

① SPM (Software Project Management)

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SHORTNOTE 4U

UNIT 1 → Project Evaluation & Project Planning.

Software project → A Software project is an planned endeavor to develop or enhance software system, involving tasks such as analysis, design, coding, testing & deployment, to meet specific goals and requirement within a given timeframe & budget.

Software Project Management → SPM is the process of planning, organizing, and controlling software development activities to deliver projects on time, within budget, (cost) & with the desired quality.

NOTE → Software project is work itself, while project management is the way work is organized & managed.

★ Importance of SPM

1. Planning and Organization : Helps in creating clear plan & organizing the tasks, resource & time.
 - Assigned to right people
 - Schedule properly.
2. Resource Management : Efficient use of Resource.
3. Communication & Collaboration :
 - B/w Stakeholders
 - Reduce Misunderstanding
4. Timely Delivery : Monitoring Progress, tracking Milestone
 - ↳ Focus on Understanding & Meeting customer requirements
 - ↳ Implement feedbacks
 - ↳ Enhance
 - ↳ Overall Success of Projects.
5. Customer Satisfaction :
 - ↳ Focus on Understanding & Meeting customer requirements
 - ↳ Implement feedbacks
 - ↳ Enhance
 - ↳ Overall Success of Projects.

Activities involved in project Management. (Tasks)

(2)

1. Planning → Deciding what is to be done
 2. Organizing → Making arrangements
 3. Staffing → Select Right people
 4. Directing → Giving instructions
 5. Monitoring → Checking progress
 6. Controlling → Taking action to ^{minimize} hold up. Cause of delay
 7. Innovating → Coming up with new solutions ↓ improve
 8. Representing → Represent Plan & resource.
- AIM → High Quality S/w, Efficient & Evolve changes.

Different Methodologies used in SPM. (Approaches)

1. Agile development Methodology → Divide into sprints, small portion of the software is developed, test & review.
2. DevOps deployment Methodology → (Development + Operational team work together) ⇒ Automation.
3. Waterfall development Method → Work together
4. Rapid Application development → Create (Prototype) (Delivered) + Incremental ↳ fast update with time.

Different types of Software

- 1) System Software → Manages & operates Computer H/w (OS)
- 2) Application Software → Performs specific task or funⁿ for users (web browser)
- 3) Real time Software
- 4) Business Software
- 5) Utility S/w → Provide tools → to enhance performance (Antivirus).

Phases of Project Management

1. Initiation - Goals & objective are determined
2. Planning - Detailed Plan is created, including tasks, timeline, resources & budget
3. Execution - Plan is Executed & tasks are completed by project team
4. Monitoring & Control - Progress is monitored, adjustment made if required.
5. Closure - Project completed → project Report → present in deliverables to stakeholders

Software Management Principles

1. Clear Goals → Clearly defines goals & objective → help → clarity.
2. Effective Planning → Develop well-structured & detailed plan.
3. Strong Communication → Effective commun b/w team Member, Stakeholder & customer.
4. Stakeholders Engagement → Involve ST throughout process - feedback
5. Risk Management → Identify Risks → And develop strategies to minimize.
6. Quality Assurance → Regularly testing, code Review.
7. Adaptability & Flexibility → Adapt to evolve changes.
8. Continuous improvements →

Management Principles

- ① Division of Work → Division of Work. → Increase Parallelism
→ Increase Productivity
→ Increase Efficiency.
- ② Authority & Responsibility → Authority → Right of Superior to give order to his Subordinate.
Responsibility → Obligation for performance.
- ③ Discipline → Respect of Auth. → Smooth functioning.
- ④ Unity of Command → Subordinate receive order from only 1 Superior otherwise create confusion.
- ⑤ Unity of Direction → Related Category under same group & under the control of Manager.
- ⑥ Remuneration → Workers → Paid Timely
Increase Motivation
Payment → Should be fair & reasonable.

 Setting Objectives → Defining clear and specific goals that guide the project and help measure its success.

When Setting objective, it is important to follow SMART Criteria.

S(Specific) → Obj should be specific & well defined - no room for ambiguity (ans of ques → who, what, where, when & why)

M(Measurable) → Project progress can be tracked & evaluate.

A(Achievable) → Realistic & Attainable within project's constraint.

R(Relevant) → Satisfy the purpose of the project.

T(Time bound) →

- Clear timeframe or deadline for completion
- Help in Prioritizing activities and allocating resource efficiently.

- Management Control → AIM → Achieved goal within a set time
- ↳ Process of Monitoring and regulating activities within an organization to ensure that goals & objectives are achieved effectively & efficiently.
- Comparing actual & planned performance
- PPM (Project Portfolio Management) ^{AIM} → Find best combination of resource to achieve objective.
- PPM Process define → how an orgn approaches project prioritization on resource allocation, budgeting, scheduling and other major components.
- Enhance ability to manage multiple projects in an efficient and effective way.
- Benefits →
 - Strategic Alignment ; Resource Optimization ; Risk Management (Prevent Proj. failure)
 - Value Maximization

- Cost Benefit Evaluation Techniques → Determine if the Benefits of the project outweigh its costs. ($\text{Benefit} > \text{Cost}$)

1. Net Profit → Total cost spent - Total income earned.
2. Payback Period → Time taken to payback the initial investment.
3. ROI (Return on Investment) → How much profit you can expect → Relative to money you invested.

$$\text{Eq} \Rightarrow \text{Invest} = 10000$$

$$= \text{Profit} = 2000 - 1 \text{ year}$$

$$\text{ROI} = \frac{\text{Profit}}{\text{Investment}} * 100 = \frac{200}{1000} * 100 = 20\%$$

$\Rightarrow 1 \text{ Rs Mai } 20 \text{ paisa Profit}$

4. Net Present Value → Determine investment is financially beneficial by comparing value of future Profit to its Initial investment.

$$\text{NPV} = \text{CF}_1 / (1 + r)^1 + \text{CF}_2 / (1 + r)^2 - \dots - \text{CF}_n (1 + r)^n - \text{Initial Investment.}$$

$CF \rightarrow$ Cashflow $\begin{cases} \text{Inflow} \\ \text{Outflow} \end{cases}$

$r \rightarrow$ discount (Value of Money decrease over time)

(4) \Rightarrow Investment = 100000 , $r = 10\% = 0.10$

Year 1 = 30,000
Yr 2 = 40000
Yr 3 = 50,000

$$NPV = \frac{30000}{(1+0.10)^1} + \frac{40000}{(1+0.10)^2} + \frac{50000}{(1+0.10)^3} - 100000$$

$$NPV = -1036$$

\leftarrow Project is not generated enough cash flow.

Q3

Risk Management (Process of identifying, assessing & mitigating risk).

Risk Assessment

(Identify & Evaluate Risk)

a) Risk Identification \rightarrow Identify Risk that could affect Project & organization.
 \rightarrow List of Risk (Maintain).

b) Risk Analysis \rightarrow After Identify - They need to be analyzed to understand their nature, cause & consequences.

\hookrightarrow Quantitative Analysis (using numerical data)

\hookrightarrow Qualitative Analysis (using Expert judgement)

c) Risk Prioritization \rightarrow Prioritize Risk based on their significance & impact.

- Take immediate action

Risk Control.

(taking action to manage & mitigate Risk).

d) Risk Planning \rightarrow produce a plan \rightarrow dealing with each Risk

e) Risk Monitoring \rightarrow keeping a close watch on risks to detect any changes or new risk.

f) Risk Resolution

Taking appropriate action to minimize the impact of Risk.



Strategic Project Management \rightarrow Is about planning & executing Projects in a way \rightarrow to achieve goals & objective.
 \Rightarrow Prioritize Projects.



Software Project Planning \rightarrow Process of defining project goals, tasks, timelines & resource requirements for the successful execution of a software development project.

\Rightarrow Outline the steps to be taken, estimate effort & cost.

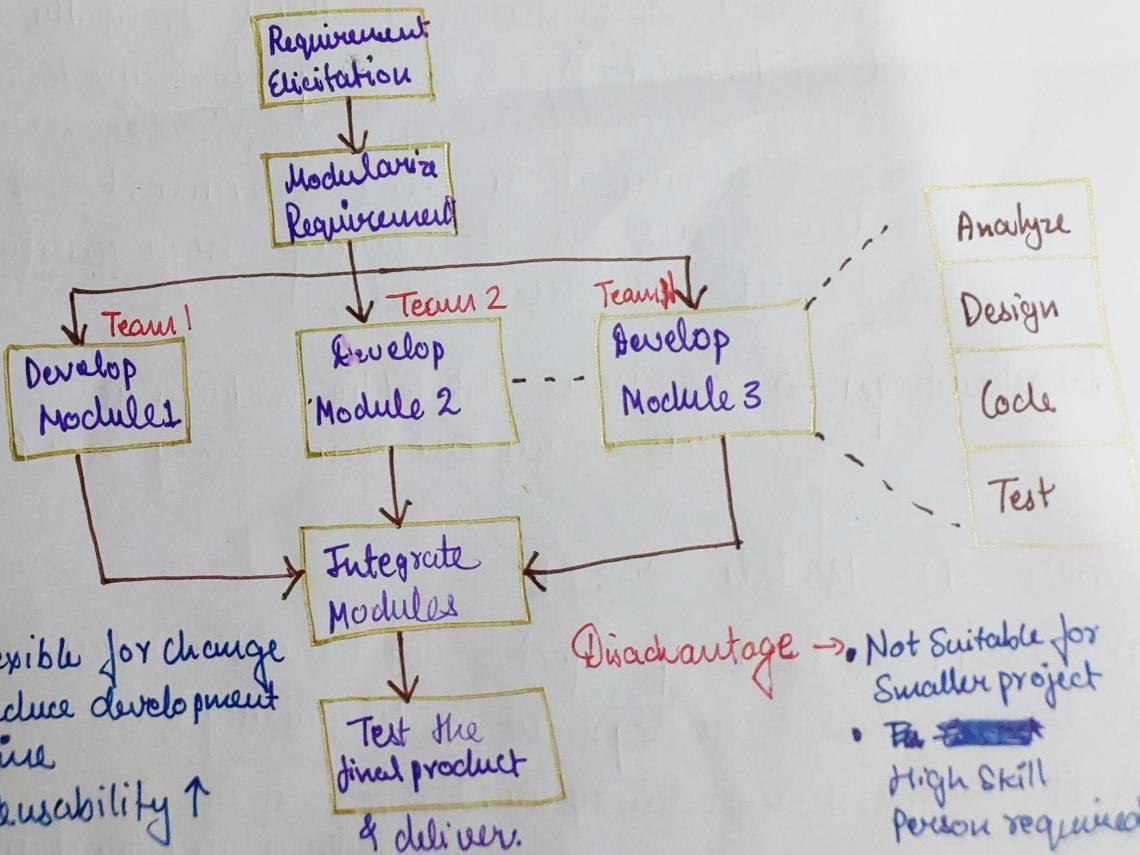
UNIT-2 Project life Cycle. (SPM).

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Software Process Model → • Representation of Software Process

⇒ A software process Model is a structured approach that defines the steps and activities involved in developing and maintaining Software System.

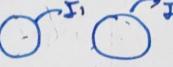
- Choice of Process Model → Factor : • Project Requirements
• Project Size
• Complexity
• Client Environment
• Skills & knowledge.
(Developer & team number)
- RAD (Rapid Application Development) :
⇒ Project can be broken down into small Module where each Module can be assigned independently to separate teams.
⇒ Use → Short time span (60-90 days).



Advantage: Flexible for change
• Reduce development time
• Reusability ↑

Disadvantage → • Not Suitable for smaller project
• High Skill Person required

AGILE METHOD → AIM → To facilitate quick project completion
(Iterative + Increment) - Agile Model

- 1) Flexibility → Adaptable to changes in requirements.
- 2) Iterative development → Instead of delivering the entire project at once, Agile break it down into smaller pieces called Iteration & sprint.
- 3) Continuous feedback → Agile emphasizes regular feedback from stakeholders, including customers, throughout the development process → help refine & improve product.

Defn → Agile Method are a way of developing software that focuses on being flexible, collaborative, & customer centric, instead of trying to plan and build everything at once, Agile breaks the work into smaller parts and deliver them in iterations.

It involves continuous feedback from the customers and stakeholders, allowing for quick adjustments and improvements. Agile emphasize teamwork, open communication and teamwork, open communication, and a focus on delivering high quality software that meets customer needs.

Disadvantages →
• Increase Stakeholder involvement
• less documentation → Complexity ↑

AGILE SDLC Models → ~~SCR~~

- 1) SCRUM → Breaking Project → fixed length iteration (Sprints) [1-4wk]
- 2) Lean Software development → Minimizing Waste → optimize
- 3) FDD (Feature Driven development) → Focusing on delivering specific features and functionalities.
- 4) XP (Extreme Programming) → XP is a teamwork-focused Agile Method that

Promote simple processes, continuous improvement, and collaboration for better software development.

prioritize → Good Communication, working together as a team, adjusting to what project needs & making high-quality software.

extreme Programming (xp) → Good practices need to be Practiced in Extreme programming.

⇒ Some of the good practices that have been recognized in extreme programming are -

- Code Review :
 - Detect and Correct errors efficiently
 - Carried Out by pair of programmers.
- Testing :
 - Helps to remove error and increase reliability
 - Suggest TDD (Test-driven development) approach.
 - TDD → Test cases are written even before any code is written.
- Incremental development :
 - Customer feedback is gained
 - New increments → after each iteration.
- Simplicity :
 - Test & debug easy.
- Design :
 - Good design → develop good quality Software.
- Integration testing :
 - Helps to identify bugs at the interface of different functionalities -
 - Continuous Integration testing - should perform.

Application :

- Small projects → Small team → face to face meeting
- project involving new technology → Need to change ^(Easy) frequently.

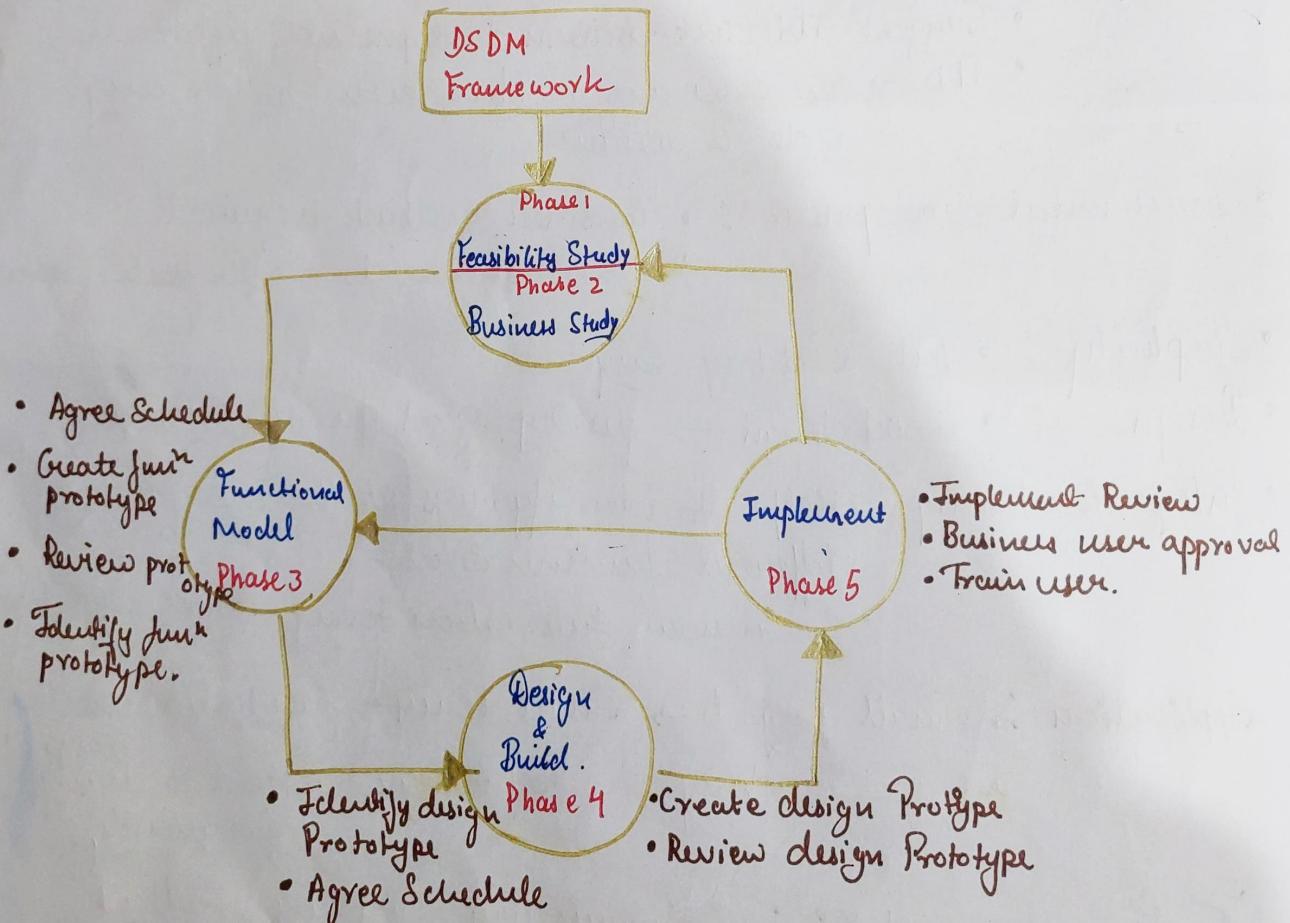
⑦ Five Values of XP : Communication, Simplicity, feedback, courage and respect.
(Moral Values)

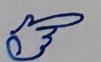
Dynamic System development Method.

- Agile framework
- Iterative + Incremental Approach
- Emphasizing Collaboration
- It encompasses not only development practices but also addresses areas such as project Management, governance & business analysis.

DSDM LIFE CYCLE

DSDM LIFE CYCLE Defines 3 different iterative cycles, preceded by 2 further life cycle.



 DSDM follows a process of understanding the business requirements, creating prototypes to gather feedback & refine the design, and eventually implementing the S/w incrementally. The focus on delivering value to business & involving user throughout the development process.

life cycle activities:

Feasibility Study → Check project is suitable for DSDM by understanding the requirements & constraints.

2) Business Study →

- Define - user & functional requirements necessary for application to provide business value.
- Also identify how the application is designed & maintained in the long run.

3) Functional Model Iteration →

- Create prototype → get feedback from users to gather more requirement and make improvement.

4) Design and build Iteration →

- Refine the prototype.

5) Implementation →

- Put the latest Version of the S/W into real life working environment
- It might not be fully complete, & changes could be requested.
- If Needed go back Functional Model to keep improving.

 Managing Interactive Process → ^(Monitoring) Overseeing Collaboration, Communication and feedback to ensure effective Coordination and Successfull outcome in Software development.

Two level of development.

i) Macro process →

- Understanding the requirements
- designing the System
- Managing Maintenance

ii) Micro process →

- The detail day to day activities of individual developer or small teams.
- Identify Classes
- Relationship classes & object
- Specifying implementation.

Basic of Software Estimation

Estimation determines how much money, effort, resources, and time it will take to build a specific system or product.

Estimation is based on →

- Past data / Past Experience
- Available document / Knowledge
- Assumptions
- Identified Risk.

The four basic steps in Software Project Estimation are -

- Estimate the size of the development process.
- Estimate the effort in person-months or person-hours.
- Estimate the schedule in calendar months.
- Estimate the project cost in agreed currency.

Estimation Issue :

↳ 4 person month).

- Uncertain gray area
- Not splitting bigger task
- Idealistic & optimistic estimation
- Estimation person.

☞ Effort and Cost Estimation Techniques.



1. Top down Estimation
2. Bottom up Estimation
3. Expert Judgement
4. Analogous Estimating
5. Three point Estimating (Optimistic, Pessimistic, most-likely estimates)

50 Hrs

120 Hrs

100 Hrs

☞ Cost Estimation Model

- 1) Empirical Estimation Techniques (Use formula or eqn based on historical data & assumption).
- 2) Heuristic Technique (Use shortcut & simplified Method to make quick decision)
- 3) Analytical Estimation Techniques (Task divide) (Limited time & resource)

Cost Estimation Model vs Cost Estimation techniques

CEM are the Mathematical Model or Equations are the used to Estimate project Cost. (Structured framework)

- CET are the practical approach or Method employed to derive these cost estimates. (Tools and Method).

Cosmic function Points.

- Cosmic function point (CFP) is a Software metric used to measure the Size & Complexity of a Software System.
- It quantifies the functionality of the system rather than focusing on lines of code or technical detail.
- Features and functionalities of the Software are assigned weight based on their complexity & impact.
- Total cosmic function points are calculated by summing up the weighted values.
- CFP helps estimate the effort and resources required for software development.
- It provides a standardized measure for comparing and estimating the size and complexity of different Software System.

6.22 -



COCOMO MODEL I

- Estimate ^{Effort} Cost based on size i.e Line of codes.

A B
10K 10K

- less accurate
- limited Customization

COCOMO MODEL II

- Estimate cost based on project complexity, team capabilities & potential Risk.
- More Accurate
- Flexibility & Customization.



Parametric Productivity Model : Mathematical Model Estimate how different factor affects the efficiency of SW development. It consider variables like - team experience, project complexity & tools to predict the productivity levels.

SPM → UNIT - 3

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⇒ Activity Planning

AIM: Break down Project → Manageable task → Determine order & dependencies of these activities

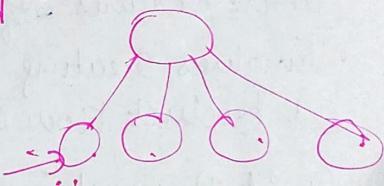
• Objectives of Activity Planning →

- Feasibility Assessment → Completed in given time & resource constraint
- Resource Allocation → Most effective way to allocate resource
- Detailed Costing → Estimate the project cost
- Motivation → Set target and monitor progress against them
- Coordination → Use project plan to coordinate & communicate different teams and departments.

• Project Schedule →

Project Schedule Shows the date when each activity should start and finish, along with the resources required for each activity.

Four Main Stages



1. Determine Activities & Order :

- Identify Task that need to be done and their sequence.
- Create an ideal activity plan - without resource constraint.

2. Activity Risk Analysis

- Analyze the ideal activity plan to identify potential problems or risk.
- Make necessary adjustment to the plan & consider resource allocation implication

3. Resource Allocation.

(Manpower, Equipment, Material)

- Determine when & how much of each resources required for each activity.
- Consider resource availability constraint.

4. Develop the Project Schedule

• Activity → An activity is a specific task or work that needs to be performed as a part of project.

• Identifying Activities

1) The Activity Based Approach :

- Involve creating a list of all the activities that the project is thought to involve.
→ Identified through Brainstorming sessions & past projects.
- (WBS) Work Breakdown Structure → Get clear picture about what needs to be done & how different tasks relate to each other.

2) The Product Based Approach :

- Focus on identifying activities based on the final products or deliverables of the Project.
- Involves creating a Product Breakdown Structure (PBS) & a Product Flow diagram (PFD) to identify sequence of activities

3) Hybrid Approach :

- Combⁿ → Activity Based + Product Based.
- Suitable for projects that have both distinct components & tasks.
- Sequencing and Scheduling : Sequence and Scheduling activities involved determining the order and time of tasks, considering resource availability & logical dependencies ^{with} in project.
↳ larger project → Better to separate sequence & schedule.
- Network Planning Model ;
 - Sequencing the tasks acc. to their logical relationship.
 - Scheduling them taking into account resources & other factors.
- NPM helps to visualize and analyze the project's activities and their order of execution using graphical representation.

- Activities are represented as nodes & relationship b/w activities are depicted as arrows & link.

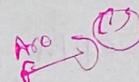
Commonly used N/w Planning Model :

- CPM (Critical Path Method)
- PERT (Program Evaluation and Review Techniques)

These models used Mathematical algorithms to calculate project duration, identify critical activities & assist in resource optimization.



Activity - ON- ARROW



↳ Used by CPM and PERT to visualize project as a N/w.

- Activities are drawn as arrow joining circles, or nodes, which represent the possible start and/or completion of an activity or set of activity.



Activity - ON-NODE



↳ Used by Precedence N/w.

(Popular + widely adopted)

- Activities are represented as Node.
- Link represent Sequence.

• Formulating a N/w Model.

❖ Constructing Precedence N/w Rules .

- One Start Node
- One End Node
- Node has duration
- Link normally has no duration
- Time Move Left to Right
- N/w May Not Contain Loops



PERT / CPM (Method Used for N/W Planning).

- ↳ Managing a project with Networking planning method involves 4 step.
 - Describing the Project
 - Diagramming the NW
 - Estimation time of completion.
 - Monitoring Project Progress.

CPM (Critical Path Method).

- The CPM Method is an algorithm for scheduling a set of project activities.
- The process of determining and optimizing the critical path.

Key Steps of CPM :-

1. Identify Activities → Make list of all Activities (Req. to complete project)
2. Determine Activity duration → Estimate time needed to complete each activity.
3. Define dependencies → Relationship & dependencies of activities
 - Which should completed first.
4. Create a NW dig → Show activities & their dependencies
5. Calculate the Critical Path →
 - Find longest path of dependent activities (delay)
 - Best path Slack or float = 0 (min.)

⇒ Forward pass, Backward pass is used to calculate critical path.

→ In forward pass calculate Early Start & Early finish.

→ In backward pass calculate latest start & latest finish time.

Activity → A, B
Duration → 5, 4.

ES	D	EF
Activity		
LS	SL	LF

FP →

0	5	5
A		
0	0	5

AOA

BP →

5	4	9
B		
5	0	9

$$SL = LF - EF$$
$$LS = LF - Duration$$

6. Determine Project Duration : Add duration of Activities of Critical path.

→ Project Manager can identify the critical Path to ensure the project stays on schedule.

Risk Identification and Assessment

- Risk Identification is the process of Identifying Potential threat and opportunities that could impact the objective of Project.
- Risk assessment involves evaluating the impact of each identified Risk
- Techniques like brainstorming, checklists and reviewing historical data can help in Identify and assessing risks.

Risk Planning

- Risk Planning is about developing strategies to address identified risks.
- Strategies →
 - Avoid risk , • Transferring Risk to another party
 - Accepting Risk and preparing for their potential impact.
 - Mitigating Risk by taking proactive measures.

PERT (Program Evaluation & Review Technique)

- Project Management techniques
- Use to estimate the time required to complete a project.
- Breaking down the project in smaller task , & Estimate the time needed for each task . by considering three estimates : Optimistic(O), Pessimistic & most likely (M)

$$\text{Formula} \rightarrow \text{Expected Duration} = \frac{(O + 4M + P)}{6}$$

- It was developed to handle projects with high uncertainty & non-repetitive activities.

- PERT incorporates Network diagram, known as PERT Chart
- PERT identifies the Critical Path (longest path of dependent tasks, & Project's Min duration).
- PERT allows for better Risk assessment & management by considering the uncertainties associated with task duration.
- It provides a range of possible project duration based on the Variability of task durations & allows manager to focus on high-risk activities.

PERT	CPM
<ul style="list-style-type: none"> • Nature of Project : Used for project with uncertainties & non routine activities 	<ul style="list-style-type: none"> • Used for projects with well defined task and known duration.
<ul style="list-style-type: none"> • Time Estimate : Consider 3 time estimate for task duration (Optimistic, pessimistic & most likely) 	<ul style="list-style-type: none"> • Use single deterministic estimate for task duration
<ul style="list-style-type: none"> • Calculation of Task duration : Calculated expected task duration using weighted averages. 	<ul style="list-style-type: none"> • Use the estimated task duration directly.
<ul style="list-style-type: none"> • Project Duration : Provides a range of possible project based on variability 	<ul style="list-style-type: none"> • Focuses on determining the critical path for the minimum project durations.
<ul style="list-style-type: none"> • Project Focus : More suitable for research & development projects 	<ul style="list-style-type: none"> • Commonly used in construction & engineering projects with well-defined activities.

- Monte Carlo Simulation
- Resource Allocation
- Cost Schedule.

Management

Project Framework : A project framework is a set of processes, task and tools that guide and organize the execution of Project.

- It helps an organization plan & track different steps of project from start finish.

⇒ 3 Main Components : Project life Cycle, Project Control Cycle & Tools & templates.

1) Project life cycle → Consist of 5 stages → Represent different phases of the project.

- **Initiation** : This is the starting point of the project where ideas are generated, research is conducted & key components are analyzed.
- **Planning** : Project thoroughly planned, teams are assigned, milestones are set & risk are analyzed.
- **Execution** : Actual work is done - project deliverable - Each team member specific task - to complete.
- **Management** : Focus - Documenting, Monitoring & reporting project progress at each milestone, involves keeping track of the project performance.
- **Review** :
 - Analyze, what went well, any challenges faced & how to improve in the future.

2) Project Control Cycle → P. Control Cycle involves actively monitoring and managing the project throughout its life cycle.

- **Initial Planning** : The Project Plan is created, outlining the task, resource & timeline.
- **Progress Monitoring** : The Project Manager keeps an eye on the progress made by different teams & ensure that things are on track.
- **Progress Evaluation** : Actual Progress - compared with planned progress.
- **Deviation Analysis** : Deviations occur → project Manager investigate the reason behind them & evaluate them.
- **Corrective Action** : If necessary, adjustments are made to bring the project on track.

3) Tools and Templates: These are ready made resources that provides structure and assistance in implementing the project Management framework. They include various Software tools and pre-designed templates that help in planning, scheduling, tracking & reporting.

 The Project Management Framework Serves as a roadmap for managing project Efficiently, Ensuring that tasks are completed in timely Manner & goals are achieved.

 → Collection of Data. → Help how much work completed & what task are remaining.
⇒ Partial Completion Reporting: (Maintain control over a project)

- Gather information on partial completion of activities
- Estimate remaining work based on percentage of completion.
- Monitor progress and Make necessary adjustment.

⇒ Reporting Risk using a Traffic light Method.

Analyzing the project's elements or components using a traffic light concept.

- Identify the first level elements for analyzing assessment
- Break the first level elements into second level element.
- Analyze the Second level Elements and Mark the color as →

Yellow ↪ GREEN - ON TARGET .

AMBER - Not on Target but recoverable .

RED - Not on Target - difficult to recover .

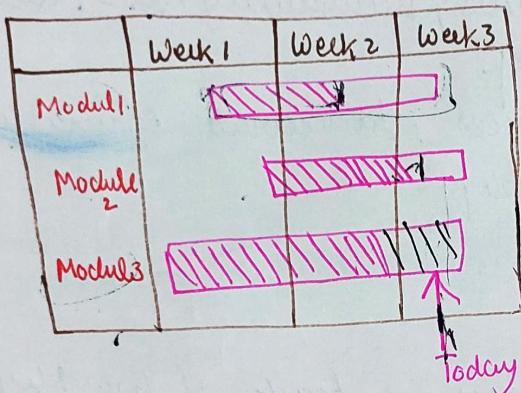
- Review all the Second level elements to reach the first level assessment .
- Review both 1st & 2nd → To produce overall assessment
- Assessment form → Used to evaluate overall ~~process~~ status of the project .
- Critical activities → Red color → Must be reconsidred during the revision of project Schedule .

Visualizing Progress

Collected data → Show Visually.

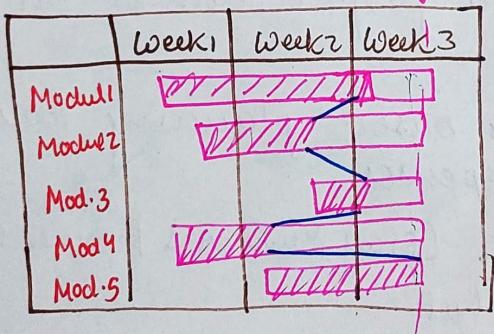
Visualizing Progress is important to effectively communicate the project status to everyone involved.
⇒ 3 categories of visualizing Progress techniques.

⇒ Gantt Chart techniques.



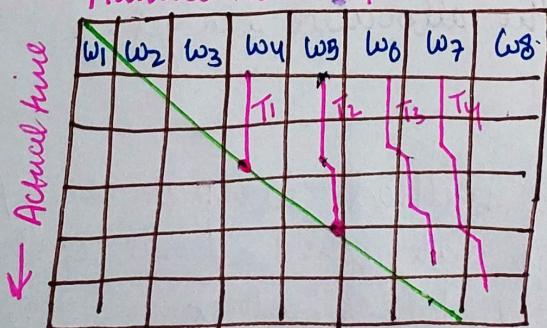
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⇒ Split Chart techniques.



⇒ Timeline Sheets.

Planned time →



- Record & display the target changes during the project life cycle.

Cost Management

- Process of estimating, allocating and controlling the cost of a project.
- Ensure that project stays within budget and effectively utilize resources.

Benefit → Preventing cost overruns, minimizing risk & aiding in future planning.

Challenges → Lack of resources, inaccurate estimation, outdated technology.

Cost Monitoring

- Cost Monitoring is about keeping track of how much money is being spent on project.
- It is important because a project can be on time but still go overbudget.
- Cost Chart and Computer based planning tools are used to help monitor expenses.
- A project → behind schedule (staff member & resource not deployed) but can be under budget.
- It is necessary to monitor both project progress & costs to ensure success within the allocated budget.

earned Value Analysis :

- EVA (Earned Value Analysis) is a method to measure a project progress, predict its completion date and final cost, and analyze differences in Schedule & budget.
- Compares planned work with actual work completed to see if the project is on track or not.

To measure progress and variances, we use three values for each activity.

1) Planned Value (PV) : Budgeted cost for the work schedule to be done.
(BCWS)
Budget Cost of Work Schedule.

- Portion of the project budget planned to be spent at any given point of time.

2) Actual Cost (AC) : Money Spent for the work accomplished.
(ACWP)
Actual Cost Work performed.

- Total cost incurred up to a specific point in time.

3) Earned Value (EV) : Percent of the total budget actually completed at a point in time.
(BCWP)
Budgeted Cost Work performed.

$$\Rightarrow EV = \% \text{ Complete} \times \text{Budget}$$

Earned Value Analysis Calculation

Ex: Task → Create a Website for a client, and you have budget 5000 Re.
• You breakdown the work into different tasks, such as Designing, Coding & Content.
• Each task has planned cost associate with it.

1. Planned Value (PV) : Let say you plan to spend 2000 on the design, 2500 on the coding & 500 on adding content.

- Design (PV) = 2000
- Coding (PV) = 2500
- Content (PV) = 500

2. Actual Cost → Design (AC) = 1800
Coding (AC) = 2000
Content (AC) = 400.

3. Earned Value : • Asses the progress made on each task .
- Assume completed - 80% design
60% Coding
90% Content

Earned Value for each task .

- Design (EV) ; $80\% \times 2000 = 1600$
- Coding (EV) ; $60\% \times 2500 = 1500$
- Content (EV) ; $90\% \times 500 = 450$

↳ Calculations using Earned Value data :

- Cost Variance (CV) : • CV help us understand whether we are under or over budget.

$$CV = EV - AC$$

Eq → CV for design $\rightarrow EV = 1600$
 $AC = 1800$

$$CV = 1600 - 1800 \\ = -200$$

(-ve indicate you've spent more than planned).

- Schedule Variance (SV) : Help us to understand whether we are behind or ahead of schedule .

$$SV = EV - PV$$

Eq → SV for Content $\Rightarrow EV = 450$
 $PV = 500$

$$EV = 450 \quad PV = 500$$

$$SV = 450 - 500 \\ = -50$$

(-ve means you are behind schedule)

- Cost Performance Index : Measure efficiency of your spending

$$CPI = \frac{EV}{AC}$$

Eq CPI for Coding $\Rightarrow \frac{1500}{2200} = 0.68 < 1$

means spending More than planned

* Schedule Performance Index: Measure Efficiency of Your Schedule (SPI)

$$SPI = \frac{EV}{PV}$$

$$Eg = SPI \text{ for design} = \frac{1600}{2000} = 0.8 < 1 \text{ indicate behind the schedule.}$$

By analyzing these earned value metrics, you can identify areas where you may be over or under budget & behind or ahead of schedule.

This information helps us

to make informed decisions & take corrective actions to keep the project on the track.

Goal → Earned Value Analysis → Provide insight into project performance, enable forecasting, and allow for better control over costs & schedule.

 Change Control: 1. Record (Req. for Change)

TRICK

R - Record
A - Analysis
P - ~~Plan~~ ^{Review & Re-plan} Plan
T - Build & test
I - Implement
C - Close

2. Assess (Risk Analysis)
3. Plan (Assign to team)
4. Test (Build & test)
5. Implement (Review - Meeting)
6. Close . (Delivered to Client)

 Contract Management (Discuss T & C -- etc.)

Types → Pre-award CM

Post-award CM

Financial Contract M. (chk logo ya cash.)

Risk & Compliance CM.

- Staff Selection play vital Role (Developing a project)
- Select Suitable person for suitable Job (help to complete the project efficiently).

Overview : We are going to discuss → How to manage people , how to select staff , & how to motivate them in order to have a good & professional working environment .

Managing People

- Process → Managing individual and group of individual.
- people → Most important assets of the organisation.
- Goal achieved efficiently → Managing people is the most essential part.

Various activities involved in Managing people.

- Problem Solving : • Divide problem into sub problems or assign it to individual or group.
- Motivating : • Motivating people continuously → currently working on a project.
→ Help to develop positive attitude - Yield to better result.
- Planning : • Plan each and every task. (time + Resources)
• Ensure → On track or not.
- Estimating : prediction of people's performance.
 - ↳ How fast they work
 - ↳ How much time they take to complete the project
 - ↳ How fast they produce output .
- Controlling : process of controlling ~~the~~ activities involved in developing a project (control resource, control task)
- Organizing : Organizing the way in which people work .
 - preparing plan .
 - Provide roadmap about a project
 - Organize meeting .
 - Provide alternative way in case of any problem

Organizational Behaviour

- Fredrick Taylor → Study about organizational behaviour.
- Taylor analyze the most productive way of doing manual task.
- Taylor has 3 basic objectives.
 - Select best people for job.
 - Train them in best Method
 - Provide incentives based on performance.
- Taylor emphasized on the importance of "Performance related pay".

Theories of the organizational behaviour.

Research showed how the state of mind of person / workers influenced their productivity..

This attitude was divided into 2 types of theories, i.e Theory X and Theory Y.

Theory X : Suggest that some managers believe people dislike work. (People tends to avoid responsibility)

- There is a need of control and direction.

Theory Y :

- Assume people enjoy work, can be self directed.
- Take responsibility and possess creative qualities.

 Theory X environment makes everybody to relax which can be seen visibly, whereas Theory Y is more a goal oriented approach of the people involved in the development.

Best method for Staff Selection / Selecting the Right person for the job.

- Taylor method.
- Other factors include → use of software tools, methodologies, programming productivity & so on.
- It is always better to have the best people employed in the right place.
- Acc. to Gerald Weinberg, "Most programmers prefer to work alone".

Recruitment Process.

- Recruitment process → Selecting individuals for a team or organizations.
- Two types of Candidates are considered : Eligible Candidate
Met the required qualification of on paper, while
Suitable Candidates possess the actual skills and
ability to job well.
- Actual Skills & abilities should be prioritize over
eligibility Criteria.
- Recruitment policies avoid discrimination based on
race, gender, age or irrelevant disabilities.
- The Recruitment process includes creating job specifications
& profiles, advertising the job, reviewing resumes,
conducting Interviews & test, checking references
& potentially conducting a medical examination.
- The goal is to select the best candidate who can
contribute effectively to the organization.

The Oldham - Hackman job characteristic Model.

- The Oldham - Hackman job characteristics model focuses on creating meaningful and satisfying assignment for employees.
 - ↳ When employees find their work meaningful & satisfying, they are more likely to be happy and motivated in their jobs.
- Job satisfaction depends on factor like skill variety, task identity, task significance, autonomy & feedback.
 - ↳ Impact of Job on other → freedom (make decision & take actions)
 - ↓ Provide info about result of an employee's work.
 - ↳ Extent to which work and its result are identifiable.
- To increase motivation, Manager should set specific & challenging goals, provide feedback on performance.
- Job enlargement → Assigning additional responsibility within a broader scope
- Job enrichment → Giving employees authority & decision making power. } Methods to improve Motivation
- ⇒ The goal is to create a job that is personally meaningful, provides growth opportunities, & enhance motivation for employees.
- ⇒ Ethical & programming concerns:
 1. Ethics refer to moral obligations beyond legal responsibility
 2. Three group of responsibility → Universal Responsibility
 - Organizational "
 - Professional "
- ⇒ Organizational Ethics :
 - Uniform treatment of employee
 - Promoting

Social Responsibility: Business have an obligation to protect the community and follow safety standards.

Financial Ethics: Running clean oprn, avoiding bribery and insider trading & treating share holders fairly.

⇒ Small companies should support employees with mental health or substance abuse issue & provide help where possible.

Professional Ethics : Professionals have duty to warn people about risk - related to their expertise.

- Many professions have established code of conduct that serve as guidelines for ethical behaviour among their members
- Promotes trust & confidence among clients, customers & the public.

⇒ Working teams

- Working in a group is a common practice in a software development, but not everyone enjoys it.
- Organization have various departments reflecting their structure → task group can be formed based on specific task.

Team Formation Model.

Team has to go through 5 stages.

1. **Forming:** Team is formed, Members introduced each other.

2. **Storming:** Conflict & differences may arise, everyone has different opinion.

3. **Norming:** Team starts to establish some guidelines & rules
→ Members begin to understand each other better way
→ like storm passed.

Performing : • When a team is functioning at its best
• Everyone work together - achieve great result.

Adjourning (Garnwell) : • Team's task comes to an end
• Member reflect on their achievement & say goodbye

=> Individual Characteristics.

→ Any project team must be formed with the best mix of different personalities.

Beblin formulated the need of balanced teams based on individual characteristics of people.

- Chair : Good in Conducting meeting
- Plant : Good in generating ~~new~~ Ideas
- Monitor-Evaluator : Good Evaluator & Best in Selecting feasible Sol'n.
- Shaper : Directing the team → Attention to important issue
- Team worker
- Resource investigator : Find resources (Physical + information)
- Complete finisher : people concerned with - completing the task
- Compromiser - worker

=> Group performance -

Project Man. Decide

↳ Depend on nature of task (work ⁱⁿ group or work as individual)

4 ways to categorizing group task

1. Additive Task
2. Compensatory Task
3. Disjunctive Task
4. Conjunctive task