control in a single stroke. It's critical to understand that when a work is marked as completed, it really is hence the value of quality assurance. Of course, making provisional plans for the longer-term activities is vital because thinking about what has to be done can help uncover potential problems, but the fact that these plans are provisional should not be overlooked.

Review Questions

1. *What are the steps in planning a project ?*
2. *What are the steps in creating a successful project plan ?*
3. *How do you write a software project plan ?*

2.2 PERT and Gantt Chart

Project Management : A Critical Path

When designing a project plan and schedule, project managers employ a variety of tools, including the critical path. It tells them how long each task will take, how many resources will be needed and how much each task will cost. They can begin planning the timeframe in their scheduling software and managing their project after they have this laid out.

What are the Benefits of Critical Path ?

In project management, critical path plays a significant part in defining a timetable. It is used in conjunction with PERT (program evaluation and review technique) to determine the length of time required to perform a task. Simply said, employing the critical path is a method of bringing order to any project's seemingly chaotic complexity.

If meeting deadlines is critical to completing a project on time, the duration of each activity must be understood in order to more accurately predict where those deadlines will fall on the project timetable.

PERT Chart

PERT and Gantt charts are popular visualization techniques in project management. Both of these diagrams are used to plan, control, and administer the tasks that are required to complete a project. The only distinction is that a PERT chart is a network diagram, whereas a Gantt chart is a bar chart.

The acronym for PERT Chart is (Program Evaluation and Review Technique). A PERT chart is a project management tool for planning, organizing, and coordinating work in a project. It's a technique for analyzing the activities involved in completing a project, particularly the time required to perform each work, and determining the shortest time required to finish the entire project.

PERT was created to account for the uncertainty around work duration predictions. It was created in a world of high-cost, high-risk, cutting-edge initiatives, not different to many of today's huge software projects.

The method is similar to CPM (Critical Path Method), except instead of utilizing a single estimate for each task's length, PERT requires three estimates.

Most likely time : Under normal circumstances, how long would we expect the task to take? The letter m will be used to denote this.

Optimistic time : The quickest time we could expect to accomplish the activity, if nothing goes wrong. For this, we'll utilize the letter a.

Pessimistic time : We'll name this b. the worst possible time, accounting for all reasonable scenarios but eliminating acts of God and warfare.

PERT then uses the formula $t_e = \frac{(a + 4m + b)}{6}$ to integrate these three estimations into a single estimated duration, t_e .

Using Expected Timeframes :

Using the same way as the CPM methodology, the expected durations are used to perform a forward pass through a network. However, in this situation, the predicted event dates represent the dates by which we intend to complete those events, not the earliest potential dates.

The PERT network depicted in Fig. 2.2.1 suggests that the project will take 13.5 weeks to complete. We utilized an activity-on-arrow network in the Fig. 2.2.1 because this type of presentation makes it simpler to visually distinguish between estimated and calculated activity data. Of course, activity-on-node diagrams can also be used to support the method.

Unlike the CPM method, the PERT method indicates the predicted date rather than the earliest date by which the project could be completed. This method has the advantage of emphasizing the uncertainty that exists in the real world. Rather than saying 'the project's completion date is...', we're encouraged to say 'we hope to complete the project by...'.

It also emphasizes the uncertainty associated with estimating activity periods. Requesting three estimates for each activity underlines the reality that we don't know what will happen and we're obliged to accept that estimates are necessary.

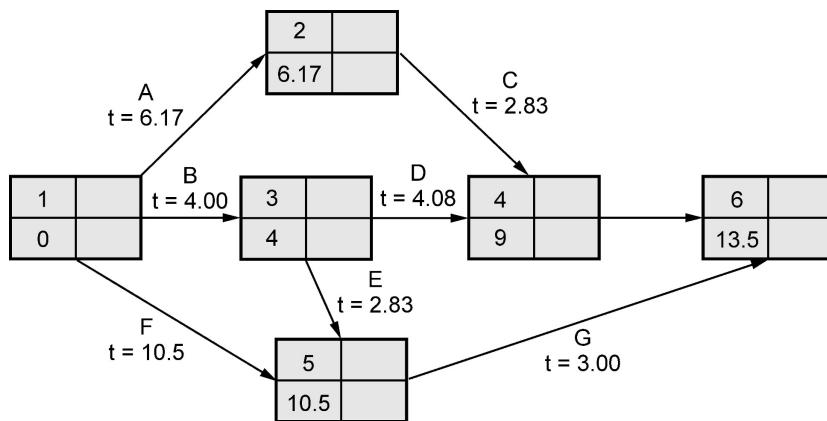


Fig. 2.2.1 After the forward pass, the PERT network

How does one make PERT chart ?

We can make our PERT chart in a variety of ways. The typical PERT chart (sometimes called an activity-on-arrow diagram) has two components :

Nodes in our project reflect events or milestones. Numbered circles or numbered boxes can be used.

Tasks are represented by **arrows**. The task sequence is shown by the direction of the arrows. Diverging arrows suggest that those tasks can be completed at the same time.

To make our PERT chart, follow these steps :

1. Make a list of all the project's actions.
2. Take into account the interdependencies.
3. Using the information that is acquired, place nodes and arrows.
4. For each activity, add the time it takes to complete it.

Advantages and Disadvantages of PERT :

The PERT technique's key benefit is that it provides a mechanism for predicting the likelihood of meeting or missing goal dates. Although there may just be one target - the project completion date - we may want to create extra immediate targets.

PERT draws attention to the uncertainty of forecasting by demanding multi-valued activity duration estimates and calculating predicted dates. We may use the technique to compute the standard deviation for each task and rank them based on the level of risk they pose.

A PERT chart is similar to a critical path analysis (CPA), which is another approach used by project managers to track project tasks. The key distinction between the two is that a PERT chart estimates each project stage using a variety of time frames and probability variables. PERT charts have several specific advantages and limitations as a project management tool.

Advantages

1. Managers can use a PERT chart to estimate the amount of time and resources needed to complete a project. This assessment includes the ability to track required assets at any point in the manufacturing process throughout the duration of the project.
2. Data and information from several departments are combined in a PERT study. This merging of data promotes departmental accountability and identifies all responsible parties throughout the organization. It also allows a company to commit to projects that are related to its strategic orientation and increases communication throughout the project.
3. Finally, PERT charts can be used to perform what-if scenarios. Management can obtain the most effective and productive project path by understanding the possibilities regarding the flow of project resources and milestones.

Disadvantages

1. The application of a PERT chart is very subjective, and its success is determined by management's experience. For this reason, these charts may contain inaccurate data or irrational cost or time estimates.
2. PERT charts are deadline-driven and may not adequately indicate a project's financial status. Because a PERT chart is labor-intensive, it necessitates more time and resources to set up and maintain the data. For a PERT chart to be useful, it must be reviewed on a regular basis, both for the information presented and for the project's future placement.

Gantt Chart

A Gantt chart is a sort of horizontal bar chart that is often used in project management to provide a visual representation of tasks that are scheduled to be completed over time. It creates a graphical representation of a timetable that aids in the planning, coordination, and tracking of individual project tasks (or aspects).

The Gantt chart is one of the simplest and oldest methods for tracking project progress. This is simply an activity bar chart that shows scheduled activity dates and durations, often with activity floats added in. A 'today cursor' offers an instant visual indicator of which activities are ahead or behind schedule, and reported progress is recorded on the chart (usually by shading activity bars).

The Gantt chart is the more traditional of the two, and it works well for simple, short-duration projects. The project manager begins by associating a rectangle bar with each activity to create a Gantt chart (see Fig. 2.2.2). The duration of the activity is represented by the length of the bar. The bars are then horizontally placed along a time line in the order in which the activities should be accomplished. There are times when activities are placed on the time line so that they can be completed simultaneously with other tasks. The sequencing is frequently influenced by resource availability rather than any other factor.

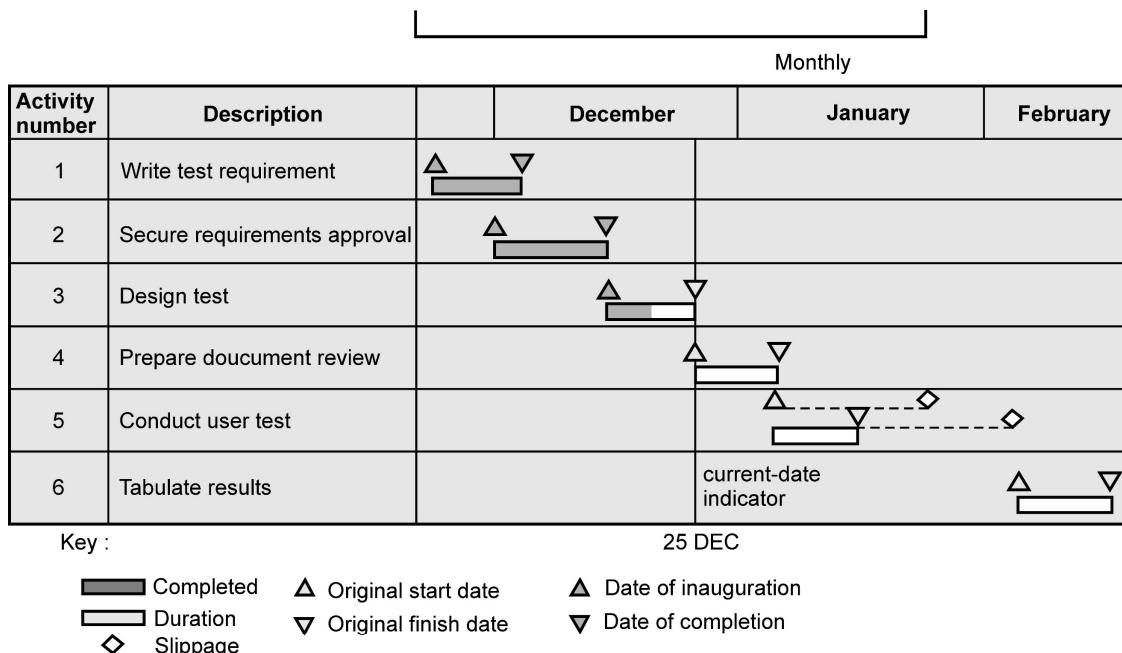


Fig. 2.2.2 Gantt chart

There are two disadvantages to utilizing the Gantt chart :

1. The Gantt chart does not offer detailed information due to its simplicity. It simply represents the manager's order and, in fact, conceals much of that information. We can't identify what must occur before and after what from the Gantt chart unless we are very familiar with the project operations.
2. Second, the Gantt chart does not notify the project manager whether the schedule that arises from the Gantt chart completes the project in the shortest time possible or even properly utilizes the resources.

How can we make Gantt chart ?

Gantt charts resemble bar graphs in appearance. Vertically, the tasks are displayed, while the timeline runs horizontally over the top of the chart. A horizontal block represents each task, and the length of the block indicates how long the task will take.

To create our own Gantt chart, follow the steps below.

1. Make a list of tasks and subtasks.
2. Make a list of the tasks that are connected.
3. Make a timetable.
4. Prioritize tasks.
5. Make use of a template.
6. Assign responsibilities.
7. Keep track of our development.

Difference between PERT and Gantt Chart

PERT chart	Gantt chart
A PERT chart resembles a network diagram.	The bar chart is referred to as a Gantt chart.
The United States Navy created the PERT chart.	Henry L. Gantt invented the Gantt chart.
For large and complex projects, a PERT chart might be employed.	For small projects, a Gantt chart is frequently utilized.
The PERT chart emphasizes the interdependence of relationships.	The Gantt chart shows how long it will take to accomplish a task.
PERT charts might be difficult and complex at times, but they are useful for showing essential paths.	The Gantt chart is more clear and uncomplicated.

2.2.1 Gantt Project

Gantt Project is a Java-based project management program that runs on Microsoft Windows, Linux, and Mac OS X. It is GPL-licensed (free software). In comparison to other full-fledged project management software, Gantt project follows the KISS concept in its design.

It includes the most basic project management tools, such as a Gantt chart for work scheduling and resource management via resource load charts. It is only capable of handling days, not hours. It lacks features such as cash flow, message, and document management.

The following are the key features :

Make a structure for work breakdown.

Dependencies and Hierarchy of tasks

Gantt diagram

Chart of resource consumption

Keeping and comparing baselines

PERT chart generation

Reports in PDF and HTML

MS Project import/export using the MPX (*.mpx) and MSPDI (*.xml) file formats.

CSV and Excel formats are used to exchange data using spreadsheet programmes.

WebDAV-based collaboration

XML is the project file format.

Management of vacations and holidays

More than 20 languages are supported.

Review Questions

1. *What is the difference between a Gantt chart and a PERT chart and how can you illustrate them using examples ?*
2. *What is the purpose of a PERT chart in software project management ?*
3. *What is a PERT and how can we make one ?*
4. *What is the difference between a PERT and a Gantt chart ?*
5. *What are the advantages and disadvantages of PERT chart ?*

2.3 Microsoft Project and Primavera Project Management Software

Primavera is a project management programme similar to Microsoft project. Primavera software, like MS-project, includes portfolio management, product management, collaboration management, and a variety of other project management controls. Primavera interacts with various corporate software such as ORACLE, ERP and others. Primavera software is ideal for project planning, reporting, and progress updates, as well as project tracking. Primavera and MS-Project are both project management softwares that are used for project planning and execution in order to reduce project management hassles and boost productivity and efficiency. Primavera and MS-Project are two of the most important technological innovations in the field of project management for removing waste and unnecessary waste from the business process.

The primary distinction between Primavera and MS-Project software is that Primavera is a database-based application, whereas MS-Project is a file-based application. Primavera is a more powerful project management software than MS-Project because it decreases project risks. Excess expenditures can be reduced because inconsistencies, errors, and flaws are previously scheduled and examined using project management software. Primavera project management software was built from the ground up as an enterprise programme, whereas MS-Project began as a desktop application and was later transferred to a project server, with enterprise capabilities added to fulfil the goal of enterprise project management.

Primavera and MS-Project are both project management software, although they differ in minor ways and can thus be used for different sorts of projects depending on the project's nature. The decision to use enterprise project management software is based on the organization's needs and the type of their projects.

Features of Primavera

- Project management for multiple projects
- Management of portfolios and programs
- Automation of business processes
- Access for many users
- Email updates on project status
- Forms that can be customized
- Gantt charts
- User functions based on roles
- Modeling workflows graphically

Analysis and allocation of resources
Management of risk
Analysis and reporting in real-time
Dashboard of information
Allocation and analysis of resources
Views of the calendar and activities

Primavera Pros and Cons

The following are the key advantages of utilizing oracle primavera :

Reduces risks : Primavera excels at signaling and identifying the risks of project overruns, schedule discrepancies, and eros, all of which can significantly increase the project's cost.

Forecasting is simple : It enables project managers to quickly develop reliable project forecasts and communicate them with corporate leaders or stakeholders.

Worker access and responsibility : It allows employees to set schedules, request timesheets, and submit them whenever and wherever they choose.

Great visibility : It allows users to analyze data in one place to ensure that the project complies with all applicable norms and guidelines.

Good communication : It allows C-level personnel access to all project regions, allowing them to communicate with workers wherever they are. Project Reader improves communication while lowering the requirement for a constant internet connection.

Breaks down a large project into smaller ones : It allows users to break down a large project into smaller ones in order to complete activities and tasks.

Easy to use : Primavera is a simple project planning and scheduling program with a short learning curve. It can manage large amounts of data and swiftly provide analyses and reports. With all of the fundamentals, even a junior project manager can operate effectively.

The following are some of Primavera's drawbacks :

1. Primavera lacks a sophisticated user interface and well-organized options. In addition, the tools are not appropriately organized.
2. It is a more costly tool than other project management software.
3. The most difficult task in Primavera is printing PDF project reports.

MS Project features

Portfolio management of projects
We may practically access it from anywhere.
Real-time communication
Simplify IT administration
Prepare for the unexpected.
Carry out projects
Collaboration is improved.
Presentations that work
Information can be found and shared.
Organized
Work in unison with our tools.
Choose the best portfolios.

MS Project Pros and Cons

The advantages of MS Project are as follows :

Intuitive interface : MS Project has a very user-friendly interface that allows us to get the most out of its features and functions. It allows users to work on new tasks or project revisions at any time without being interrupted.

High visibility : With scheduling tools like Gantt charts and configurable menus, it provides a 360-degree view of project information for efficient project planning.

Pre-installed templates : It provides pre-installed templates based on user requirements to assist users in quickly creating a project plan.

Integration : MS Project can be integrated with other Microsoft products such as Word, PowerPoint, and Excel. Project managers are efficiently using Skype to improve communication. It may also be used in conjunction with Power BI Pro to perform business intelligence analytics.

Flexibility : It allows customers to view project data from a desktop computer as well as a mobile device.

The following are the disadvantages of MS Project :

1. MS project is a pricey program. Many consumers can only afford a few licenses due to the exorbitant cost, resulting in low production.

2. It has a lot of advanced or new features, which may account for the expensive price.
3. Without integration, MS Projects does not deliver real-time updates.

Difference between Microsoft project and primavera project management software:

Sr. No.	Microsoft project	Primavera project
1	MS-project is compatible with 11 different baselines.	It allows for an endless number of baselines.
2	MS project does not allow many users to collaborate on a single project.	Primavera allows numerous people to collaborate on a single project and its features.
3	Project issues and risk tracking are not available in MS-Projects	Issue and disc recording are both possible with Primavera.
4	MS-project does not include a functionality that allows us to transform data from one format to another. If we are using Microsoft Project, we can use third-party software for this.	Support material, such as project planning and documentation, can be translated to HTML straight from Primavera Web without the use of any third-party software.
5	There is no such facility for creating sub-activities in MS-Project.	It enables for the creation of activity sub-activities by dividing the primary activity into several phases, each with its own start and end date.
6	MS-project allows users to create custom fields with sophisticated formulas and additional values, reducing the user's manual effort.	A blank custom field can be created in Primavera. It does not, however, assign formulas to fields. As a result, users must manually enter formulas in each column's field.
7	Multiple activity relationships are not supported by MS-Project software. It only allows for one form of activity-to-activity interaction.	Primavera can be used for a variety of tasks. More than one type of relationship can be formed between the actions in this relationship.
8	There is no facility in MS-Project for developing a project website.	Primavera has a function that allows us to create a website. This project website allows us to create a website that contains information such as project issues, risks, and resources, all of which are fed into the Primavera project management software.

9	MS-project enables for the creation of numerous projects, but not for additional operations such as tracking multiple projects, cost, other computations, and comparisons at the same time.	Primavera software allows us to create, track, and view multiple projects. It provides for project tracking, comparisons of numerous projects or Work Breakdown Structures, and cost and unit calculations.
10	MS-project does not have a unique ID feature, hence the activity ID is determined by the activity's location.	The unique ID function in Primavera software P6 is useful in projects that use activity ID systems.
11	Microsoft project enables for flexible activity control, allowing us to relocate individual activities from their current locations to the location where we want them to appear.	Primavera allows us to sort activities by several fields such as date, activity id, and so on.
12	Other expenses cannot be calculated in MS-project.	In addition to project expenses, Primavera allows us to add different project expenses such as training costs, travel costs, and so on.
13	MS-project, on the other hand, only supports up to 40 columns.	It may accommodate up to 200 columns, including custom columns, with each column providing important data.
14	Activities in MS-Project are created to resemble or work like WBS.	WBS (Work Breakdown Structure) can be created in Primavera, and activities can be added to them.
15	When compared to Primavera, MS-project provides a smaller number of activities.	Primavera can handle a bigger amount of tasks.
16	MS-project is project management software that works with files.	Primavera is a project management software that runs on a database.

Review Questions

1. *What are the benefits of using Primavera for project management ?*
2. *What are the benefits of using microsoft project for project management ?*
3. *MS project or Primavera: which is superior ?*
4. *Differentiate between Microsoft project and Primavera project management.*
5. *Explain advantages and disadvantages of microsoft project.*
6. *Explain advantages and disadvantages of primavera project.*

2.4 Objectives of Project Planning

Feasibility assessment : A feasibility study is only an assessment of the feasibility of a proposed plan or project. Pay attention to possible problems during project implementation. In order to determine whether the project is feasible after considering all important factors, that is, whether it is worth solving.

Resource allocation : Resource allocation is the process of allocating and scheduling available resources as efficiently and economically as possible. Projects always need resources, but these resources are usually scarce. Therefore, it is the responsibility of the project manager to determine the appropriate time and allocate resources. These resources are within the project schedule. So what is the resource allocation in project management ? It is about managing and delegating resources throughout the project to ensure that it runs as evenly and successfully as possible.

Detailed costing : After generating an activity plan and allocating particular resources, we will acquire extra complete estimates of prices and their timing.

Motivation : Motivation to set goals and track progress against goals is an effective way to motivate employees, especially if they are initially involved in setting these goals.

Coordination : The project plan offers a useful service means of communication and collaboration between teams, especially for large projects with multiple project teams. Can be used as needed, will not be affected by forced shutdown.

The goal of activity planning and scheduling strategies is to complete the project in the shortest possible time at the lowest possible value, or to fulfill an arbitrary deadline at the lowest possible value.

A successful method to shorten the project duration is to hold activities in parallel. Obviously, we cannot complete all activities at the same time, some of which require completion of other activities to start, and there may be resource constraints that limit the scope of work. However, activities planning will enable us to understand the cost of these restrictions in terms of extending the time frame, and will let us understand how to reduce the time frame by relaxing these restrictions. For example, priority restrictions make it possible to start coding the program before the design is complete to ensure that we have a clear understanding of the potential impact on product quality.

Review Question

1. *What are the project's objectives and goals ?*

2.5 Project Schedules

In the case of large projects, detailed planning for subsequent stages will be postponed till the details of the necessary task is available at an earlier point in time.

Before starting work on a project, or perhaps in a bigger project phase, a project plan should be created to show the date when each activity should start and end and the amount of each resource. When a plan is improved to a level of detail it is called a project schedule.

There are four phases to developing a project schedule.

The initial stage in creating a plan is deciding which activities must be completed and in what sequence they must be completed. On this basis, we can create an ideal activity plan, that is, if resources are not limited, ideally a time plan for each action can be taken. This is about making the perfect plan of activity. The activity plan is gradually created in steps 4 and 5, as shown in the Fig. 2.1.1.

The ideal activity plan then becomes the subject of activity risk analysis, the purpose of which is to identify potential problems that can come up with an activity plan that will almost certainly affect the allocation of resources.

The third phase is to allocate resources. Expected resources availability may limit how some activities can be taken, and our ideal plan may need to take this into account.

The last step is scheduling. Once resources are allocated for each activity, we can create and produce a project schedule, which contains the start and end dates of the plan and an overview of the resource requirements for each activity.

Review Questions

1. *How do you plan a software project's schedule ?*
2. *What is Project Scheduling and how does it work ?*

2.6 Activities

Project activities are actions taken by the project to achieve the set goals. These are very specific, practical and well-defined measures. By reading the description of the project activity, we can immediately describe the project in our mind effortlessly.

Activities need to be defined to fulfill these standards. Any activity that does not fulfill these standards should be reviewed.

- The project consists of many interrelated activities.
- When at least one activity is ready to start, the activities can begin.
- When all activities in the project are completed, the project is complete.

- Activities should have a clearly defined starting and ending point, usually characterized by achieving tangible results.
- When an activity requires a resource, the demand for that resource should be predictable, and it is assumed that as the activity decomposes, it will continue to be needed.
- The period of an pastime need to be forecastable assuming regular circumstances, and the affordable availability of resources
- Certain activities may require other users to complete before they can begin.

Identifying activities

The activity-based approach, the product-based approach, and the hybrid approach are the three basic techniques to determining the activities or tasks that make up a project.

The activity-based approach

The activity-based approach involves making a list of all the project's activities should include, which can be brainstormed with the entire project team or derived from an analysis of previous projects. For large projects, it may be helpful to break the project down into lifestyle milestones and view each milestone separately.

The preferred method of creating a task list is to create a Work Breakdown Structure (WBS) instead of performing this operation all at once, and there is an obvious risk of tasks being missed or calculated twice. This includes defining the main goal (or high level). It is necessary to finish the project first and then divide it down into sub-tasks. Fig. 2.6.1 shows an excerpt from the PSP, where the design task is split into three tasks, and one of the tasks is split into two tasks.

Activities are introduced to a branch with inside the shape in the event that they at once make a contribution to the task right away above - in the event that they do now no longer make a contribution to the parent task, then they must now no longer be introduced to that branch

The task at every degree in any branch has to consist of the whole thing this is required to finish the task on the better degree.

When making ready a WBS, attention should accept to the very last degree of element or intensity of the shape. Too outstanding a intensity will bring about a massive wide variety of small duties so that it will be hard to control, while a too shallow shape will offer inadequate element for task control. Branches should, however, be deteriorated as a minimum to a degree wherein every leaf can be allocated to an person or accountable phase in the corporation.

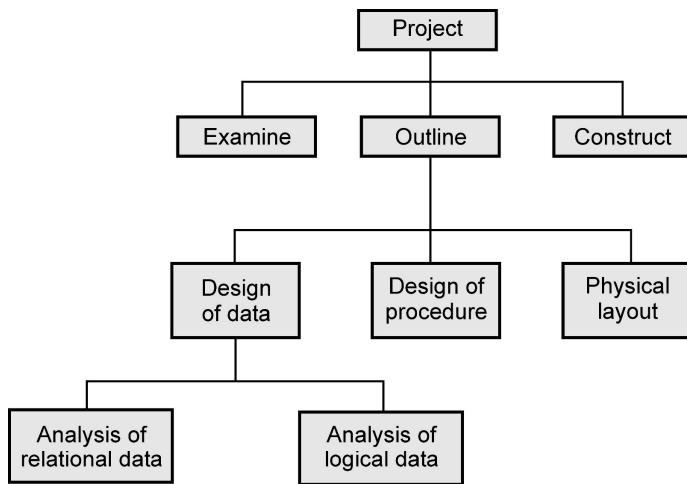


Fig. 2.6.1 A fragment of an activity-based work breakdown structure

One of the aforementioned advantages of the WBS method is to determine that it tends to generate a complete task catalogue with non-overlapping activities. Please note that only the outline table constitutes the list of activities that make up the project. The top node is just a collection of operations.

The product-based approach

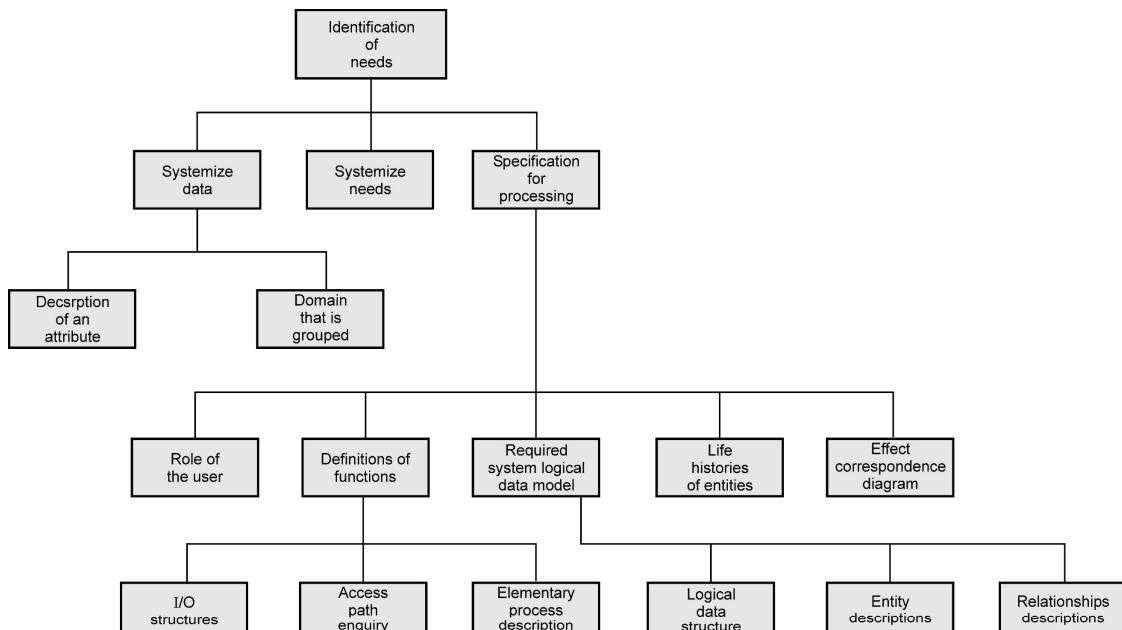


Fig. 2.6.2 SSADM product breakdown structure

It includes creating a hierarchical product structure and product block diagram. For each product, the PFD indicates which other products are required as input. Therefore, by identifying some proponents who led to this approach argued that products are less likely to be excluded from PBS than activities in unstructured activities, and PFD can easily become an ordered list of activities.

This method is in particular suitable if the usage of a technique inclusive of SSADM, which without a doubt specifies, for every step or task, every of the goods required and the task required to supply it. The SSADM Reference Manual gives a fixed of regularly occurring PBSs for every level in SSADM (inclusive of that proven in Fig. 2.6.2), which may be used as a foundation for producing a project-precise PBS.

The SSADM reference guide also provides generic activity networks that is a good starting point for designing project-specific action networks by using project-specific PBS and PFD derivatives.

The hybrid approach

The WBS shown in Fig. 2.6.1 is based largely on structured activities. Or, possibly more frequently, the WBS can be based on the results of the project, as shown in Fig. 2.6.3 and the results of the project are based on a simple list of results. For each result, a series of activities are required to achieve the goal. Fig. 2.6.3 shows a flat WBS and it is likely that the introduction of additional layers of structured products and activities is useful in projects of any size. When the structure is related to the product or the activity may depend on the type of project and the specific development method used. In the same way that pure action-based PSPs, after recognizing actions, our task is to organize them.

The structure defines the number of layers in the structure and the type of each layer, which can be superimposed on the PSP. For example, IBM recommends using the following five levels in WBS in its MITP method :

Level 1 : Project

Level 2 : Deliverables

Level 3 : Components

Level 4 : Work-packages

Level 5 : Tasks

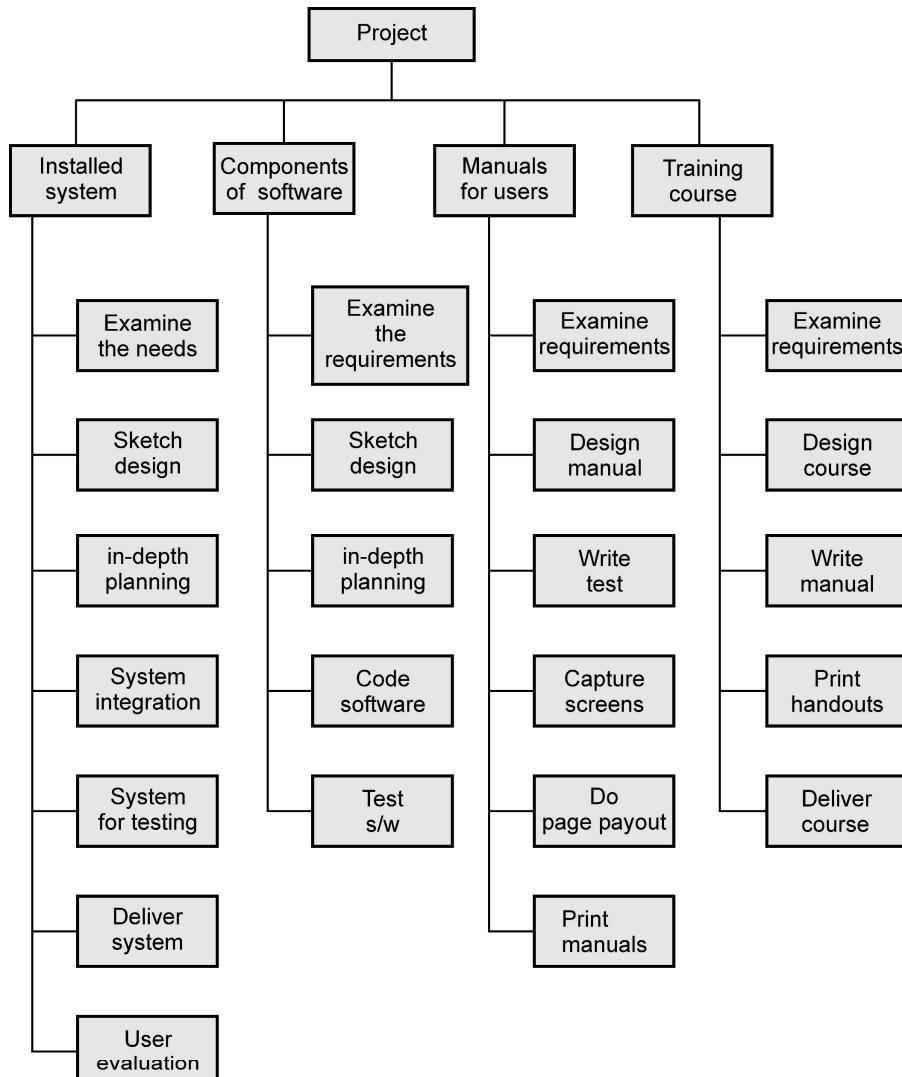


Fig. 2.6.3 Hybrid work breakdown based on deliverables and activities

Review Questions

1. What are the activities of project management ?
2. How do you recognize a project-worthy activity ?

2.7 Sequencing and Scheduling

During the course of the project, we need a schedule that clearly shows the planned time of each project activity and what resources we need. One way to express this type of plan is to use bar charts, as shown in Fig. 2.7.1.

Activity key :

- A : Overall design
- B : Specify module 1
- C : Specify module 2
- D : Specify module 3
- E : Code module 1
- F : Code module 3
- G : Code module 2
- H : Integration testing
- I : System testing

Weeks Task: person	1	2	3	4	5	6	7	8	9	10	11	12	13
A : Bob													
B : Bob													
C : Bob													
D : Bob													
E : John													
F : John													
G : James													
H : James													
I : Roy													

Fig. 2.7.1 A project plan as a bar chart

The chart was created with consideration of the development process's nature and available resources. So when creating the chart, we did two things: we organized and planned the task. If we have a different number of employees, or if we have to distribute events in a different way, the schedule may be completely different.

This method combined with sequential planning is very suitable for small projects, especially if we want to assign personnel to perform specific tasks early in the planning phase. However, for bigger projects, It's best to keep two activities distinct: organizational tasks. Tasks are planned according to their logical relationship, and then considering resources and other factors.

2.8 Network Planning Models

Project activities and their interactions are modeled as networks in these project scheduling systems. Time moves from left to right in the network.

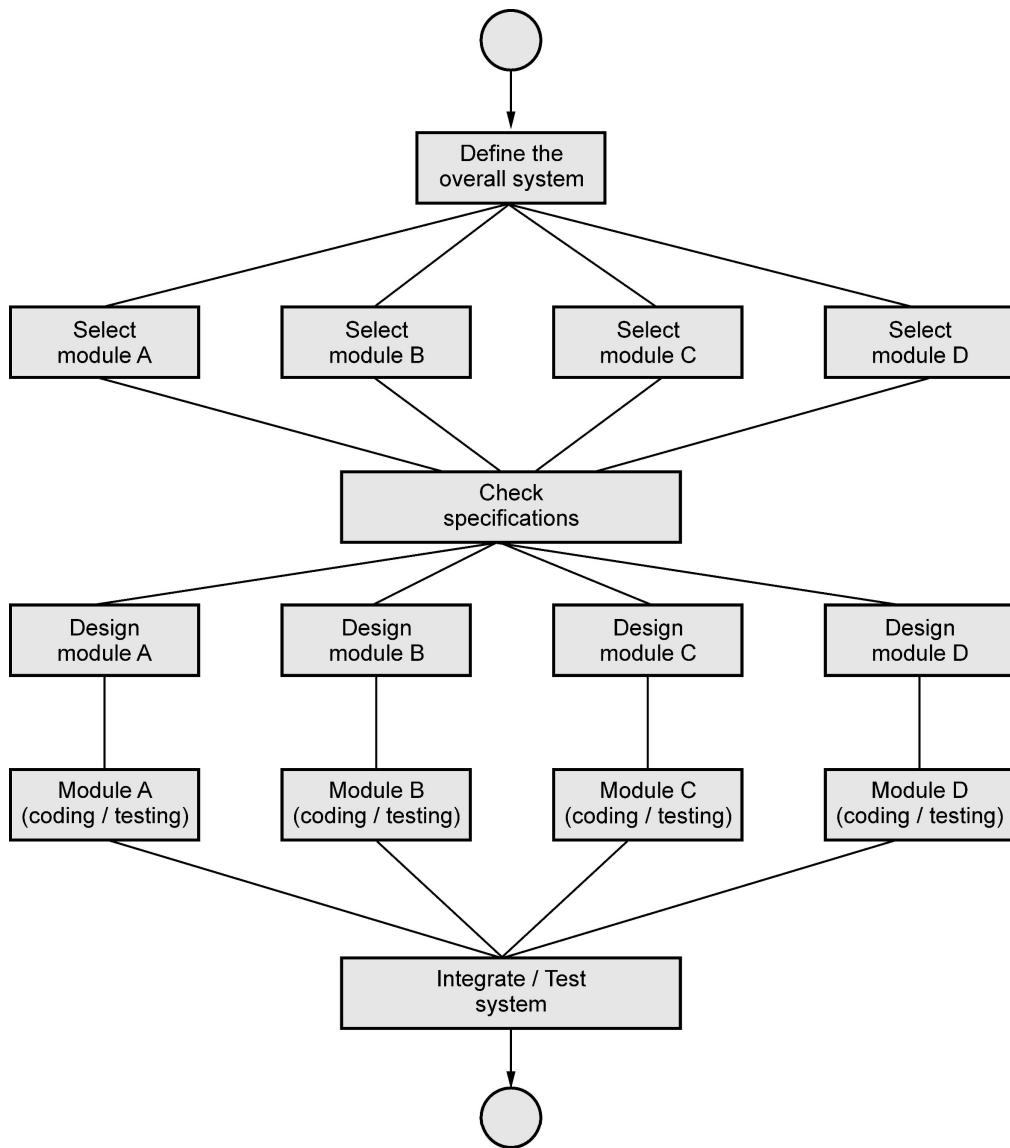


Fig. 2.8.1 The IOE maintenance group accounts project activity network fragment with a checkpoint activity added

CPM (critical path method) and PERT (project evaluation and reporting technique) are two of the most well-known of these methods, which were created in the 1950s (program evaluation analysis method). Recently, variants of these technologies called precedence networks have become popular. This is the method accepted by most computer applications. These three strategies have a lot in common. It's worth noting that many people refer to all of them by the same term (particularly CPM). Fig. 2.8.1 shows the fragment of the network

2.9 Formulating a Network Model

The representation of activities is the initial step in developing a network model and their relationships in the form of graphs. In CPM, we use links (lines with arrows), nodes (circles) and events on the graph to represent them of Start and end activities.

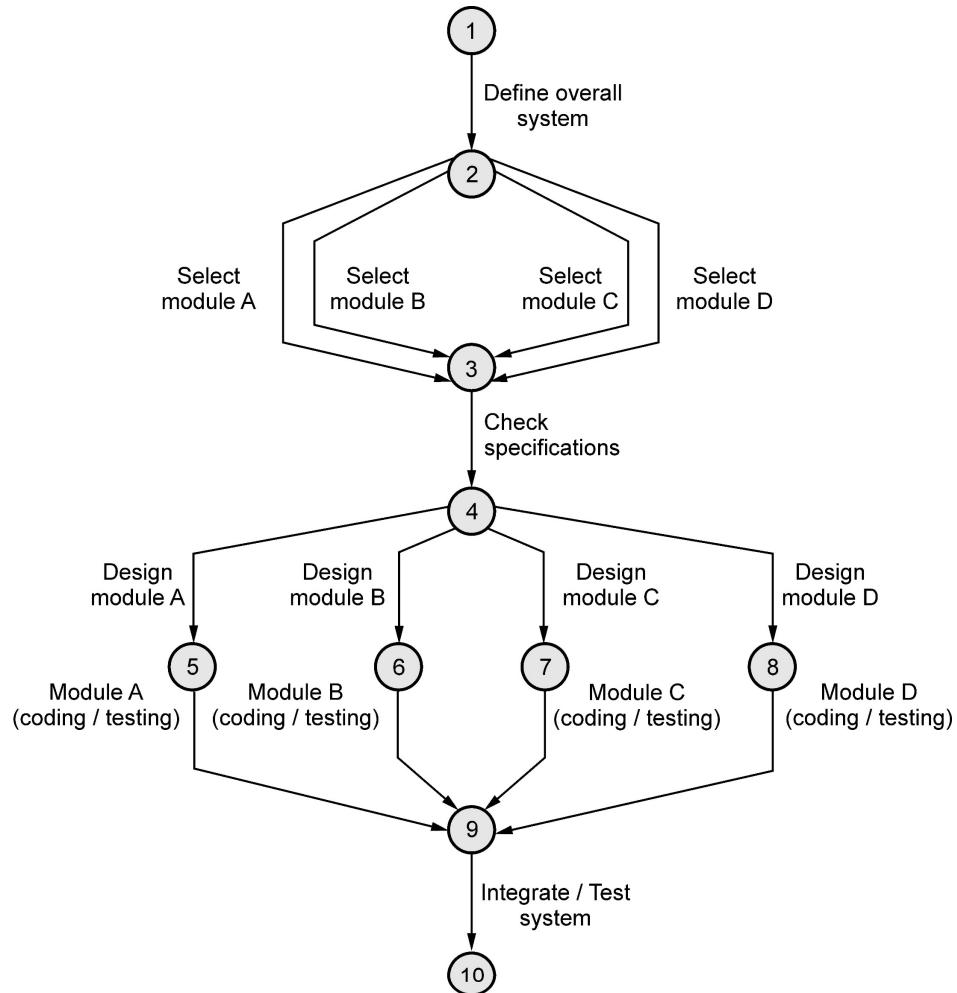


Fig. 2.9.1 The IOE maintenance group accounts project activity network fragment represented as a CPM network

Fig. 2.9.1 shows how this network looks like a network with a critical path.

CPM networks are examples of directed graphs

There can only be one start node in a project network. The start node (node I in Fig. 2.9.1) represents the point where the project can start. All operations issued from this

node can be started immediately, and resources are available, that is, they are not available. We must wait for other operations to start.

A project community can also additionally have most effective one end node. The project's completion is indicated by the end node and a project can also additionally most effective end once! The end node for the project fragment proven in Fig. 2.9.1 is the only numbered 10.

The link continues. Linking is an operation that usually takes some time to complete. Note, however, that the network in Fig. 2.9.1 does not contain any reference to duration period. The network diagram only depicts the project's logic, that is, the guidelines that determine the sequence in which operations are performed.

There is no time limit on nodes. Nodes are instantaneous moments in time that occur as a result of events. The source node represents the project's readiness to begin, while the sink node represents the project's completion.. The intermediate node represents two simultaneous events. An event that causes all operations to the node to be completed and an event that causes all operations to the node to be ready to start.

In Fig. 2.9.2 , node 3 is the event where the coding and data collection is completed and the activity program can be tested. The installation can only start when event 4 is reached, that is, immediately after the program is tested.

From left to right, time passes. If possible, draw the network so that time goes from left to right. This agreement is rarely made fun of, however. In either case, the arrows on the activity line clearly and intuitively represent the lime flow in the project.

The nodes are assigned a number in order of appearance. There is no precise rule for node numbering, but nodes should be numbered so that the main node is always higher than the number of the end event. This convention simplifies loop detection.

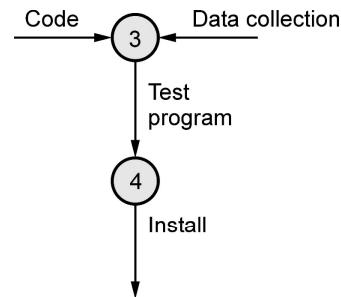


Fig. 2.9.2 Fragment of a CPM network

Review Questions

1. *What methods are used to sequence and schedule activities ?*
2. *What role does the network play in project planning ?*
3. *What will the network model look like ?*

2.10 Multiple Choice Questions

- Q.1** There is no mention of inter-task interdependence in _____.
 a) PERT charts b) Gantt charts
 c) Both a) and b) d) None of the above
- Q.2** On the basis of the project's schedule, you can get an idea of the start and end dates of major activities or final items.
 a) True b) False
- Q.3** A software project management focus on which of the following is not effective ?
 a) Popularity b) Process
 c) Product d) People
- Q.4** What is the description of the data and control that is going to be handled ?
 a) Planning process b) External hardware
 c) Project complexity d) Software scope
- Q.5** The initial phase in project planning _____.
 a) determine the budget b) establish the objectives and scope
 c) select a team organizational model d) determine the project constraints
- Q.6** Which of the following is regarded the most basic parameter in project planning ?
 a) Project effort b) Project duration
 c) Project schedule d) Project size
- Q.7** Planned projects are documented in the form of a _____.
 a) SRS document b) detailed design document
 c) excel sheet d) SPMP document
- Q.8** Project planning does not employ the following strategy.
 a) CPM b) Activity diagram
 c) Gantt chart d) Timesheet
- Q.9** The PERT method assigns the most weightage to _____.
 a) the most pessimistic estimate obtained
 b) the most optimistic estimate obtained
 c) the most likely estimate obtained
 d) all the estimates obtained have equal weights

Q.10 Managers can use a _____ to estimate the amount of time and resources needed to complete a project.

- [a] Gantt chart [b] PERT chart
[c] Activity diagram [d] None of the above

Q.11 PERT charts are not deadline-driven.

- [a] True [b] False

Q.12 A Gantt chart is a sort of horizontal bar chart

- [a] True [b] False

Q.13 The _____ is one of the simplest and oldest methods for tracking project progress.

- [a] Gantt chart [b] PERT chart
[c] Activity diagram [d] None of the above

Q.14 _____ is a Java-based project management program that runs on Microsoft Windows, Linux, and Mac OS X.

- [a] PERT project [b] Gantt project
[c] Research projects [d] Management projects

Q.15 MS-Project is compatible with _____ different baselines.

- [a] 10 [b] 12
[c] 11 [d] none of these

Q.16 MS-Project, on the other hand, only supports up to _____.

- [a] 40 columns. [b] 60 columns
[c] 30 columns [d] 200 columns

Q.17 Primavera is a project management software that runs on a _____

- [a] database [b] Linux
[c] files [d] none of these

Q.18 WBS (Work Breakdown Structure) can be created in _____

- [a] Microsoft project [b] Primavera
[c] PERT [d] All of the above

Q.19 In Microsoft project, what types of constraints are available ?

- [a] As late as possible [b] As soon as possible
[c] Both A and B [d] None of these

Q.20 How can we establish a deadline in Microsoft project ?

- a Double-click a task -> it will open a task information dialog box
- b Now, click on the advanced tab
- c Then click on the arrow in the deadline field to show the calendar and then choose a date
- d All of the above

Q.21 Project issues and risk tracking are not available in _____

- a Primavera
- b MS-project
- c WBS
- d PERT

Q.22 A project scheduling method that can be used in software development is which of the following ?

- a CMM
- b PERT
- c CPM
- d Both PERT and CPM

Q.23 It's common for a project to have a timeline chart that was proposed by _____.

- a Barry Boehm
- b Jacobson
- c Henry Gantt
- d None of the mentioned

Q.24 A _____ can be formulated for the project scheduling techniques.

- a Hybrid model
- b Network model
- c Critical model
- d None of these

Q.25 In _____, we use links , nodes and events on the graph to represent them of start and end activities.

- a CPM
- b PERT
- c Gantt chart
- d PERT chart

Q.26 Critical Path of CPM used in project planning techniques implies _____

- a delays in the project
- b early start and late end of the project
- c time require for the completion of the project
- d none of the above

Q.27 Project planning does not include which of the following ?

- a IRR (Internal Rate of Return)
- b PERT
- c Gantt chart
- d CPM

Q.28 According to the Network Model, activity completion times might fluctuate due to _____.

- a PERT
- b CPM
- c CUSUM
- d Gantt chart

Q.29 When it comes to CPA, which of the following things is true ?

- a The critical path is the longest path through the network.
- b The critical path is the shortest path through the network.
- c Tasks with float will never become critical.
- d The network should remain constant throughout the project.

Q.30 As the name suggests, the path through the project network that has no slack is termed _____.

- a slack time
- c delay time

- b start time
- d critical path

Q.31 A bar chart is used for _____

- a resources vs progress
- c progress vs time

- b time vs activity
- d activity vs resources

Answer Keys for Multiple Choice Questions :

Q.1	b	Q.2	a	Q.3	a	Q.4	d
Q.5	b	Q.6	d	Q.7	d	Q.8	d
Q.9	c	Q.10	b	Q.11	b	Q.12	a
Q.13	a	Q.14	b	Q.15	c	Q.16	a
Q.17	a	Q.18	b	Q.19	d	Q.20	d
Q.21	b	Q.22	d	Q.23	c	Q.24	b
Q.25	a	Q.26	c	Q.27	a	Q.28	a
Q.29	a	Q.30	d	Q.31	b		



Notes

UNIT- III

3

Activity Based Scheduling

Syllabus

Introduction, Objectives of Activity Planning, Project Schedules. Activities : Sequencing and Scheduling, Network Planning Models, Formulating Network Model, Activity relationships (FS,SF,SS,FF), Forward Pass and Backward Pass techniques, Critical Path concept and remedies.

Contents

- 3.1 *Introduction*
- 3.2 *Objectives of Project Planning*
- 3.3 *Project Plan*
- 3.4 *Project Schedule*
- 3.5 *Activities*
- 3.6 *Activity Relationships*
- 3.7 *The Forward Pass*
- 3.8 *The Backward Pass*
- 3.9 *Critical Path*
- 3.10 *Multiple Choice Questions*

3.1 Introduction

The approaches for estimating the amount of effort needed for a project, both overall and for particular activities. A complete project plan, on the other hand, must include a timetable detailing the start and finish timeframes for each task. We'll be able to do the following as a result of this :

- Ensure that the necessary resources are available at the precise moment they are needed;
- Prevent many activities from vying for the same resources at the same time;
- Create a complete list of events who is performing each operation;
- Develop detailed plans to measure actual performance;
- Make a cash flow prediction for a specific period of time;
- Re-arrange the project during the project life cycle to correct deviations from the target.

An activity is commonly one level of a project management plan. Each activity includes one or greater movements that, upon completion, will result in the next project stage. Taken collectively as a series, the activity will bring about the fast deliverable.

As the project progresses, everything is unlikely to proceed as planned. Most of the work of project management is to identify when problems occur, determine their causes, and analyze plans to mitigate the problems.

The action plan must include a way to evaluate the outcome of not being completed on time and provide guidance on how to change the plan more effectively to get the project back on track.

As we will see, the activity plan can also provide guidance on which project components need to be monitored more closely.

3.2 Objectives of Project Planning

Objectives of project planning are as follows :

Feasibility assessment : A feasibility study is only an assessment of the feasibility of a proposed plan or project. Pay attention to possible problems during project implementation. In order to determine whether the project is feasible after considering all important factors, that is, whether it is worth solving.

Resource allocation : Resource allocation is the process of allocating and scheduling available resources as efficiently and economically as possible. Projects always need

resources, but these resources are usually scarce. Therefore, it is the responsibility of the project manager to determine the appropriate time and allocate resources. These resources are within the project schedule. So what is the resource allocation in project management? It is about managing and delegating resources throughout the project to ensure that it runs as evenly and successfully as possible.

Detailed costing : After generating an activity plan and allocating particular resources, we will acquire extra complete estimates of prices and their timing.

Motivation : Motivation to set goals and track progress against goals is an effective way to motivate employees, especially if they are initially involved in setting these goals.

Coordination : The project plan offers a useful service means of communication and collaboration between teams, especially for large projects with multiple project teams. Can be used as needed, will not be affected by forced shutdown.

The goal of activity planning and scheduling strategies is to complete the project in the shortest possible time at the lowest possible value, or to fulfill an arbitrary deadline at the lowest possible value.

A successful method to shorten the project duration is to hold activities in parallel. Obviously, we cannot complete all activities at the same time, some of which require completion of other activities to start and there may be resource constraints that limit the scope of work. However, activities planning will enable us to understand the cost of these restrictions in terms of extending the time frame, and will let us understand how to reduce the time frame by relaxing these restrictions. For example, priority restrictions make it possible to start coding the program before the design is complete to ensure that we have a clear understanding of the potential impact on product quality.

Review Questions

1. *What is activity based scheduling ?*
2. *What are the objectives of activity planning? Explain in detail.*

3.3 Project Plan

Planning is a process of continuous improvement, and each iteration is more detailed and precise than the previous one. Iterations after iterations, focus and the plan's objective will change.

Throughout the feasibility study and start-up of project period, the main objective of the plan is to assess the time and risk of non-compliance with the deadline for completion

or exit within the budget. Develop an action plan to ensure the availability of resources and control of cash flow.

From the entire project to the delivery of the final product to the customer, monitoring and re-planning should continue to correct any deviations that may hinder the achievement of time or cost goals.

Review Question

1. *Explain the importance of project plan.*

3.4 Project Schedule

In the case of large projects, detailed planning for subsequent stages will be postponed till the details of the necessary task is available at an earlier point in time.

Before starting work on a project, or perhaps in a bigger project phase, a project plan should be created to show the date when each activity should start and end and the amount of each resource. When a plan is improved to a level of detail it is called a project schedule.

There are four phases to developing a project schedule.

The initial stage in creating a plan is deciding which activities must be completed and in what sequence they must be completed. On this basis, we can create an ideal activity plan, that is, if resources are not limited, ideally a time plan for each action can be taken. This is about making the perfect plan of activity. The activity plan is gradually created in steps 4 and 5, as shown in the Fig. 3.4.1. (Refer Fig. 3.4.1 on next page)

The ideal activity plan then becomes the subject of activity risk analysis, the purpose of which is to identify potential problems that can come up with an activity plan that will almost certainly affect the allocation of resources.

The third phase is to allocate resources. Expected resources availability may limit how some activities can be taken, and our ideal plan may need to take this into account.

The last step is scheduling. Once resources are allocated for each activity, we can create and produce a project schedule, which contains the start and end dates of the plan and an overview of the resource requirements for each activity.

Review Questions

1. *What is a project ?*
2. *Explain how project schedule is done in step wise.*

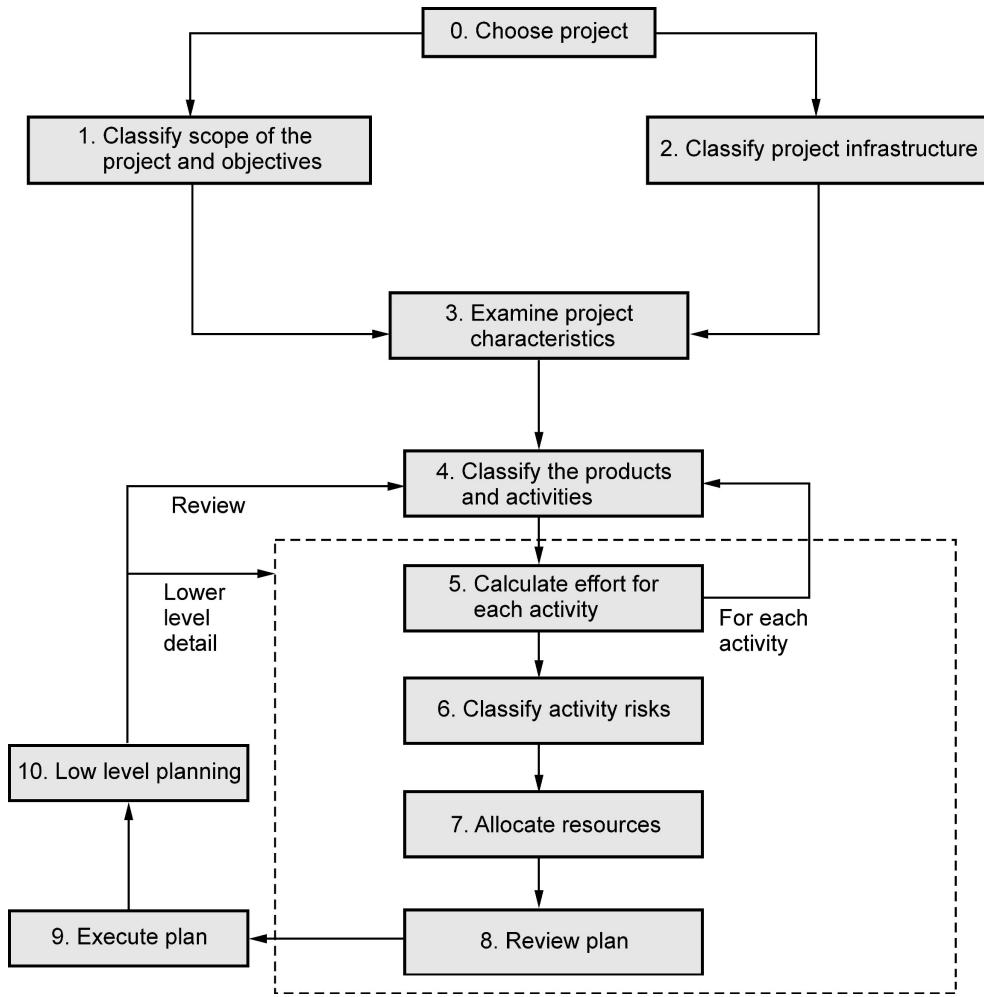


Fig. 3.4.1 The activities are planned for step 4 and step 5

3.5 Activities

Project activities are actions taken by the project to achieve the set goals. These are very specific, practical and well-defined measures. By reading the description of the project activity, we can immediately describe the project in our mind effortlessly.

Activities need to be defined to fulfill these standards. Any activity that does not fulfill these standards should be reviewed.

- The project consists of many interrelated activities.
- When at least one activity is ready to start, the activities can begin.
- When all activities in the project are completed, the project is complete.
- Activities should have a clearly defined starting and ending point, usually characterized by achieving tangible results.

- When an activity requires a resource, the demand for that resource should be predictable, and it is assumed that as the activity decomposes, it will continue to be needed.
- The period of a pastime need to be forecastable assuming regular circumstances, and the affordable availability of resources.
- Certain activities may require other users to complete before they can begin.

Identifying activities

The activity-based approach, the product-based approach, and the hybrid approach are the three basic techniques to determining the activities or tasks that make up a project.

The activity-based approach :

The activity-based approach involves making a list of all the project's activities should include, which can be brainstormed with the entire project team or derived from an analysis of previous projects. For large projects, it may be helpful to break the project down into lifestyle milestones and view each milestone separately.

The preferred method of creating a task list is to create a work breakdown structure (WBS) instead of performing this operation all at once, and there is an obvious risk of tasks being missed or calculated twice. This includes defining the main goal (or high level). It is necessary to finish the project first and then divide it down into sub-tasks. Fig. 3.5.1 shows an excerpt from the PSP, where the design task is split into three tasks, and one of the tasks is split into two tasks.

Activities are introduced to a branch with inside the shape in the event that they at once make a contribution to the task right away above - in the event that they do now no longer make a contribution to the parent task, then they must now no longer be introduced to that branch.

The task at every degree in any branch has to consist of the whole thing this is required to finish the task on the better degree.

When making ready a WBS, attention should accept to the very last degree of element or intensity of the shape. Too outstanding a intensity will bring about a massive wide variety of small duties so that it will be hard to control, while a too shallow shape will offer inadequate element for task control. Branches should, however, be deteriorated as a minimum to a degree wherein every leaf can be allocated to an person or accountable phase in the corporation.

One of the aforementioned advantages of the WBS method is to determine that it tends to generate a complete task catalogue with non-overlapping activities. Please note that only the outline table constitutes the list of activities that make up the project. The top node is just a collection of operations.

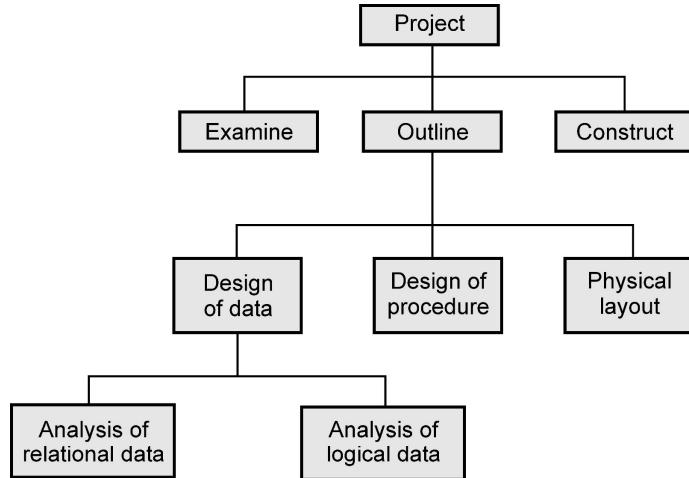


Fig. 3.5.1 A fragment of an activity-based work breakdown structure

The product-based approach

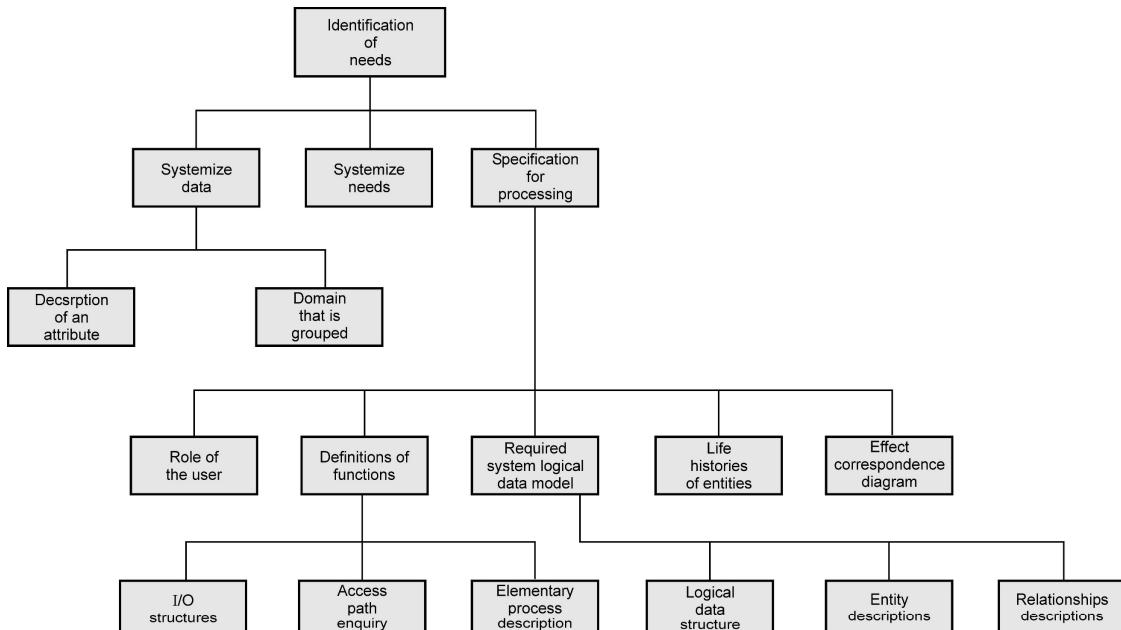


Fig. 3.5.2 SSADM product breakdown structure

It includes creating a hierarchical product structure and product block diagram. For each product, the PFD indicates which other products are required as input. Therefore, by identifying some proponents who led to this approach argued that products are less likely to be excluded from PBS than activities in unstructured activities and PFD can easily become an ordered list of activities.

This method is in particular suitable if the usage of a technique inclusive of SSADM, which without a doubt specifies, for every step or task, every of the goods required and the task required to supply it. The SSADM Reference Manual gives a fixed of regularly occurring PBSs for every level in SSADM (inclusive of that proven in Fig. 3.5.2), which may be used as a foundation for producing a project-precise PBS.

The SSADM reference guide also provides generic activity networks that is a good starting point for designing project-specific action networks by using project-specific PBS and PFD derivatives.

The hybrid approach

The WBS shown in Fig. 3.5.1 is based largely on structured activities. Or, possibly more frequently, the WBS can be based on the results of the project, as shown in Fig. 3.5.3 and the results of the project are based on a simple list of results. For each result, a series of activities are required to achieve the goal. Fig. 3.5.3 shows a flat WBS, and it is likely that the introduction of additional layers of structured products and activities is useful in projects of any size. When the structure is related to the product or the activity may depend on the type of project and the specific development method used. In the same way that pure action-based PSPs, after recognizing actions, our task is to organize them.

The structure defines the number of layers in the structure and the type of each layer, which can be superimposed on the PSP. For example, IBM recommends using the following five levels in WBS in its MITP method :

Level 1 : Project

Level 2 : Deliverables

Level 3 : Components

Level 4 : Work-packages

Level 5 : Tasks

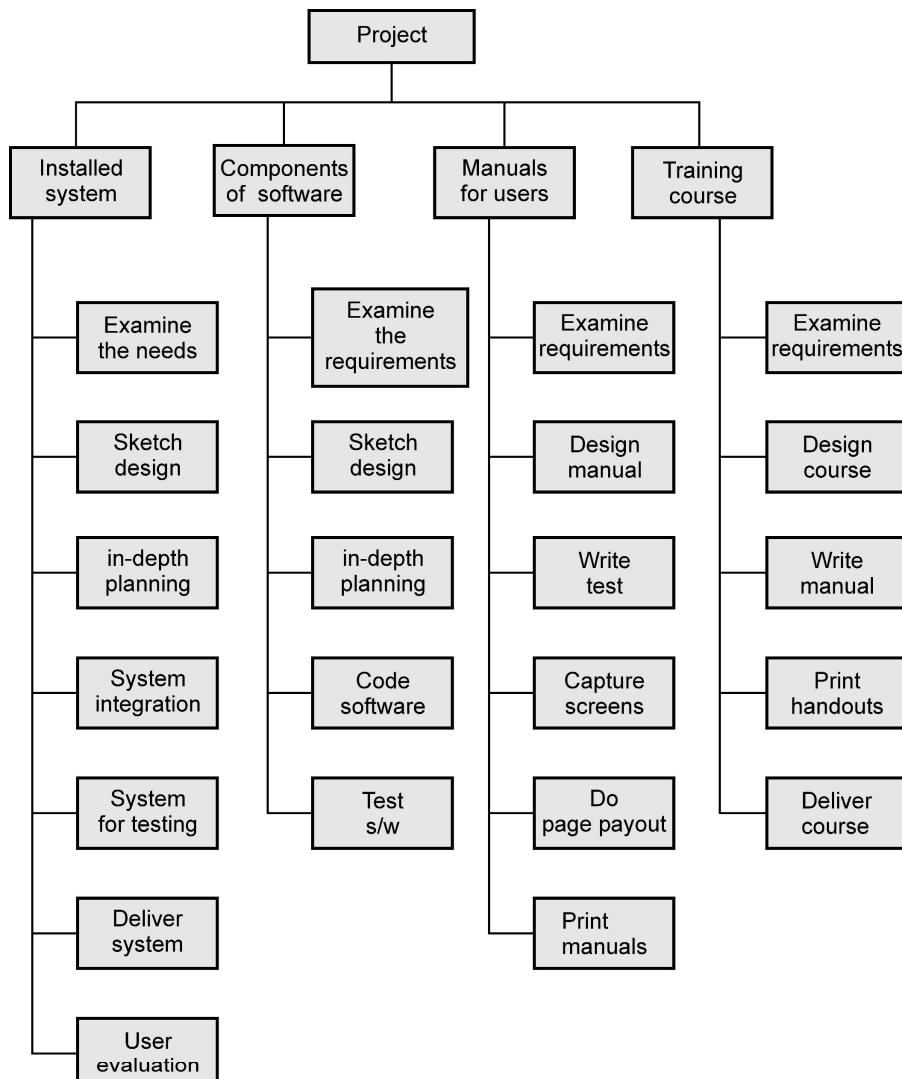


Fig. 3.5.3 Hybrid work breakdown based on deliverables and activities

Review Questions

1. Write a short note on activity.
2. Explain different approaches for identifying the activities that make up a project.

3.5.1 Sequencing and Scheduling Activities

During the course of the project, we need a schedule that clearly shows the planned time of each project activity and what resources we need. One way to express this type of plan is to use bar charts, as shown in Fig. 3.5.4.

Activity key:

- A : Overall design
- B : Specify module 1
- C : Specify module 2
- D : Specify module 3
- E : Code module 1
- F : Code module 3
- G : Code module 2
- H : Integration testing
- I : System testing

Weeks Task : person	1	2	3	4	5	6	7	8	9	10	11	12	13
A : Bob													
B : Bob													
B : Bob													
D : Bob													
E : John													
F : John													
G : John													
H : James													
I : Roy													

Fig. 3.5.4 A project plan as a bar chart

The chart was created with consideration of the development process's nature and available resources. So when creating the chart, we did two things: we organized and planned the task. If we have a different number of employees, or if we have to distribute events in a different way, the schedule may be completely different.

This method combined with sequential planning is very suitable for small projects, especially if we want to assign personnel to perform specific tasks early in the planning phase. However, for bigger projects, It's best to keep two activities distinct: organizational tasks. Tasks are planned according to their logical relationship, and then considering resources and other factors.

3.5.2 Network Planning Models

Project activities and their interactions are modeled as networks in these project scheduling systems. Time moves from left to right in the network.

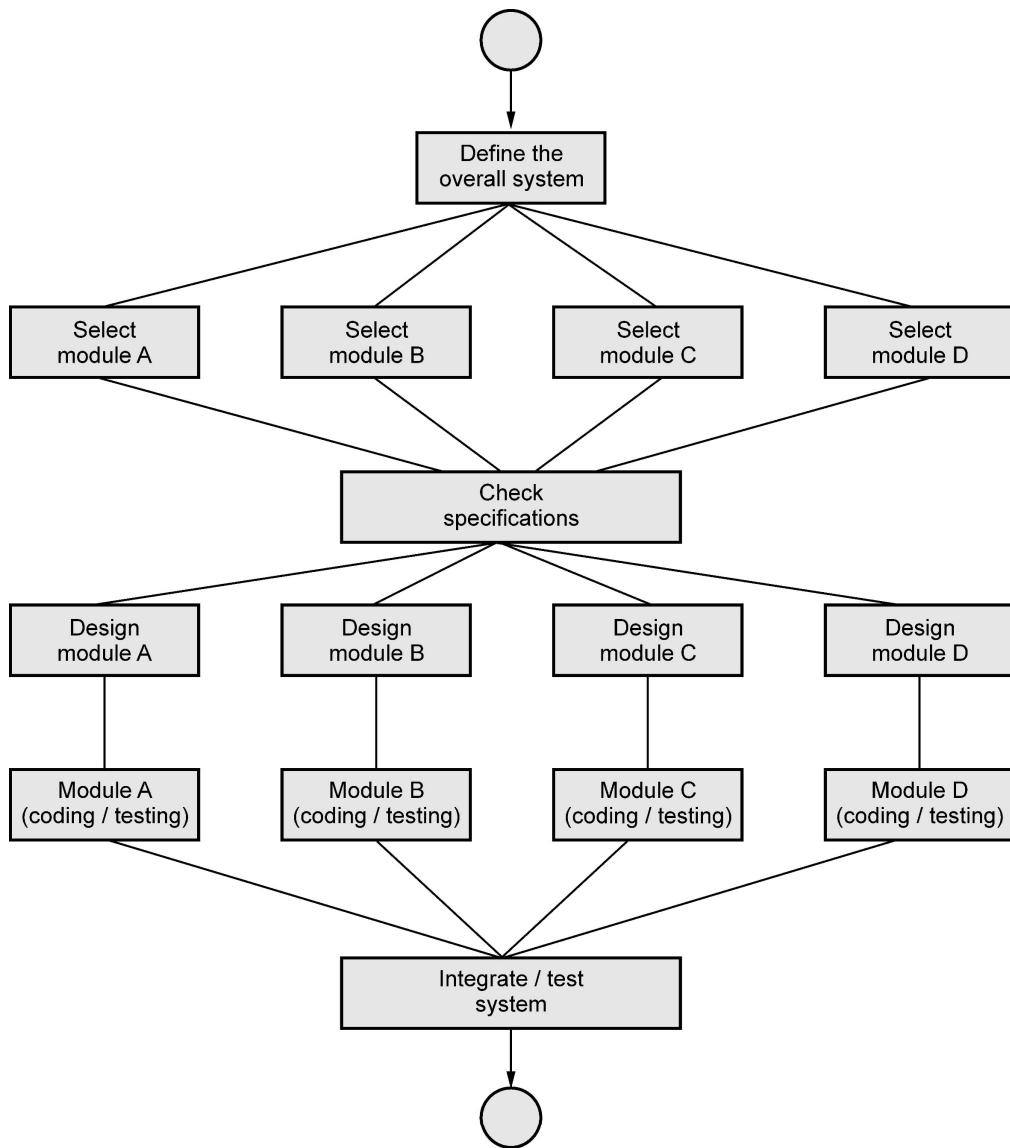


Fig. 3.5.5 The IOE maintenance group accounts project activity network fragment with a checkpoint activity added

CPM (critical path method) and PERT (project evaluation and reporting technique) are two of the most well-known of these methods, which were created in the 1950s (program evaluation analysis method). Recently, variants of these technologies called precedence networks have become popular. This is the method accepted by most computer applications. These three strategies have a lot in common. It's worth noting that many people refer to all of them by the same term (particularly CPM).

3.5.3 Formulating a Network Model

The representation of activities is the initial step in developing a network model and their relationships in the form of graphs. In CPM, we use links (lines with arrows), nodes (circles) and events on the graph to represent them of Start and end activities.

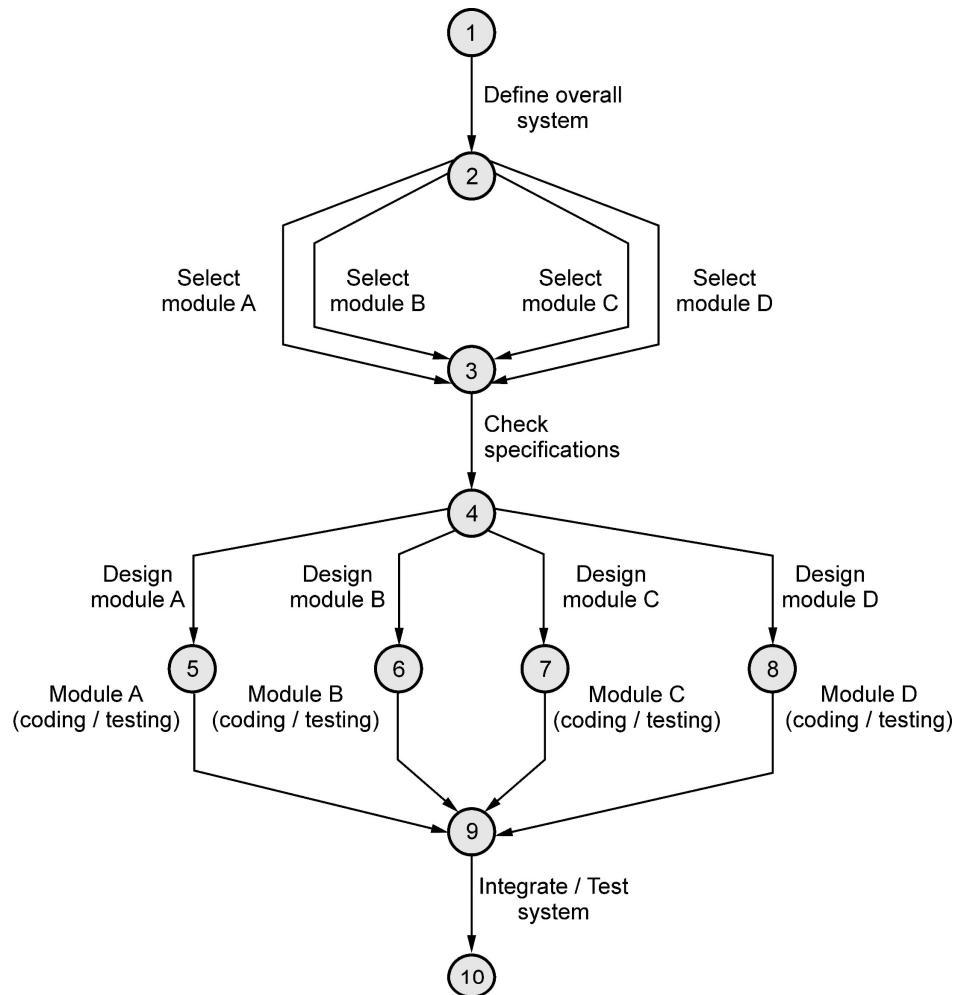


Fig. 3.5.6 The IOE maintenance group accounts project activity network fragment represented as a CPM network

Fig. 3.5.5 shows the fragment of the network and Fig. 3.5.6 shows how this network looks like a network with a critical path.

CPM networks are examples of directed graphs

There can only be one start node in a project network. The start node (node I in Fig. 3.5.6) represents the point where the project can start. All operations issued from this

node can be started immediately, and resources are available, that is, they are not available. We must wait for other operations to start.

A project community can also additionally have most effective one end node. The project's completion is indicated by the end node and a project can also additionally most effective end once! The end node for the project fragment proven in Fig. 3.5.6 is the only numbered 10.

The link continues. Linking is an operation that usually takes some time to complete. Note, however, that the network in Fig. 3.5.6 does not contain any reference to duration period. The network diagram only depicts the project's logic, that is, the guidelines that determine the sequence in which operations are performed.

There is no time limit on nodes. Nodes are instantaneous moments in time that occur as a result of events. The source node represents the project's readiness to begin, while the sink node represents the project's completion. The intermediate node represents two simultaneous events. An event that causes all operations to the node to be completed and an event that causes all operations to the node to be ready to start.

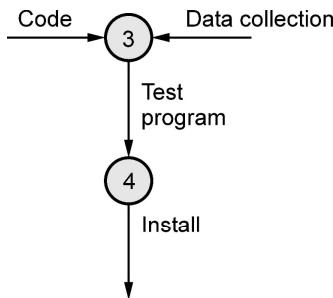


Fig. 3.5.7 : Fragment of a CPM network

In Fig. 3.5.7, node 3 is the event where the coding and data collection is completed and the activity program can be tested. The installation can only start when event 4 is reached, that is, immediately after the program is tested.

From left to right, time passes. If possible, draw the network so that time goes from left to right. This agreement is rarely made fun of, however. In either case, the arrows on the activity line clearly and intuitively represent the lime flow in the project.

The nodes are assigned a number in order of appearance. There is no precise rule for node numbering, but nodes should be numbered so that the main node is always higher than the number of the end event. This convention simplifies loop detection.

The network must not contain any loops. Fig. 3.5.8 shows a loop in the CPM network. In a sense, the loop is an error; since it reflects a condition that does not exist in reality.

Loops in the iterative sense can occur in practice, but they cannot be directly mapped to the project network. It should be noted that the logical assumption in Fig. 3.5.8 cannot start the program test until the error is corrected.

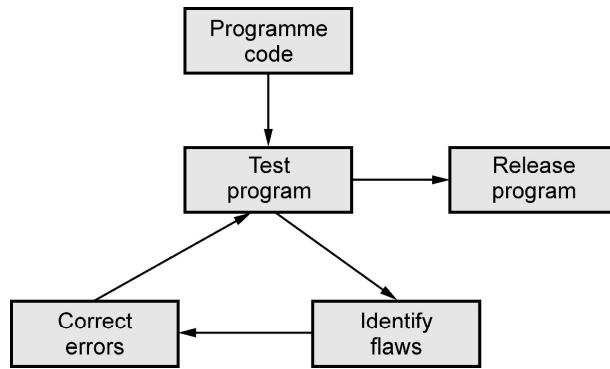


Fig. 3.5.8 An impossible sequence is represented as a loop

If we know how many times we plan to repeat a set of actions, such as a test-diagnose-correct sequence, we can draw it as a straight sequence and repeat it the necessary number of times. We can't compute the duration of a project if we don't know how many times a sequence will be repeated unless we use a different technique, such as reframing the entire sequence as a single activity and calculating how long it will take to complete it.

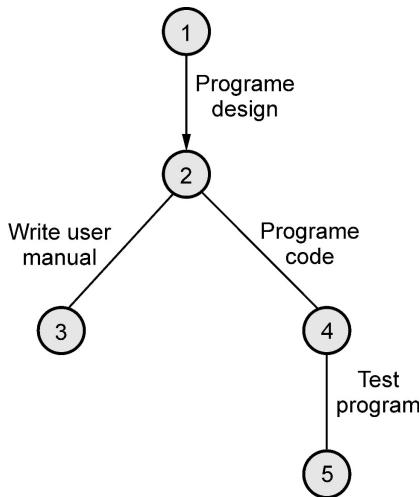


Fig. 3.5.9 A dangle

The network cannot contain dangling nodes. A completion action like the entry in the user manual in Fig. 3.5.9 cannot exist because it assumes that the project has two endpoints. In Fig. 3.5.9, node 5 represents the true end of the project, and there are no related activities. If we write a user manual, we must redraw the network so that the

operation of writing the user manual starts at node two and ends at node five. In actuality, we'd have to add a dummy activity between nodes three and five, as indicated in Fig. 3.5.9. In other words, save for the first and last, all events must have at least one activity entering and departing them, and all activities must begin and conclude with an event. The redrawn network is shown in Fig. 3.5.10.

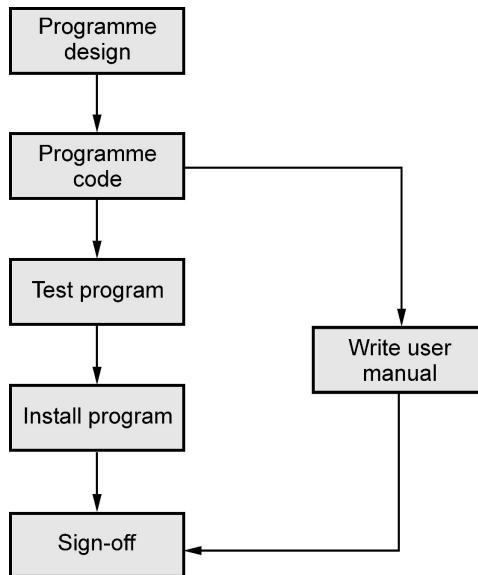


Fig. 3.5.10 Resolving the dangle

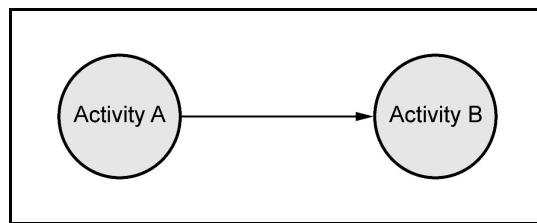
Review Questions

1. *What are the network planning models ?*
2. *With the neat sketch explain formulating a network model.*
3. *Explain sequencing and scheduling activities with example.*

3.6 Activity Relationships

After determining the activities, we analyze them to see if there is any relationship between them. If there is a relationship, it is best to show it, so as to better comply with the project schedule. There is a link between these two activities shown in Fig. 3.6.1. Let's do two exercises to understand this concept and name activity A and B.

Activity A and B are predecessor and successor activities. If something goes wrong with the previous operation, it will affect the subsequent operation. Therefore, the subsequent action B is a subordinate action of the previous action A. We can see here-A is an independent action. Logically speaking, action A precedes action B.

**Fig. 3.6.1 Activity relationships**

There are four types of relationships between Action A and B :

Finish-to-start (FS)

Finish-to-finish (FF)

Start-to-start (SS)

Start-to-finish (SF)

We use F or S to define the relationship between these two characters (AB).

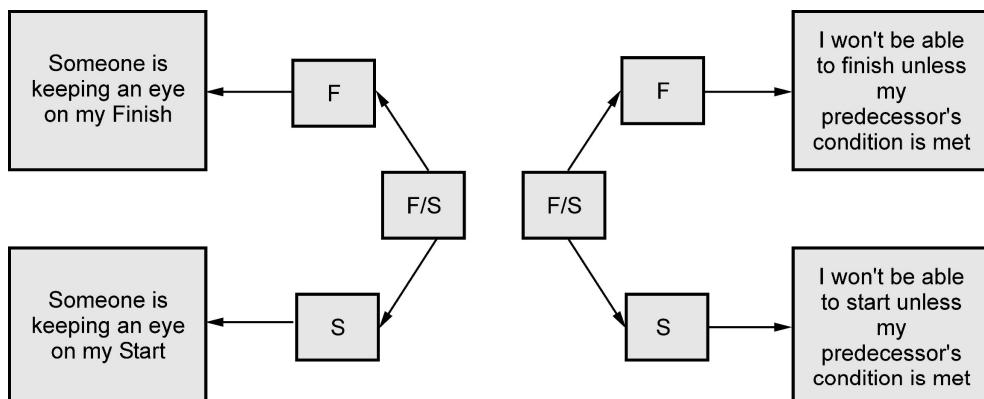
The first character is linked to the preceding activity (Activity A), It specifies the processor's current state of operation, In the same way, we attach the second character to the successor (Activity B), The character specifies the rule that must be applied to the next activity shown in the Fig. 3.6.2.

Finish-to-Start (FS)

A logical link between two activities in which a successor endeavor cannot begin until the predecessor activity is complete.

The most prevalent logical relationship is Finish to Start.

As we can see, this limitation of relationships does not affect independent activities, but only dependent activities, that is, in our case activity B.

**Fig. 3.6.2 Activity relationships with finish and start activities**

As a result of this FS connection, F represents the end of action A, and it is at this point that activity B can begin. The second character "S" is the successor rule, making it dependent on the final state of the successor of the action shown in Fig. 3.6.3.

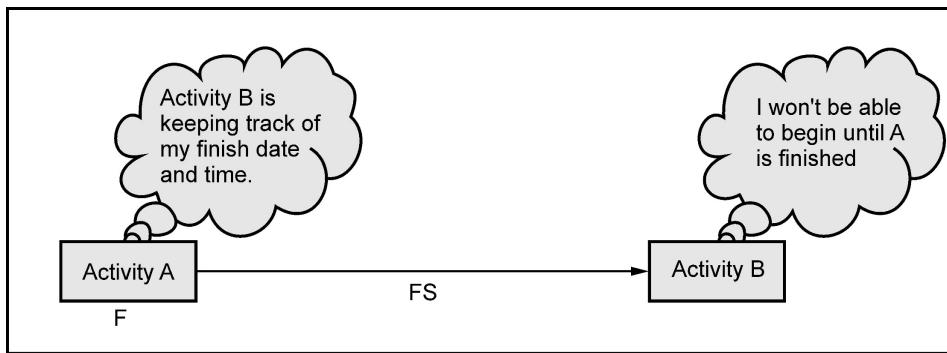


Fig. 3.6.3 Finish-to-start

Example

We cannot start development before the design is complete. The development here is an activity that depends on the design activity. Design is the activity that comes before development, and it can only begin once it is completed.

Start-to-Start (SS)

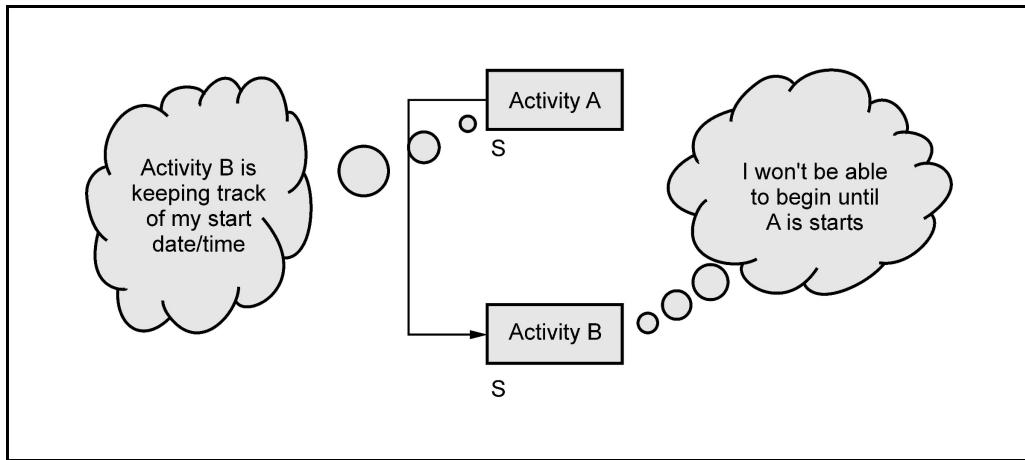
A logical relationship where a successor activity cannot begin until the predecessor activity has begun.

As a result, if action B is dependent on this relationship, it cannot begin until the preceding (independent) activity A has begun. The start of the predecessor activity B depends on the start status of the successor activity A from activity B shown in Fig. 3.6.4.

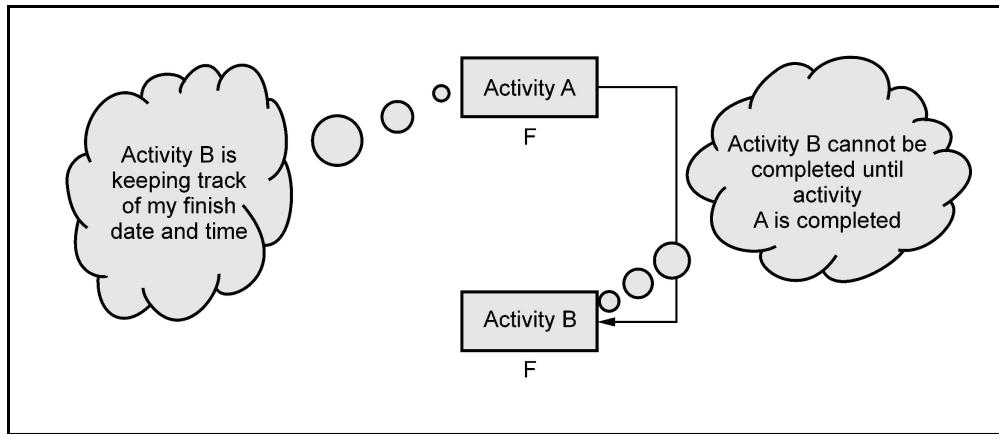
Example

The marketing manual preparation activity can only start after the user document is run, so A and B can run in parallel after A starts.

If we want to know the actual conditions under which operation B can be made dependent on the initial state of operation A.

**Fig. 3.6.4 Start-to-start****Finish-to-finish (FF)**

A logical relationship in which a successor action cannot complete until the predecessor has completed.

**Fig. 3.6.5 Finish-to-finish**

If activity B is associated with this relationship, it means that it cannot be completed until the previous (independent) activity A is completed. Therefore, B must complete their result and continue A until A completes. For example, playing a football game cannot end before the game is over. Therefore, the game does not rely on rebroadcasting, but on rebroadcasting. If the game lasts longer than originally planned, the transmission will also continue until this point in time shown in Fig. 3.6.5.

Even if the game is over, the broadcast can continue. The show can continue to discuss highlights and so on. This means that it will end after subsequent operations, but it must end immediately.

Start-to-Finish (SF)

A logical connection in which successor activity cannot be completed before the start of the predecessor activity.

So, if activity B is tied to this relationship, it won't be able to finish until independent action A begins. It appears perplexing since, in most circumstances, the predecessor action is completed before the successor activity. The successor, however, comes first in this scenario. However, even if the successor occurs first, the predecessor is unaffected by successor activity. It is self-sufficient. However, the successors (Activity B) will not be able to finish until the predecessor has begun (Activity A starts) shown in Fig. 3.6.6.

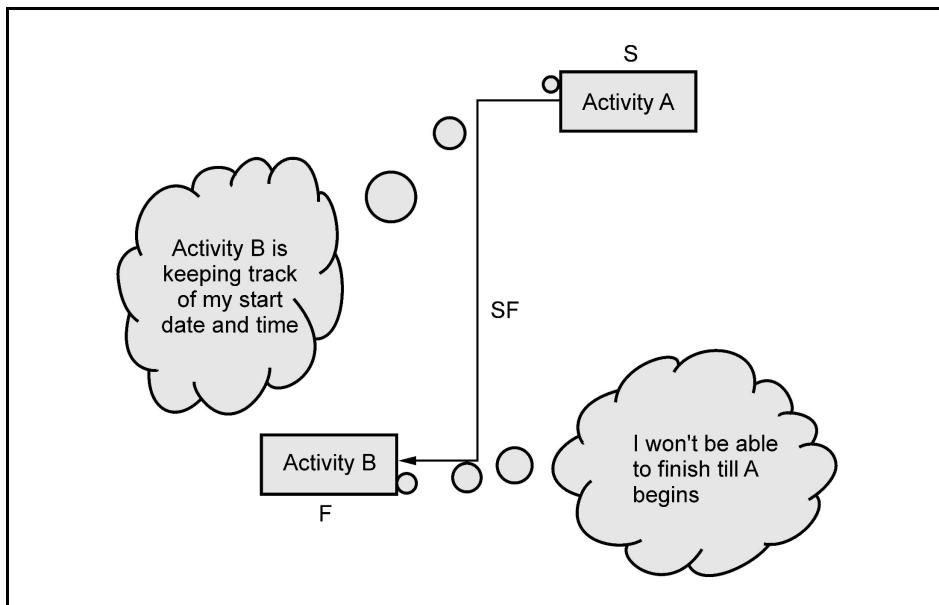


Fig. 3.6.6 Start-to-finish

Review Questions

1. What is activity relationships in software project management ?
2. How many activity relationships are used in software project management ? Explain any two relationships in detail.
3. Explain any good example of finish to-start in detail.
4. What is Start-to Start activity relationship between two activities. Give suitable example.

3.7 The Forward Pass

In the forward pass, the earliest date is recorded in the calculation. They are recorded in the network diagram of the activities and the activity table of the activity.

The forward pass is used to determine the earliest date on which each event and activity can be begun and completed. The earliest date for an event is the earliest date that all of the activities that it depends on may be accomplished.

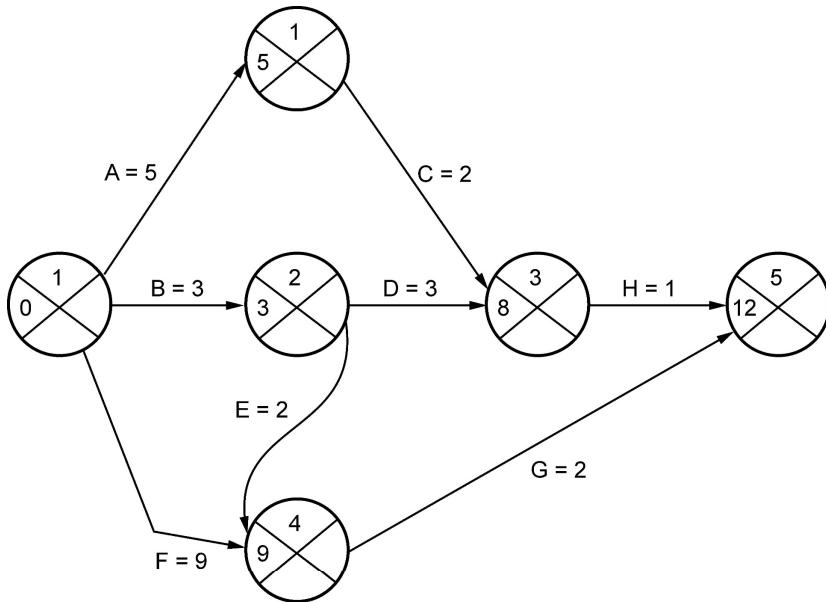


Fig. 3.7.1 A CPM network after the forward pass

Dates are used to signify the conclusion of a period by convention, therefore the project is portrayed as beginning in week zero (or the beginning of week I).

The calculation of the forward pass and earliest start date is based on the following considerations.

- Because activities A, B, and F can begin at any time, the earliest start date for event 1 is zero, as well as the earliest start date for these three activities.
- Activity A will take five weeks to complete, thus the earliest it may be completed is week five (recorded in the activity table). As a result, the earliest we can complete event 2 is week five.
- Activity B will take three weeks to complete, therefore the earliest it can be completed and the earliest we can complete event three is week three.
- Because activity F will take nine weeks to complete, the earliest it can be completed is week nine; but, because we have not yet estimated when activity E will be

completed, we cannot say whether or not this is also the earliest date that we can complete event five.

- When both E and F have been finished, that is, week 9, event 5 can be performed (the later of 7 and 10).
- We can also assume that event 4 will occur in week 8. This is the later of activity D's (week 7) and activity C's (week 7) earliest completion dates (week 8).
- The earliest project completion date, Activity 5, is the end of week 12 and the last is week 10 (H is the earliest completed) and week 12 (G is the earliest completed).

Fig. 3.7.1 and Table 3.7.1 shows the results of the forward pass.

Activity	Duration (Weeks)	Earlier start date	Latest start date	earliest finish date	total float
A	5	0		5	
B	3	0		3	
C	2	5		8	
D	3	3		7	
E	2	3		6	
F	9	0		9	
G	2	9		12	
H	1	8		II	

Table. 3.7.1 The activity table following the forward pass

The Forward Pass Rule : The earliest date of an event is the earliest end date of any activity that ends with the activity. If more than one event ends with the same activity, we will use the latest of the earliest end dates of these activities.

3.8 The Backward Pass

The second stage is to go back and calculate the last date that each event can reach, and start and stop each activity without delaying the project completion date. All follow-up actions must be started so that the project can be completed on time. We assume that the project's latest finish date is the same as the earliest finish date when computing the latest dates - that is, we want to finish the project as soon as possible.

Fig. 3.8.1 shows our network, and Table 3.8.1 shows the activity table after backward pass, because the forward pass records the activity data in the figure and the activity dates in the activity table.

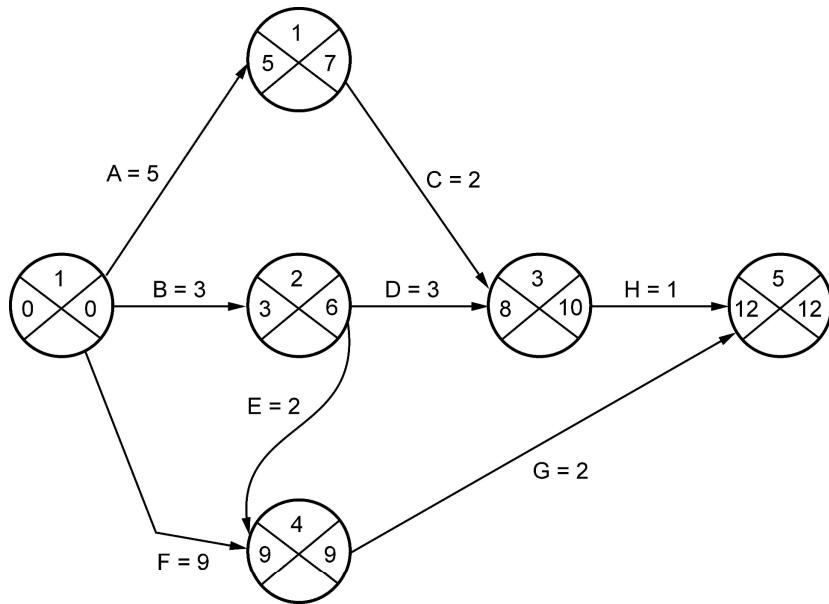


Fig. 3.8.1 A CPM network after the backward pass

The following are the most recent event dates :

- Week 12 is supposed to be the latest date for node 6. The earliest date is the same as the current date.
- The final date of activity 5 is week nine. Because activity G lasts for three weeks, if the project completion date is not exceeded, it should be completed in week twelve.
- The final date for activity 4 is week ten, because if activity H lasts for one week and does not have to be completed before week twelve, then activity H does not have to start before week II.

Activity	Duration(Weeks)	Earlier start date	Latest	Earliest	Latest	Total
			Start date	finish date	finish date	Float
A	5	0	1	5	7	
B	3	0	2	3	6	
C	2	5	7	8	II	

D	3	3	6	7	II	
E	2	3	6	6	9	
F	9	0	0	9	9	
G	2	9	9	12	12	
H	1	8	10	II	12	

Table. 3.8.1 The activity table following the backward pass

- The final date for activity 3 is the date when we can start activities D and E. Activity E does not have to end before week nine, nor is it required. So start before the 6th week. Activity D does not have to end before week 10. If it is three weeks, it does not have to start before week six. So the final date for event 3 is week six.
- The final date for event 2 is week seven, because C, which lasts for two weeks, does not have to end before week ten.
- Unless there is an arithmetic error, the start event's earliest and latest dates must always be the same.
- The deadline for event I is that we should be able to perform operation A (should begin from week one), operation B (must start from week two), and the deadline for operation F (must start from week 0) The date must start).

Review Questions

- What are forward and backward pass ?
- What do you meant by activity table ? Explain activity table of forward pass.
- Differentiate between forward and backward pass techniques.

3.9 Critical Path

Identifying the critical path

Any time spent on the critical path will cause the project to be delayed. The slack is the difference between the earliest and latest dates for an event; it is a measure of how late an event can be without compromising the project's finish date. Any non-slack event is critical, because any delay in reaching that event will delay the completion date of the

entire project. At least one path will always exist connecting these critical events through the network. This path is called the critical path (Fig. 3.9.1)

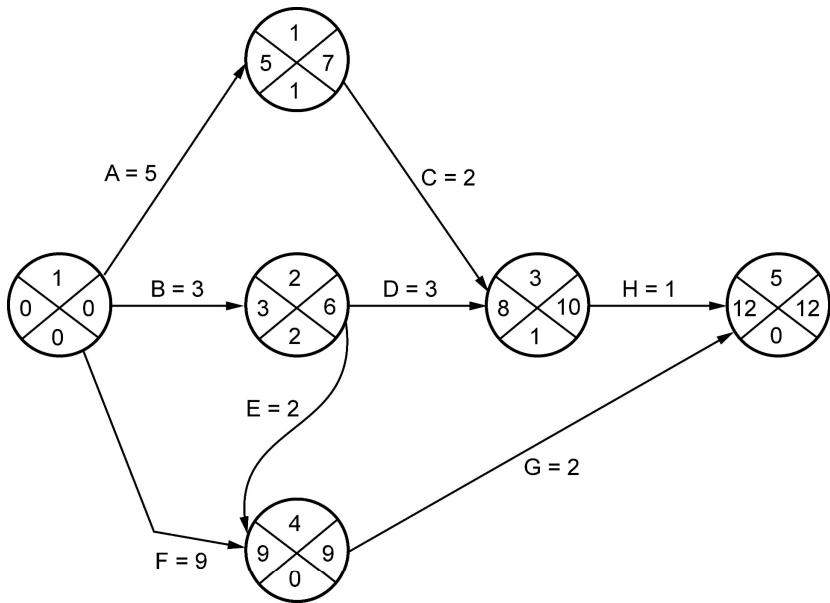


Fig. 3.9.1 The critical path

The significance of the critical path is two-fold

When it comes to project management, the next steps on the critical route must be given considerable attention in order to identify and correct the consequences of resource delays or unavailability as quickly as possible. If we want to shorten the project's overall time, we must shorten the critical path during planning. The crucial path is the network's longest path.

Activity Float

As the event slows down, the action remains the same. The cumulative list shown in Table 3.9.1. is the distinction between the first and last start dates of an activity (or the difference between the earliest and most recent end date). We can postpone the start or end of an event for an extended amount of time without influencing the project's completion date.

Activity	Duration (Weeks)	Earlier start date	Latest	earliest	latest	start date	finish date	Total float
			date	date	date	date	date	
A	5	0	*	m	5	7	mm	
B	3	0	2	3	6	6	2	

C	2	5	7	8	II	1
D	3	3	6	7	II	2
E	2	3	6	6	9	2
F	9	0	0	9	9	0
G	2	9	9	12	12	0
H	1	8	10	II	12	1

Table. 3.9.1 The activity schedule showing total float for each activity

Only a certain amount of float may be available. Although the total float is displayed for each activity, it actually 'belongs' to a path that was only used once. Both Activities A and C have a total float of two weeks. If, on the other hand, activity A exhausts its float (i.e., it is not completed until week 8), activity B will have no float (it will have become critical). In such cases, publicizing entire float could be deceptive and damaging to the project's success! Other activity float metrics include the following :

Free float : The amount of time that an activity can be postponed without having an impact on other activities. It's calculated as the difference between the previous activity's earliest completion date and the next activity's earliest start date. This could be a better way to publicize the activities to the people who are actually doing them.

Interfering float : Total float and free float are not the same thing. This is a term that is frequently used, especially in conjunction with the term "free float." The interfering float tells us how far the activity can be delayed without delaying the project end date (even if it delays the start of future activities) if the free float has been exhausted (or if it is 0).

3.9.1 Remedies of Critical Path

- Shorten the construction period on the critical path.
- Change task limits to allow greater planning flexibility.
- Breaks down key tasks into smaller tasks that different resources can handle at the same time.
- Check task relevance for greater planning flexibility.

Shortening the project duration

If we want to shorten the overall duration of the project, we usually consider shortening the duration of the activity. In many cases, this can be achieved by using more resources, working overtime, or hiring more employees. We should try to save time. When trying to postpone the completion date of a project, it is obviously meaningless to

reduce unimportant activities. Fig. 3.8.1 shows that we can complete the project in 12 weeks and then reduce the activity timeframe F by one week (to nine weeks).

As we shorten the activity time of critical paths, we must constantly look for new critical paths and refocus our efforts where appropriate.

One day, we will no longer be able to safely or cheaply shorten the duration of critical operations in order to advance the project completion date. The logical sequence of activities. Time saving is usually achieved by increasing the degree of parallelism in the network and eliminating bottlenecks (of course, always consider resource and quality constraints).

Identifying critical activities

The critical route indicates actions that are crucial to the project's completion date; nevertheless, activities that are not on the critical path may become critical in the future.

As the project progresses, the activity will inevitably consume its outstanding part, which will require periodic recalculation of the network.

Once the activities on a particular route reach their total float, that route becomes a critical path, and many previously unimportant activities suddenly become vital.

Therefore, it is common practice to define "almost critical" paths of limited length. 10-20 % of the critical path duration or total inventory is less than 10 % of the unfinished project duration.

It is important to identify critical and close to critical actions because they are most likely to cause delays in project completion.

Review Questions

1. *What do you understand by critical path ?*
2. *What are the limitations of critical path ?*
3. *Write short notes on : i) Activity float ii) Shortening the project duration.*
4. *How to improve the critical path ?*
5. *Differentiate between free float and Interfering float.*

3.10 Multiple Choice Questions

Q.1 _____ is the process of allocating and scheduling available resources as efficiently and economically as possible.

- | | |
|--|---|
| <input type="checkbox"/> a Resource allocation | <input type="checkbox"/> b Activity selection |
| <input type="checkbox"/> c Scheduling | <input type="checkbox"/> d All of the above |

Q.2 What are the objectives of project planning ?

- a Feasibility assessment
- b Detailed costing
- c Resource allocation
- d All of the above

Q.3 What happens after the development activities begin ?

- a Project monitoring and control
- b Project planning
- c Project cost estimation
- d Project size estimation

Q.4 Software project planning has a _____ primary goal.

- a estimation of resources
- b estimation of cost
- c estimation of schedule
- d all of the above

Q.5 What is the first step in the planning of a software development project ?

- a Find out the team size.
- b Determination of budget.
- c Determination of software scope.
- d None of the above.

Q.6 When a plan is improved to a level of detail it is called a _____.

- a project creation
- b project schedule
- c resource allocation
- d activity plan

Q.7 What are the basic techniques to determining the activities or tasks that make up a project ?

- a Activity-based approach, the product-based approach, the hybrid approach.
- b Product-based approach, the hybrid approach.
- c Activity-based approach, product-based approach.
- d Hybrid approach, activity-based approach.

Q.8 CPM predicts the time required to finish the project.

- a True
- b False

Q.9 CPM has the following advantages :

- a Graphical view of the project
- b Inter-relationship among various tasks
- c Predicts time required to complete the project
- d All the above

- Q.10** A task network's critical path can be finished in any order, provided the project's schedule allows it.
- a True b False
- Q.11** Critical path and project completion times can be calculated from activity networks using two tools, which are _____.
- a PERT & CPM b FM
 c CPM d all of the above
- Q.12** The Gantt chart is useful for _____.
- a motion study b sales forecasting
 c production scheduling d time study
- Q.13** The Johnson's rule is applicable for _____.
- a assignment problem b sequencing problem
 c scheduling d aggregate planning
- Q.14** Sequencing is a part of _____.
- a scheduling b expediting
 c routing d none of the above
- Q.15** The completion of a CPM network diagram activity is well-known :
- a Connector b Event
 c Node d All the above
- Q.16** In the network, an event is indicated by a number enclosed in _____.
- a circle b a square
 c a triangle d all the above
- Q.17** In an activity, if the latest start time is 28 days and the earliest start time is 18 days then the total float shall be _____.
- a 9 days b 14 days
 c 10 days d 46 days
- Q.18** During construction project planning, which of the following is affected by free float _____.
- a preceding activity b overall completion
 c succeeding activity d only that particular activity

- Q.19** The artificial activity, which indicates that an activity following it cannot be started until the preceding activity is complete, is known as _____.
 a dummy b free float
 c constant d event
- Q.20** It is possible to find the earliest expected completion time for an activity by using _____.
 a crashing b expected time calculation
 c backward pass d forward pass
- Q.21** Activity-on-Node (AON) project network arrows indicate :
 a Dependency b Project flow
 c An activity d Both a & b are correct
- Q.22** Activities must be accomplished promptly before a certain activity.
 a Burst b Predecessor
 c Merge d Successor
- Q.23** Activities must be accomplished promptly after a certain activity.
 a Burst b Predecessor
 c Critical d Successor
- Q.24** In a project network calculation, the forward pass determines _____.
 a duration of the project
 b earliest time's activity can be finished
 c earliest time's activity can begin
 d all of the above
- Q.25** In a project network calculation, the backward pass determines _____.
 a critical path
 b earliest time's activity can be finished
 c latest time's activity can begin
 d both a and c
- Q.26** The requirement for a freshly pored foundation to cure before beginning construction is a example of which of the following type of lag _____.
 a SS b SF
 c FF d FS

Answer Keys for Multiple Choice Questions :

Q.1	a	Q.2	d	Q.3	a	Q.4	d
Q.5	c	Q.6	b	Q.7	a	Q.8	a
Q.9	d	Q.10	b	Q.11	a	Q.12	c
Q.13	b	Q.14	a	Q.15	d	Q.16	a
Q.17	c	Q.18	a	Q.19	a	Q.20	d
Q.21	d	Q.22	b	Q.23	d	Q.24	d
Q.25	d	Q.26	d				



UNIT - IV

4

Project Tracking and Control

Syllabus

Introduction, Collection of Project data, Visualizing progress, Cost monitoring, Earned Value Analysis, Project tracking, Change Control, Software Configuration Management, Managing contracts, Contract Management.

Contents

- 4.1 *Introduction*
- 4.2 *Creating Framework*
- 4.3 *Collection of Project Data*
- 4.4 *Visualizing Progress*
- 4.5 *Cost Monitoring*
- 4.6 *Earned Value Analysis*
- 4.7 *Project Tracking*
- 4.8 *Change Control*
- 4.9 *Software Configuration Management*
- 4.10 *Managing Contracts*
- 4.11 *Contract Management*
- 4.12 *Multiple Choice Questions*

4.1 Introduction

Project tracking and control activities occur concurrently with project execution process group activities, so that the project is monitored and controlled while the project work is being completed by implementing the appropriate level of oversight and corrective action.

Project tracking and controlling are processes that are required to track, review, and regulate the project's progress and performance. It also identifies any areas where the project management method needs to be changed and initiates the necessary changes.

The project is frequently inspected and measured against the project plan to ensure that cost, schedule, and scope deviations are within acceptable limits, and that risks and issues are continuously monitored and remedied as needed.

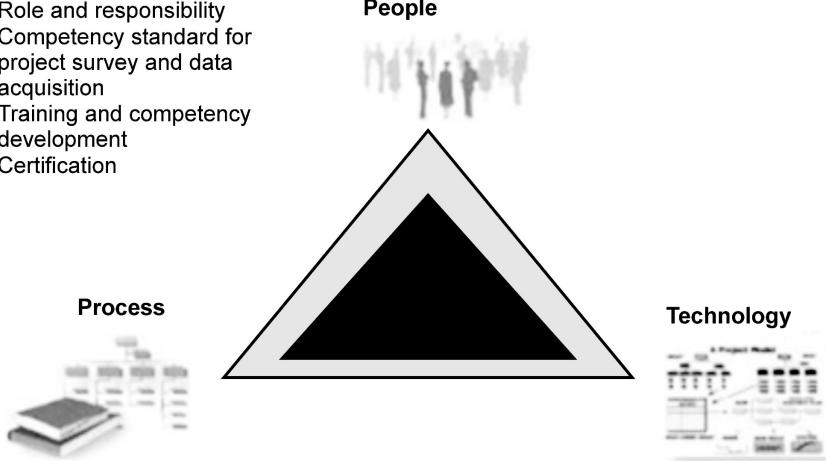
4.2 Creating Framework

- The project management plan serves as the project's foundation.
- This document serves as a guide for tracking and controlling the project.
- Access to work performance information, performance reports, and change requests will be required of a project manager.
- The inputs to monitoring and controlling project work are :
 1. **Project management plan :** The project management plan is the primary source of information for the project's execution, monitoring, and control. It is the plan, as well as any other subsidiary plans that may be required.
 2. **Work performance information :** Information about project activities is known as work performance information. This information contains progress, deliverables, costs and quality assurance validations.
 3. **Rejected change requests :** When examined in the context of determining how the project is progressing, reject change requests might be instructive.
- Always keep in mind that the measurement's quality is only as good as the data used to make it. While it may take some time, being alert and evaluating this information in the long run will save you time and money. So, how do you shift through the nitty-gritty details and turn them into data? So, The good news is that this isn't a unique issue; it affects all project managers, and solutions are available.
- Monitoring and regulating project operations using tools and procedures.

- The following are some of the tools and methods :
 - **Expert judgment** : Project managers and team members can use expert judgement to make judgments, such as whether to take corrective or preventive actions, based on current project information and previous experience with similar projects.
 - **Earned Value Technique (EVT)** : Earned Value Technique (EVT) is a method of calculating the current project schedule and cost performance for project managers. This data can then be used by project managers to predict future schedule and cost performance.
 - **Organisational project management** : The organisational project management approach offers project managers with detailed instructions and processes to enable effective monitoring and control during each stage of a project.
 - **PMIS (Project Management Information System)** : A PMIS helps you to keep track of and regulate variables like cost and resource utilisation. A project management information system (PMIS) can also help project managers calculate and manage earned value data, as well as request and update project data automatically.
- Using the right tools and strategies helps keep you informed about the status of your project.
- The following are the outputs of project work monitoring and control :
 - **Recommended corrective actions** : These are based on project work performance information. The project manager or team employs professional judgement to provide solutions to problems that have occurred by comparing this information to the project plan.
 - **Preventive actions recommendations** : These are based on project work performance data. The project manager or team utilises professional judgement to identify strategies to prevent project risks by comparing this information to the project plan.
 - **Predictions** : Forecasts allow for the projection of successful project outcomes based on work performance data collected during the monitor and control project work process.
 - **Recommended defect repairs** : These are the results of project monitoring and control. When a product fails to satisfy quality standards, this output suggests what has to be done to fix it.

- **Requested changes :** These are new actions that are required to accomplish the project's goals. The project manager or members of the project team frequently make requests in order to improve processes or solve difficulties.
- Every company is different, and project monitoring and control experiences will vary depending on firm's project management approach and the project type.

- Role and responsibility
- Competency standard for project survey and data acquisition
- Training and competency development
- Certification

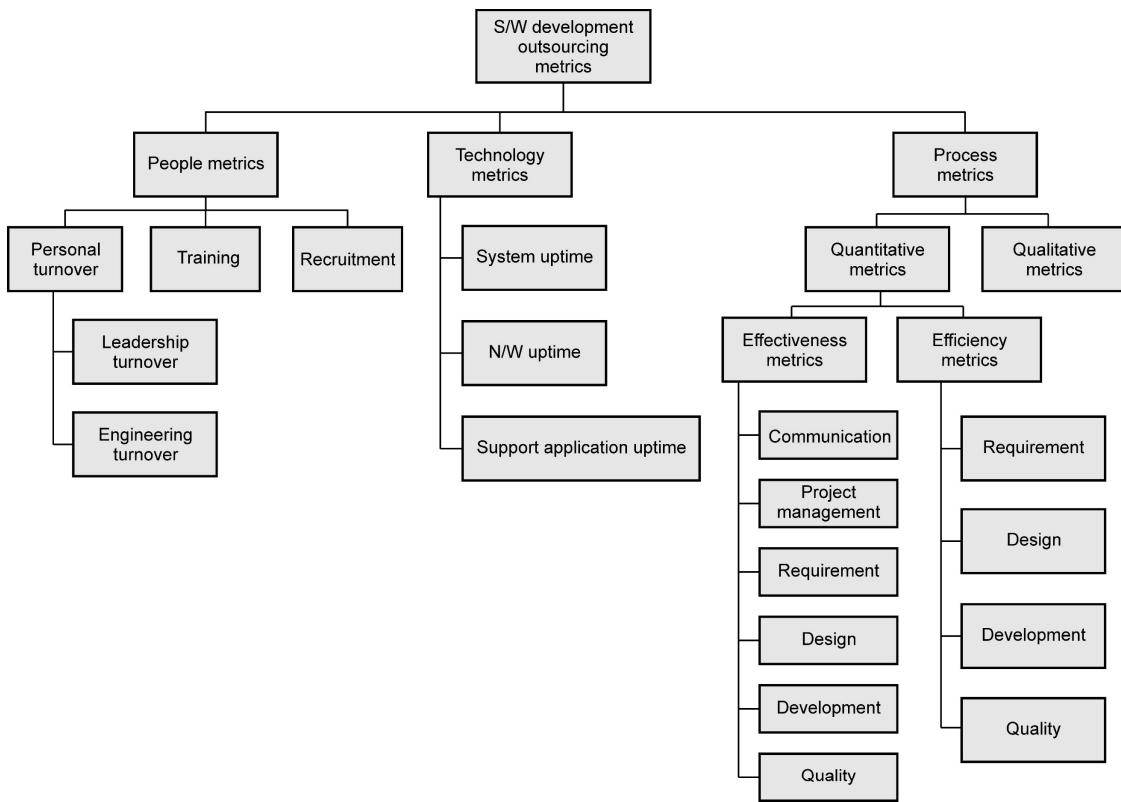


- Aligning with corporate starategy
- Fine tune PM methodology
- Provide SOP :
 - Policy > Processes > Procedures > Workflow > Forms > Checklists
- Quality and audit process
- Continuous improvement

- PM software (PMCS)
 - Project's data interface
 - Master schedule and AFE upload
 - PSC progress entry
 - Collaboration tools for clarification
 - Change order approval workflow
 - Report analysis and dashboard for executive
 - Potential risk register per project and per activity
- Knowledge and document management
- Infrastructure and network
- Development methodology

Fig. 4.2.1 : Project tracking and control solution framework

For defining projects and managing their implementation, there are a variety of frameworks available. IT project framework for Entrepreneurial Culture – Iterative System Development is depicted in the diagram below. The EC-ISD project framework is a realistic method for establishing a scalable structure that promotes discipline and best practises. It provides a high-level overview of the phases needed in any IT project, albeit the level of information required for each step will vary depending on the project's complexity and criticality. For smaller, less significant projects, all of the procedures in the first two columns, for example, might be done in a two-hour meeting with an email summary.

**Fig. 4.2.2 EC-ISD IT project framework**

Review Questions

1. Explain in detail about creating the framework for monitoring and control.
2. What are the different tools and methods used for monitoring and regulating project operations ?

4.3 Collection of Project Data

- Any form of research project requires data collection. Inaccurate data gathering might skew a study's findings and lead to erroneous conclusions.
- For impact evaluation, there are a variety of data collection approaches. Quantitative data gathering methods are on one end of the spectrum, while qualitative data collection methods are on the other.
- “What data should I collect?” is a question that many people have. The answer is to gather all of the information needed to create the metrics primitives and additional qualifiers.

- In most circumstances, the ideal response to the question of "who should gather the data?" is the "owner" of the data. The data's "owner" is the person who has direct access to the data's source and, in many situations, is also responsible for its generation. The proprietors of various types of data are depicted in Table 4.3.1.
- The following are some of the advantages of having the data owner gather the data :
- Data is captured in real time as it is generated, ensuring accuracy and completeness.
- Data owners are more likely to notice irregularities in data as it is being collected, which improves accuracy.
- Duplicate recording (once by the data recorder and twice by the data entry clerk) eliminates human error, increasing accuracy.

Owner	Data Owned
• Management	• Project schedule, Budgets
• Programmers	• Time per task, Bugs, Cause for bugs
• Tester	• Test case plan/execution/passed • Test coverage
• End users	• Real time problems • Time spent on application

- There should be a training programme to ensure that the datacollectors understand what to do and when to do. Appropriate procedures must be developed and documented in the creation of the training programme. These courses might be as short as an hour with simple collection mechanisms. The best outcomes will get from practical, interactive training, where the group works on actual data collecting situations.
- Without this training, support workers' hours can be spent to respond repeatedly to the same inquiries. Another advantage of the training is that it fosters a sharing of when and how the data are collected. This decreases the chance of invalid and incoherent data being collected.
- When the correct data are not correctly collected, it is not possible to achieve the goals of the measuring programme. Without proper data, data analysis is useless. The creation of a good data collection plan is therefore the cornerstone of any successful programme of measurements. The collecting of data should be :
 - **Consistency** : The same person will gather the data in the same manner every time.

- **Unambiguous** : Two people taking the same measurement for the same item will get the same results.
- **Convenient** : Data gathering must be simple enough to not disrupt the individual collecting the data's working patterns. As a result, data collecting must become an integral component of the process rather than an afterthought.
- **Accessible** : In order for data to be useful and utilised, it must be easily accessible. This means that even if data is collected manually on forms, it must be entered into a metrics database at some point.
- It is widely agreed that as much of the data collection process as feasible should be automated. Standardized forms should be utilised at a minimum for data collection, but the data from these forms must be entered into a metrics database at some point if it is to be relevant in the long run.
- Another technique to inject human error into metrics values is to dump raw data and hand tally or calculate metrics. Even if the data is kept in a simple spreadsheet, automatic sorting, data extraction, and calculation are all available and should be used. Using a spreadsheet or database also speeds up the production of measurements when compared to hand tallies.

4.3.1 Type of Tools

Various data collection methods necessitate the use of appropriate recording forms. These are referred to as data collection tools or instruments. They are as follows :

Observation schedule

- Guide to conducting interviews
- Timetable for interviews
- Questionnaire sent by mail
- Scale of evaluation
- List of items to consider
- Data sheet/document schedule
- Institutions Calendar

Each of the instruments listed above is used for a specific type of data collection :

- Schedule of observations for method of observation
- Interview schedule and guidance for interviewing, and questionnaire
for example, a mail survey

The data collection tools translate the study objectives into particular questions/items, the answers to which will offer the data needed to meet the research goals. To do this, each question/item must transmit to the respondent the notion or collection of ideas required by the research objectives, and each item must elicit a response that can be analysed in order to meet the research goals.

Below is a brief explanation of the various data collection tools.

- **Schedule of Observations**

This is a format for recording observations of an object or phenomena. The things to be observed are chosen in accordance with the study's nature and goals. They're organised into categories and mentioned in the schedule in the order in which the observer would notice them.

The schedule must be designed in such a way that it provides the necessary verifiable and quantitative data while also avoiding selective bias and misinterpretation of observed items. Simple and properly stated observation units are required to ensure precise and uniform recording.

- **Guide to Interviewing**

Non-directive and depth interviews are conducted using this method. It does not provide a detailed list of items for which information must be obtained from a responder; rather, it focuses on the broad subjects or areas that will be discussed throughout the interview.

During the interview, the interview guide serves as a helpful reference or prompter. It assists in focusing attention on important study points and obtaining similar results in different interviews conducted by the same or different interviewers.

Schedule of Interviews and Questionnaire Sent by Mail

In surveys, both of these tools are commonly employed. Both are comprehensive lists of questions designed to collect information from responses. The main distinction between them is how they record replies. The respondent fills out a questionnaire while the interviewer writes up a timetable.

Scale of evaluation

This is a form for capturing individual attitudes, aspirations, and other psychological and behavioural characteristics, as well as group behaviour.

Checklist

This is the most basic of the devices. It is a prepared list of items that are relevant to an object or a specific task. Each item's presence or absence can be specified by checking "yes" or "no" or using a multipoint scale. The use of a checklist guarantees that all parts of the object, act, or task are considered. Checklists contain phrases that the respondent understands and that express his opinions more briefly and succinctly than open-ended questions.

It's a rudimentary device, but with proper pre-testing, it may be made less so. When used to examine specific hypotheses, it is at its best. It can be used on its own or as part of a timetable or questionnaire.

Data Sheet/Document Schedule

This is a list of data that can be gleaned through documents, records, and other sources.

The components contained in the schedule are limited to those that can be uniformly obtained from a large number of case histories or other records in order to secure measurable data.

Institutional Calendar

This is used to conduct surveys of businesses, educational institutions, social and cultural organisations, and other organisations. It will contain information on their profile, functions, and performance in several categories.

4.3.2 Construction of Schedules and Questionnaires

Questionnaire vs. Schedule

The most frequent data collection instruments are schedules and surveys. Both of these tools have a lot in common. Both feature a set of logically related questions; both aim to elicit responses from respondents; and in both cases, the content, response structure, question wordings, question order and other factors are the same for all respondents. So why are they referred to as "schedule" and "questionnaires," respectively? This is due to the fact that the strategies they employ are different. A questionnaire is utilised for mailing, whereas a timetable is used for interviewing.

Because of this difference in usage, there is a slight distinction between these two recording formats. In a face-to-face interview, the interviewer fills out a schedule, whereas the respondent fills out a questionnaire. As a result, two distinct terms are required.

When used for interviewing, the tool is referred to as a schedule; when delivered to a respondent for completion and return, it is referred to as a questionnaire.

The Construction Process

Except for a few minor modifications in mechanics, the process of creating a schedule and a questionnaire is nearly identical. This isn't a simple issue of making a list of questions that come to mind. It's a methodical procedure that takes a lot of time, effort, and thought. It consists of the major steps listed below:

1. **Data must be determined :** Because an interview schedule or postal questionnaire is a tool for acquiring data for a specific study, it should be built logically from the information needed for that study.
2. **Development of "dummy" tables :** Developing "dummy" tables in which to present the data to be acquired is the best way to ensure that the information requirements are met.
3. **Establishing the respondents' level :** Who are the people who have responded to our survey? Are they people who have specialist knowledge about the problem under investigation? Or are they ordinary citizens? What is their level of understanding and knowledge ? The choice of terms and concepts is determined by the respondents' degree of knowledge.
4. **Choosing a data collection method :** Should you do a face-to-face interview or send a letter? The type of question structure you use is greatly determined by the communication medium you use.

5. **Instrument composition :** Following the determination of the data needed for the study, a basic outline of the instrument, identifying the many major categories of data, can be written.

Second, the order in which these categories appear must be determined. The third step is to make a list of the questions that will be asked under each group category. All elements that are relevant to the 'data need' should be gathered.

6. **Evaluation of the draught instrument :** The researcher must thoroughly evaluate each question in the draught instrument in cooperation with other knowledgeable individuals.
7. **Pre-testing :** The new draught must be pre-tested in order to detect the instrument's flaws and make the necessary changes to correct them.
8. **Procedures/instructions specification :** Once the instruction has been finalised after pre-testing, the procedures or instructions for its use must be provided.

- 9. Choosing a format :** The format should be appropriate for the research. The instrument should be organised into sections that correspond to various facets of the situation.

Question Construction

A survey instrument - interview schedules or questionnaire - is useful for collecting different categories of information, viz.,

- a) Factual information - Facts about the respondents: sex, age, marital status, education, religion, caste or social class, income, and occupation; as well as historical information and conditions.
- b) Psychological data such as attitudes, views, and belief and
- c) Socioeconomic data expectancies, and behavioural data, such as social participation, etc.

Question construction can begin after determining the information need, as mentioned in the preceding article. There are four primary decision areas here. They are (a) relevancy and content of the question, (b) question language, (c) response form, and (d) question order or sequence.

Relevance and content are two factors to consider.

Query should pass specific checks in order to be included in the instrument. Is it connected to the study's goals? Is it likely to provide useful information in the case of a police investigation ?

If it isn't already in the instrument, it should be.

Wording of the Question

This is a challenging task. In a schedule/questionnaire, the purpose of a question is to elicit specific information without distorting it. "Interrogating people is more like attempting to catch a specific elusive fish by casting different kinds of bait at different depths, without knowing what goes on underneath the surface," adds Oppenheim. Because words have different meanings depending on who you ask, the question designer should use terms that have the following characteristics :

Shared vocabulary

Uniformity

Exactness

Simplicity

Neutrality

Some more problem areas are: a. Unwarranted assumptions, b. personalization, c. presumptions, d. hypothesis, e. questions in difficult cases.

Order of questions or sequence of questions

The arrangement of questions in a timetable/questionnaire is just as significant as the language of the question. It has two main consequences. First, a suitable sequence can easily answer the questioner's task. Second, because of contextual effects, i.e. the impacts of previous questions on reply to later questions, the sequence could either produce or prevent biases.

Timetable and questionnaire mechanics

In the designing of a schedule/questionnaire, in addition to question wording and question building, the mechanics of the form should be considered. The form mechanics has various aspects: form items, instructions, precoding,etc.

Form items : For schedules and questionnaires, the following are mandatory :

1. At the top of the main page should appear the name of the organisation that collects data.
The name, if applicable, of the sponsor of the study.
2. In a huge type next to the organization's name on the first pages the title of the study should be shown. The title - e.g., "Consumer schedule;" - may be noted underneath this title.
3. Cleat should be made of the confidentiality of the data.
4. A place should be provided to write a date of completion on the form.
5. Each tool copy can be provided a serial number.
6. Number of pages of the instrument.

4.3.3 Measurement Scale and Indices

In social science research, scales are designed to measure variables. In the last decades, researchers in sociology, psychology, education, psychiatry, ethics, behaviour, economy, administration and other domains have drawn tens of thousands of scales.

4.3.4 Pilot and Preliminary Trials

Pilot Study

It's difficult to organize a big study or project without a thorough understanding of the topic matter, the target population, and their degree of knowledge and understanding,

among other things. What are the problems that need to be addressed? What are the ideas that go along with the topic? What are the options for putting these into action? Which research approach is best? What is the expected duration of the study? What will the price tag be? These and other such concerns necessitate a thorough understanding of the study's topic matter and scope. A preliminary research is carried out in order to get such pre-knowledge of the subject matter of a large study. A pilot study is what it's known as.

Preliminary trials

A pre-test is a trial test of a single aspect of the study, such as the method of data collecting or data collection instrument - interview schedule, mailed questionnaire or measuring scale - while a pilot study is a full-fledged tiny investigation of a topic.

The requirement for Pre-testing

The data collection instrument is created keeping the study's data requirements in mind. However, it cannot be perfected just through the designer's and other researchers' rigorous inspection. It should be put to the test. As a result, pre-testing a draught instrument is essential.

Pre-testing entails putting the instrument through its paces with a small group of people before finalizing it.

Review Questions

1. *What are the different ways of collecting data ?*
2. *What is check list ?*
3. *What is difference between schedule and survey ?*
4. *Explain in detail construction process of schedule for data collection.*

4.4 Visualizing Progress

The project manager only needs to provide a few remarks to generate a project status report for the project and the project management report will be generated automatically, showing :

Milestones from the previous period and if they were met, milestones due the following time

- Action items that have not been completed by the deadline.
- The Project Manager's opinion on action items due to be completed in the next period.

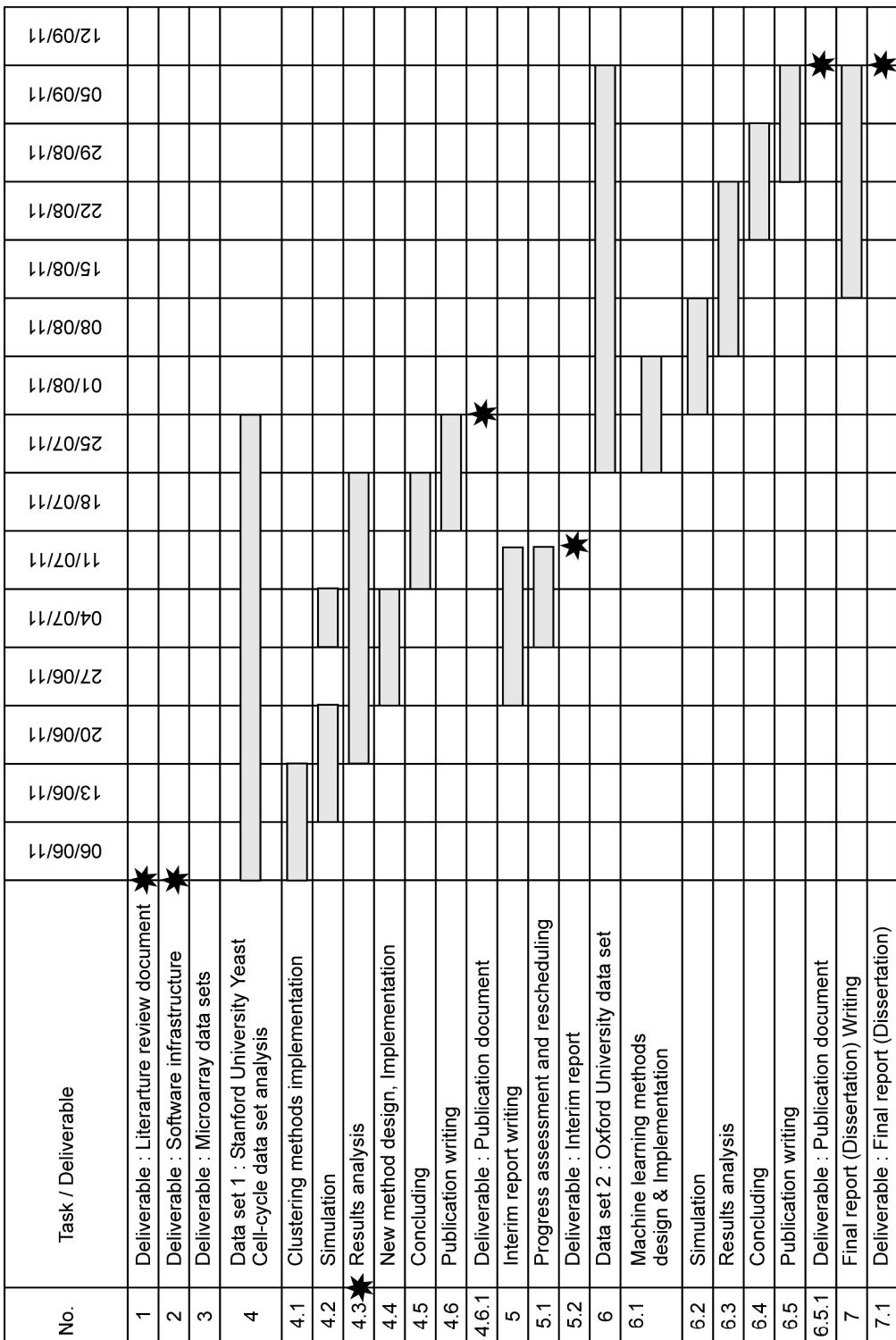


Fig. 4.4.1 : Gantt chart for the project current progress

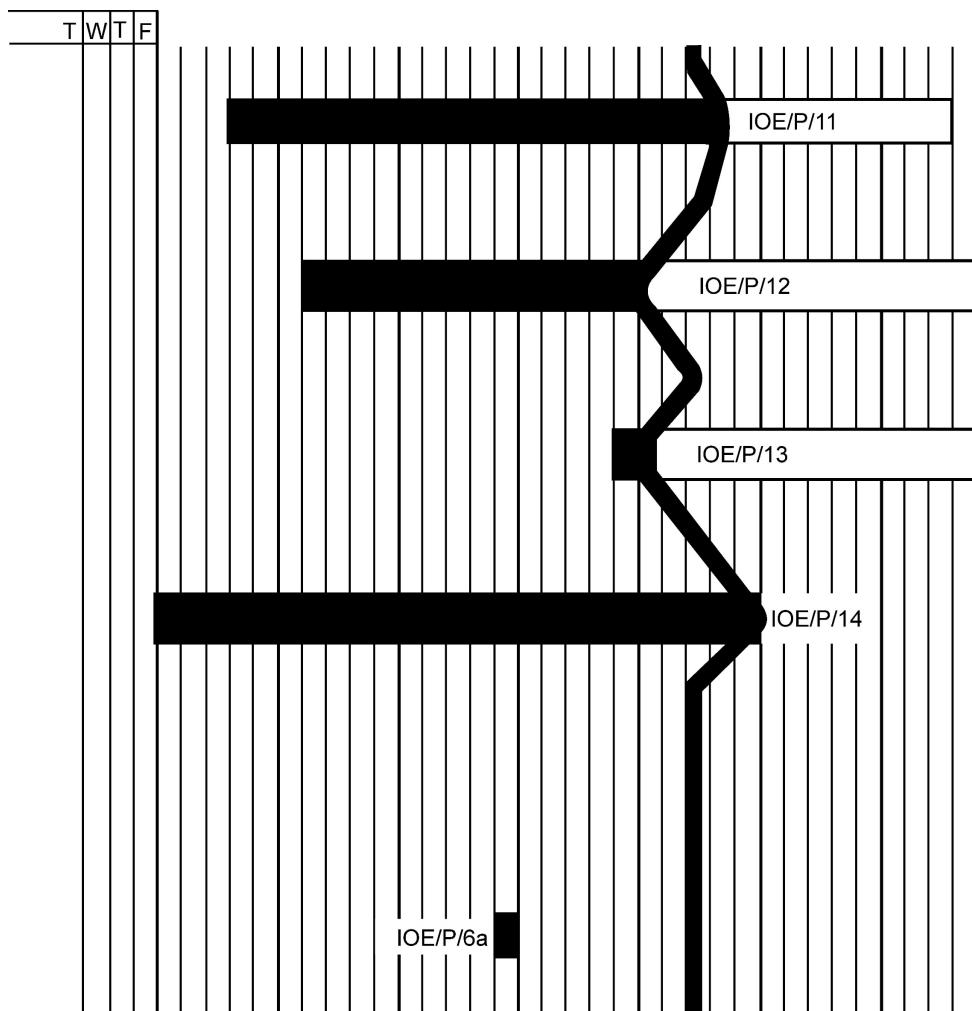


Fig. 4.4.2 Slip chart showing relative position of each activity

- The report can be sent to a specific distribution list via e-mail. The project manager can decide on the time frame.
- The report's worth isn't as high as it appears. The benefit comes from ensuring that the team is required to examine due and outstanding items at least once per reporting period. This usually forces them to concentrate on accomplishing tasks and milestones in order to avoid being included in the report. This function can be used as a project status report template or as software for reporting period status.
- **Benefits of visualizing progress**
 - It is simple to understand, as the information is presented in a single, consistent style.

- The project team is required to review progress on a regular basis.
 - To create a report, only a small amount of effort is required.
 - Periods can be customized to meet the needs of the firm.
- **Methods used for Visualizing Project Progress**

A management must show the data collected regarding the project's development after gathering it. Some approaches for presenting the picture of a project and its future are:

1. **Gantt chart** : A Gantt chart is essentially an activity bar chart with activity floats that shows the scheduled activity dates and duration. (See Fig. 4.4.1)
2. **Slip chart** : The slip chart provides a more vivid visual depiction of the operations. The more the slip line bends, the more deviation from the plan there is. A very jagged slip line suggests that rescheduling is required. (See Fig. 4.4.2)
3. **Time line** : A timeline is a way of keeping track of and illustrating how targets have changed during the course of a project.

Review Questions

1. *What are the different methods used in visualizing progress explain in detail ?*
2. *What are the benefits of visualizing progress ?*

4.5 Cost Monitoring

To stay inside the project budget, you'll need precise project estimations and a solid project budget. Estimate costs and determine budget are both steps in the project planning process.

The project will almost certainly never be delivered on time if the true costs are not kept in mind while it is being implemented. According to the PMBOK, there are numerous approaches for monitoring and controlling project costs :

1. Budgeting for the project

Making a budget for the project at hand should preferably be done at the start of the planning session. This budget will be used to aid you with all payments and charges that you will incur during the project's life cycle. As a result, creating this budget necessitates extensive research and critical thinking.

You must always provide room for revisions in your budget, just as you would in any other budget, because costs may not remain constant over the project's duration. The key to making a profit from a project is to stick to the budget at all times.

2. Keeping expenses tracked

It's just as crucial to keep track of all actual expenditures as it is to use any other strategy. It's preferable to make a time-based budget here. This will assist you in keeping track of a project's budget at each phase. Actual expenditures must be compared against the budget's periodic targets. If the project will last a long time, these goals could be set on a monthly, weekly, or even yearly basis.

Rather than having a single complete budget for the duration of the project, this is considerably easier to deal with. If you need to do any new work, you'll need to make some estimates to see if it can be done within your budget.

3. Time management effortlessly

Time management is another useful strategy. Although this strategy can be used in a variety of management situations, it is particularly useful in project cost management.

The reason for this is that if you don't meet your project deadlines, the cost of your project will continue to rise; the longer the project drags on, the greater the costs will be, effectively resulting in a budget overrun.

In order to ensure that work is finished on time, the project manager would need to remind his or her team of the project's key deadlines on a regular basis.

4. Project change management

Another important strategy is project change control. Change control systems are required to account for any potential changes that may occur over the project's duration.

This is because each modification to the project's scope will have an influence on the deliverables' dates, therefore the adjustments may raise project costs by increasing the amount of effort required.

5. Earned value applicability

Similarly, using the accounting technique known as 'Earned Value' to determine the value of the work that has been completed thus far is quite beneficial.

This is especially beneficial for large projects since it allows you to make any last-minute changes that are critical to the project's success.

Review Question

1. Write short notes on cost monitoring.

4.6 Earned Value Analysis

Earned Value Analysis (EVA) is a project management approach that is used for monitoring and controlling purposes.

The Earned Value Analysis comprises the indicators

Earned Value (EV),

Planned Value (PV),

Actual Cost (AC) and

Budget at Completion (BAC)

Earned Value(EV)

The projected value is the percentage of the budget (excluding management reserve) allotted to the activities or periods under consideration.

Planned Value (PV)

This metric represents the project's progress. Its worth is equal to the total of the budgeted and permitted funds for the work that has already been done.

Actual Cost (AC)

The AC stands for the amount paid for the work done.

Budget at completion (BAC)

The total budget is the allowed value (plus the sum of expected costs) of a project's scope at the end.

The purpose of an earned value analysis is to assist and support the control cost process. Earned Value Management (EVM) uses the outcomes of this study to analyse variations, trends, and forecasts based on the EVA results.

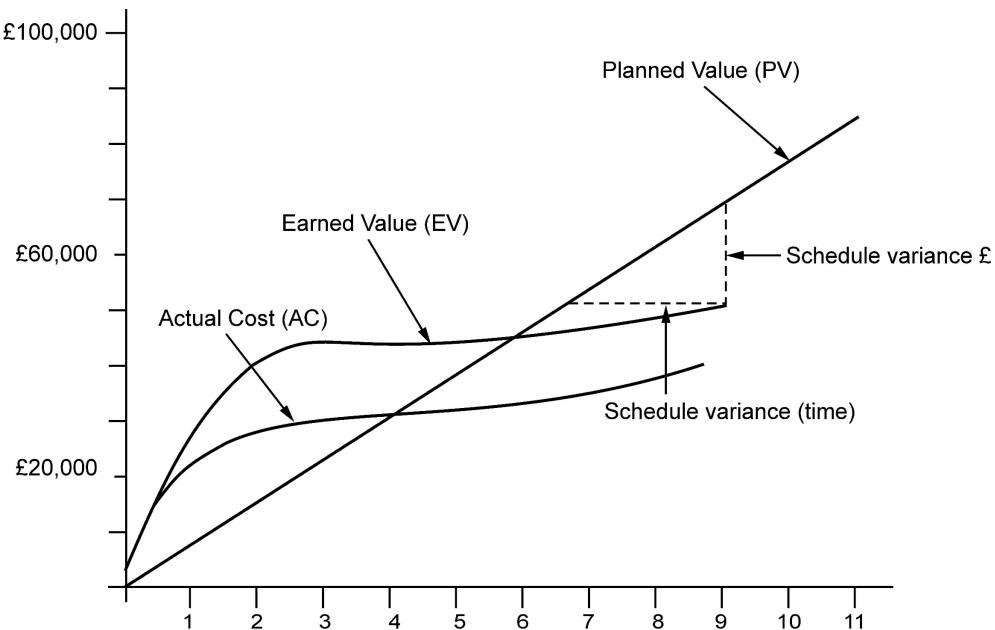
Earned value analysis is a suggested approach of the following procedures for projects adopting the PMI methodology:

Work on the project should be monitored and controlled.

Schedule of control,

Cost-cutting and

Control the procurement process.

**Fig. 4.6.1 Earned value analysis****Ex. Earned Value**

- Task
 - Specify module 5 days
 - Code module 8 days
 - Test module 6 days
- At the beginning of day 20, Planned Value (PV) = 19 days
- If everything but testing completed, EV = 13 days
- Schedule variance = EV - PV i.e. $13 - 19 = 6$
- Schedule performance indicator (SPI) = EV/PV

$$13/19 = 0.68$$

Actual cost (AC) is also known as actual cost of work performed

In previous example, if

'Specify module' actually took 3 days (planned 5)

'Code module' actually took 4 days (planned 8)

Actual cost = 7 days

Cost variance (CV) = EV - AC i.e. $13 - 7 = 6$ days

Cost performance indicator (CPI) = EV/AC i.e. $13/7 = 1.86$

Positive CV or CPI > 1.00 means project under budget or the work is completed better than planned.

Common method of assigning Earned Value(EV)

0/100 technique

A task is assigned a value zero until it is completed On completion itsvalue will be 100 of the budgeted value.

50/ 50 technique

At the starting 50 of the budgeted value Uponcompletion 100 % (remaining 50 %) of the budgeted value.

75/25 technique

At the starting 75 of the budgeted value Uponcompletion 25 of the budgeted value.

The milestone technique

Value is given based on the achievement of the milestones

Percentage complete

Value will be assigned based on the objective measurement of the work completion 0/100 technique is preferred for software development.

Review Questions

1. Explain the earned value assigning methods.
2. What is earned value ?
3. Explain in detail earned value analysis.

4.7 Project Tracking

To ensure that the project runs smoothly, create a reporting system that keeps you up to date on the many variables that explain how the project is progressing in comparison to the original plan.

The following are characteristics of a reporting system :

- Provides timely, complete and accurate status information;
- Does not add enough overhead time to be inefficient.
- Is easily accepted by the project team and top management
- Warns of impending problems in time for action to be taken.
- Those who have a need to know will find it simple to comprehend.

The majority of project management software packages allow you to tailor basic reports to match even the most precise requirements.

4.7.1 Types of Project Status Reports

The following are the five different types of project status reports :

1. **Reports for the current period** : These reports only cover the most recently completed period.

They provide updates on activities that were open or slated for work throughout the time period. Reports may emphasise completed tasks as well as the difference between expected and actual completion dates.

2. **Cumulative reports** : These reports detail the project's progress from the start to the end of the reporting period. Because they illustrate trends in project progress, they are more informative than current period reports.

3. **Exception reports** : Exception reports detail deviations from the original plan. Typically, these reports are intended for senior management.

4. **Stoplight reports** : Stoplight reports are a version of the previous report kinds that can be used on any of them. On the top right of the first page of the project progress report, stickers of various colours are placed. The different colours of stickers serve the following purposes :

- a) **Green sticker** : It indicates that the project is on track and that everything appears to be going according to plan. Senior managers will see this sticker and know that everything is going according to plan, and they won't even need to read the linked report.

- b) **Yellow sticker** : This indicates that the project has met a problem or has slipped behind schedule. That's a signal to upper management that the project isn't progressing as planned, but you've got a back-up plan in place.

- c) **Red stickers** : This indicate that a project has gotten out of hand. Red reports should be avoided at all costs because they indicate that a problem has arisen on the project, and you don't have a fix in place or even a suggestion for top management.

5. **Reports on variance** : Variance reports reflect discrepancies between what was intended and what really occurred. Typical variance reports are snapshots of the status of an entity being tracked in time (the current period). The majority of variance reports leave out information on how the project got to that point.

4.7.2 How and What Information to Update

As input to each of these report types, activity managers and the project manager must report the progress made on all of those activities that were open for work during the period of time covered by the status report. Recall that your planning estimates of activity duration and cost were based on little or no information. Now that you have completed some work on the activity, you should be able to provide a better estimate of the duration and cost exposure. This reflects itself in a re-estimate of the work remaining to complete the activity. That update information should also be provided.

The following is a list of what should be reported in actuality :

1. Determine a certain time and day of the week when all updated information will be available is expected to be submitted
2. Actual work completed within this time period should be reported.
3. Keep track of the past and recalculate the amount of time left (in-progress work only).
4. Actual start and end dates of activities that began or ended within the reporting period.
5. As evidenced in the record days of length accomplished of so far working re-estimated duration in the amount of days to completion.
6. Report on the amount of time and effort spent (hours per day) and the amount of time left (in-progress work only).

4.7.3 Variances

- Deviations from the plan are known as variances. Consider a variance to be the difference between what was expected and what happened. Variations can be divided into two categories:
- **Positive variances**
 - Positive variances are variations from the plan that show an event that occurred ahead of time or that an actual cost was lower than anticipated. The project manager will be pleased with this type of variation.
- **Negative variances**
 - Negative variances are variations from the plan that indicate a scenario that is behind schedule or that an actual cost is higher than the projected cost. Negative variances aren't always bad news, just like positive variances aren't always good news. For example, you may have overspent because you completed more work

than anticipated within the report period. However, by overpaying during this time, you could have completed the work for less money than you had anticipated. By glancing at the variance report, you won't be able to know.

Review Questions

1. Explain in detail variance in terms of project control.
2. List and explain different types of project status reports.

4.8 Change Control

Changes are unavoidable when developing and maintaining a product. People make mistakes, consumers require adjustments, and the product's operating environment changes. People also continue to improve their understanding of the problem and their abilities to solve it. It's a common adage in software development that solving one problem will lead to the creation of additional ones.

The goal of change control is to have complete control over all product change requests and completed modifications. Any configuration item must be able to be distinguished from its predecessor in terms of changes.

Inputs

An event triggers the control of change. A longing for change might be referred to as an event, yet it isn't necessary to express it as a specific wish. An event is any observation made in this context. Something unexpected, uncomfortable, or outright wrong occurs while using the thing to be configured. For example, it may be:

- During the inspection of a document, a misspelling was discovered.
- During a walk-through of some source code, a coding mistake was discovered.
- During the course of the project, the customer comes up with a new idea, which leads to an enhancement request.
- An error was discovered during the integration test.
- A desire to expand or improve the finished product after it has been put into service.
- A request to a helpdesk for assistance with a problem relating to the use of a system.
- An upgrade to a new version of the middleware necessitated a change in the code.
- supporting a system that may or may not be backwards compatible

- **Outputs**

- Documented events and change requests derived from these are the result of change control.
- Events. Both should be kept in a secure database so that relationships between them can be tracked.
- Change requests and configuration items can be kept up to date in a reliable manner.
- Change requests may be referred to configuration management, but this is uncommon.

Where configuration management must be done in a structured manner.

4.8.1 Change Control Activities

- A change management process is a mini-development project in and of itself. A written and controlled life cycle for an event registration should broadly follow the phases. Each phase should be outlined in depth, including the company's responsibilities and particular activities.

Depending on the kind of events to be handled, a corporation may need to specify many types of life cycles.

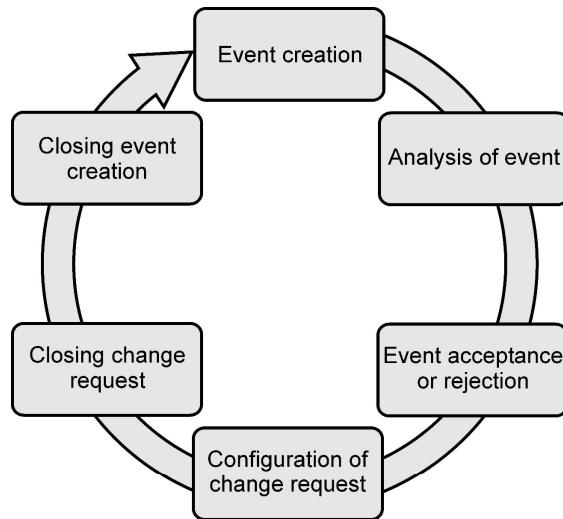


Fig. 4.8.1 : Phases of change control activities

Event creation : The registration page for the event has been developed, as well as a description for the event.

Event analysis : The configuration item(s) that may be affected by potential changes are identified, and the scope of these changes is calculated.

Event acceptance or rejection : If the event registration is approved, a change request for each configuration item that is affected is created.

Configuration of change request : The update is implemented after a new configuration item is recognised and generated. Feedback is supplied to the configuration control board during the acceptance and storage of the new item.

Change request closing : After the change has been implemented and accepted, the request can be closed.

Event creation closing : When all change requests are completed, the event registration can be closed.

4.8.2 Usage of Metadata

Metadata is utilised for analytical purposes during the modification process. This could take the form of reports or a direct search in the database or databases that store metadata. Trace data is frequently used, for example, to determine which configuration items need to be changed as a result of an incident. Information about variants or branches associated with a configuration item is also useful to see if a change has several consequences.

Finally, metadata can be utilised to see if a configuration item has any other outstanding event registrations, such as whether or not other modifications are being implemented or are awaiting a decision.

Analysis of consequences

When studying an event, it's important to factor in the cost of making modifications. This isn't always an easy task. The checklists below, based from a list by Karl Wiegers, may be useful in assessing the impact of a proposed change. The lists are not exhaustive and should only be used as a source of inspiration.

Identify

- All requirements that are affected by or in conflict with the proposed change.
- Consequences of not implementing the proposed change.
- Potential negative effects and other risks associated with implementation.
- How much of the product's value will be lost if the proposed solution is implemented ?

Check to see if the requested change is feasible

- Has an impact on nonfunctional criteria, such as performance requirements (ISO 9126, a quality standard, includes six quality characteristics: functional, performance, availability, usability, maintainability, and portability). Nonfunctional is a term used to describe the last five.)
- May be implemented using existing technology and resources.
- Will result in unacceptably high resource requirements during development or testing.
- Will result in a higher unit price.
- Will have an impact on marketing, production, services, or support.

Follow-on effects

Additions, changes or deletions in user interfaces or reports, internal or external interfaces, or data storage, designed objects, source code, build scripts, include files, test plans and test specifications, help texts, user manuals, training material, or other user documentation, project plan, quality plan, configuration management plan, and other plans are examples of follow-on effects.

Roles

The configuration (or change) control board (CCB) is in charge of change management. When a document or a piece of code is originally written, a configuration control board may consist of a single person, such as the author or developer, or an agile team working in direct touch with users and sponsors, if work can be done in an informal manner without bureaucracy and piles of paper. It may also, and in most cases will, include a number of personnel, including the project manager, a customer representative and the person in charge of quality assurance.

Descriptions of procedures

The methods, conventions and procedures required for carrying out the activities in change control may include :

- description of the change control process structure,
- procedures in the life cycles of events and changes,
- convention(s) for forming different types of configuration control boards,
- definition of responsibility for each type of configuration control board,
- template(s) for event registration,
- template(s) for change request.

Relationship to other activities

Though all actions in a fully automated system may be done in the same tool, change control is clearly separated from other configuration management tasks. Change control may or may not be considered a configuration management function depending on the organisation.

It is undoubtedly intertwined with project management, product management, and quality assurance, and is sometimes included in quality assurance or test activities. Still, when defining and distributing duties, it's critical to make the lines between roles and responsibilities as clear as possible, so change control belongs to configuration management and nothing else.

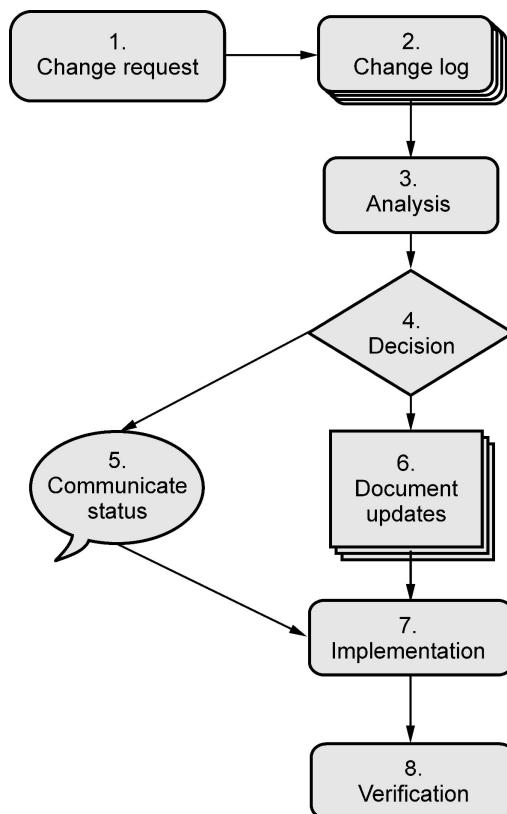


Fig. 4.8.2 Change control process

Review Question

1. Explain in detail change control process.

4.9 Software Configuration Management

SCM is concerned with tracking and controlling software changes. Because each work product must be accessed and modified by multiple people during the software development process, a robust configuration management system is essential to avoid several difficulties.

Problems that may occur if a proper SCM is not used

Concurrent access

Undoing changes

System accounting

Handling variance

Accurate determination of project status

Preventing unauthorized access to the work products

Configuration Management Process

Configuration management is carried out using the two main tasks listed below.

Configuration identification : The process of determining which components of the system should be retained under configuration management is known as configuration identification.

Configuration control : The term "configuration control" refers to the process of ensuring that changes to a system go smoothly.

Changes to a work product that are under configuration control

When a developer needs to make a change to a work product, he or she submits a reserve request.

After the reserved instructions have been executed successfully, a

In the local environment, a private copy of the work product is created.

along with the modifications to the directory

The configuration must be restored once the changes were performed.

depository for management information

Permission is required to restore the modified work product.

A Change Control Board is a group of people who are in charge of making changes to a system (CCB)

The CCB is usually made up of members of the development team members.

Open Source Configuration Tools

SCCS (Source Code Control System) and RCS (Revision Control System) are two popular configuration management tools available on most UNIX systems. They are used for controlling and managing different versions of text files (but not binary files) and provide an efficient way of storing versions that minimises the amount of occupied disc space.

4.10 Managing Contracts

- The management of contracts with customers, vendors, partners or staff is known as contract management or contract administration.

Types of contract

- Contracts can be classified majorly in two categories
 - Acquiring software from external supplier
 - Acquiring software based upon payment

Acquiring software from external supplier :

Further classified into 3 categories

- A bespoke system created specially for the customer
- Off the shelf bought 'as it is'
- Customized off the shelf(COTS) - a core system is customized to meet needs of a particular customer.

Acquiring software based upon payment

1. Fixed price contracts

Customer benefits :

- Known spending;
- Supplier incentivized to be cost effective;

Loss :

- Supplier will increase price to fulfil contingencies;
- Difficult to amend requirements;
- Upward pressure on the cost of modifications;
- Threat to system quality

2. Time and materials contracts

Customer benefits :

- Requirements are simple to adjust

- Product quality might be aided by a lack of pricing pressure.

❑ Loss :

- Liability of the customer. The buyer bears the entire risk.
- Linked to criteria that aren't well specified or are constantly changing

3. Fixed price per delivered unit

❑ Customer benefits

- Customer awareness of how prices are calculated
- Comparability of multiple pricing schedules
- Developing functionality can be accounted for
- A supplier incentive to be cost-effective

❑ Loss :

- Problems with software size measurement may necessitate the use of a separate FP counter.
- Changing (rather than new) requirements : how do you charge ?

Typical terms used in contract

- Definition Form of agreement lease, license, Sale
- Goods and services to be supplied
- Ownership of software
- Environment
- Acceptance standards
- Time table
- Price and payment method
- Legal requirements

4.11 Contract Management

Contract management is a complex monitoring process that includes execution, vendor selection, issue identification and control, tracking and processing of contracts from pre-award to conclusion. Contract management techniques, when effectively implemented, ensure that budgets and capabilities are in line with project goals.

The best contract management integrates project management and control seamlessly throughout the company, always incorporating team members for input and outcomes, and closely monitoring contractors for performance and deadlines.

The Stages of Contract Management

Contract management entails more than just drafting and approving contracts. It consists of a number of stages that guide the process to a successful end. Any missing steps can lead to delays and errors later on. Here's a rundown of the five most important stages:

1. **Create** : The contract management system must be able to include standardised procedures with specific features tailored to the organization's objectives. The first step is to determine the sort of contract and who will be in charge of each duty. While developing an overview of prospective problems and hazards, the planning process should take into account company resources, objectives, and team member strengths and limitations.
2. **Negotiate** : The contract should be designed in a way that matches the organization's needs and beliefs, in order to enable the two parties create confidence. As part of the negotiating process, line items might be discussed, altered or eliminated.
3. **Approve** : Approval normally entails a number of signatures. Before the final deal is made, a number of managers, departments and even contractors may need to sign off on the details.
4. **Finalize** : The signing of contracts between businesses is the last step before the project can begin. It's critical to get signatures from a variety of parties and bodies immediately, especially when distance is an issue, to minimise delays in the process.
5. **Manage** : Changes can still happen once the project starts. Revisions must be meticulously monitored and notified to all relevant parties. Deadlines, audits, revenue and expenses must all be kept track of, completed and communicated with the rest of the team.

Contract Management Challenges

- Contract management processes can be difficult to manage, especially when done manually. The following are some specific challenges :
- **Execution** : Without adequate administration, paperwork can quickly become misplaced, and final approvals and signatures can take considerably longer than they should.

Contract tracking and auditing can be challenging once contracts have been signed and passed on to other employees who may not comprehend the intricacies that

must be tracked. Budget information, e-mails, meeting minutes and modifications are all stalled in transit before being addressed. Project delays reduce profitability since time is money.

- **Revisions :** It's just as vital to manage change before a contract is approved as it is after it's been performed. Larger projects usually involve national or international teams, posing challenges to deadlines and teamwork. Original documentation updates might take days, if not weeks, to complete. Furthermore, if teams work from various versions of the same document, incorrect conclusions may be made. Any of these possibilities could result in higher risk, missing deadlines, errors, and even legal action.
- **Contractual compliance :** Contractual responsibilities are non-negotiable. There may be regulatory or compliance problems that must be followed to the letter from a legal aspect. Failure to comply can result in serious consequences.
- **Stages in contract placement**

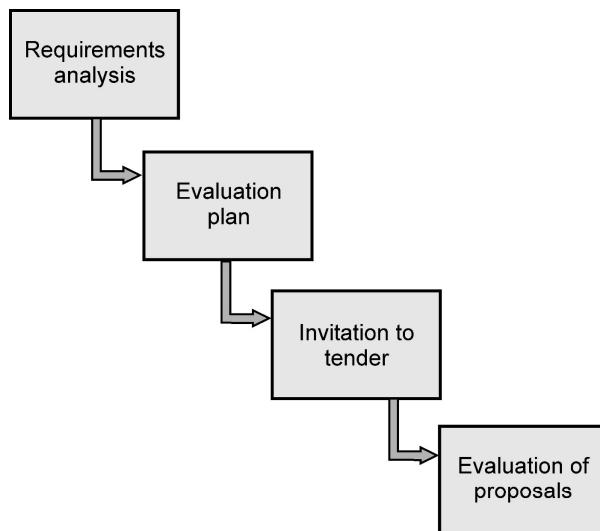


Fig. 4.11.1 Stages in contract placement

- **Requirement :** All the requirements are documented and which consist of following things
 - Description of the current system and its surroundings
 - Plans or strategies for the future
 - Features that are required or desired by the system
 - Deadlines
 - Software functions with required inputs and outputs

- Other apps with which software must be compatible must follow certain standards.

For example, there are quality requirements that must be met. Timeliness of responses

- Bidders are needed to provide further information.
- **Evaluation plan :**

This include different methods for evaluation of proposals

- Reading proposals
- Interviews
- Demonstrations
- Site visits
- Practical tests
- Need to assess value for money for each desirable feature
- **Example :**
 - feeder file saves data input
 - 6 hours a month saved
 - cost of data entry at RM20 an hour
 - if cost of feature RM1000, would it be worth it?
- **Invitation to tender (ITT)**

Note that the bidder is responding to the ITT with an offer.

- Acceptance of an offer creates a contract;
- The customer may require additional information
- Different technical solutions to the same problem
- **Evaluation of proposals**
 - Verify that the paper meets all of the requirements. Supplier interviews, demonstrations, site visits, and practical tests are all part of the process.
- **Benefits of contract management process**
- Communication, response time, goal alignment, transparency and accountability are all improved when contracts are managed properly. Good contract management can help you track and improve these and other project performance metrics:
- **Efficiency :** Contract management streamlines contract adherence and can help businesses save money. All essential documentation may be discovered and tracked in one location, providing greater transparency for team members from other departments as well as contractors operating offsite. Automation makes documents

and modifications more accessible, which can shorten the time it takes to respond to changes, additions, or issues. Positive contracting experiences may help lock in better raw material pricing and availability, as well as lower service expenses in the future.

- **Risk reduction :** When a contract is established, important company objectives and goals are identified. A good contract management strategy establishes expectations around those priorities and ensures that contract commitments are kept. The benefit has a wide range of applications, including keeping businesses accountable to performance clauses and ensuring vendor compliance. Regulations are always changing, and staying on top of them necessitates ongoing monitoring to guarantee that your projects remain compliant. Assets, commitments, and provisions must all be tracked to reduce the risk of financial loss. A contract management tool's tracking feature constantly monitors performance and compliance in real time.
- **Building relationships :** When vendors and subcontractors have a favourable contract experience, they become long-term business partners. Finding good staff is critical for future initiatives, especially in the construction business.
- Contract management technologies organise and centralise documents and processes, allowing for easier access to corporate data and analytics. Standardized reporting and record-keeping ensures accuracy and transparency, resulting in actionable insights. Projects are less likely to become stuck due to an unanticipated challenge or compliance issues when contracts are managed transparently.

Review Questions

1. *What are the different types of contracts ?*
2. *List the various typical terms of a contract ?*
3. *Write short notes on contract management ?*
4. *Explain the different stages in contract placement.*
5. *What are the different challenges in contract management ?*

4.12 Multiple Choice Questions

- Q.1** The difference between the extra money spent on prevention and the commensurate reduction in the cost of failure is called the _____.
- | | |
|---|---|
| <input type="checkbox"/> a) cost-benefit analysis | <input type="checkbox"/> b) implicit cost |
| <input type="checkbox"/> c) cost of quality | <input type="checkbox"/> d) variable cost |

Q.2 Which of the following is an improper activity for software system configuration management ?

- | | |
|--|--|
| <input type="checkbox"/> a Internship management | <input type="checkbox"/> b Change management |
| <input type="checkbox"/> c Version management | <input type="checkbox"/> d System management |

Q.3 Earned value analysis compares planned cost and schedule with _____.

- | | |
|--|--|
| <input type="checkbox"/> a actual figure | <input type="checkbox"/> b earned figure |
| <input type="checkbox"/> c growth figure | <input type="checkbox"/> d lagged figure |

Q.4 In Earned value analysis EV stands for _____.

- | | |
|--|---|
| <input type="checkbox"/> a End Value | <input type="checkbox"/> b Earned Value |
| <input type="checkbox"/> c Estimated Value | <input type="checkbox"/> d Economic Value |

Q.5 In Earned value analysis PV stands for _____.

- | | |
|--|---|
| <input type="checkbox"/> a Project Value | <input type="checkbox"/> b Profit Value |
| <input type="checkbox"/> c Planned Value | <input type="checkbox"/> d Processing Value |

Q.6 The budgeted cost for all the activities in project with help of EVA (Earned Value Analysis) is defined by _____.

- | | |
|--|---|
| <input type="checkbox"/> a actual cost | <input type="checkbox"/> b budget at completion |
| <input type="checkbox"/> c budget for completion | <input type="checkbox"/> d estimate at completion |

Q.7 Which of the following is a software configuration management concept that allows us to manage change while not inhibiting justified change ?

- | | |
|---------------------------------------|--|
| <input type="checkbox"/> a Baselines | <input type="checkbox"/> b Source code |
| <input type="checkbox"/> c Data model | <input type="checkbox"/> d None of the mentioned |

Q.8 Software Configuration Management (SCM) can be managed in a variety of methods.

These include the following :

- | |
|---|
| <input type="checkbox"/> a A single software configuration management team for the whole organization |
| <input type="checkbox"/> b A separate configuration management team for each project |
| <input type="checkbox"/> c Software Configuration Management distributed among the project members |
| <input type="checkbox"/> d All of the mentioned |

Q.9 Which of the following is not a software configuration management activity ?

- | |
|--|
| <input type="checkbox"/> a Configuration item identification |
| <input type="checkbox"/> b Risk management |
| <input type="checkbox"/> c Release management |
| <input type="checkbox"/> d Branch management |

Q.10 The definition and use of configuration management standards is essential for quality certification in _____.

- | | |
|-------------------------------------|---|
| <input type="checkbox"/> a ISO 9000 | <input type="checkbox"/> b CMM |
| <input type="checkbox"/> c CMMI | <input type="checkbox"/> d All of the mentioned |

Q.11 The Function Point (FP) metric is :

- | |
|---|
| <input type="checkbox"/> a Calculated from user requirements |
| <input type="checkbox"/> b Calculated from Lines of code |
| <input type="checkbox"/> c Calculated from software's complexity assessment |
| <input type="checkbox"/> d None of the above |

Q.12 Which of the following are data collection tools ?

- | |
|---|
| <input type="checkbox"/> a Guide to conducting interviews |
| <input type="checkbox"/> b Timetable for interviews |
| <input type="checkbox"/> c Questionnaire sent by mail |
| <input type="checkbox"/> d All the above |

Q.13 A horizontal bar chart that shows project tasks against a calendar is called _____.

- | | |
|--|---------------------------------------|
| <input type="checkbox"/> a milestone | <input type="checkbox"/> b goal |
| <input type="checkbox"/> c gantt chart | <input type="checkbox"/> d PERT chart |

Q.14 The statistical tool that depicts a project's tasks and the relationships between those tasks is known as _____.

- | | |
|--|---------------------------------------|
| <input type="checkbox"/> a milestone | <input type="checkbox"/> b goal |
| <input type="checkbox"/> c gantt chart | <input type="checkbox"/> d PERT chart |

Q.15 Which of the following is/are type of project status report ?

- | | |
|---|---|
| <input type="checkbox"/> a Report on variance | <input type="checkbox"/> b Spotlight report |
| <input type="checkbox"/> c Exception report | <input type="checkbox"/> d All of the mentioned |

Q.16 Which of the following report uses different colour stickers to show project status _____.

- | | |
|---|--|
| <input type="checkbox"/> a report on variance | <input type="checkbox"/> b spotlight report |
| <input type="checkbox"/> c exception report | <input type="checkbox"/> d cumulative report |

Q.17 Which of the following is not a main phase in Configuration Management (CM) Process ?

- | | |
|--|---|
| <input type="checkbox"/> a CM Planning | <input type="checkbox"/> b Executing the CM process |
| <input type="checkbox"/> c CM audits | <input type="checkbox"/> d None of the mentioned |

Q.18 Which of the following is a type contracts used in software project management ?

- | | |
|---|--|
| <input type="checkbox"/> a Fixed price contract | <input type="checkbox"/> b Unit price contract |
| <input type="checkbox"/> c Time , Material contract | <input type="checkbox"/> d All of the above |

Q.19 Which of the following is not a stage in contracts management ?

- | | |
|--------------------------------------|------------------------------------|
| <input type="checkbox"/> a Start | <input type="checkbox"/> b Create |
| <input type="checkbox"/> c Negotiate | <input type="checkbox"/> d Approve |

Q.20 In case of slip chart when there is greater variation in plan when _____.

- | | |
|---|---|
| <input type="checkbox"/> a line bends | <input type="checkbox"/> b line is straight |
| <input type="checkbox"/> c ball movement is there | <input type="checkbox"/> d none |

Answer Keys for Multiple Choice Questions :

Q.1	c	Q.2	a	Q.3	a	Q.4	b
Q.5	c	Q.6	b	Q.7	a	Q.8	a
Q.9	b	Q.10	d	Q.11	c	Q.12	d
Q.13	c	Q.14	d	Q.15	d	Q.16	b
Q.17	d	Q.18	d	Q.19	a	Q.20	a



Notes

UNIT- V

5

Agile Project Management

Syllabus

Predictive versus Empirical Management, Comparison between Non-Agile and Agile Project, Three stages of Agile Project, Estimation, Scope Management, Roles and Responsibilities, Scheduling and Tracking.

Contents

- 5.1 *Introduction*
- 5.2 *Agile Methodology*
- 5.3 *Predictive versus Empirical Management*
- 5.4 *Comparison between Non Agile and Agile Project*
- 5.5 *Three Stages of Agile Project*
- 5.6 *Estimation*
- 5.7 *Scope Management*
- 5.8 *Roles and Responsibilities*
- 5.9 *Scheduling and Tracking*
- 5.10 *Multiple Choice Questions*

5.1 Introduction

Agile project management divides enormous projects into smaller, more manageable portions known as iterations. Something of value is created at the end of each iteration (which normally takes place over a regular time interval). Every iteration's product should be able to go out into the world and collect input from stakeholders or users.

Unlike waterfall project management, agile project management follows a rigorous timeline : we don't start designing until all of our research is finished, and we don't start developing until all of our designs have been approved. Agile allows engineers, designers, and business people to collaborate at the same time.

5.1.1 Agile Project Management

Agile project management is an iterative approach to project delivery that takes place across the course of the project's life cycle.

Iterative or agile life cycles are made up of a series of iterations or incremental phases that lead to a project's completion. Iterative techniques are commonly employed in software development projects to increase velocity and adaptability since they allow us to alter as we go rather than following a linear path. An agile or iterative strategy strives to deliver benefits throughout the process rather than just at the end. Trust, adaptability, empowerment, and cooperation should all be essential ideals and behaviors in agile initiatives.

Agile Project Management is one of the most innovative approaches to project management that has been offered. This is a new project management strategy that is mostly used in the software development industry. When learning about agile project management, it's ideal to think of it as akin to the software development process.

There have been a number of methods in place since the beginning of software development as a company, such as the waterfall model. Traditional models are no longer robust enough to meet the demands of software development, technology, and business requirements.

As a result, in order to address the needs' agility, more flexible software development methods were needed. As a result, software development frameworks for agile software have emerged in the information technology community.

The term "agile" refers to a variety of agile development paradigms, including Scrum. Agile project management is a specific area in project management due to the differences between the agile development paradigm and traditional methodologies.

5.1.2 Agile Process

To comprehend agile project management, one must first have a solid understanding of the agile development process.

When compared to traditional development paradigms, agile development has a number of differences :

- The agile model emphasizes the importance of the entire team working as a cohesive one. Developers, quality assurance, project management, and the customer are all included.
- One of the main components that allows for this integration is frequent communication. As a result, daily meetings are held to plan out the day's activities and dependencies.
- Deliveries are only made for a limited time. A delivery cycle usually lasts one to four weeks. Sprints are the most frequent name for this type of exercise.
- Open communication strategies and tools are used by agile project teams to enable team members (including customers) to express their opinions and feedback freely and swiftly. These suggestions are then taken into account when developing the software's specifications and implementation.

Scope of agile project management

It is the responsibility of the entire team, not just the project manager, to manage the team in an agile project. Common sense prevails over formal policies when it comes to processes and procedures.

This ensures that managerial decision-making is not delayed, allowing things to move forward more quickly.

The agile project management position should display leadership and motivational skills in addition to being a manager. This aids in the retention of team spirit and encourages the team to adhere to discipline.

The software development team's agile project manager is not the 'boss.' This function, on the other hand, organizes and coordinates the activities and resources required for high-quality, quick software development.

Agile project manager responsibilities

The following are the tasks of an agile project management function. These obligations can differ slightly from one project to the next and are perceived differently.

- In charge of ensuring that the project team adheres to agile values and practises.

- The main function of the agile project manager is to remove barriers.
- Assists project team members in converting the requirements backlog into functioning software.
- Within the team, facilitates and encourages effective and open communication.
- Responsible for facilitating agile meetings in which short-term plans and strategies for overcoming hurdles are discussed.
- Enhances the development process's tools and procedures.
- The agile project manager is the team's principal motivator and also serves as a mentor to the team members.

Agile Project Management does now no longer include

- Organize and lead a software development team.
- override the team members' well-informed decisions.
- instruct team members on how to complete tasks or conduct procedures.
- Motivate the team to meet particular deadlines or deliverables.
- Assign tasks to members of the team.
- make decisions on the team's behalf
- Participate in technical decision-making or the development of a product strategy.
- In agile projects, project management is the duty of everyone (developers, quality assurance engineers, designers, and so on).

Furthermore, the agile project manager plays an important role in the agile team by providing resources, keeping the team engaged, removing roadblocks, and resolving obstructions as quickly as feasible.

An agile project manager, rather than being a manager, serves as a mentor and guardian for an agile team.

5.1.3 Agile Software Development

One of the simplest and most successful ways to turn a vision for a company need into software solutions is to use the Agile software development methodology. Continuous planning, learning, improvement, team collaboration, evolutionary development, and early delivery are all terms used to describe agile software development methodologies. It increases adaptability in the face of change.

The four essential values of agile software development are given :

1. Interactions between individuals and teams over processes and tools

2. Working software trumps thorough documentation.
3. Collaboration with customers rather than contract negotiations
4. Adapting to change in accordance with a strategy

5.2 Agile Methodology

The Agile Methodology is an approach that encourages continuous development and testing throughout the project's software development lifecycle. In contrast to the Waterfall methodology, the Agile model allows for simultaneous development and testing.

Agile manifesto

The Agile Manifesto is a declaration of the agile methodology's beliefs and principles. It tries to identify new ways of producing software by offering a clear and measurable structure that supports iterative development, team cooperation, and change recognition. It is made up of four basic ideals and 12 key principles.

The manifesto for agile software development's values and principles are as follows:

Values

1. Over processes and tools, it's about people and their interactions.
2. Working software trumps thorough documentation.
3. Collaboration with customers is preferred over contract negotiations.
4. Adapting to change in accordance with a strategy.

As listed below, there are 12 principles that guide agile project management.

Principles

1. Agile's first aim is to satisfy customers by delivering critical products and services on time and on schedule.
2. Projects are delivered on a regular basis, ranging from a few weeks to a few months, with a preference for shorter timelines.
3. Accept any changes in requirements, even if they occur late in the project's development. Agile processes take advantage of change to give customers a competitive edge.
4. Throughout the project, developers and stakeholders must work together and collaborate.

5. Build our projects around people who are excited about what they're doing. Give them the support and environment they require, and trust them to complete their tasks.
6. The most efficient means of communicating information to and within the development team is through face-to-face conversations.
7. The true test of a project's success is the ultimate working product.
8. Agile processes aid in the promotion of long-term development. The pace must be maintained indefinitely by the creators, sponsors, and users.
9. Continuous attention to good design and technological excellence improves agility significantly.
10. Simplicity is crucial, as it is the skill of increasing the amount of unfinished work.
11. Self-organizing teams produce the finest designs, requirements, and architectures.
12. The team should reflect on how they can become more productive at frequent intervals, then adapt and tune their behavior accordingly.

These ideals and principles are followed by those who use any sort of agile approach. When it comes to agile development life cycle techniques, the manifesto provides a solid picture of what is expected.

Advantages of agile methodology

Agile was created for the software industry to enhance and expedite the development process so that flaws and issues could be identified and corrected fast. Through short, iterative sprints/sessions, it allows teams and developers to create a better project, faster. Agile is a fantastic fit for organizations trying to improve the way they manage projects and operate in general, especially as many companies move to the digital workplace. Here are some reasons why the agile methodology is advantageous.

Speed to market

We can use the agile process to bring the notion to our users as quickly as feasible. An agile project creates something useful during each iteration. We could opt to launch what has been supplied at any time to begin building our user base or to test our idea.

Flexibility

The agile methodology is built on the idea of adapting to change. Projects, especially software, are always changing. We must be able to adapt and update the product as new products are released or the market expands. Agile also recognises that brilliant ideas

might emerge in the middle of a project, and that locking ourself inside a scope will prevent us from taking advantage of such insights.

Risk management

Users and stakeholders might use and test a product early in the process if incremental releases were available. This allows us to spot feature deficiencies and difficulties early on in the manufacturing process. Being responsive to changes also means that changing the scope of our project midway through is not a problem, which is difficult with the waterfall process.

Cost control

Agile, unlike fixed-budget projects, is extremely flexible in terms of scope. In most cases, clients learn that the features they originally wanted are no longer necessary, allowing them to launch considerably sooner and for a lower price. Agile, on the other hand, is about paying only for what we need rather than overpaying for high degrees of uncertainty. Do we want to stay inside our budget? That shouldn't be an issue because agile allows us to restructure the product backlog so that the most important new features get developed at the expense of the less important ones, rather than our budget.

Quality

Testing is integrated into the agile methodology throughout the project lifecycle. Delivering tested products on a regular basis means higher overall quality and less time spent quality-assuring the product as a whole. Early and regular product testing is possible with incremental releases. Even if the items aren't yet out to the general public, it's easier to find defects and make improvements when we have the actual product to play with rather than a series of new designs to work with from beginning.

Criticism of agile methodology

1. It is not based on documents.
2. There is a lack of structure.
3. There are a lot of meetings.
4. Requires a significant amount of cultural change to implement
5. Adds ambiguity to the contract negotiation process because actual work effort estimates are difficult to create.
6. If not adequately managed, can be inefficient.
7. Can raise the danger of scope creep.

5.2.1 Scrum

Scrum is a popular agile process for product development, particularly software development. Scrum is a project management methodology that may be used on any project with tight deadlines, complicated requirements, or a high level of uniqueness. Projects in Scrum are progressed through a series of iterations known as sprints. Each sprint usually lasts two to four weeks shown in the Fig. 5.2.1.

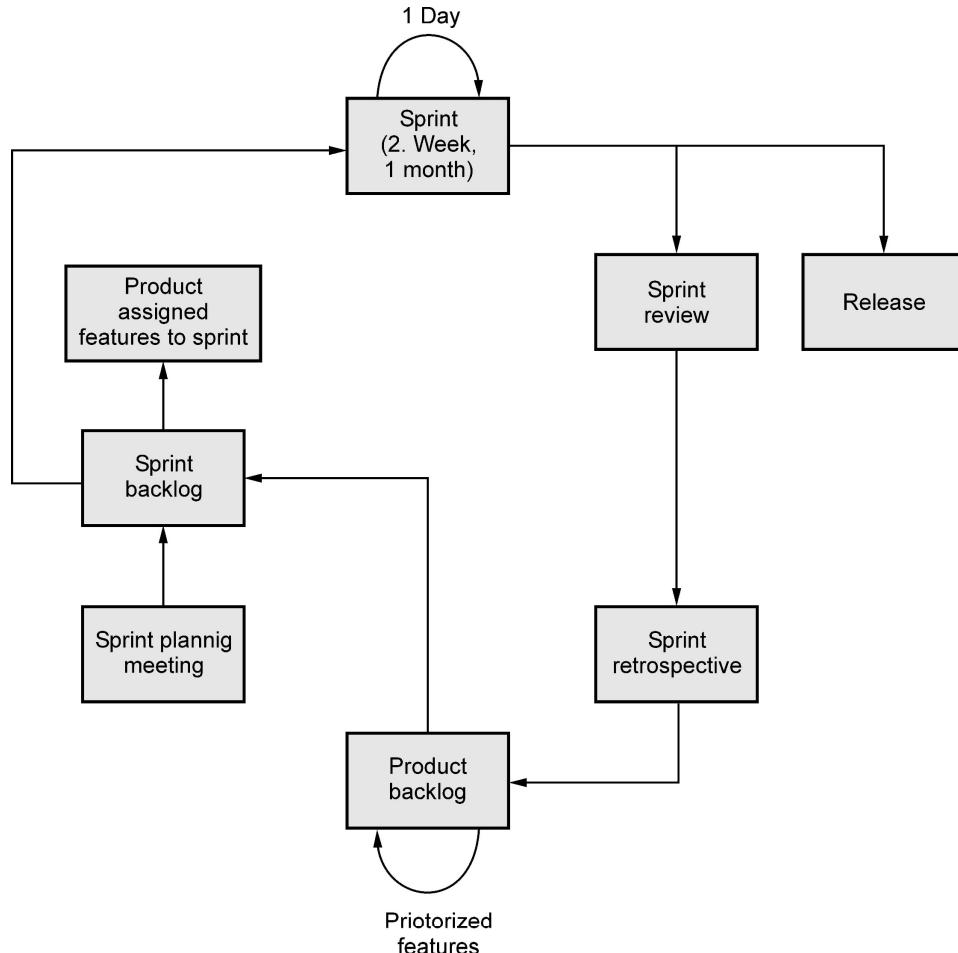


Fig. 5.2.1 : Scrum

Scrum team : A scrum team typically consists of five to nine persons, but Scrum projects can easily reach the hundreds. One-person teams, on the other hand, can readily and frequently adopt Scrum. There are no programmers, designers, testers, or architects on this team.

Product owner : The product owner is a crucial stakeholder in the project who represents users, customers, and others throughout the process. The product owner is frequently a member of product management or marketing, as well as a key stakeholder or user.

Scrum master : The Scrum Master is in charge of ensuring that the team works as efficiently as possible. The Scrum Master accomplishes this through assisting the team in using the Scrum method, removing roadblocks to development, and safeguarding the team from the outside world, among other things.

Product backlog is a prioritized feature list that includes every desired item or update to the product. Note: The term "backlog" is sometimes misunderstood since it refers to two separate things. To be clear, the product backlog is a list of the product's intended features. A sprint backlog is a list of tasks that must be accomplished in a given sprint.

Sprint planning meeting : At the start of each sprint, the product owner presents the team with the top items on the product backlog in a sprint planning meeting. The Scrum team prioritizes the tasks that can be completed in the next sprint. The work is then shifted from the product backlog to a sprint backlog, which is a list of activities required to finish the product backlog items that the team has committed to completing during the sprint.

Daily scrum : Throughout the sprint, a brief meeting known as the daily scrum is held each day. This meeting helps the team stay on track by providing context for each day's work. The daily scrum is mandatory for all team members.

Sprint review meeting : At the end of each sprint, the team holds a sprint review meeting to show off the finished functionality. Typically, this takes the form of an informal demonstration of the new capabilities; for example, PowerPoint slides are not permitted. The meeting should not become a chore in and of itself, nor should it become a diversion from the process.

Sprint retrospective : At the end of each sprint, the team (including its Scrum Master and product owner) holds a sprint retrospective, which is a meeting in which the team (including its Scrum Master and product owner) considers how well Scrum is working for them and what changes they might want to make to make it even better.

Review Questions

1. *What is agile ?*
2. *What is agile project management ?*
3. *What is agile software development ?*

4. What is agile methodology ?
5. What is agile manifesto ? What principles aid in the development of agility ?
6. What are the benefits of agile methodology ?

5.3 Predictive versus Empirical Management

Predictive project

This is a project where the needs and effort required are well-understood enough to meet those requirements in a predictable manner. This means, in project management terms :

1. At the start of the project, the whole scope can be precisely characterized and captured in a detailed Work Breakdown Structure (WBS).
2. Work packages from the WBS can be broken down into a definite set of jobs, each of which can be properly evaluated in terms of length.
3. The outcomes of the task definition and estimating processes can be compiled into a schedule that also depicts task dependencies. This is also known as huge up-front planning, and the end product is usually a Gantt chart that is used to orchestrate the project's execution. Because a Gantt chart resembles a sequence of waterfalls, large-scale up-front planning initiatives are known as "Waterfall" executions.

Predictive management

A predictive control process is one that specifies the actions or phases that must be followed in order to deliver a solution. The assumption is that providing software is a straightforward problem domain from which an ideal procedure can be derived to get good results. The Waterfall Model, in which a process is shown, is a good example of a predict and control process.

A predictive control technique is ideal for well-known and repeated problem areas that can be forecasted with a high degree of precision, such as manufacturing processes where a run of 100,000 duplicate goods must be produced.

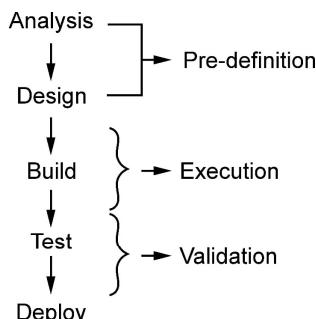


Fig. 5.3.1 : Predictive Process

The problem is that most software development is focused on product development and creating the first of its type, and as a result, it tends to operate in a complex domain that is difficult to forecast. The approach must be adjusted to the empirical evidence in this case.

Empirical management

Scrum is built on empirical process control and employs empiricism to make evidence-based decisions. In the philosophy of science, empiricism emphasizes the use of facts gathered via testing rather than innate notions or traditions to gain knowledge.

Scrum can be compared to a scientific approach in which a hypothesis or inquiry is created, which may or may not be related to the Sprint Goal. During sprint planning, an experiment is created and then carried out during the Sprint. The hypothesis is then confirmed, discounted, or refined during product backlog refinement, after which the results are validated during the sprint review and retrospective.

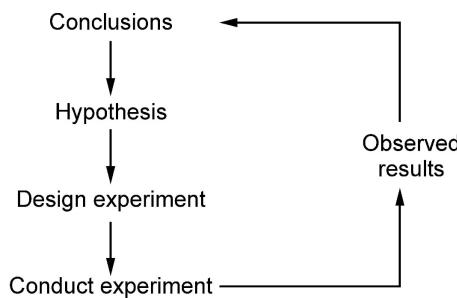


Fig. 5.3.2 : Empirical Process

This method uses a looping experimental cycle to fine-tune the final solution to meet actual demands and capabilities rather than those that were anticipated at the outset.

The approach can be open-ended and ambiguous at first, and it may take several cycles to provide something useful; however, the cost of experimenting and providing an accurate solution is arguably much less expensive than predefining the solution and then discovering that it is deficient, as with a predict and control process.

An empirical process is excellent for examining complex issue areas in order to find a solution that is evidence-based, meets the needs, and provides something that may not be quantifiable at first.

Empirical process control

Scrum is built on the empirical process control paradigm, which has three pillars: transparency, inspection, and adaptation as a method of process feedback control. Agile's

capacity to make good judgments and act on them without distractions or delays is a critical differentiator.

Transparency

The goal is to make the data open and transparent so that it can be objectively reviewed and good judgments can be made. It is far more difficult for teams to react efficiently and properly if there is insufficient openness.

The product backlog, sprint backlog, and increment are examples of artefacts that promote transparency by displaying what has been done, what has not been done, and where changes need to be made.

Inspection

The data linked to a project's process should be reviewed on a regular basis to detect any deviations from the sprint goal or unanticipated outcomes as soon as feasible so that appropriate action or course correction may be taken.

In Scrum, there are various formal chances to inspect and adapt the data, including:

- Sprint planning to determine what can be done to achieve the Sprint Goal
- Scrum every day to check on progress toward the Sprint Goal
- Sprint review to look over the increment, the work that has been completed, and what the next Sprint goal should be.
- Sprint retrospective to examine the team and their work-production process.

Adaptation

To avoid additional deviation, the process or substance being inspected should be modified in response to the feedback. Adaptation is the process of acting on the observations and decisions made during the inspection and making course changes to achieve the objectives.

Typical adaptive actions include :

- Backlog of products refinement activity to alter and curate the product backlog based on current knowledge of the product and its value.
- When the development team adapts their methodologies as they work toward the Sprint Goal, it is called Daily Scrum.

Review Questions

1. *What is predictive management ?*
2. *What is empirical management ?*

3. What is scrum ?
4. Differentiate between predictive and empirical management ?

5.4 Comparison between Non Agile and Agile Project

Non agile and agile projects

Traditional projects are well-defined, with detailed documentation and understanding of their requirements, functions, and features. Despite the fact that this level of specificity is unlikely to occur, the project manager is prompted to create a comprehensive project plan that includes all resources assigned to tasks and activities assigned to precise time frames.

Agile initiatives do not have a complete requirements document and must find it as the project progresses. As a result, the project manager avoids guesswork and just develops a strategy for the established needs. The identification and learning of missing or mis-specified functions and features drives this just-in-time planning method. Iterations, which characterize agile project methodologies, are used to develop the solution. Compared to traditional initiatives, agile projects have a higher risk. The customer's and development team's failure to describe requirements totally and clearly is a sign that something is different and needs to be handled differently. The unknowns are the things that raise the danger.

Sr. No.	Traditional	Agile
1	Make a plan for what we want to happen.	Make a detailed plan for what we expect to happen based on the horizon.
2	Make certain that what occurs matches what was planned. <ul style="list-style-type: none"> • Directive Management • Containment, containment, containment 	"Control" is achieved through inspection and adaptation. <ul style="list-style-type: none"> • Reviews and Retrospectives • Teams that self-organize
3	To manage change, use change control. <ul style="list-style-type: none"> • Replace the control board • Management of Defects 	Manage change with Agile practices : <ul style="list-style-type: none"> • Loops of feedback that never end. • Development that is iterative and gradual. • Backlogs that have been prioritized.

Table. 5.4.1 : Traditional Vs Agile

Traditional and agile processes eventually converge on the same set of artefacts. They just appear at different times over the project's life cycle. Between the two groups of

artefacts, there is one significant difference. A typical methodology would have identified and planned for a number of deliverables that were either changed after deployment or never completed. Agile approaches, on the other hand, would have planned just what was really delivered. As a result, the agile project has a clear lack of waste. Traditional Vs Agile project is given in the Table 5.4.1.

Difference between agile and waterfall

Despite the fact that both approaches are viable and mature, the decision to use one over the other is based on the project at hand and the firm carrying it out. The following diagram illustrates the differences between agile and waterfall.

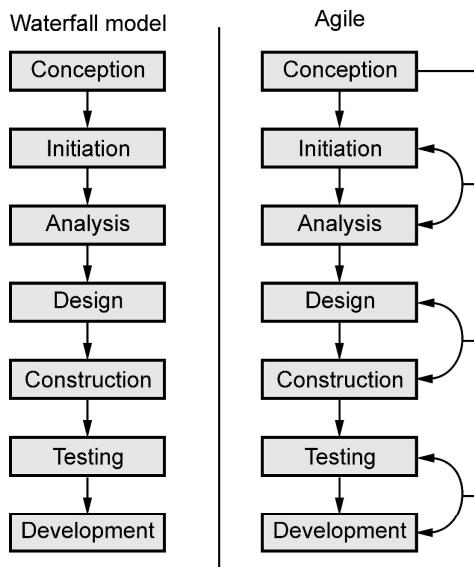


Fig. 5.4.1 : Agile Vs Waterfall

Project scope

- Changes could be made well in advance in agile while staying within the project budget. Even when the scope isn't established in advance, the agile process works perfectly.
- When the scope is well-defined in advance, the waterfall methodology works perfectly. The alterations that can be made are often limited by the contract terms.

Project team

- Small to mid-sized specialized teams working in close collaboration are common in Agile.
- Large teams are commonly used in waterfalls, which reduces member coordination.

Customers

- Customers can be available throughout the project thanks to the agile process.
- Customers' availability is only required at milestones in a waterfall project.

Feature prioritization

- Features are usually prioritized in agile, and issues are dealt with according to their priority. This improves financial efficiency while also preventing project failure.
- Features are never prioritized, and as a result, the project either succeeds or fails completely.

Funding

- Agile is effective at increasing funding efficiency.
- Waterfall works perfectly because it reduces fixed costs by using up-front contracts.

Project changes

- During an ongoing process, agile management allows for sporadic modifications.
- Waterfall does not enable adjustments during the project process, and if a mistake is made, the project must be restarted from the beginning.

Review Questions

1. *What do you mean by traditional project ?*
2. *What is the difference between agile and traditional project ?*
3. *What is the difference between agile and waterfall project management ?*

5.5 Three Stages of Agile Project

Three stages of agile project

1. Survival : Survival mode is the first step toward becoming an agile team. Regardless of whether they are agile or not, all teams begin here. They're attempting to get projects up and running, as well as solve bugs and give a solution. There isn't much time for innovation or proactively when we are solely focused on 'surviving,' getting things done, and following new processes.

What's the best way to get to the next agile stage ?

- During stand-ups and planning sessions, observe our team as a whole and each individual to see where improvements may be made.
- What types of people make up our team?

- What are the barriers they're up against?
- Are their roadblocks a result of their interpersonal skills or their technical abilities?
- Do our employees exemplify our company's values? If not, what are the ones that are missing?
- Are they on track to accomplish their short-term objectives? Is there a pattern to their failures if not?

Our staff will learn via experience, but this process can be accelerated with adequate planning and organisation.

- Keep our team's pipeline organized so they can concentrate on what matters.
- Evaluate future jobs and determine the resources needed by choosing people who will work well together on that assignment.
- Allow our team members to see what they're working on now and in the future. This aids our team's psychological as well as practical preparation.
- To avoid over scheduling our team, try to schedule all project resources three months ahead of time.
- Ascertain that our team is familiar with our client's long-term business objectives and values.
- Remove disruptions from our team's work (such as asking for the whereabouts of login information) and multitasking.
- Make sure that everyone on our team contributes to weekly status reports. These provide a picture of how our team is progressing on their projects at any one time, and will include information such as what was accomplished and next actions, general concerns and positive outcomes, hours worked, leave schedules, and sprint burndown charts. These aid in identifying and improving problematic areas in our project, as well as identifying team members' strengths and weaknesses.

2. Learning : Teams that are in the learning stage are one step ahead of those who are in survival mode. Their teething issues are no longer an issue, and they now have more time to learn and enhance their job, processes, and skill sets. Team leaders and project managers may now devote more effort to implementing these changes in their organisations.

How to advance to the next agile level

Stakeholders must be informed about why project delivery may take longer (due to time spent learning), so that our team's performance isn't measured by the same standards as previously.

Our team will learn how to work together throughout this stage. It's critical that they have enough time to get to know each other's strengths and limitations.

We should be able to get a good combination of personalities to establish a high-performance team by using DISC profile techniques (dominant, influencers, steady, compliant).

It is not necessary to spend a lot of money to train our employees. Pairing juniors with senior team members is a terrific approach for our team to gain experience while staying productive. Some team members may benefit from external training in the form of seminars and workshops.

Team's up skilling

More than just up skilling our employees is part of the learning stage. To get to self-sufficiency, we need to create motivation for the team to upskill by identifying their professional goals and a path to achieving them.

Improve our team's abilities :

- They're honing their technical abilities.
- They're working on improving their communication with clients and co-workers.
- To promote clear communication, they should improve their attitude and language. A simple shift from "I might be able to finish this by Friday" to "I will deliver this by Friday at 2 pm" can make a significant difference.

Motivate people to learn new skills :

- Discuss their career goals and how they might improve their skills to reach them.
- SMART goals, one-on-ones, and surveys can all be used to see if our team is on track to meet their personal and professional objectives.

3. Self-sufficient agile team : Any agile team's last step and ultimate goal is to be self-organizing and self-sufficient, allowing for quick and flexible response to change. Processes are fully defined and followed at this point. A truly agile team's day-to-day activities include adaptive planning, evolutionary development, early delivery, and continuous improvement. Rather than having a direct involvement in the day-to-day

management of projects, team leaders can take a step back and monitor the team and identify areas for development.

It takes time to develop into a self-sufficient agile team. Experience is what makes a teamwork agile. Our team members must have prior team experience, understand how to communicate and engage with one another, and be aware of each other's strengths and flaws. This allows them to plan ahead of time and organise fast and efficiently. Self-sufficient teams may readily adjust their approach and are willing to do so if it improves their processes and produces better results.

Retrospective sessions will be held by agile teams to examine what they've learned, what went well, and what didn't. These discussions discuss project outcomes and lessons learned, as well as how they may improve and attempt again. This is essentially a form of trial and error, with the goal of improving with each project or sprint.

In this stage, Team Leaders and Project Managers will have the least day-to-day involvement because they will be providing crucial direction and higher-level decisions rather than dealing with day-to-day processes and firefighting.

Overall, a highly agile team will be able to deliver projects more quickly and with fewer faults than a team that has gone through the previous two stages. Their proactive nature, as well as their ability to learn and develop, allows them to make a significant and valued addition to our company.

Review Question

1. *What are the different stages of Agile? Explain each one in brief.*

5.6 Estimation

The deconstruction of work into epics and user stories, which are then added to the backlog for development, is central to Agile. Each user narrative is divided into use cases, which are then calculated using story points.

Understanding how much work each story point will take a developer is an art form in Agile estimating, which team leads and managers polish over time. If stakeholders don't understand that each iteration rapidly raises the accuracy of estimating on a project, this apparent fluctuation might cause concern early in the development process.

Traditional and Agile Estimates given in the Table 5.6.1.

Approach	Advantages	Disadvantages
Traditional	A good estimate can be obtained by performing well regarded significant work ahead of time.	Often ineffective and projects are already over budget and behind schedule.
Agile	Stakeholder are in charge.	Senior management does not yet accept it.
Combination	<ul style="list-style-type: none"> • A realistic estimate. • Stakeholders are in charge. 	It's possible that the initial budget and schedule aren't detailed enough.

Table. 5.6.1 : Traditional and Agile Estimates

Review Questions

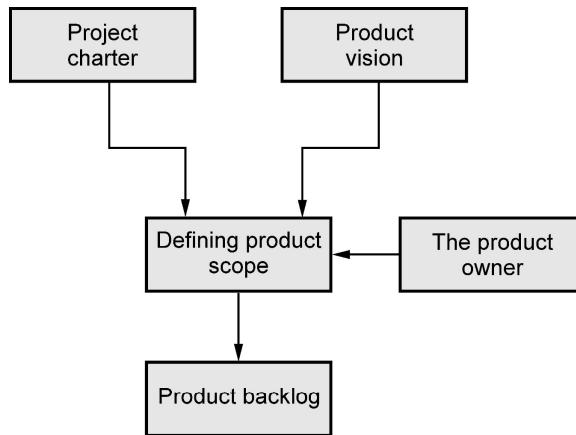
1. Explain the importance of estimation in agile project management.
2. Differentiate between traditional and agile estimates.

5.7 Scope Management

Agile scope management differs from traditional waterfall scope management in that Agile manages scope flexibly while waterfall manages it rigidly. Because the business environment and client requirements regularly change in the global world, it is difficult to fix all scope from the outset, which is why Agile keeps scope flexible. Agile is also built to adapt flexibly to changing business requirements through time-bound iterations (one to four weeks in length) and frequent reviews (Sprint Review and Daily Scrum).

- In an Agile project, the scope must be controlled flexibly. Time and resources are essentially fixed. When making changes to the project, keep in mind that scope is the first item to consider.
- The scope of work is a live document that should be adaptable to the changing business environment.
- Because time is always a constraint in business, Agile thinks in terms of "what we can do in the restricted time."

The product scope is defined in an Agile project by the product backlog shown in Fig. 5.7.1, which is an ordered list of everything that needs to be implemented in the product. The Product Backlog is the central artefact that evolves as the business environment and product needs change, and which all project participants may see in order to maintain project transparency.

**Fig. 5.7.1 : Product backlog****Input :**

- The Project Charter is a formal document that contains detailed information on the project.
- Product Vision : A product's vision describes the product's purpose and accomplishments. Typically included in the project charter.

Output :

Items in the Product Backlog explain all of the product's features, functions, and services.

Defining the scope of the product :

- Themes, Epics, and User Stories are all examples of Agile Product Backlog Items.
- WBS : WBS is used to establish the product scope in a waterfall project. It is considered to be the Agile Product Backlog's equivalent of the Product Backlog.

One of the roles clearly defined in Agile is Product Owner, who is responsible for setting the scope and Product Backlog as well as optimizing the product's value. Who is similar to a captain on a trip who determines the project's destination and purpose. Despite the fact that all project members should contribute to defining the scope, the Product Owner is ultimately responsible for the outcome.

The project scope is a broader term that includes product scope and specifies all actions performed by the project team, as well as what they do not do. Despite the fact that the goal of the software project is to create a software product, the project team is occasionally involved in other activities such as customer support or sales. Some

organizations even outsource one of their development processes, such as testing, to a third party. Input and output of defining the scope of the project is shown in the Fig. 5.7.2.

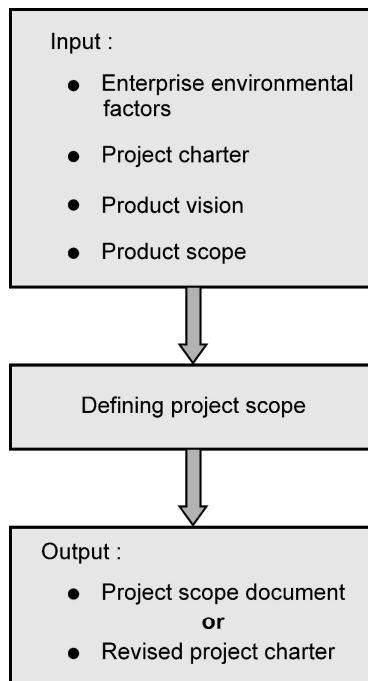


Fig. 5.7.2 : Project scope

Defining the scope of the project

As projects are subject to a corporate and business context, the approaches and techniques for establishing project scope differ. Because product scope is such an important part of the project scope, the majority of the project scope will arise once the product scope is defined.

- To collect all essential information, brainstorm with stakeholders and project members.
- Consider activities other than software development that are required, such as customer service, sales, and so on.

In terms of the relationship between the project scope and the Product Owner, the Product Owner is also responsible for the project scope's output.

Traditional and Agile scope management is given in the Table 5.7.1

Traditional	Agile
Scope definition	Backlog and planning meeting
Create WBS	Release and iteration plans WBS
Scope verification	Feature acceptance
Scope change control	Constant feedback and the ranked backlog

Table. 5.7.1 : Scope management of traditional and agile project**Review Questions**

1. *List the factors to be considered for scope management.*
2. *Differentiate between traditional and agile scope management.*

5.8 Roles and Responsibilities**Procedure and safeguard:**

1. Organize meetings.
2. Remove stumbling barriers
3. Keep the team focused and free of distractions.
4. Assist with communication
5. Serve as the team's memory :
 - Remind everyone of the big picture.
 - Remind the team of the process's purpose.
 - Remind the team of the decisions they made.
6. Be the truth's voice :
 - If what they're doing doesn't seem to make sense, ask the team to explain it to us.
 - Keep an eye on our velocity estimates.
 - Bring up the possibility of unfinished features with them.
 - Keep track of our metrics.

Communication :

1. Resolving team conflicts
2. Ascend the escalation ladder from the bottom.

3. Negotiate with people that aren't on our team.
4. Provide highly visible information radiations as well as a formal progress report.
5. External dependencies to be managed.
6. Coordinate releases with others

Establishes a community :

1. Create a secure atmosphere that enables experimentation and collaborative decision-making.
2. Maintain a work climate that encourages high output.
3. Function as a connector, advocate, and ambassador
4. Participate in the management of the organization.
5. Share our knowledge with others.

We do not

1. The product owner is in charge of the product backlog.
2. The delivery team is in charge of the estimates.
3. Make delivery decisions: we enable this activity for the team and then make judgments on project administration, as well as strategic and organizational issues.
4. Customers or product owners make product decisions.
5. If we need all the answers, consult the team.

Agile team roles

Depending on the Agile methodology, particular team roles may be required to conform to the framework, or no roles may be required at all. Though not every Agile implementation would necessitate all of these roles, here are a few that we might encounter:

Scrum master : The Scrum Master keeps each sprint on track and assists in the removal or resolution of any issues or challenges that may arise. They are the team's spokesman.

Product owner : The owner of the product. The product owner's job is to create each sprint's goals, manage and prioritise the team backlog, and act as the customer's or internal stakeholder's voice.

Team members : Members of the team. This team's members are the ones who carry out the job in each sprint. These teams, which often consist of three to seven people,

might be made up of people with diverse skills and talents, or they can be made up of people who have the same job functions.

Stakeholders : is purely an informational job. Stakeholders should be kept informed about the product and sprint goals, given the opportunity to evaluate and approve work throughout the sprint, and given the opportunity to provide feedback during the sprint retrospective.

While each Agile approach has its own set of team members and roles, there are a few universal role features that should be included in most Agile team structures :

1. **T-shaped** : A valuable Agile team member has a broad understanding of their subject, as well as in-depth knowledge, experience, and ability in one (or more) specific areas.
2. **Cross-functional** : Agile team members with talents outside of their usual areas are called cross-functional. They may have a rudimentary understanding of graphic design principles and data analysis, as well as HTML/CSS.
3. **Adaptable** : If they have a wide range of abilities, they know how to put them to good use. Their output is consistent regardless of the environment.
4. **Curious** : Asking the correct questions and challenging the status quo when it's appropriate are all part of optimizing and being more efficient.
5. **Entrepreneurial** : A member of an Agile team is one who does not wait to be told what to do. Wherever they sense a need, they're ready to step in and design campaigns.
6. **Team-oriented** : Team members put the team's success ahead of their own personal glory. They consider it a triumph if everyone delivers on time and works effectively together.
7. **Committed to excellence** : One of the main advantages of Agile projects is the ability to deliver high-quality work more quickly. Team members that are dedicated to greatness do not accept second best. They aren't perfectionists, but they are committed to providing their finest work at all times.

Review Questions

1. Briefly explain agile team roles.
2. What are the responsibilities of agile project ?

5.9 Scheduling and Tracking**Scheduling in agile projects**

1. Just detailed plans are produced for jobs that are about to start.
2. Staff schedules their tasks with only oversight.
3. Staff chooses their tasks rather than being assigned assignments.
4. Make brief iterations a priority.
5. Create a timetable that prioritizes requirements.
6. Organize tasks involving outside groups.
7. It incorporates education.
8. Take into account the environment

How to schedule a project using Agile methods

Kanban and Scrum are two frameworks or methodologies that aid in the implementation of Agile principles by teams. Despite the fact that they are two separate techniques, they have certain similarities. They usually work with three types of tasks: those that need to be completed, those that are in process, and those that have already been completed. This is where Agile project management software can really help with project planning. When designing a project timeline, a project manager can follow these broad guidelines :

- Break the project down into manageable tasks and set sprint lengths: An Agile project begins with a list of features to implement and multiple iterations to do so. These tasks should be identified by the project management, prioritised with the support of their team, and entered into the schedule. Each feature will be assigned a timeframe that will correspond to each iteration. Each feature will be assigned a timeframe that will correspond to each iteration. A status will be required for each feature and sprint, such as not started, in progress, or completed.
- Include the tasks that must be accomplished as part of the sprint: Agile management software can assist project managers and their teams in viewing the tasks that must be completed and marking them as "done" when they are complete.

Agile management software includes tools like Jira, Trello, Monday, and Zoho Sprints, to name a few.

- Define the sprint's anticipated time for each issue :

The project team, which should include some of the project's numerous stakeholders, reviews each part or iteration. The following stages are determined by the insights gathered from the feedback.

Monitoring

- While there are many misconceptions about Agile, tracking the progress of teams on Agile projects is a major worry for firms unfamiliar with the methodology.
- One temptation is to deal with this unpredictability by cramming conventional Waterfall-based project management cost measures into arbitrary specified milestones within an Agile plan. This can add needless reporting to the project while also obstructing significant visibility into actual progress toward success. Agile, when properly applied, allows project productivity and quality to be measured.
- Understanding the principles that govern how these are monitored can give stakeholders and managers with a high level of continuing visibility into progress and early detection of possible issues.
- Over the last few years, rapid technological innovation has enabled businesses and organizations to become more efficient than ever before. Not only may new software improve work procedures, but it can also boost team productivity. The journey to digital adoption, on the other hand, is rarely easy. As a result, many project managers employ the agile methodology to maintain their projects on schedule..
- Agile project management is an iterative planning process that divides a project into short portions called sprints. After that, each sprint is made available for testing and quality assurance. The purpose of Agile is customer happiness and a successful product, hence it relies on a continual feedback mechanism.

Review Questions

1. *How to schedule a project using agile methods ?*
2. *Write important factors to be considered while monitoring an agile project.*

5.10 Multiple Choice Questions

Q.1 Agile software development is built on a set of principles.

- | | |
|--|--|
| <input type="checkbox"/> a Linear development | <input type="checkbox"/> b Incremental development |
| <input type="checkbox"/> c Iterative development | <input type="checkbox"/> d Both b & c |

Q.2 Which of these agile words has the most accurate definition ?

- | |
|--|
| <input type="checkbox"/> a Acceptance criteria : What need to be done for a user story to be achieved. |
| <input type="checkbox"/> b Users personas : A summary of a feature from the user's perspective. |
| <input type="checkbox"/> c Use cases : A characterization of your intended end user. |
| <input type="checkbox"/> d User stories : Documentation of user paths through an app. |

Q.3 Which of the following metrics is important in agile software development ?

- | | |
|---------------------------------------|---|
| <input type="checkbox"/> a Lead time | <input type="checkbox"/> b Cycle time |
| <input type="checkbox"/> c Throughput | <input type="checkbox"/> d All of the above |

Q.4 Choose the option that best fits the agile software development manifesto.

- | | |
|---|---|
| <input type="checkbox"/> a Working software | <input type="checkbox"/> b Customer collaboration |
| <input type="checkbox"/> c Individuals and interactions | <input type="checkbox"/> d All of the mentioned |

Q.5 Which of the following methods is not agile ?

- | | |
|--------------------------------|---|
| <input type="checkbox"/> a AUP | <input type="checkbox"/> b XP |
| <input type="checkbox"/> c 4GT | <input type="checkbox"/> d All of the mentioned |

Q.6 Scrum has how many phases ?

- | | |
|------------------------------|------------------------------|
| <input type="checkbox"/> a 2 | <input type="checkbox"/> b 4 |
| <input type="checkbox"/> c 3 | <input type="checkbox"/> d 5 |

Q.7 Agile project management is an _____

- | | |
|--|---|
| <input type="checkbox"/> a iterative approach | <input type="checkbox"/> b incremental approach |
| <input type="checkbox"/> c repetitive approach | <input type="checkbox"/> d none of the above |

Q.8 Which of the following is not required for a software process to be agile ?

- | |
|--|
| <input type="checkbox"/> a Uses incremental product delivery strategy |
| <input type="checkbox"/> b Processes allows team to streamline tasks |
| <input type="checkbox"/> c Eliminate the use of project planning and testing |
| <input type="checkbox"/> d Only essential work products are produced |

Q.9 Agile software engineering is characterized by _____.

- | | |
|--|---|
| <input type="checkbox"/> a collaboration among all who serve on it | <input type="checkbox"/> b fosters communication |
| <input type="checkbox"/> c self-organizing and in control of its own destiny | <input type="checkbox"/> d all of the mentioned above |

Q.10 Agile software engineering has a track record of swiftly delivering successful systems.

- a True b False

Q.11 The agile software development method of dynamic systems development provides a framework for _____

- a uses of incremental prototyping in a controlled project environment
 b meets time constraints
 c building and maintaining systems
 d all of the mentioned above

Q.12 Which of the following agile approaches is/are the kind of agile methodology ?

- a DSDM b FDD
 c Scrum d All of the mentioned above

Q.13 When does a sprint end in Scrum ?

- a When the final testing is completed
 b When the time box expires
 c When the product owner suggests
 d When all the sprint backlog items are completed

Q.14 _____ one of the characteristics of an agile leader ?

- a Supportive b Task focused
 c Process oriented d Disinterested

Q.15 What distinguishes agile planning from traditional planning methods ?

- a Agile planning places emphasis on the plan
 b Agile planning places emphasis on planning and is iterative
 c Agile planning is done only once
 d Agile planning is non iterative

Q.16 What, according to the agile manifesto, is more valuable ?

- a Individuals and interactions over projects and tools.
 b Individuals and interactions over products and tools.
 c Individuals and interactions over processes and tools.
 d Individuals and interactions over people and technique.

Q.17 In an agile project, how should work be distributed among the team members ?

- a Tasks should be randomly allocated using planning poker
- b The biggest tasks should be done by the project leader themselves
- c The project leader should give tasks to individuals to create challenges for them
- d Team members should self-select tasks

Q.18 Who will be the most effective user proxy ?

- a Developer
- b Agile coach
- c Scrum master
- d Customers

Q.19 It is employed in the creation of complex software.

- a Agile software
- b Traditional software
- c Scrum master
- d None of the above

Q.20 _____ provides less security.

- a Agile software
- b Traditional software
- c Scrum master
- d None of the above

Q.21 Stages of agile are_____

- a Self-sufficient agile team, Survival
- b Learning, Self-sufficient agile team
- c Survival, Learning
- d Survival , Learning, Self-sufficient agile team

Q.22 _____ is a tool that allows a team to keep track of their work.

- a Jira
- b Trello
- c Kanban
- d Zoho

Q.23 Is there a distinction between iterative and incremental development ?

- a True
- b False

Q.24 When there are multiple teams working on a project, “Scrum of Scrums” is employed.

- a True
- b False

Q.25 Tracking project issues in an agile project is the primary responsibility of the _____

- a Project leader
- b Developer
- c Tester
- d Functional manager

Answer Keys for Multiple Choice Questions :

Q.1	d	Q.2	b	Q.3	d	Q.4	d
Q.5	c	Q.6	c	Q.7	a	Q.8	c
Q.9	d	Q.10	a	Q.11	d	Q.12	d
Q.13	b	Q.14	a	Q.15	b	Q.16	c
Q.17	d	Q.18	d	Q.19	a	Q.20	b
Q.21	d	Q.22	c	Q.23	a	Q.24	a
Q.25	a						



UNIT- VI

6

Staffing in Software Projects

Syllabus

Managing People, Organizational behaviour, Best methods of Staff Selection, Motivation, The Oldham, Hackman job characteristic Model, Stress, Health and Safety, Ethical and Professional concerns, Working in Teams, Decision Making, Organizational structures, Dispersed and Virtual Teams, Communications Genres, Communication Plans.

Contents

- 6.1 *Introduction*
- 6.2 *Managing People*
- 6.3 *Organizational Behaviour*
- 6.4 *Best Methods of Staff Selection*
- 6.5 *Motivation*
- 6.6 *Oldham, Hackman Job Characteristic Model*
- 6.7 *Stress, Health and Safety, Ethical and Professional Concerns*
- 6.8 *Working in Teams*
- 6.9 *Decision Making*
- 6.10 *Organization and Team Structures*
- 6.11 *Dispersed and Virtual Teams*
- 6.12 *Communication Genres*
- 6.13 *Communication Plan*
- 6.14 *Multiple Choice Questions*

6.1 Introduction

Over the course of a project's life cycle, project managers will be required to encourage the project team in times of temporary setbacks, assist in the resolution of stakeholder issues, and address team retention, labour relations, and performance reviews. Team communication management is the process of developing, collecting, disseminating, storing, and disposing of information in a timely and suitable manner.

There are three main concerns in organizational behaviour; staff selection, staff development, and staff motivation. The project manager may promote effective teamwork and decision-making while also providing meaningful leadership where it's needed.

6.2 Managing People

- Project managers are required to be strong leaders, communicators, negotiators, problem solvers, and capable of persuading stakeholders to engage in behaviours and activities that will contribute to the project's overall success.
- Project human resource management, thus comprises a set of processes required to make effective use of all stakeholders such as sponsors, customers, project team members, and subcontractors.
- The following are some of the most significant things that a project manager must consider when managing a team :
 - i) Techniques that are appropriate for personal and organizational connections are selected.
 - ii) Techniques that are suited for the project's current demands are chosen.
 - iii) To ensure compliance, the performing organization's administrative human resource requirements must be known. The project manager makes sure that everyone in the team is aware of what is going on.
 - iv) Efforts made to encourage members of the project team to act in a professional and ethical manners.

- Stepwise framework overview of managing people and organizing teams

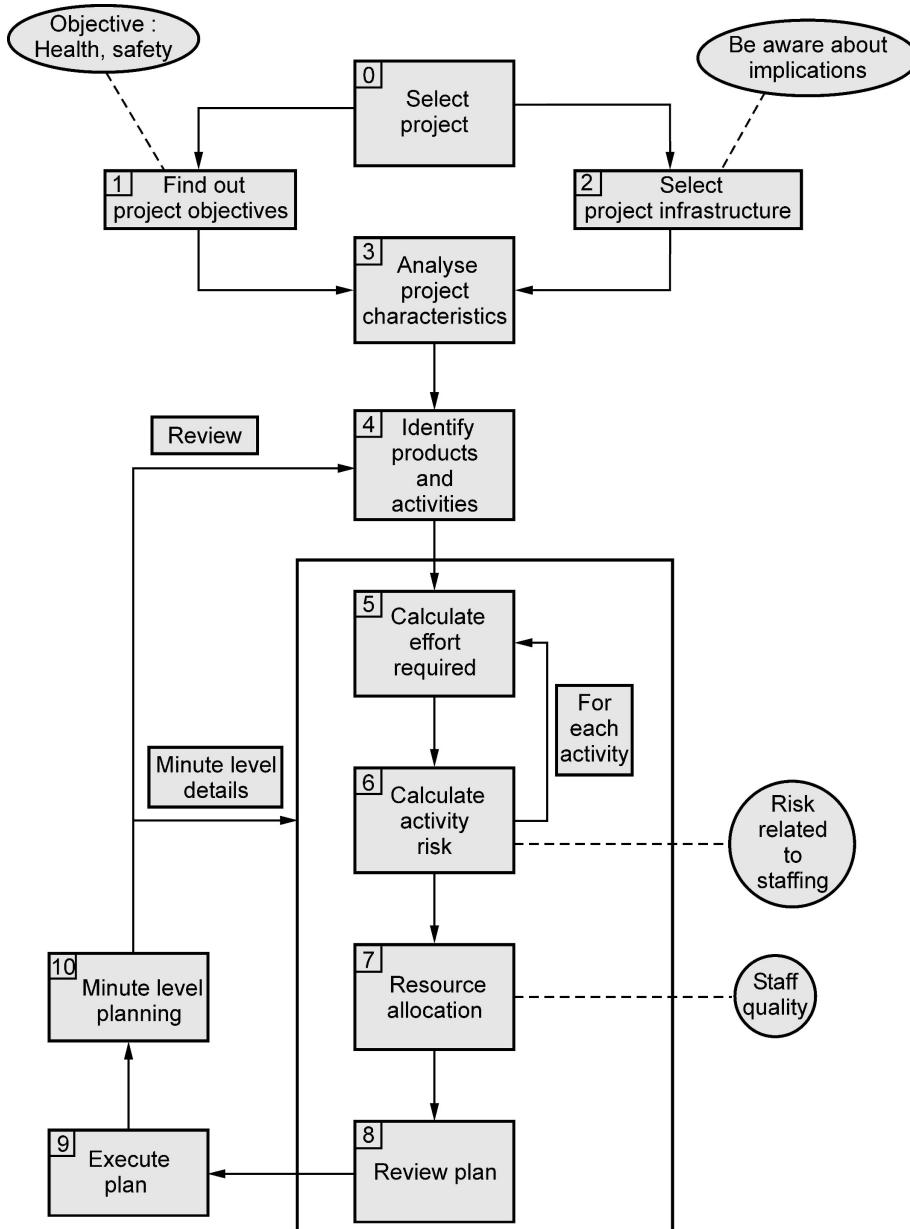


Fig. 6.2.1 Stepwise overview

- In stepwise framework allocation all stakeholders have agreed on the objectives and are committed to achieving them. While doing this project manager must consider some objective related to safety and health. Activities are selected in such manner which will lead to staff motivation. Staff risk is need to be considered while

identifying activity related risk. Staff selection related to must be considered while acquiring resources for project. Based upon all above people management fact project success is depends.

Review Question

1. *What are the roles of manager ?*

6.3 Organizational Behaviour

• Understanding Behaviour

People management is a key part of project management. There are two approaches,

- Positive approach
- Interpretivist approach

• Positive approach

- Based on the system's development
- "If A is the situation, then B is likely to occur," according to organisational behaviour theories.
- It has a tendency to be objective and empirical in nature.
- Looks for reasons for behaviour.
- Conduct research that can be used to a bigger group of people.

• Interpretivist approach

- Smaller samples were used.
- More qualitative.
- Each eating circumstance should be treated as distinct and unpredictable.
- Look for trends that appear in a variety of settings when it comes to consumption.
- Both perspectives (positivist and interpretivist) are acceptable and valuable when it comes to managing employees in the software industry.
- Organizational Behavior (OB) is described as the study, prediction, and control of human behaviour within an organisation, whether it occurs individually or in groups.
- The two views of how organisational behaviour might be viewed from the perspective of an organisation are internal and external perspectives.

- **Importance of OB**

- It is critical to understand other people's behaviours and to help them understand our own when working in a company. We must adapt to our surroundings and comprehend our objectives in order to maintain a good working atmosphere. If we grasp the necessity of OB, we can accomplish this with ease.
- The following aspects highlight the significance of OB.
 - It clarifies the interpersonal ties that employees have with one another, as well as with their superiors and subordinates.
 - Individual behaviour can be predicted and explained.
 - It maintains an enterprise's friendly relationship by maintaining effective communication.
 - It helps with marketing.
 - It aids managers in motivating their employees.
 - Any organisational transition can be made less difficult.
 - It aids in the prediction of human behaviour and its application to organisational objectives.
 - It contributes to the organization's efficiency.

- **Influencing elements of OB**

- OB is influenced by three primary elements. Because all three criteria are based on the working environment, they are also known as determinants of OB. The following are the four determinants :
 - People
 - Structure
 - Technology
 - Environment

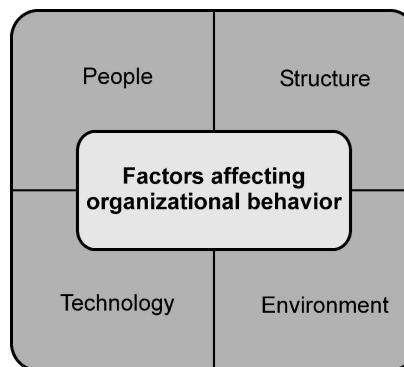


Fig. 6.3.1 Factors affecting OB

• People

- People with various traits, personalities, skills, qualities, interests, backgrounds, views, values, and intelligence make up an organisation. To maintain a healthy workplace, all employees should be treated equally and judged based on their work and other factors that affect the company.
- For example, a corporation recruits trainees from Maharashtra, Haryana, West Bengal, and other places. During and after training, however, all students are evaluated only on their success in the duties that have been allocated to them.

• Structure of the Organization

- An organization's structure is its layout design. It is the process of constructing and arranging linkages and methods in order to achieve the organisational purpose.
- The relationship between a boss and his or her employees and co-workers is defined by organisational structure.

• Technology

- Technology can be described as the application of scientific knowledge to real-world problems. It also gives the resources that people require in order to improve their work and task performance.
- Individual and organisational success is determined, for example, by the introduction of SAP, big data, and other tools to the market.

• Environment

- Every business operates in a specific internal and external environment. The internal environment of a company can be defined as the conditions, factors, and aspects that influence the company's actions, decisions, and, most importantly, employee behaviour. The external environment, on the other hand, can be defined as external elements that have an impact on a company's ability to operate.
- Employee morale, culture changes, and financial changes or challenges are examples of the internal environment, while political considerations, economic changes, and the company itself are examples of the external environment.

• Nature of People

- People's nature, in simple terms, is the underlying attributes of a person, or the character that personifies an individual. These qualities might be similar or

different. Some key elements affecting the nature of individuals have been identified at the organisational level. They are -

- i. **Individual difference** - is the managerial approach to each employee as an individual, i.e. a one-on-one approach, as opposed to the statistics method, i.e. avoiding single rules. For instance, a manager should not be biased toward any one employee, but rather should treat all employees equally and avoid judging them on anything other than their performance.
 - ii. **Perception** - is the ability to observe, listen, and draw conclusions about something. It entails trusting our senses. In a nutshell, perception is how we perceive things and form our opinions. For example, Anay believes that late night parties degrade youth, whilst Radha believes that late night parties are a great opportunity to meet new people. We can observe that Anay and Radha have opposing viewpoints on the same issue.
 - iii. We must engage a whole person since, as we all know, a person's skill or brain cannot be hired. Background and knowledge contribute to skill. Our personal lives cannot be completely separated from our professional lives, just as emotional states cannot be separated from physical states. As a result, people's function is the whole functioning of a human being, rather than a specific attribute of human beings.
 - **Positive motives** - To encourage others to change their behaviour or to say that they complete a task by offering promotions or any other profit. Example - "If you're done, you're going to gain it."
 - **Negative motivation** - It can have serious implications to force or warn others to change their behaviour otherwise. Example - "You will be deprived of the office if you don't complete this."
- **Persons value** - Employees want their abilities to be respected and appreciated, as well as opportunities to further their careers.

• **Organizational nature**

- The motive of the company is the nature of the organisation. It's the global market opportunities it gives. It also establishes the benchmark for employees; in other words, it establishes the company's character by acting as a mirror image. With its social system, common interests, and work ethics, we can understand the nature of each company.
- Let's take a short look at each of these elements.

- Every corporation interacts with other firms, clients, or just the outside world, as well as all of its personnel - each with their own social duties and position. Their actions are mostly affected by both collective and individual motivations. There are two sorts of social systems :
 - i. **Formal social systems** : are developed by people who work together in a corporation or who belong to the same club. A success celebration after receiving a project is one example.
 - ii. **Informal social systems** : People freely mingling with others, enjoying, partying, or lounging in an informal setting. Consider a birthday celebration.
- **Mutual interest** : All organisations need people and organisations to live and flourish. It is essentially a mutual agreement that helps to both achieve their respective objectives between the organisation and their employees. Example – In return the bank gives us credit, interest and so on, we deposit our money in a bank.
- **Ethics** : The moral foundations of a person, group and organisation. Ethical treatment is necessary and moral standards must be established in order to attract and maintain valuable employees. Actually, firms now develop ethical education code for remarkable ethical conduct.

• **Organizational Theories**

- Even though people's needs and values differ from one another, group effort makes it easier for them to achieve organisational goals effectively. Human relations can be defined as the process of motivating people in organisations to work together as a team. Although human relationships have existed for a long time, the study of human relations has only recently emerged.
- Organizational theories explain how different organisational arrangements affect the behaviour of groups and individuals. Those were derived from organisational structures and procedures that emerged in England and Europe during the industrial revolution. Organizational theories provide insight into how people work and how organisations operate.
- These theories are used by project managers to identify the strengths and weaknesses of their teams, as well as to reduce project time and costs.

• **McGregor's Theory of X and Y**

- According to this theory, there are two types of employees. Theory X employees are to be watched, cannot be trusted, and must be micromanaged because they avoid work, do not take responsibility, and generally dislike work. Theory Y employees

are motivated, take on responsibilities, enjoy their jobs, are given challenging assignments, and are encouraged to work independently.

Theory X	Theory Y
• Work avoiding	• Work is natural
• Need to control	• Capable of self-direction
• Avoid responsibility	• Take responsibility
• Worker seek security	• Can make good decisions

• Z Theory

- Workers must be included in the decision-making process, according to the Z hypothesis, because this will make them more responsible and accountable for their choices.

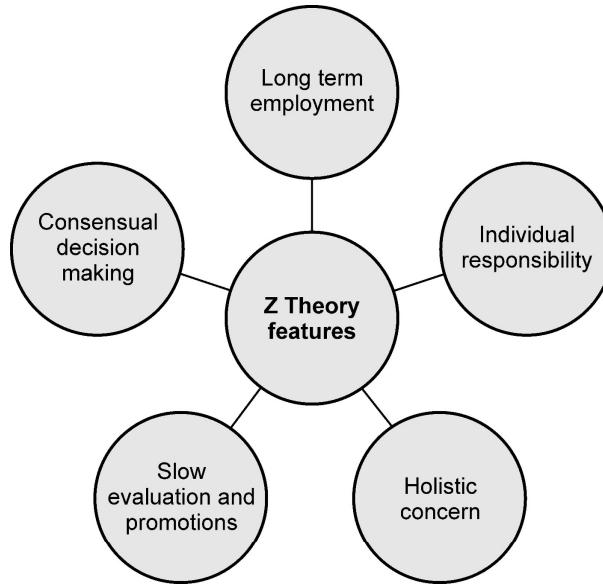


Fig. 6.3.2 Z theory features

• Maslow's Hierarchy of Needs

- There is a hierarchy of human needs, according to this well-known organisational idea. Only after their lower-level requirements have been met can people look for higher-level needs. The following is a list of these demands, in order of importance :
 - Needs for self-actualization - seeking knowledge and maximising potential.

- Respect for others, self-respect, freedom, and acknowledgment are all requirements for self-esteem.
- Social requirements - community and social phobias.
- Needs for safety - job security and financial stability.
- Physiological requirements - basic requirements such as water, shelter, and food.

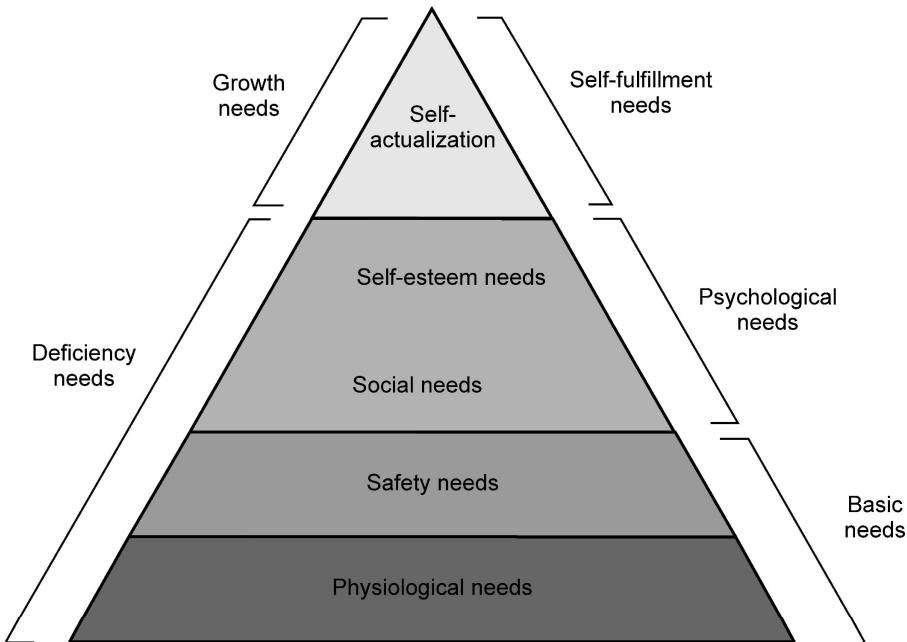


Fig. 6.3.3 Maslow's hierarchy of needs

Review Questions

1. Explain influencing elements of organizational behaviour.
2. Explain theory of X and Y.
3. Explain Z theory.
4. Explain different organizational theories.
5. Explain Maslow's hierarchy of needs.

6.4 Best Methods of Staff Selection

- **Selecting Right Person for Job**
- Programming productivity is affected by factors such as the use of software tools and approaches.
- In addition, experience also has a significant influence on programme productivity from the point of view of human resources.

- Individuals who are able to converse effectively with one another may be more suitable.
- Project resource management requires a staffing management plan and a resource management plan. Every project will necessitate resources in order to carry out project tasks. There will be a requirement for both human and physical resources. Each activity's resource requirements will be estimated. The resources will be acquired in accordance with the project's schedule.
- A staffing management strategy will include a plan for dealing with all areas of manpower :
 - Human resource identification
 - How will human resources be obtained?
 - Criteria to be applied in the selection of human resources
 - Where will the human resources be obtained?
 - How can I get resources from within the company?
 - How to get resources from outside sources
 - When will the resources be acquired? (based on the project schedule).
 - Human resource guidelines for safety and security
 - Identification of team training needs and a strategy for meeting those needs
 - Plan for the team's rewards and recognition
 - How can you develop a team and improve its performance?
 - How do you keep track of each team member's performance?

• General approach for recruitment policy

- Create a job description : The job description should accurately reflect the duties and responsibilities of the position. Job title, job purpose, job duties and responsibilities, needed qualifications, desirable qualifications, and working circumstances are all included in a job description.
- Create job holder profile.
- Receive applications
- Review CVs
- Conduct interviews (e.g., aptitude tests, personality tests, and a review of examples of past work)
- Perform other procedures (e.g. medical examination)

• Instructions in best methods

- For an existing project, a special effort must be taken to recruit a new member.
- When new team members are hired, the Team Leader (TL) will need to carefully prepare their entrance into the team.
- The TL should be aware of the importance of assessing the training needs of their team members on a regular basis.
- Some external training may be provided to the new hire, such as through commercial training providers.
- Internal training : Internal training given by their co-workers in the company.

Review Question

1. *State and explain the basic steps involved in a typical selection procedure.*

6.5 Motivation

- It is critical to motivate people to work. Motivation is a state of mind characterised by vigour and zeal that propels a person to operate in a specific manner in order to attain desired outcomes. Motivation is a force that drives a person to work with a high level of dedication and focus, even when the odds are stacked against him. Motivation results in a specific type of human behaviour.
- The following are the various models for motivating employees in an organisation.

• Maslow's hierarchy of needs

- Our physiological needs, such as air, food, and water, are the first important motivating needs, according to Maslow. After our physiological demands have been met, we become anxious about our own physical safety and security, as well as the security of our jobs. The second need to satisfy is social: our want to form bonds with other people. The need for love, friendship, and family is widely regarded as a basic human drive. Our need for esteem - the need to be respected by one's peers, to feel important, and to be appreciated - becomes more crucial after we have a sense of belonging. The urge for self-actualization is at the top of the hierarchy.
- There is a hierarchy of human needs, according to this well-known organisational idea. Only after their lower-level requirements have been met can people look for higher-level needs. The following is a list of these demands, in order of importance :
 - Needs for self-actualization - seeking knowledge and maximising potential.

- Respect for others, self-respect, freedom, and acknowledgment are all requirements for self-esteem.
- Social requirements - community and social phobias.
- Needs for safety - job security and financial stability.
- Physiological requirements - basic requirements such as water, shelter, and food.

• **Hertzberg's two factor theory**

- Hertzberg divided the requirements into two groups : hygienic elements and motivating factors.
- To ensure that an employee is not unsatisfied, hygiene criteria are required. Employee happiness and motivation for improved performance are both dependent on motivator factors. The presence of hygiene factor does not ensure motivation, and motivation factors do not work in the absence of hygiene aspects.

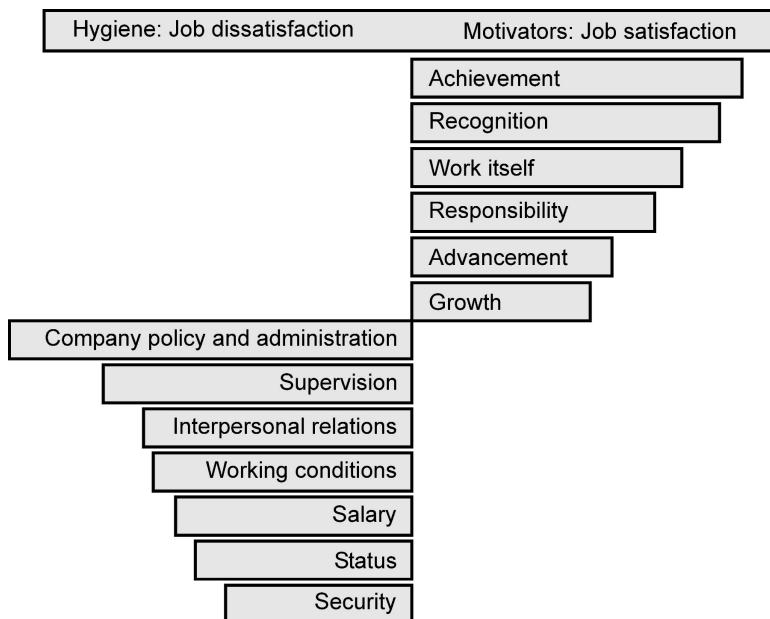


Fig. 6.5.1 Hertzberg's two factor theory

• **Vroom's theory of expectancy**

- Individuals will be highly productive and driven, according to Victor Vroom, if two criteria are met :
 - 1) People believe their efforts will likely result in successful results, and
 - 2) those people believe they will be rewarded for their achievement.

- People will be more driven to put up a high degree of effort if they believe there are links between their efforts and their performance.

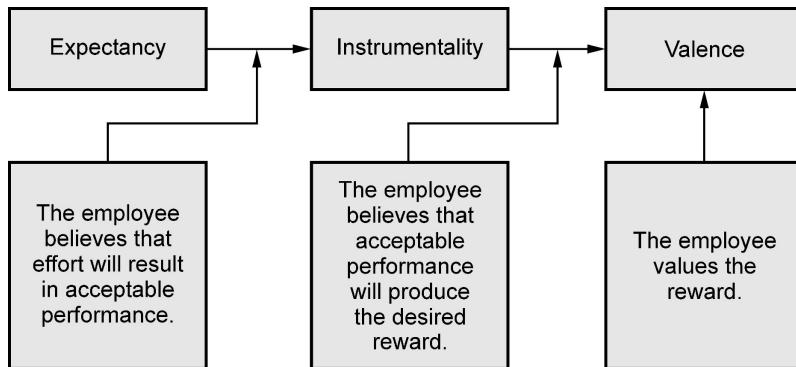


Fig. 6.5.2 Vroom's theory of expectancy

Review Questions

1. List out the basic needs in a hierarchy.
2. Explain different motivational theories.

6.6 Oldham, Hackman Job Characteristic Model

- Hackman and Oldham's work characteristics model is founded on the premise that the task itself is crucial to employee motivation. A boring and monotonous job, on the other hand, stifles motivation to perform effectively, but a tough job boosts motivation. Adding variety, autonomy, and decision authority to a work are three methods to make it more challenging. The two methods of a job enrichment are job rotation and job enrichment.
- It asserts that there are five core job characteristics (skill variety, task identity, task significance, autonomy, and feedback) that influence three critical psychological states (experienced meaningfulness, experienced responsibility for outcomes, and knowledge of actual results), thereby influencing work outcomes (job satisfaction, absenteeism, work motivation, etc.).

Five core job characteristics

- **Skills variety** : Do tasks vary, and are they challenging ? Or are they monotonous and too easy ?
- **Task identity** : Do tasks have a defined beginning, middle and end ? Without this, it's hard to achieve the satisfaction of an attained goal.

- **Task significance :** Does the employee feel that their role has meaning ?
- **Task autonomy :** Can individuals have a say in how they carry out their work ?
- According to Hackman and Oldham's job characteristics theory, high motivation is associated with three psychological states while working :

1. Meaningfulness of work

- That labour has meaning for you, something to which you can relate, and does not simply occur as a series of movements to be repeated. This is central to intrinsic motivation, which holds that work is motivating in and of itself (as opposed to motivating only as a means to an end).

2. Responsibility

- Because you have sufficient flexibility of action, you have been given the potential to be a success or failure at your employment. This would involve the capacity to make adjustments and utilise what you learn on the job.

3. Knowledge of outcomes

- This is significant for a few of reasons. To begin, present the person with information on how successful their job has been, allowing them to learn from their mistakes. The second is to emotionally tie them to the recipients of their outputs, giving the work more meaning.

Techniques for boosting motivation

Managers could do the following to boost motivation :

- Set precise objectives.
- Staff must be challenged while also being able to accept the goals.
- Provide feedback on regular basis.
- Consider job redesigning if you get regular feedback on your progress.
- It is possible to change jobs to make them more engaging.
- There are two ways to improve the work design.

Job diversification : to engage in a broader range of activities

Adding value to your job : to able to make decision.

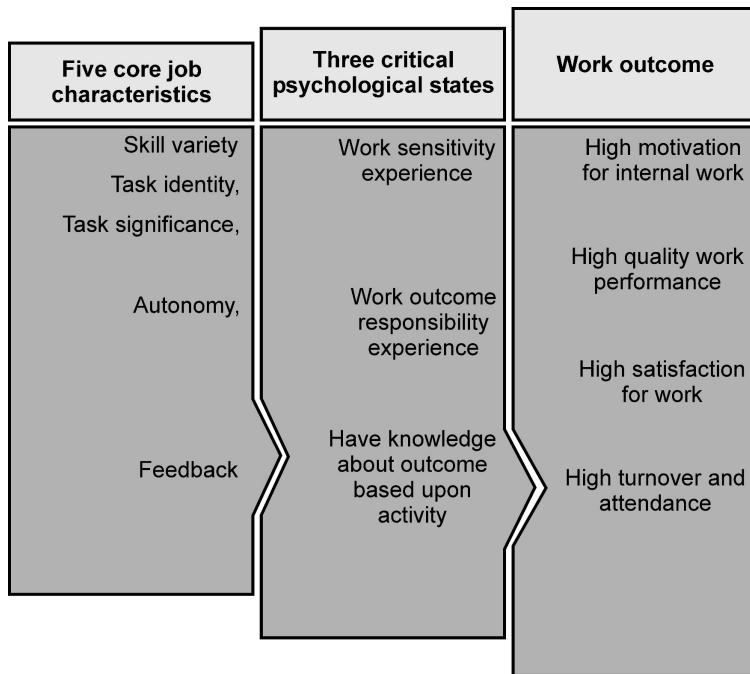


Fig. 6.6.1 The Oldham, Hackman job characteristic model

Review Question

1. Explain Oldham, Hackman job characteristic model.

6.7 Stress, Health and Safety, Ethical and Professional Concerns

• Stress

- To overcome some temporary difficulties or to deal with an emergency, extra effort is sometimes required.
- Unexpected difficulties that cause avoidable crises can be avoided with good planning and control.
- Stress can be brought on by a variety of factors.
- Uncertainty about the role
- When employees do not have a clear understanding of the goals
- Conflict between roles
- Two distinct roles are required for example parenting and doing business both are having separate demands.

• Health and Safety

- Any project's health and safety are critical, and the Project Manager is responsible for ensuring that this is addressed.
- Either a safety expert should be added to the team or guidance from a consultant should be sought. Often, industry standards will apply.
- At all levels, responsibility for safety must be clearly stated.
- The safety policy must be supported by top management.
- The duty for safety must be clearly delegated.
- Those who are entrusted with obligations must be aware of them and consent to them.
- Definitions of duties linked to safety should be included in the job description.
- The deployment of a safety officer, as well as the assistance of experts in specific technical areas must be done.
- Safety consultation required
- Budgeting for safety costs is essential.

Some ethical and professional concerns

- There is a legal obligation to act to reduce dangers to employees' health and safety.
- Even in the absence of legislation, all members of the community, regardless of their rank, share some ethical duties.
- In the event of an accident, to notify the emergency services.
- The corporation must also protect the assets of its stakeholders.
- ICT professionals have unique obligations.
- It would be immoral for an ICT professional to remain silent if their skills could prevent a colleague from doing anything detrimental.
- They should make decisions that are not just technically sound but also fair.
- The software engineer is responsible for pointing out flaws in high-level decisions.

6.8 Working in Teams

- To complete a cooperative assignment, a team is formed.
- Software development tasks necessitate considerable human brain effort since software systems are vast in nature.
- Individual developers inside teams or organisations must share this human effort.

- As a result, effectively coordinating the efforts of various developers within a team is a challenge.
- Step-wise project planning**

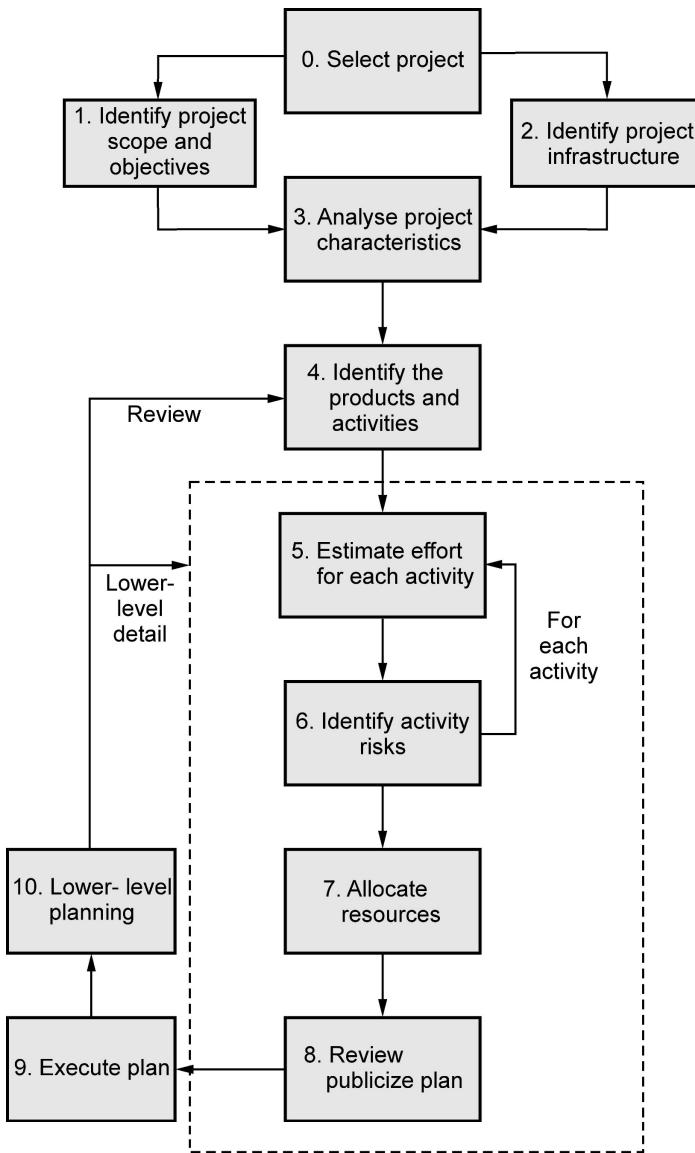


Fig. 6.8.1 Influence of step-wise project planning

- Nearly every stage of the step-wise project planning framework will be influenced by the collaborative nature of project work.

1. Define the project's scope and goals

- The project's stakeholders are identified here, and communication channels are developed.

2. Determine the project's infrastructure

- The structure of the organisation in which the project team will operate is determined.

3. Examine the qualities of the project

- Decisions regarding how the project will be carried out are made.

4. Calculate the amount of effort required for each task

- Developer productivity will be influenced by both individual and group experience.

5. Determine the dangers associated with the activity

- Staff-related risks, such as continuing availability, will be present.

6. Distribute resources**7. Revise and advertise the plan**

- A communication strategy could be devised.

The Five stages of team development

- The PMBOK - Project Management Body of Knowledge - defines five phases for team building : forming, storming, norming, performing, and adjourning.
 - **Forming** : The formation phase is where team members are introduced to one another. In the relationships between team members, this phase is characterised by politeness and formality.
 - **Storming** : The team begins to shift from "as is" to "to be." Some team members may be at odds with one another due to a power struggle or a clash of individual identities or cultures. As a result, the term "storming" was coined. During the storming phase, team members are more likely to clash. The team's leadership or management, on the other hand, makes a concerted attempt to reconcile their conflicts.
 - **Norming** : Following the storm,' the team comes to an agreement on the 'to be' method and learns to collaborate. However, if problems or concerns arise, the team may be forced to return to the storming phase. When a new team member joins, the norming and storming phases are reenacted for the entire group. It is

during this phase that unique, team-specific norms emerge and become entrenched with all members of the team.

- **Performing** : The team is stated to be ready for high performance if the main team members have settled their disputes and built strong working connections. The team rarely returns to the storming phase while in the performing phase. A team is characterised by high levels of initiative at this phase.
- **Adjourning** : The team shares its improved processes with the rest of the group. Many relationships developed within a team last long after the team has dispersed after the project is completed.

Balancing team with different types of people

- The chairperson : They don't have to be brilliant leaders, but they must be good at handling meetings, be calm, strong, and tolerant.
- The plant : someone has a knack for coming up with new ideas and potential answers to issues.
- The monitor evaluator : is skilled at assessing ideas and prospective solutions and assisting in the selection of the best option.
- The shaper : is a member of the team who helps to focus the team's attention on the most essential concerns.
- The team player who excels in fostering a positive working atmosphere.
- The resource investigator is skilled at locating resources, both physical and informational.
- The task finisher is concerned with completing the task.
- The company's employee is good team player and is willing to take on less pleasant jobs if the team's success requires it.

	Surroundings	Team Member Feelings	Team Lead Actions
Forming	Breaking the ice	Excitement	Promote optimism
	Formal introductory meeting	Anxiety	Give clear role and directions
	Routine work	Confusion	Write "Collaboration agreement"

Storming	Turbulence zone	Defensiveness	Promote respect
	Lack of progress	Anger	Stay focused on job
	Conflicts, resistance	Compotation	Encourage participation
Norming	Clam after storm	Comfort	Task are delegated
	Order and consistency	Acceptance	Stay involved
	Clarity	Trust	Reinforce the team spirit
Performing	On fire	Motivated	Look for optimization
	Decision making	Integrated	Milestone achievement appreciation
	Unity and flexibility	Appreciation	Gateway between organization
Adjourning	Toward another prospect	Satisfaction	Complete deliverables
	Ending	Uncertainty	Captures best practices
	Goodbye	Sadness	Celebrate successes

Table 6.8.1 Summary of stages of team development**Review Questions**

1. Explain all the stages of team development.
2. Explain forming and storming phases of team building.

6.9 Decision Making

- Decision making can be categories in two different types as follows :
 - i. **Structured** : Simple, everyday decisions
 - ii. **Unstructured** : More difficult, necessitating a certain amount of ingenuity
- Although all project managers must make decisions, successful decisions are usually the result of following a logical and sensible procedure. When employed correctly, the project manager increases the likelihood of making the best option possible. The following are the steps in a good decision-making process :

- **Identify the problem** - Identifying the problem is the first and most crucial phase in the decision-making process. The project manager can only begin looking for a solution after he or she has a thorough knowledge of the challenge or choice to be made. Your decisions will be inaccurate if the problem is expressed wrongly or is unclear.
- **Identify alternatives** - The project manager and team should next begin to build a list of all available options. Most of the time, there will be numerous options, and it is worthwhile to devote sufficient time to ensuring that there are a sufficient number of feasible options.
- **Evaluate the alternatives** - The analysis of the alternatives begins at this point. Techniques can be used by the project manager based upon ranking.
- **Make a choice** - After you've weighed your options, it's time to make a decision. Two or more of the high-ranked alternatives should be chosen by the project manager. All low-ranking options should be discarded. The project manager must then analyse the problem statement, compare the solutions to the alternatives, and choose the solution that has the best probability of solving the problem.
- **Implement the decision** - Before implementing the chosen solution, the project manager must revise the project plan, timeline, budget, and other resources to guarantee that the solution can be implemented. The follow-up phase is a part of the implementation phase. The follow-up confirms that the solution was implemented correctly and that the problem was solved.

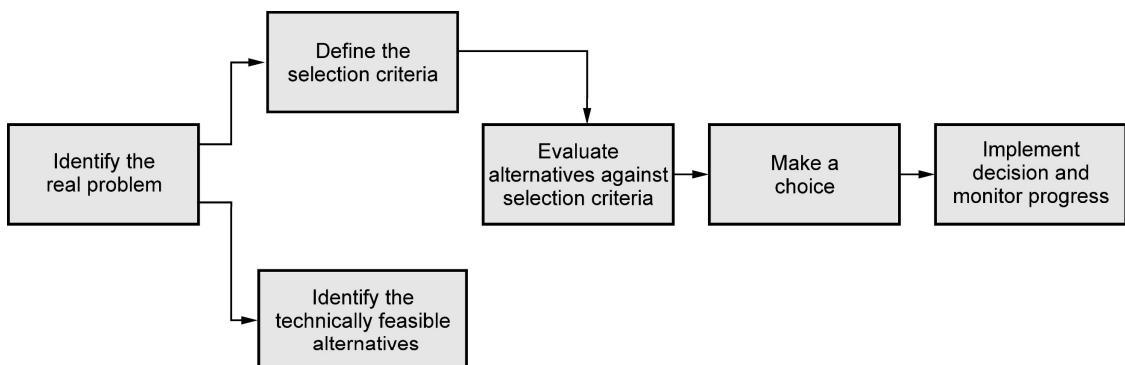


Fig. 6.9.1 Basic steps in decision making process

Group decisions

- Team decisions are more likely to be accepted than imposed decisions.

- Groups have a harder time dealing with challenges that aren't well-structured and require creative solutions.
- In this case, brainstorming approaches can be beneficial to groups.

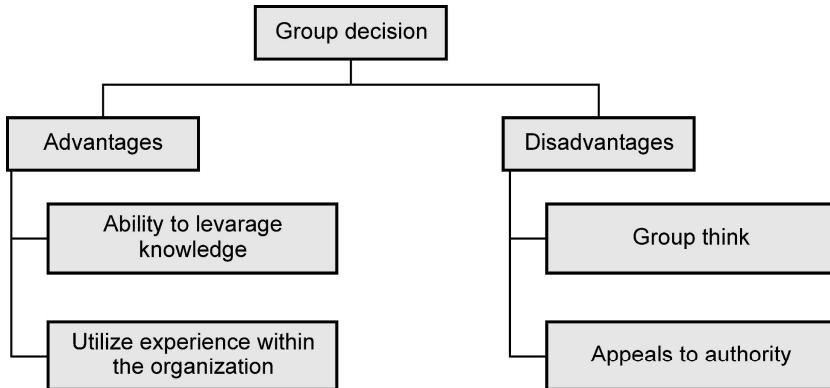


Fig. 6.9.2 Group decision

Barriers to effective group decision-making

- It takes a long time.
- It has the potential to cause internal problems in the group.
- The dominating personality might have an undue influence on decisions.
- Taking a chance people in groups are more inclined than individuals to make dangerous decisions.

Measures to mitigate the disadvantages of making decisions as a group

- Delphi strategy is to teach the members how to follow the prescribed procedures.
- A group of experts has been invited to help.
- The specialists are presented with the problem.
- The experts write down their suggestions.
- These suggestions have been compiled and duplicated.
- The responses collected are recirculated.
- The experts make comments on other people's suggestions and, if necessary, change their recommendations.

Team vigilance

- Members of the group are aware of the activities of others that contribute to the group's overall success and can develop ways to support those efforts.

- The appearance of a 'collective mind' is the result of common understanding, familiarity, and effective communication.
- Concepts for providing a favorable environment for software development.

Concepts for promoting s/w development environment

- Egoless programming
- Chief programmer teams
- Extreme programming and
- Scrum

Egoless programming

- Rather than being kept confidential, the programmes become public property, and programming becomes egoless.
- Peer code reviews are based on this concept, in which a person's programmes are reviewed by their peers.

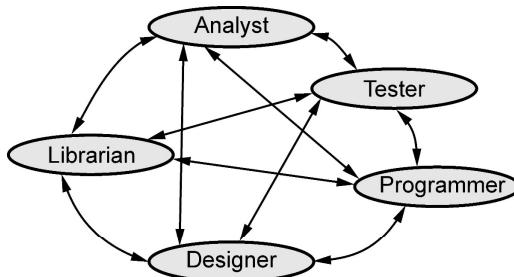
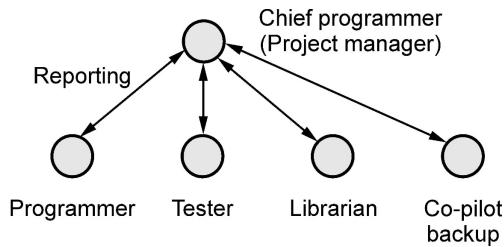


Fig. 6.9.3 Egoless programming structure and communication path

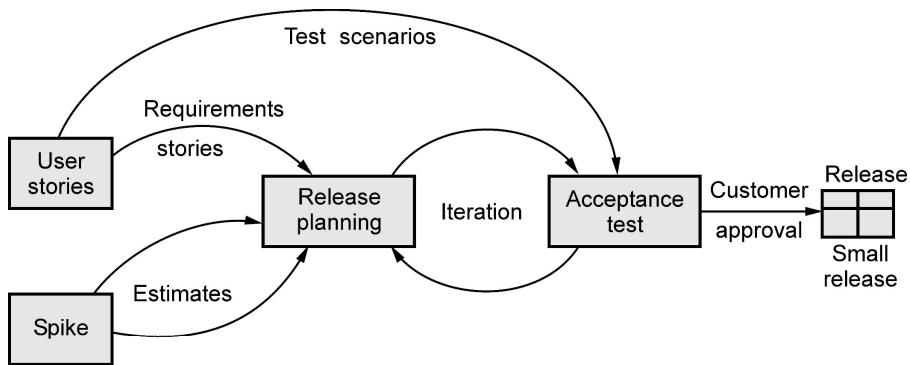
Chief programmer teams

- Due to greater communication, development slows down as the group size grows.
- As a result, a more formalized and centrally hierarchical team is required (Chief programmer team).
- The chief programmer creates the specification, designs the software, tests it, and documents it.
- Assists with co-piloting editor and chief programmer debate issues and write code.

**Fig. 6.9.4 Chief programmer team**

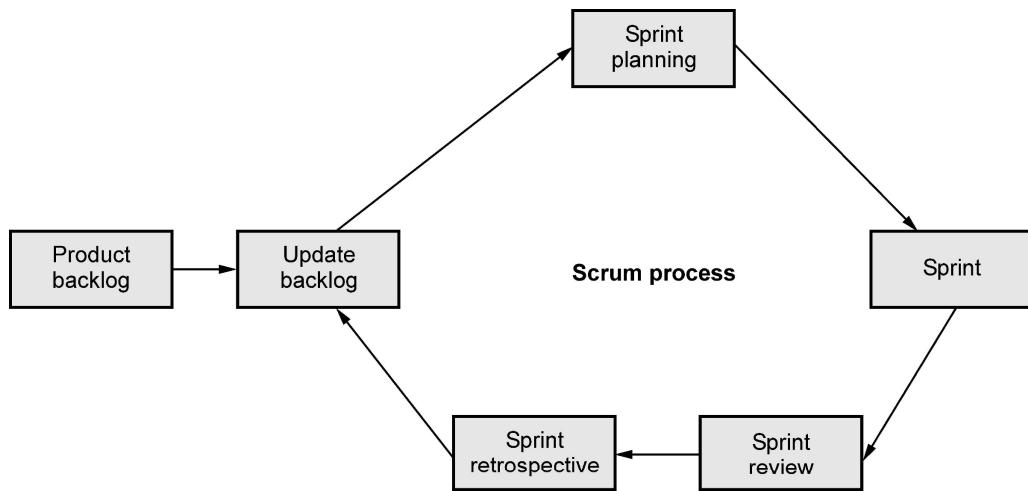
Extreme programming

- It's a new take on the connection between the chief programmer and the co-pilot.
- The majority of XP encourages the use of the 'collective mind.'
- The major software products, software code, and test data are upgraded rather than producing distinct documents.
- Improved communication and cooperation thanks to a less formal approach.
- Before the code is written, test cases and expected results are created, and they serve as a type of specification.

**Fig. 6.9.5 Extreme programming structure**

Scrum

- The Scrum method begins with a phase of system architecture and planning.
- This stage establishes the product's needed release date as well as a list of the product's desirable features.
- This phase, which is followed by a series of sprints, usually lasts one to four weeks.
- Sprints are run by teams of seven to ten developers.
- Each day, small meetings mark the progress of a sprint.

**Fig. 6.9.6 Scrum process****Review Questions**

1. Explain decision making process.
2. Explain the barriers in group decision.
3. Explain the concept egoless programming.

6.10 Organization and Team Structures

- **Departmental organization**

What is the structure of the department's teams ?

- **Structure of the group**

What is the structure of project teams ?

Departmental organization

There are three basic organisational structures for departments.

1. Functional

Developers are classified into groups based on their areas of expertise.

Because members of a functional team working on a project do not physically interact with members of other functional teams, good documentation must be maintained.

2. Project

The project's assigned team is responsible for all project activities and remains in the same group until the project is completed.

3. Matrix

A functional format extender that gives you the best of both worlds, formats for projects and functions

Depending on the project, a pool of functional specialists is assigned and has a matrix representation.

Functional vs Project structure

	Functional	Project
Ease of staffing	Provides an efficient solution to the staffing problem	Mandates the manager to accept a fixed number of developers at the start of the project
	As needed, any number of required personnel can be brought into projects, and once completed, they can be returned to the functional group.	Because these developers work for the entire project, many individuals are idle in the beginning, and the entire team is put under pressure in the later stages.
Document quality	It produces good quality document.	Quality of documents produced is poor.
Job specialization	Developer get specialized in different domains	No specialization is available.
Efficiency of job handling	It handles job efficiently.	Doesn't adequately deal with the problem.
Career orientation	Technical orientation	General form of career orientation such as business analyst

Structure of the team

- Individual project teams' reporting, responsibility, and communication structures are identified.

- Three different types of team structures
 1. Democratic
 2. Chief programmers team
 3. Mixed-team organisations'

1. Democratic

- There is no explicit team hierarchy in place.
- Discussions are used to make decisions, and any member is free to speak with any other member.
- A manager who provides administrative leadership benefits team members' morale and job satisfaction.
- Appropriate for research-based programmes
- Encourages programming that isn't egotistical.
- Has a reduced personnel turnover rate.
- Productivity is lower.

2. Chief programmers team

- A senior member is appointed as the head/chief programmer and provides technical leadership.
- The chief programmer specifies the requirements.
- Creates the high-level design.
- The remaining activities of detailed design, such as coding, testing, and documentation, are divided into several smaller tasks.
- Assigns them to the members of the team
- Verifies and combines the work of various team members.

Advantages

- For simple and small projects, a chief programmer is more efficient than a democratic team.

Disadvantages

- Gives you the power to assign work to team members and keep track of their progress.
- Team members' collective and unique thinking is hampered.
- Because there is too much duty and authority, there is a single point of failure.

3. Mixed-team organisations

- Draws on both the democratic and chief programmer team structures for inspiration.
- Suitable for big groups
- Many software development companies use it since it is really popular.
- Both hierarchical reporting and a democratic configuration are included.

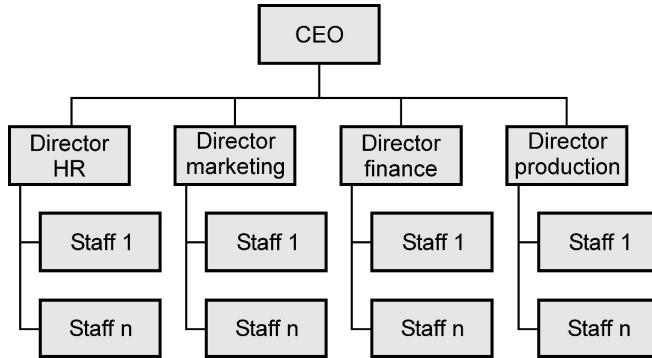


Fig. 6.10.1 Mixed team organization

Review Questions

1. Explain different types of departmental organization.
2. Explain different types of team organization.

6.11 Dispersed and Virtual Teams

A virtual team, also known as a geographically dispersed team, distributed team, or remote team, is a group of people who interact using technology like as email, instant messaging, and video or phone conferencing. Asynchronous groups or teams are also referred to as asynchronous groups or teams.

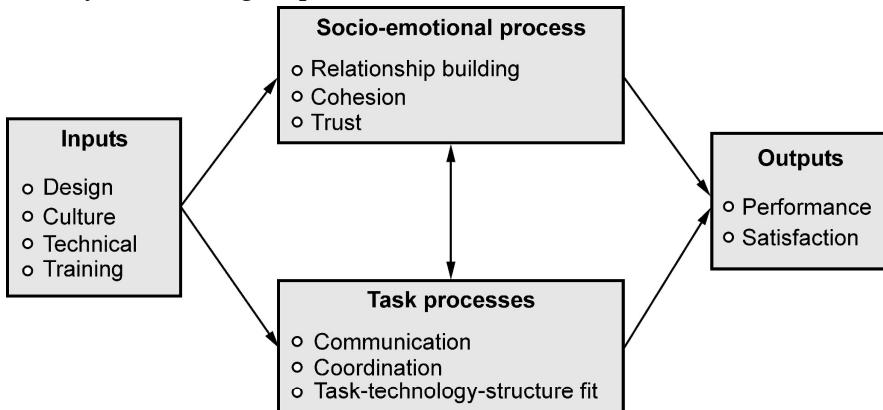


Fig. 6.11.1 Structure of virtual team

Inputs

Design : The term "design" refers to the process of putting together a virtual team. This entails determining how interactions will be structured, such as the communication technologies to be utilised, the amount of face-to-face time available, and so on. Additionally, shared knowledge databases share the same language and mental models, which serve as stand-ins for face-to-face interaction. Furthermore, design can focus shared mental models by requiring teams to define goals and tactics.

Culture : Coordination issues and barriers to efficient communication might arise as a result of cultural differences. These issues can be resolved by actively understanding and respecting cultural differences. People from different cultures viewed virtual communication environments differently, according to a multi-country study based on the GLOBE cultural model. When compared to face-to-face meetings, the cultural dimension individualism-collectivism was most strongly and very significantly related to how positively or adversely team members experienced videoconferences and telephone calls.

Technical : A team's technical expertise appears to have a favourable impact on the team's performance and satisfaction with being a part of it. At the same time, a high level of trust appears to be developing. "The association between technology and task performance is found to be more dependent on expertise with technology and group membership than the type of activity on which the group was working," according to the researchers.

Socio-economical process

This section discusses the emotional issues that must be addressed, as well as the strategies that must be used to build team cohesion and trust. Overall, the research found "a favourable link between socio-emotional process and outcomes of the virtual team project." Face-to-face time is rare due to geographical spread. According to research, this leads to weakened social ties among teammates and a team that is more task-oriented than socially minded.

Task process : Task processes are the actions that team members do to achieve their goal and finish their project. Communication, coordination, and task-technology-structure fit are the three primary components of task processes.

Output : Output means all the things that come out of work process of team.

Challenges

- The specifications for work that is provided to contractors must be precise.

- The procedures to be followed must be formally stated.
- It can be challenging to coordinate dispersed labour.
- Modifications to payment mechanisms are required.
- Co-workers' lack of trust
- Evaluation of the given products' quality
- Different time zones can wreak havoc on communication and collaboration.

Review Question

1. *Explain challenges in working with virtual team.*

6.12 Communication Genres

- To avoid communication-related problems, project managers create a communication management strategy, prepare reports based on it, question and discuss stakeholders' needs, define what communication procedures they require, and examine communication needs of stakeholders at team meetings on a regular basis.
- The procedures involved in good communication management are, at a high level :
 1. **Establish a communication system** : This procedure determines the project stakeholders' information needs and builds a communication system.
 2. **Manage communication** : Managing communication is the process of putting the communication management plan into action as well as responding to unanticipated information demands.
 3. **Control communication** : This is a method of gathering and communicating performance data.
- More than just a way of communication based on technology.
- There are some general guidelines for when and how much communication should be done.
- These guidelines may be fairly formal at official meetings.
- Meetings of management, each with its own conservation goals.
- Advanced email-based applications can be developed in the email communication genre.
- A major influence on the nature of communication genre is the constraints of time
- Mode of communication can be categorized as combinations of two opposites same time/different time and same place/different place.

Communication Genres

	Same Location	Different Location
Same Time	Meetings Interviews, Conferences, Town hall	Telephonic conversations Instant messaging, Webinar
Different Time	Notice board, bulletins Pigeon hole	E-mail Documentation

Review Question

1. Explain different communication genres used in organization.

6.13 Communication Plan

Effective internal and external communication is vital to project success thus, communication plans are important in your initiatives. Communication is required for receiving feedback on a deliverable, asking a coworker where a file is saved, receiving critical information from a client, executing the review and approval process, and other everyday project chores. It's critical to have a project communication plan that outlines stakeholders, as well as when and how to contact them.

- **Benefits of project communication plans**

Project communication plans, at their core, help people communicate more effectively. They'll assist you avoid project failure by making your projects run more smoothly. Setting and managing expectations, better stakeholder management, and assisting with the project planning process are some of the other main advantages

- **Expectations should be set and managed**

It's a two-way street when it comes to project communication. Expectations must be made, and both the project team and client stakeholders must carry out their obligations in order for communication to run successfully, much like project planning.

- **Management of stakeholders and clients**

Stakeholder buy-in and transparency on project status are dependent on effective communication about alignment on goals and milestones, as well as future re-alignment as projects change.

A project communication plan can help you maintain that common knowledge of what's occurring and what should be happening throughout your project, which is crucial to maintaining a healthy connection with the customer.

- **Planning a project**

A project management communication strategy specifies how, when, and by whom vital information will be communicated throughout the project. While you're working on project planning, you should also be working on communications planning.

- **What should communication plans include ?**

- While the specifics of your communication plan will vary based on the type and scale of your project, there are a few fundamental components that should be included in every project communication plan :
- **Essential stakeholders** : Including your primary client contact, should be noted. Include contact information such as phone numbers and emails in the communication strategy so that everyone who accesses it may locate it.
- **Members of the team** : Include the major members of your project team, as well as their responsibilities. This is useful for anyone who is new to the project or is unfamiliar with it. Make a list of who's on your list.
- **Key communication techniques** : Describe the key communication techniques and channels you'll use to reach out to stakeholders, including email, phone calls, in-person meetings, video meetings, Slack, social media, and any others. Make a note of the channels that the stakeholders prefer.
- **Stakeholder and communication method communication styles** : can be broken down. Is it necessary to have a formal tone when communicating with a certain stakeholder, or may you use a more informal tone ?
- **Schedule of meetings** : While you can alter this as needed throughout the project, having a general sense of how frequently you'll meet with stakeholders is beneficial.
- Determine the important message or information that will need to be shared with each stakeholder throughout the project for each stakeholder. This includes any data or feedback you may require from them.
- **Communication goals** : Having a communication plan that includes communication goals will help you make decisions that are based on your objectives.

Communication plan example

#	Communication	Medium	Delivery Date	Frequency
1	Project team communication	Meeting	Ongoing	Weekly
2a	Executive communication	Presentation	Ongoing	Weekly
2b	Executive communication	Meeting	Ongoing	Monthly
3	Formal : merit notification	Letter	12/9/20	One-Time
4	Merit responsibility	Email	14/9/20	One-Time
5	Communication regrading department minimum	Email	19/9/20	One-Time
6	Faculty merit guidance	Letter	23/9/20ss	One-Time
7	FAQ	Webpage	30/9/20	One-Time

Review Question

1. Write note on communication plan.

6.14 Multiple Choice Questions

Q.1 Project managers have the highest level of authority and the most power in which type of organizational structure ?

- | | |
|---|---|
| <input type="checkbox"/> a) Projectized | <input type="checkbox"/> b) Strong matrix |
| <input type="checkbox"/> c) Functional | <input type="checkbox"/> d) Balanced matrix |

Q.2 What is one of the most important skills a project manager can have ?

- | | |
|--|--|
| <input type="checkbox"/> a) Negotiation skills | <input type="checkbox"/> b) Influencing skills |
| <input type="checkbox"/> c) Communication skills | <input type="checkbox"/> d) Problem solving skills |

Q.3 Which of the following contracts should you use for projects that have a degree of uncertainty and require a large investment early in the project life cycle ?

- | | |
|---|---|
| <input type="checkbox"/> a) Fixed price | <input type="checkbox"/> b) Cost reimbursable |
| <input type="checkbox"/> c) Lump sum | <input type="checkbox"/> d) Unit price |

Q.4 A project manager would find team development the most difficult in which form of organization ?

- | | |
|--|--|
| <input type="checkbox"/> a) Weak matrix organization | <input type="checkbox"/> b) Balanced matrix organization |
| <input type="checkbox"/> c) Projectized organization | <input type="checkbox"/> d) Tight matrix organization |

- Q.5 A narrative description of products or services to be supplied under contract is called ?**
- [a] The project plan [b] A statement of work
[c] An exception report [d] Pareto analysis
- Q.6 All of the following are contract types except : _____.**
- [a] Unit price [b] Make or Buy
[c] Cost reimbursable [d] Lump sum
- Q.7 Which type of leadership is best suited for optimizing team performance in projects ?**
- [a] Democratic leadership [b] Participative leadership
[c] Autocratic leadership [d] Authoritative leadership
- Q.8 What are the 4 stages of team development ?**
- [a] Forming, Storming, Norming, Performing
[b] Enthusiasm, Hope, Panic, Solution
[c] Forming, Solutioning, Normalizing, Communicating
[d] Direction, Motivation, Cooperation, Collaboration
- Q.9 Your IT company is responsible for making software virus programs. You are responsible for managing both individual product releases and co-ordination of multiple released over time. Your role is that of a :**
- [a] Project manager [b] Program manager
[c] Functional manager [d] Operations manager
- Q.10 Which of the following is not a feature of a project ?**
- [a] Constrained by limited resources
[b] Planned, executed and controlled
[c] Creates unique product or service
[d] May be ongoing and repetitive
- Q.11 Following is (are) the motivational technique(s) : _____.**
- [a] Job based techniques [b] MBO techniques
[c] Leadership techniques [d] All of the above
- Q.12 Following is the higher level need : _____.**
- [a] Safety and security needs [b] Belonging and social needs
[c] Self-actualization needs [d] Basic physiological needs

Q.13 Following need is the desire to become everything that one capable of becoming.

- | | |
|---|---|
| <input type="checkbox"/> a Esteem and status needs | <input type="checkbox"/> b Belonging and social needs |
| <input type="checkbox"/> c Self-actualization needs | <input type="checkbox"/> d Basic physiological needs |

Q.14 Herzberg's theory of work motivation is also known as _____.

- a maintenance theory of motivation
- b hygiene theory
- c two factor theory of motivation
- d all of the above

Q.15 _____ emphasizes the importance of workers in the accomplishment of enterprise objectives.

- | | |
|-------------------------------------|--|
| <input type="checkbox"/> a Theory X | <input type="checkbox"/> b Theory Y |
| <input type="checkbox"/> c Theory Z | <input type="checkbox"/> d None of the above |

Answer Keys for Multiple Choice Questions

Q.1	a	Q.2	c	Q.3	b	Q.4	a
Q.5	b	Q.6	b	Q.7	b	Q.8	a
Q.9	b	Q.10	d	Q.11	d	Q.12	c
Q.13	c	Q.14	d	Q.15	b		



SOLVED MODEL QUESTION PAPER (In Sem)

Software Project Management

T.E. (Computer Engineering) Semester - V (Elective - I) (As Per 2019 Pattern)

Time : 1 Hour]

[Maximum Marks : 30]

Instructions to the candidates :

- i) Attempt questions Q.1 or Q.2, Q.3 or Q.4, Q.5 or Q.6.
- ii) Neat diagrams must be drawn wherever necessary.
- iii) Figures to the right indicate full marks.
- iv) Assume suitable data, if necessary.

Q.1 a) Differentiate between software projects versus other types of project.

[Refer section 1.2.1] [5]

b) What are the different PMBOK knowledge area ? Explain its subdivisions in detail.
[Refer section 1.7] [5]

OR

Q.2 a) What challenges do you believe the project manager will face at each stage of the project life cycle ? [Refer section 1.3] [5]

b) Explain in detail Work Break down structure with suitable example.
[Refer section 1.6] [5]

Q.3 a) What is the difference between a PERT and a Gantt chart ? [Refer section 2.2][5]

b) What is Project Scheduling and how does it work ? [Refer section 2.5] [5]

OR

Q.4 a) Write a short note on :
i. Activity based approach ii. Product based approach [Refer section 2.6] [5]

Q.4 b) What are the benefits of critical path ? [Refer section 2.2] [5]

Q.5 a) What are forward and backward pass ? [Refer sections 3.7 and 3.8] [5]

Q.5 b) Explain the importance of project plan. [Refer section 3.3] [5]

OR

- Q.6 a)** What is Start-to Start activity relationship between two activities. Give suitable example. [Refer section 3.6] [5]

- Q.6 b)** Explain how project schedule is done step wise. [Refer section 3.4] [5]

SOLVED MODEL QUESTION PAPER (End Sem) Software Project Management

T.E. (Computer Engineering) Semester - V (Elective - I) (As Per 2019 Pattern)

Time : $2 \frac{1}{2}$ Hours

[Maximum Marks : 70]

Instructions to the candidates :

- i) Attempt Q.1 or Q.2, Q.3 or Q.4, Q.5 or Q.6, Q.7 or Q.8.
- ii) Neat diagrams must be drawn wherever necessary
- iii) Figures to the right indicate full marks.
- iv) Assume suitable data if necessary.

- Q.1 a)** Discuss in detail importance of project management.

[Refer section 1.1.1] [6]

- b)** What are the objectives of project planning ? [Refer section 2.4] [6]

- c)** With the neat sketch explain formulating a network model. [Refer section 3.5.3] [8]

OR

- Q.2 a)** What is the difference between project management and portfolio management ?

[Refer section 1.8] [6]

- b)** Differentiate between microsoft project and primavera project management. [Refer section 2.3] [6]

- c)** How many activity relationships are used in software project management ? Explain any two relationships in detail. [Refer section 3.6] [8]

- Q.3 a)** Explain in detail earned value analysis. [Refer section 4.6] [8]

- b)** List and explain different types of project status reports. [Refer section 4.7.1] [8]

OR

- Q.4 a)** Explain in detail construction process of schedule for data collection.
[Refer section 4.3.2] [8]

- b)** Explain in detail change control process. [Refer section 4.8.1] [8]

- Q.5 a)** What are the different stages of Agile ? Explain each one in brief.
[Refer section 5.5] [8]

- b)** What is agile manifesto ? What principles aid in the development of agility ?
[Refer section 5.2] [8]

OR

- Q.6 a)** What are the factors to be considered for scope management ? Explain in detail.
[Refer section 5.7] [8]

- b)** What is Scrum ? Explain roles in scrum. [Refer section 5.2.1] [8]

- Q.7 a)** Explain different communication genres used in organization.
[Refer section 6.12] [9]

- b)** Explain decision making process in detail. [Refer section 6.9] [9]

OR

- Q.8 a)** Explain different types of departmental organization. [Refer section 6.10] [9]
- b)** State and explain the basic steps involved in a typical selection procedure.
[Refer section 6.4] [9]



Notes

Notes

