

Learning Resource

On

Software Project Management

Unit-1: Part-2

Prepared By:

Kunal Anand

Assistant Professor, SCE

KIIT, DU, Bhubaneswar-24

Scholar of Computer Engineering

- Costing and Pricing of projects in SPM
- The Business Case
- Project Evaluation
 - Cost Benefit Analysis
 - Cash Flow Forecasting
- Training and Development
- Project Management Techniques

Costing and Pricing of Projects

- **Costing and pricing** in projects in SPM involve estimating the expenses required to complete a project and determining the appropriate price to charge the client.
- Proper management of these aspects ensures profitability, competitiveness, and successful project execution.
- **Costing** involves calculating all the expenses incurred in delivering the project. These include direct, indirect, fixed, and variable costs.
- **Pricing** is the process of determining how much to charge the client. It includes not only the costs but also profit margins and market considerations.

- **Components of Costing**

- **Direct Costs:** Salaries and wages for developers, testers, designers, and project managers, Software licenses, tools, and hardware, Cloud services or hosting fees.
- **Indirect Costs:** Overhead expenses such as office rent, utilities, and administrative support, Training and team-building activities.
- **Variable Costs:** Costs that change based on project requirements, like third-party integrations or additional infrastructure.
- **Fixed Costs:** Costs that remain constant irrespective of project scope, such as long-term subscriptions.
- **Contingency Costs:** Buffer amount to handle unforeseen circumstances like scope changes or resource unavailability.

- **Pricing Models**

- **Fixed Price Model:** A predetermined price for the entire project.
 - Advantages: Predictability for clients, clear scope.
 - Challenges: Risk of underestimating costs or scope creep.
- **Time and Material (T&M) Model:** Charges based on the time spent and materials used.
 - Advantages: Flexibility for changes in scope.
 - Challenges: Less predictability for clients.
- **Cost-Plus Pricing:** Adding a fixed profit margin to the total cost.
 - Advantages: Guarantees profit.
 - Challenges: May not be competitive.

- **Value-Based Pricing:** Pricing based on the value the software delivers to the client.
 - Advantages: High profit potential if value is significant.
 - Challenges: Requires deep understanding of client needs and outcomes.
- **Subscription Model:** Regular, recurring payments for ongoing access to software or services.
 - Advantages: Steady revenue stream.
 - Challenges: Initial costs may not be covered immediately.
- **Freemium Model:** Offering a basic version for free with premium features at a cost.
 - Advantages: Attracts a large user base initially.
 - Challenges: Conversion to paid users may be low.

- **Factors Influencing Pricing**
 - **Market Competition:** Price competitively based on what competitors are offering.
 - **Client Budget:** Align pricing with the client's budgetary constraints.
 - **Complexity of the Project:** Higher complexity warrants higher prices due to increased effort.
 - **Technology Stack:** Costs vary based on the technology and tools required.
 - **Risk Factors:** High-risk projects may require premium pricing to account for contingencies.

- **A typical business case may include:**
 - Introduction/ background
 - The proposed project and its market
 - Organizational and operational infrastructure
 - The benefits
 - Outline implementation plan
 - Costs
 - Financial analysis
 - Risks
 - Management plan

Content of the Business case

- **Introduction/background** describes a problem to be solved or an opportunity to be exploited.
- **The proposed project:**
 - A brief outline of the project scope.
 - **The market:** The likely demand for the product would need to be assessed.
- **Organizational and operational infrastructure:**
 - How the organization would need to change.
 - This would be important where a new information system application was being introduced.

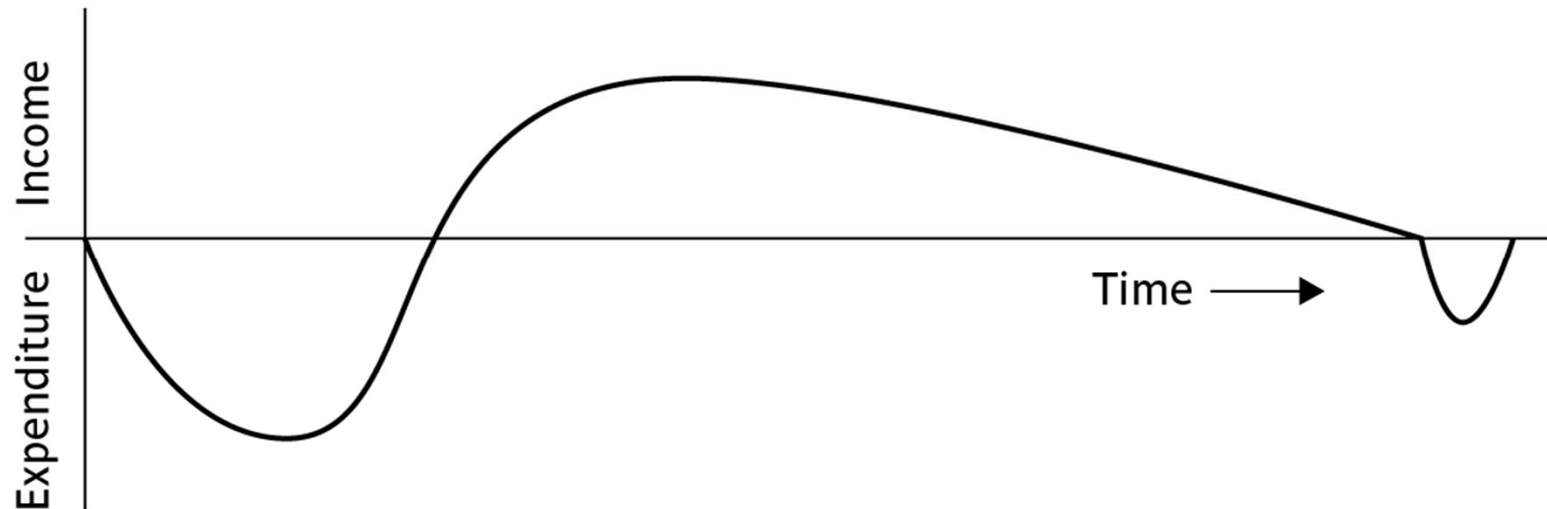
Content of the business case (cont'd)

- **Benefits** These should be express in financial terms where possible. In the end it is up to the client to assess these – as they are going to pay for the project.
- **Outline implementation plan:** how the project is going to be implemented. This should consider the disruption to an organization that a project might cause.
- **Costs:** the implementation plan will supply information to establish these.
- **Financial analysis:** combines costs and benefit data to establish value of project

Project Evaluation: 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
 - if yes then the project is evaluated as a profitable one
else it will tagged as a loss making project.

Product life cycle cash flows



- The timing of costs and income for a product or 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.

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 operational.
- **'Cash-flow'** is value of income less outgoing
- **Net profit value** of all the cash-flows for the lifetime of the application.
- **Net profit = Income - Investment**

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

Pay Back period

Pay Back period the time the project 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

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

Ans:

Project 1 ----- 5yrs;

Project 3 ----- 4yrs.

Project 2 ----- 5yrs;

Project 4 ----- 4yrs.

- **Advantages:**

- Simple to calculate
- Not sensitive to small forecasting errors

- **Disadvantages:**

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

Return on Investment (ROI)

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

In the previous example of **project 1**

- average annual profit
= $50,000/5$
= 10,000
- ROI = $(10,000/100,000) \times 100$
= 10%
- It provides a way of comparing the net profitability to the investment required.

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

Ans.

Project 1 10%;

Project 3 10%

Project 2 2%;

Project 412.5%

- **Advantage**

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

- **Disadvantage**

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

Net Present Value

- Would you rather take if I give 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
Present value =
$$\frac{\text{value_in_year_}t}{(1+r)^t}$$

- **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 1 year**
 - Discount factor = $1/(1+0.10) = 0.9091 \sim 0.91$
- In the case of **10% rate and 2 years**
 - Discount factor = $1/(1.10 \times 1.10) = 0.8294 \sim 0.83$

Applying discount factors (10%)

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-1

- 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, based on this, is the most beneficial to pursue.

Note: Refer to TABLE: A (slide no. 14)

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-2

- Calculate the NPV for each of the project's 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

Answer:

NPV Discount Factors


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 net present value.

Dealing with uncertainty: Risk evaluation

- Project A might appear to give a **better return** than B but could be **riskier**
- For riskier projects could use higher discount rates

Cost-Benefit Analysis: BuyRight's income forecast

Sales	Annual sales income (Rs.) <i>i</i>	Probability <i>p</i>	Expected value (Rs.) <i>i X p</i>
High	800,000	0.1	80,000
Medium	650,000	0.6	390,000
Low	100,000	0.3	30,000
Expected income			500,000

- Development costs are estimated = Rs. 750,000
- Sales levels are expected to be constant for 4 years
- Annual marketing and product maintenance cost = Rs. 200,000
- **Would you advise going ahead with the project???**

BuyRight's income forecast: Solution

- Expected sales per year = Rs. 500,000
- Annual costs per year = Rs. 200,000
- Expected net income / year = Rs. 300,000
- -do- for 4 years = $300,000 \times 4 = 1,200,000$
- Investment (development cost) = Rs. 750,000
- **Expected profit = Rs. 450,000**

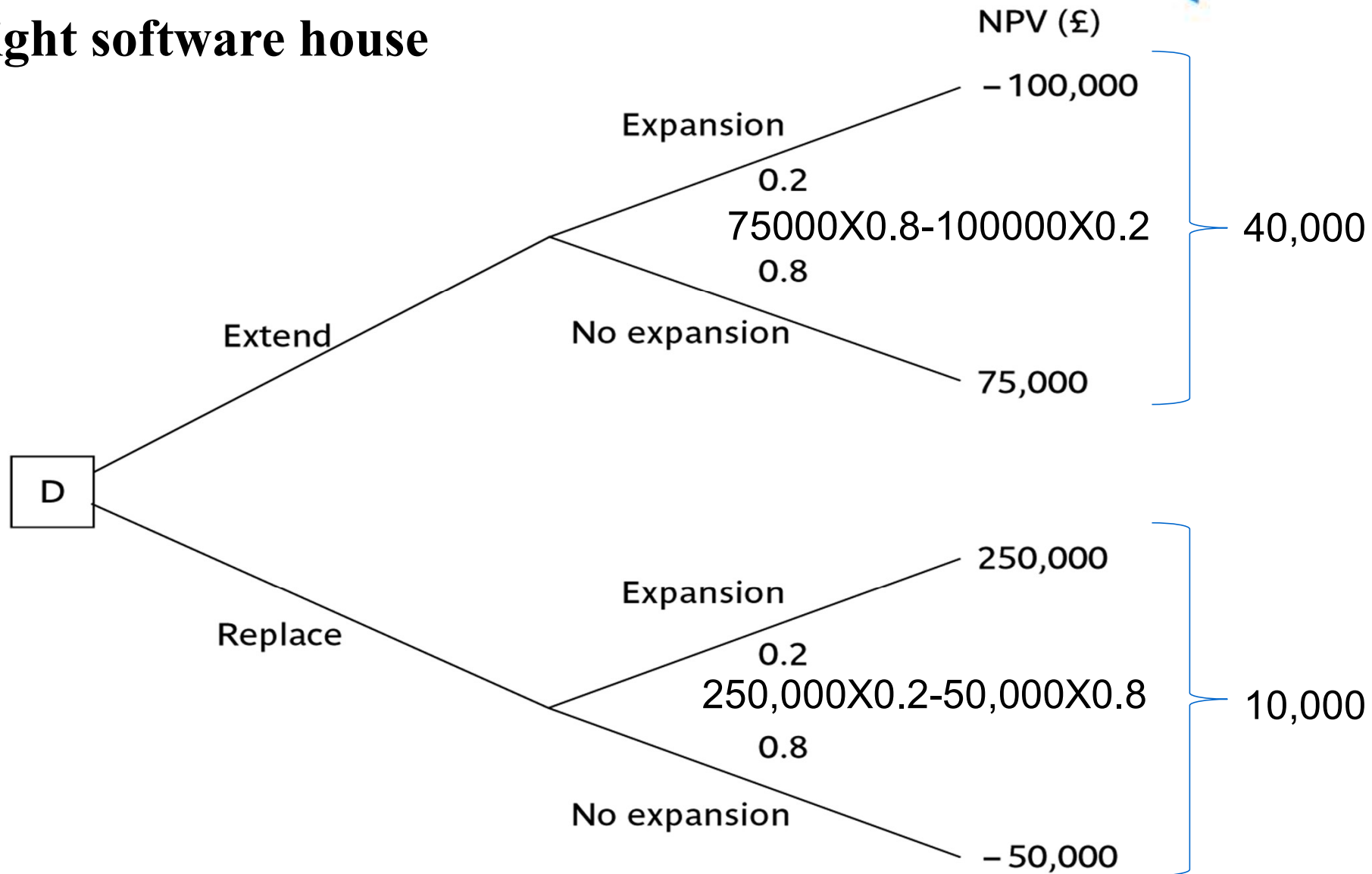
Risk involved:

- If sales will drop what happens to the benefits and costs?
- Then go for, Risk profile analysis – sensitivity analysis
- **How will a decision affect future profitability of the project?**

Decision Tree: Sample Case Study

- Suppose **Amanda** is responsible for **extending the invoicing system**. An alternative would be to **replace** the whole of the system. The decision is influenced by the likelihood of IOE expanding their market. There is a strong rumor that **they could benefit from their main competitor going out of business**: in this case they could pick up a **huge amount of new business**, but the **invoicing system could not cope**. However, **replacing the system** immediately would mean other **important projects** would have to be **delayed**.
- The **NPV of extending the invoicing system** is assessed as **75,000 INR** if there is **no sudden expansion**. If there were a **sudden expansion**, then there would be a **loss of 100,000 INR**.
- If the **whole system** were **replaced** and there was a **large expansion** there would be a **NPV of 250,000 INR** due to the benefits of being able to handle increased sales. If sales did not increase, then the **NPV would be -50,000 INR**.

BuyRight software house



- The decision tree shows these possible outcomes and shows the estimated probability of each outcome.
- The **value of each outcome** is the **NPV multiplied by the probability of its occurring**.
- The **value of a path** that springs from a particular decision is the **sum of the values** of the possible outcomes from that decision.
- If it is decided to **extend the system**, the sum of the values of the outcomes is **40,000 INR** ($75,000 \times 0.8 - 100,000 \times 0.2$) while for replacement it would be **10,000 INR** ($250,000 \times 0.2 - 50,000 \times 0.80$).
- **Final Decision:** Extending the system therefore seems to be the **best bet** (but it is still a bet!).

Training and Development in SPM

- Training and development are essential components of software project management.
- They ensure that team members are equipped with the necessary skills, knowledge, and tools to successfully complete projects and adapt to evolving technologies.
- **Importance of Training and Development**
 - Skill enhancement
 - Project efficiency
 - Adaptability
 - Innovation
 - Employee satisfaction

- **Types of Training in SPM**
 - **Technical Training:** Enhancing technical skills such as programming, database management, cloud computing, and software testing.
 - **Examples:** Training on specific tools like Git, Docker, Kubernetes; Learning programming languages such as Python, Java, or JavaScript.
 - **Methodology Training:** Familiarizing the team with software development methodologies.
 - **Examples:** Agile, Scrum, Kanban; Waterfall or hybrid models.

- **Project Management Training:** Equipping managers with leadership and organizational skills.
 - **Examples:** Courses on PMI, PRINCE2, or PMBOK; Training on project management tools like Jira or Microsoft Project.
- **Soft Skills Training:** Developing interpersonal skills for effective teamwork and communication.
 - **Examples:** Leadership, conflict resolution, and time management workshops.
- **Domain-Specific Training:** Understanding the industry or business domain relevant to the project.
 - **Examples:** Healthcare software compliance; Financial technology regulations.

- **Quality Assurance Training:** Improving testing, debugging, and quality control skills.
 - **Examples:** Selenium or Postman for automated testing; Test-driven development (TDD) practices.
- **Security Training:** Enhancing knowledge of cybersecurity principles.
 - **Examples:** Secure coding practices; Compliance with GDPR or ISO standards.
- **Continuous Learning:** Encouraging ongoing skill development.
 - **Examples:** Online courses (Coursera, Udemy, Pluralsight); Certifications (AWS Certified Developer, Microsoft Azure Fundamentals).

Methods of Training and Development

- **Workshops and Seminars:** Short-term, intensive training sessions on specific topics.
- **On-the-Job Training:** Learning while working on real project tasks.
- **Mentorship Programs:** Pairing less experienced team members with senior staff for guidance.
- **Online Learning Platforms:** Flexible and accessible learning through e-learning tools.
- **Bootcamps:** Intensive training programs focused on specific skills or technologies.
- **Conferences and Hackathons:** Opportunities to learn from industry experts and peers.
- **Self-Paced Learning:** Access to resources like documentation, tutorials, and practice exercises.
- **Simulations and Case Studies:** Using real-world scenarios to apply and practice skills.

Challenges in Training and Development

- **Time Constraints:** Balancing training schedules with project deadlines.
- **Budget Limitations:** Allocating funds for high-quality training programs.
- **Employee Resistance:** Some team members may be hesitant to adopt new skills or methods.
- **Rapid Technological Changes:** Keeping training content updated with evolving industry trends.
- **Assessing Effectiveness:** Measuring the impact of training on project outcomes and employee performance.

Outcomes of Effective Training and Development

- Enhanced productivity and efficiency in project execution.
- Reduced risks associated with skill gaps and errors.
- Higher employee engagement and retention.
- Competitive advantage through advanced technical expertise.
- Improved project quality and client satisfaction.

Project Management Techniques

- Effective project management techniques in software projects help in planning, executing, and monitoring work to ensure that the project is completed on time, within budget, and with high quality.
- Below are the widely used project management techniques tailored for software projects.
 - **Traditional SDLC models** like Waterfall model, Spiral model, Prototyping model, RAD model
 - **Agile methodologies** like Scrum Framework, Kanban, Lean Development, Extreme Programming (XP), Feature driven development (FDD)
 - **Monitoring and Review techniques** like CPM, PERT
 - **Modern management techniques** like DevOps, Hybrid methodology using Agile and waterfall, Six Sigma

Best Practices for Implementing Techniques

- **Understand Project Needs:**
 - Align the technique with the project's complexity, size, and requirements.
- **Involve Stakeholders:**
 - Collaborate with all stakeholders to select the appropriate methodology.
- **Adapt Flexibly:**
 - Be prepared to tweak methods based on project progress and feedback.
- **Leverage Tools:**
 - Use project management tools like Jira, Trello, or Asana to support implementation.
- **Monitor Progress:**
 - Regularly track and review project performance to ensure alignment with goals.