SPM : Unit 1

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Unit 1 : Syllabus

UNIT I : SPM Concepts:

Definition, Components of SPM, Challenges and opportunities, Tools and techniques, Managing human resource and technical resource, **Costing and pricing of projects, Training and development, Project management techniques.***

CO:

Definition

Software Project Management refers to the application of project management principles, techniques, and tools specifically to software development projects. It involves planning, organizing, directing, and controlling resources to achieve specific objectives within constraints such as time, cost, and quality.

Key components of software project management include:

Project Planning: Defining project scope, objectives, deliverables, timelines, and resource allocation.

Scheduling: Developing detailed timelines and workflows for tasks and milestones.

Resource Management: Allocating human, technical, and financial resources efficiently.

Risk Management: Identifying, analyzing, and mitigating potential risks that could impact the project.

Quality Assurance: Ensuring the software meets the required standards and specifications.

Stakeholder Management: Communicating with and managing the expectations of all stakeholders, including clients, developers, and other team members.

Monitoring and Control: Tracking project progress and making adjustments as needed to keep the project on track.

Delivery and Closure: Finalizing the project by delivering the software and ensuring all project objectives are met.

Components of Software Project Management

The key components of Software Project Management (SPM) include the following:

1. Project Planning

Scope Definition: Clearly defining project goals, objectives, and deliverables.

Work Breakdown Structure (WBS): Breaking down the project into smaller, manageable tasks.

Effort Estimation: Estimating the time and resources required for each task.

Components of SPM.....continues

2. Scheduling

Timeline Development: Creating a project schedule with defined milestones and deadlines.

Gantt Charts and CPM/PERT: Using tools to visualize and optimize task sequences and dependencies.

Resource Allocation: Assigning resources effectively to tasks based on priorities.

Components of SPM.....continues

3. Resource Management

Human Resources: Managing team members, skill sets, and workloads.

Financial Resources: Budget planning and monitoring expenses.

Technical Resources: Allocating tools, software, and hardware needed for the project.

Cost Monitoring: Keeping track of expenditures to avoid overruns.

Cost Control: Making adjustments to ensure the project remains within financial constraints

Components of SPM.....continues

4. Risk Management

Risk Identification: Listing potential risks that may impact the project.

Risk Analysis: Assessing the likelihood and impact of each risk.

Mitigation Strategies: Developing plans to minimize or eliminate risks.

Risk Tracking: Continuously monitoring risks and implementing contingency plans.

Issue Management: Resolving unexpected challenges effectively.

Components of SPM.....continues

5. Quality Management

Quality Assurance (QA): Ensuring processes are followed to maintain high standards.

Quality Control (QC): Testing and verifying that the product meets requirements.

Continuous Improvement: Addressing feedback to enhance future processes and outcomes.

Components of SPM.....continues

6. Communication Management

Stakeholder Engagement: Ensuring regular and clear communication with stakeholders.

Reporting: Sharing progress, risks, and changes through status updates and documentation.

Conflict Resolution: Addressing and resolving issues among team members or stakeholders.

Components of SPM.....continues

7. Configuration Management, Monitoring and Control

Version Control: Managing updates and changes to software components.

Change Management: Handling requests for modifications to the project scope or deliverables.

Performance Metrics: Tracking project performance using KPIs like cost variance and schedule variance.

Progress Tracking: Comparing actual progress with planned progress.

Corrective Actions: Implementing changes to realign the project with goals

Components of SPM.....continues

8. Delivery and Closure

Final Deliverables: Ensuring the software meets the defined requirements.

Documentation: Providing user manuals, technical guides, and lessons learned.

Post-Implementation Review: Evaluating the project's success and identifying areas for improvement.

These components work together to ensure the software project is completed successfully, meeting all specified requirements while adhering to constraints like budget, schedule, and quality standards.

Challenges in Software Project Management

1. Unclear Requirements

Difficulty in defining project scope due to ambiguous or changing client needs.

Impact: Delays, rework, and scope creep.

2.Resource Constraints

Limited availability of skilled personnel, tools, or finances.

Impact: Inability to meet deadlines or quality standards.

3.Rapid Technological Changes

Keeping up with the latest tools, frameworks, or methodologies.

Impact: Obsolescence of project deliverables or increased learning curves.

Challenges in SPM.....continues

4. Communication Issues

Poor communication among stakeholders, especially in distributed teams.

Impact: Misunderstandings, missed deadlines, or incomplete deliverables.

5. Risk Management

Failure to anticipate risks or devise effective mitigation strategies.

Impact: Increased project costs or failure.

6. Time and Budget Overruns

Underestimating project duration or costs due to optimistic assumptions.

Impact: Project delays, reduced profitability, or failure to deliver.

Challenges in SPM.....continues

7. Quality Assurance Challenges

Ensuring that the software meets the required standards amidst tight deadlines.

Impact: Low user satisfaction or increased maintenance costs.

8. Stakeholder Misalignment

Conflicting interests or expectations among clients, team members, and sponsors.

Impact: Delays, additional costs, or dissatisfaction.

9. Scope Creep

Uncontrolled addition of features or changes beyond the original scope.

Impact: Missed deadlines and resource strain.

Opportunities in Software Project Management

1. Adoption of Agile and DevOps Practices

Flexible methodologies improve collaboration, adaptability, and delivery speed.

Opportunity: Enhanced stakeholder satisfaction and project success rates.

2. Advancements in Project Management Tools

Tools like Primavera, Redmine, Jira, Trello, and MS Project streamline planning, tracking, and collaboration.

Opportunity: Increased productivity and efficiency.

3. Global Talent Pool

Access to skilled professionals through remote or distributed teams.

Opportunity: Cost savings and diverse expertise.

Opportunities in SPM.....continues

4. Data-Driven Decision Making

Utilizing analytics to forecast risks, monitor progress, and improve outcomes.

Opportunity: Better resource allocation and risk mitigation.

5. Automation

Automating repetitive tasks like testing, reporting, and deployment.

Opportunity: Time savings and improved accuracy.

6. Cloud Computing

Scalable and flexible infrastructure for software development and deployment.

Opportunity: Reduced infrastructure costs and increased speed.

Opportunities in SPM.....continues

7. Focus on User-Centric Design

Emphasis on creating intuitive, user-friendly interfaces.

Opportunity: Higher user satisfaction and adoption rates.

8. Training and Development

Upskilling team members to adapt to emerging technologies and practices.

Opportunity: Enhanced team performance and innovation.

9. Enhanced Collaboration Tools

Use of communication platforms like Slack, Microsoft Teams, and Zoom.

Opportunity: Seamless collaboration in distributed teams.

Tools and Techniques in Software Project Management (SPM)

1. Project Planning Tools

Gantt Charts: Visual timelines to schedule tasks and milestones (e.g., Microsoft Project, Smartsheet).

Work Breakdown Structure (WBS): Breaking the project into smaller, manageable tasks using tools like Lucidchart or Trello.

PERT and CPM: Techniques to identify critical paths and optimize task durations

Tools and Techniques in SPM.....continues

2. Task and Workflow Management Tools

Scrum Boards: Tracking iterations and sprints in Agile projects

3. Risk Management Techniques

SWOT Analysis: Evaluating strengths, weaknesses, opportunities, and threats.

Risk Matrices: Assessing likelihood and impact using tools like RiskWatch or Excel.

Monte Carlo Simulation: Quantitative risk analysis for complex projects.

Tools and Techniques in SPM.....continues

4. Resource Management Tools

Resource Allocation Tools: Tools like Microsoft Project and Float for assigning team members to tasks.

Time Tracking: Toggl, Clockify, or Harvest for monitoring resource productivity.

Budget Management: Cost estimation and tracking using tools like Primavera or Deltek.

Tools and Techniques in SPM.....continues

5. Quality Assurance (QA) Tools

Testing Tools: Selenium, JUnit, or Postman for automated testing.

Bug Tracking: Tools like Bugzilla, Jira, or MantisBT for defect management.

Code Review Tools: Crucible, GitHub pull requests, or Bitbucket for peer review.

Quality Management Tools: ISO Standards, SEI CMM etc.

Tools and Techniques in SPM.....continues

6. Cost Management Tools

Cost Estimation Techniques: Analogous, parametric, or bottom-up estimation.

Budget Tracking: Tools like FreshBooks or QuickBooks for monitoring expenses.

Earned Value Management (EVM): Tracking performance against budget and schedule.

Managing Human Resources

Stake holders: These are people who have a stake or interest in the project

In general, they could be *users/clients* or *developers/implementers*

They could be:

- Within the project team
- Outside the project team, but within the same organization
- Outside both the project team and the organization

Different stakeholders may have different objectives – need to define common project objectives

Managing Human Resources.....continues
Setting objectives to the Stakeholders

Objectives focus on the desired outcomes of the project rather than tasks within it. They are the *post condition* of the project.

informally, the objective of a project can be defined by completing the statement:

The project will be regarded as a success

if…….

……

Rather like *post-conditions* for the project

Focus on *what* will be put in place, rather than *how* activities will be carried out

Managing Human Resources.....continues
Setting Objectives.....continues

Objectives should be SMART

S – specific, that is, concrete and well-defined

M – measurable, that is, satisfaction of the objective can be objectively judged

A – achievable, that is, it is within the power of the individual or group concerned to meet the target

R – relevant, the objective must relevant to the true purpose of the project

T – time constrained: there is defined point in time by which the objective should be achieved

Managing Human Resources.....continues
Setting Objectives.....continues

- Goals/sub-objectives: These are steps along the way to achieving the objective

Often a goal can be allocated to an individual.

- *Individuals might have the capability of achieving goal on their own, but not the overall objective e.g.*

  Overall objective – user satisfaction with software product

  Analyst goal – accurate requirements

  Developer goal – reliable software

Managing Human Resources.....continues
Assigning Objective and Goals to Individuals

Resource Planning: Identify required roles and skills based on project scope and tasks. Use a Work Breakdown Structure (WBS) to match tasks with team members.

Recruitment and Team Building: Hire or allocate team members with the required technical and soft skills to achieve an objective.

Role Assignment: **Assign clear roles and responsibilities** and Ensure role alignment with individual expertise and interests.

Communication: Schedule regular team meetings to align objectives and address issues.

Resolve conflicts promptly with open communication and mediation techniques.

Maintain morale through recognition, incentives, and career growth opportunities.

Managing Technical Resources

Technical resource management involves ensuring all tools, software, and infrastructure are available, functional, and optimized.

Key Steps:

1. Resource Planning

Identify necessary tools, software, hardware, and infrastructure at the project planning stage.

Estimate costs and prepare a budget for acquiring technical resources.

2. Procurement and Licensing

Acquire software licenses, cloud services, and development tools as required.

3. Infrastructure Setup

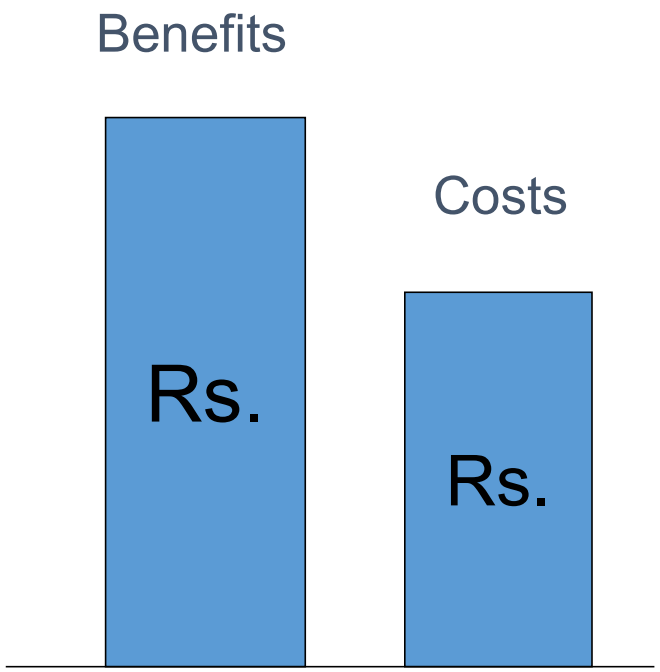
Set up development environments, servers, and cloud platforms.

4. Resource Allocation

Assign tools and systems based on team needs to achieve an objective.

Ensure efficient usage of shared resources (e.g., servers or test environments).

The business case



- Benefits of delivered project must outweigh costs

Costs include:

- Development
- Operation

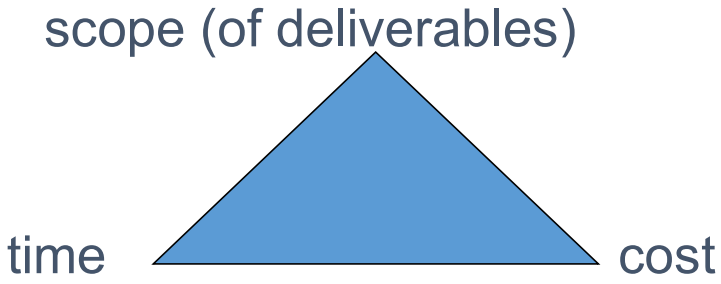
Benefits

Quantifiable

Non-quantifiable

Project success/failure

- Degree to which objectives are met



In general if, for example, project is running out of time, this can be recovered for by reducing scope or increasing costs. Similarly costs and scope can be protected by adjusting other corners of the ‘project triangle’.

Other success criteria

These can relate to longer term, less directly tangible assets

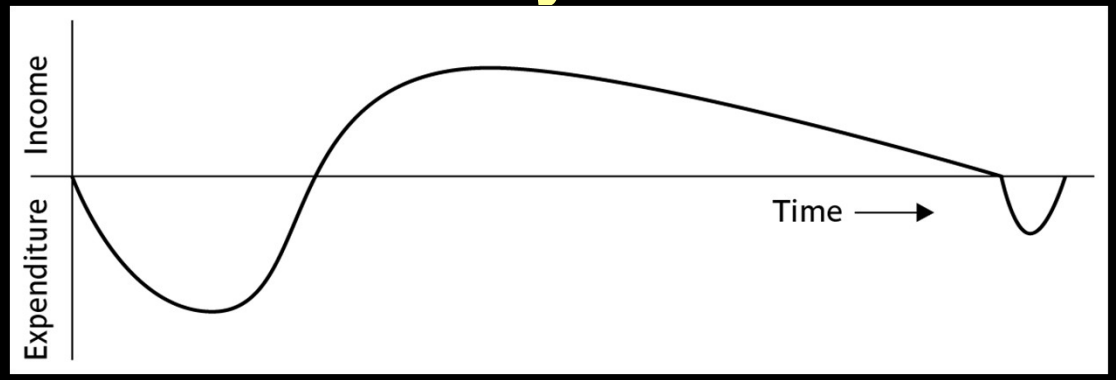
- Improved skill and knowledge
- Creation of assets that can be used on future projects e.g. software libraries
- Improved customer relationships that lead to repeat business

SPM Techniques for Costing and Pricing: Cost benefit analysis (CBA)

This relates to an individual project. You need to:

- Identify all the costs which could be:
  - Development costs
  - Set-up
  - Operational costs
- Identify the value of benefits
- Check benefits are greater than costs

SPM Techniques for Costing and Pricing...contd.
Product life cycle cash flows



- The timing of costs and income for a product of system needs to be estimated.
- The development of the project will incur costs.
- When the system or product is released it will generate income that gradually pays off costs
- Some costs may relate to decommissioning – think of demolishing a nuclear power station.

SPM Techniques for Costing and Pricing...contd. Net profit

Year	Cash-flow
0	-100,000
1	10,000
2	10,000
3	10,000
4	20,000
5	100,000
Net profit	50,000

- 'Year 0' represents all the costs before system is operation
- 'Cash-flow' is value of income less outgoing
- Net profit value of all the cash-flows for the lifetime of the application

SPM Techniques for Costing and Pricing...contd.

TABLE: A

Year	Project 1	Project 2	Project 3	Project 4
0	-100,000	-1,000,000	-100,000	-120,000
1	10,000	200,000	30,000	30,000
2	10,000	200,000	30,000	30,000
3	10,000	200,000	30,000	30,000
4	20,000	200,000	30,000	30,000
5	100,000	300,000	30,000	75,000
Net Profit	50,000	100,000	50,000	75,000

SPM Techniques for Costing and Pricing...contd.

Pay back period

This is the time it takes to start generating a surplus of income over outgoings. What would it be below?

Year	Cash-flow	Accumulated
0	-100,000	-100,000
1	10,000	-90,000
2	10,000	-80,000
3	10,000	-70,000
4	20,000	-50,000
5	100,000	50,000

Exercise:

Consider the four projects' cash flow given in TABLE: A and calculate the payback period for each of them.

Ans.

Project 1 ------- 5yrs

Project 2 ------- 5

Project 3 ------- 4

Project 4 ------- 4

Pay back period….cont

Advantages:

1. Simple to calculate
2. Not sensitive to small forecasting errors

Disadvantages:

1. Ignores the overall profitability
2. Totally ignores any income after breakeven. (project 2 and 4 are better than project 3)

Return on investment (ROI)

$$ROI = \frac{\text{Average annual profit}}{\text{Total investment}} \times 100$$

In the previous example of project 1

- average annual profit
  = 50,000/5
  = 10,000
- ROI = (10,000/100,000) X 100
  = 10%

It provides a way of comparing the net profitability to the investment required..

Exercise:

Calculate the ROI for each of the other projects shown in TABLE: A and decide which, on the basis of criterion, is the most worthwhile.

Ans.

Project 1 ……. 10%

Project 2 ……. 2%

Project 3 ……. 10%

Project 4 ……. 12.5%

Return on investment.... Cont.

- Advantage

  The return on investment provides a simple, easy-to-calculate measure of return on capital.

- Disadvantage

  1. It takes no account of timing of the cash flow.
  2. The rate of return bears no relationship to the interest rates charged by banks.
  3. It is potentially very misleading.

Net present value

Would you rather I gave you Rs. 1,000 today or in 12 months time?

If I gave you Rs. 1,000 now you *could* put it in savings account and get interest on it.

If the interest rate was 10% how much would I have to invest now to get Rs. 1,000 in a year's time?

This figure is the *net present value* of Rs. 1,000 in one year's time

The annual rate by which we discount future earnings is known as *discount rate 10%.*

- The present value of Rs. 1,000 in a year's time is Rs. 910 i.e. Rs. 1000 in a year's time is the equivalent of Rs. 910 now.

- Rs. 1,000 received in two year's time would have a present value of approximately Rs. 830 i.e. Rs. 830 invested at the annual interest rate of 10% would yield approximately Rs. 1,000 in two years time.

For any future cash flow

$$\textit{Present value} = \frac{value\_in\_year\_t}{(1+r)^t}$$

Discount factor

Discount factor = $1/(1+r)^t$

r is the interest rate (e.g. 10% is 0.10)

t is the number of years

In the case of 10% rate and one year

Discount factor = 1/(1+0.10) = 0.9091 ~ 0.91

In the case of 10% rate and two years

Discount factor = 1/(1.10 x 1.10) =0.8294 ~ 0.83

Applying discount factors (10%)

TABLE: C

Year	Cash-flow (Project-1)	Discount factor	Discounted cash flow
0	-100,000	1.0000	-100,000
1	10,000	0.9091	9,091
2	10,000	0.8264	8,264
3	10,000	0.7513	7,513
4	20,000	0.6830	13,660
5	100,000	0.6209	62,090
Net profit	50,000	NPV	618

Exercise:

Assuming 10% discount rate, the NPV for project (TABLE: A) would be calculated as in TABLE: C. The net present value (NPV) for project 1 (TABLE:C), using 10% discount rate, is therefore Rs. 618. Using a 10% discount rate, calculate the NPV for project 2, 3 and 4 and decide which, on the basis of this, is the most beneficial to pursue.

Note: Refer to TABLE: A .

Answer:

Year	Discount factor	Discounted cash flow (Rs.)		
		Project 2	Project 3	Project 4
0	1.00	-1,000,000	-100,000	-120,000
1	0.90	181,820	27,273	27,273
2	0.82	165,280	24,792	24,792
3	0.75	150,260	22,539	22,539
4	0.68	136,600	20,490	20,490
5	0.62	186,270	18,627	46,568
NPV		**-179,770**	**13,721**	**21,662**

Exercise:

Calculate the NPV for each of the projects A, B and C shown in table below using each of the discount rate 8%, 10% and 12%. For each of the discount rate, decide which is the best project. What can you conclude from these results?

Year	Project A (Rs)	Project B (Rs)	Project C (Rs)
0	-8,000	-8,000	-10,000
1	4,000	1,000	2,000
2	4,000	2,000	2,000
3	2,000	4,000	6,000
4	1,000	3,000	2,000
5	800	9,000	2,000
6	500	-6,000	2,000
Net Profit	4,000	5,000	6,000

NPV Discount Factors

TABLE: D

Year	Discount rate (%)		
↓	8%	10%	12%
1	0.9256	0.9091	0.8929
2	0.8573	0.8264	0.7972
3	0.7938	0.7513	0.7118
4	0.7350	0.6830	0.6355
5	0.6808	0.6209	0.5674
6	0.6302	0.5645	0.5066

TABLE: B (Effect on NPV of varying the discount rate)

Year	Cash flow values (Rs.)		
	Project A	Project B	Project C
0	-8,000	-8,000	-10,000
1	4,000	1,000	2,000
2	4,000	2,000	2,000
3	2,000	4,000	6,000
4	1,000	3,000	2,000
5	500	9,000	2,000
6	500	-6,000	2,000
Net profit	4,000	5,000	6,000
NPV @ 8%	2,111	2,365	**2,421**
NPV @ 10%	1,720	**1,818**	1,716
NPV @ 12%	**1,356**	1,308	1,070

Internal rate of return

- Internal rate of return (IRR) is the discount rate that would produce an NPV of 0 for the project
- Can be used to compare different investment opportunities
- There is a Microsoft Excel function which can be used to calculate NPV and IRR

NPV(10%, B3:B5): Calculates the present value of cash flows in Years 1, 2, and 3.
+ B2: Adds the initial investment (negative value).
Discount Rate: 10%
Formula:
excel
=NPV(10%, B3:B5) + B2

=IRR(values, [guess])
values: A range of cells containing the series of cash flows, including the initial investment as a negative value and subsequent returns as positive values.
guess (optional): An initial guess for the IRR (default is 10%)