Unit 2

Strategic Assessment – Technical Assessment – Cost Benefit Analysis

Before starting a software project, organizations evaluate it from different perspectives to ensure it is **feasible, beneficial, and aligned with business goals**. Three major evaluation approaches are:

- Strategic Assessment
- Technical Assessment
- Cost–Benefit Analysis

1. Strategic Assessment

Definition

Strategic Assessment evaluates whether the proposed software project aligns with the **long-term goals and business strategy** of the organization.

Key Aspects of Strategic Assessment

1. Alignment with Business Objectives

- Does the project support organizational mission and vision?
- Does it improve competitive advantage?

2. Market Position

- Will the project increase market share?
- Does it respond to customer needs or competition?

3. Risk and Opportunity Analysis

- What strategic risks are involved?
- Does it open new business opportunities?

4. Regulatory & Policy Considerations

- Is the project compliant with legal and industry standards?

Importance

- Prevents investment in non-strategic projects
- Ensures better resource utilization
- Supports long-term organizational growth

Example

Developing an AI-based analytics system may be strategically important for a data-driven company but not for a traditional manufacturing firm.

2. Technical Assessment

Definition

Technical Assessment determines whether the organization has the **technical capability and resources** to successfully implement the project.

Key Components of Technical Assessment

1. Technology Feasibility

- Is required technology available?
- Is it proven or experimental?

2. Infrastructure Availability

- Hardware requirements
- Software tools
- Network and security systems

3. Skills and Expertise

- Does the team have required knowledge?
- Need for training or external consultants?

4. Integration Issues

- Can the system integrate with existing systems?

5. Technical Risks

- Complexity level
- Scalability concerns
- Performance constraints

Importance

- Reduces technical failures
- Helps in selecting appropriate methodology
- Identifies training or hiring needs

Example

If a company plans a blockchain-based system but lacks blockchain expertise, the technical assessment may show high risk.

3. Cost–Benefit Analysis (CBA)

Definition

Cost–Benefit Analysis evaluates whether the **financial benefits of the project outweigh its costs**.

Types of Costs

1. Development Costs

- Hardware and software
- Salaries
- Training

2. Operational Costs

- Maintenance
- Support
- Licensing

3. Indirect Costs

- Downtime during implementation
- Opportunity cost

Types of Benefits

1. Tangible Benefits

- Increased revenue
- Reduced operational cost
- Time savings

2. Intangible Benefits

- Improved customer satisfaction
- Better brand image
- Employee productivity

Financial Evaluation Techniques

1. Payback Period

Time taken to recover initial investment

2. Net Present Value (NPV)

Present value of benefits minus present value of costs

3. Return on Investment (ROI)

ROI=Net BenefitTotal Cost×100

ROI = \frac{Net\ Benefit}{Total\ Cost} \times 100

ROI=Total CostNet Benefit×100

Importance

- Supports investment decision-making
- Ensures profitability
- Helps prioritize projects

Comparison Summary

Aspect	Strategic Assessment	Technical Assessment	Cost–Benefit Analysis
Focus	Business alignment	Technical feasibility	Financial viability
Key Question	Should we do it?	Can we do it?	Is it worth doing?
Concern	Long-term strategy	Technology & skills	Cost vs Benefits

Numerical Example for Cost–Benefit Analysis (CBA)

A company plans to develop a software system.

Initial Development Cost:

₹ 5,00,000

Annual Maintenance Cost:

₹ 50,000 per year

Expected Annual Benefits (Savings + Revenue):

₹ 2,00,000 per year

Project Life:

5 years

Step 1: Calculate Total Cost

Development Cost:

₹ 5,00,000

Maintenance Cost (5 years):

₹ 50,000 × 5 = ₹ 2,50,000

Total Cost:

5,00,000+2,50,000=7,50,0005,00,000 + 2,50,000 = 7,50,0005,00,000+2,50,000=7,50,000

Step 2: Calculate Total Benefit

Annual Benefit:

₹ 2,00,000

For 5 years:

2,00,000×5=10,00,0002,00,000 × 5 = 10,00,0002,00,000×5=10,00,000

Step 3: Calculate Net Benefit

Net Benefit=Total Benefit−Total Cost Net\ Benefit = Total\ Benefit - Total\ CostNet Benefit=Total Benefit−Total Cost =10,00,000−7,50,000= 10,00,000 - 7,50,000=10,00,000−7,50,000 =2,50,000= 2,50,000=2,50,000

Step 4: Calculate ROI (Return on Investment)

ROI=Net BenefitTotal Cost×100ROI = \frac{Net\ Benefit}{Total\ Cost} × 100ROI=Total CostNet Benefit×100 ROI=2,50,0007,50,000×100ROI = \frac{2,50,000}{7,50,000} × 100ROI=7,50,0002,50,000×100 ROI=33.33%ROI = 33.33\%ROI=33.33%

Step 5: Payback Period

Initial Investment = ₹ 5,00,000

Annual Benefit = ₹ 2,00,000

Payback Period=5,00,0002,00,000Payback\ Period = \frac{5,00,000}{2,00,000}Payback Period=2,00,0005,00,000 =2.5 years= 2.5\ years=2.5 years

Final Conclusion

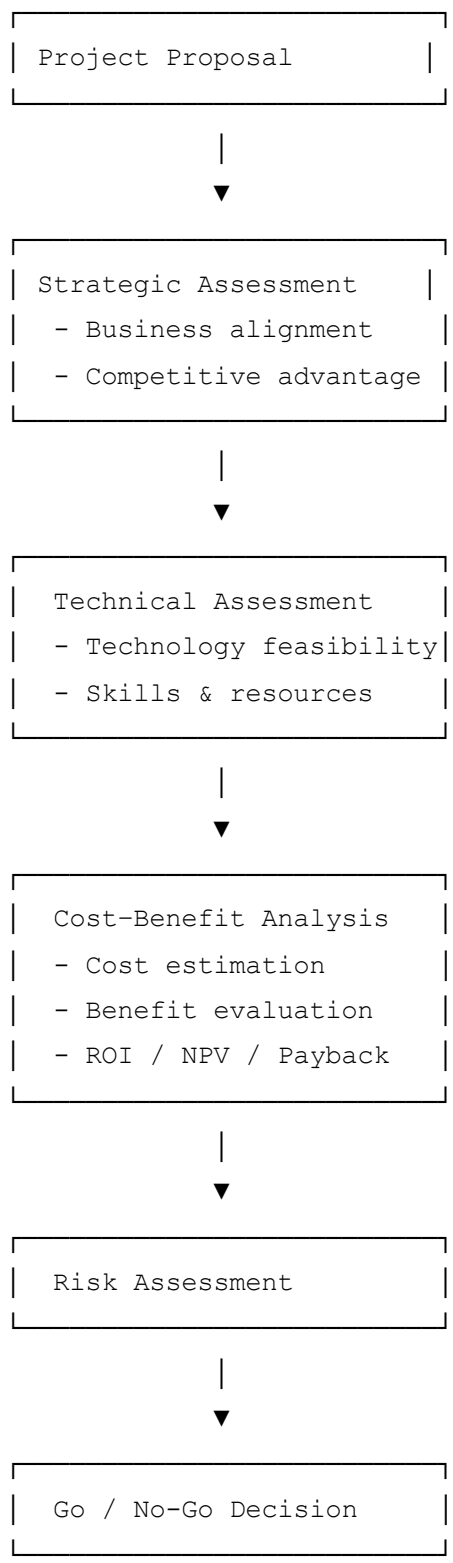
Since the project has:

- Positive Net Benefit (₹ 2,50,000)
- ROI of 33.33%
- Payback period of 2.5 years

The project is economically feasible and can be accepted.

Flow Diagram for Project Evaluation

You can draw this in exams as a flowchart with boxes and arrows.



Numerical Example for Cost–Benefit Analysis (CBA)

Problem

A company plans to develop a Payroll Management System.

Estimated Data:

- Initial Development Cost = ₹ 8,00,000
- Annual Operating & Maintenance Cost = ₹ 1,00,000
- Expected Annual Benefits (cost savings + efficiency gains) = ₹ 3,50,000
- Project Life = 5 years
- Discount Rate = 10%

Evaluate the project using:

1. Net Benefit
2. ROI
3. Payback Period
4. Net Present Value (NPV)

Step 1: Calculate Total Cost

Development Cost:

₹ 8,00,000

Maintenance Cost (5 years):

1,00,000×5=5,00,0001,00,000 × 5 = 5,00,0001,00,000×5=5,00,000

Total Cost:

8,00,000+5,00,000=13,00,0008,00,000 + 5,00,000 = 13,00,0008,00,000+5,00,000=13,00,000

Step 2: Calculate Total Benefit

Annual Benefit:

₹ 3,50,000

For 5 years:

3,50,000×5=17,50,0003,50,000 × 5 = 17,50,0003,50,000×5=17,50,000

Step 3: Net Benefit

Net Benefit=Total Benefit−Total CostNet\ Benefit = Total\ Benefit - Total\ CostNet Benefit=Total Benefit−Total Cost =17,50,000−13,00,000= 17,50,000 - 13,00,000=17,50,000−13,00,000 =4,50,000= 4,50,000=4,50,000

Step 4: Return on Investment (ROI)

ROI=Net BenefitTotal Cost×100ROI = \frac{Net\ Benefit}{Total\ Cost} × 100ROI=Total CostNet Benefit×100 ROI=4,50,00013,00,000×100ROI = \frac{4,50,000}{13,00,000} × 100ROI=13,00,0004,50,000×100 ROI≈34.61%ROI ≈ 34.61\%ROI≈34.61%

Step 5: Payback Period

Initial Investment = ₹ 8,00,000

Annual Net Cash Inflow = ₹ 3,50,000 − ₹ 1,00,000

= ₹ 2,50,000

Payback Period=8,00,0002,50,000Payback\ Period = \frac{8,00,000}{2,50,000}Payback Period=2,50,0008,00,000 =3.2 years= 3.2\ years=3.2 years

Step 6: Net Present Value (NPV)

Formula:

NPV=∑Cash Inflow(1+r)t−Initial InvestmentNPV = \sum \frac{Cash\ Inflow}{(1+r)^t} - Initial\ InvestmentNPV=∑(1+r)tCash Inflow−Initial Investment

Where:

- r = 10% (0.10)
- t = year

Year-wise Present Value Calculation

Year	Net Cash Inflow (₹)	PV Factor (10%)	Present Value (₹)
1	2,50,000	0.909	2,27,250
2	2,50,000	0.826	2,06,500
3	2,50,000	0.751	1,87,750
4	2,50,000	0.683	1,70,750
5	2,50,000	0.621	1,55,250

Total Present Value of Benefits:

=9,47,500= 9,47,500=9,47,500

NPV:

NPV=9,47,500−8,00,000NPV = 9,47,500 - 8,00,000NPV=9,47,500−8,00,000

NPV=1,47,500NPV = 1,47,500NPV=1,47,500

- Net Benefit = ₹ 4,50,000
- ROI = 34.61%
- Payback Period = 3.2 years
- NPV = ₹ 1,47,500 (Positive)

Since the NPV is positive, ROI is high, and payback period is reasonable, the project is financially feasible and can be accepted.

Cash Flow Forecasting and Cost–Benefit Evaluation Techniques

1. Cash Flow Forecasting

Definition

Cash Flow Forecasting is the process of estimating the **flow of cash into and out of a project over time**. It helps project managers understand the **financial feasibility and liquidity** of a software project.

Components of Cash Flow

1. Cash Inflows (Benefits)

These are the financial gains from the project:

- Revenue generated from software
- Cost savings due to automation
- Increased productivity
- Reduced operational expenses

2. Cash Outflows (Costs)

These are expenses incurred in the project:

- Development cost
- Hardware and software cost
- Employee salaries
- Maintenance and operational costs

Example Cash Flow Table

Year	Cash Inflow (₹)	Cash Outflow (₹)	Net Cash Flow (₹)
0	0	5,00,000	-5,00,000
1	2,00,000	50,000	1,50,000
2	2,00,000	50,000	1,50,000
3	2,00,000	50,000	1,50,000

Importance of Cash Flow Forecasting

- Helps in financial planning
- Identifies funding requirements
- Supports investment decisions
- Helps evaluate project feasibility

Cost–Benefit Evaluation Techniques

These techniques help determine whether a software project is **financially worthwhile**.

2. Net Profit

Definition

Net Profit is the difference between **total benefits and total costs**.

Formula

Net Profit=Total Benefits−Total CostsNet\ Profit = Total\ Benefits - Total\ CostsNet Profit=Total Benefits−Total Costs

Example

Total Benefits = ₹ 10,00,000

Total Costs = ₹ 7,00,000

Net Profit=10,00,000−7,00,000=₹3,00,000Net\ Profit = 10,00,000 - 7,00,000 = ₹ 3,00,000Net Profit=10,00,000−7,00,000=₹3,00,000

Decision Rule

- Positive → Accept project
- Negative → Reject project

3. Payback Period

Definition

Payback Period is the time required to **recover the initial investment** from the project's net cash inflows.

Formula

Payback Period=Initial InvestmentAnnual Net Cash InflowPayback\ Period = \frac{Initial\ Investment}{Annual\ Net\ Cash\ Inflow}Payback Period=Annual Net Cash InflowInitial Investment

Example

Initial Investment = ₹ 6,00,000

Annual Cash Inflow = ₹ 2,00,000

Payback Period=6,00,0002,00,000

Payback\ Period = \frac{6,00,000}{2,00,000}

Payback Period=2,00,0006,00,000 =3 years= 3\ years=3 years

Advantages

- Simple to calculate
- Useful for risk assessment

4. Return on Investment (ROI)

Definition

ROI measures the **profitability of the project** as a percentage of the investment.

Formula

ROI=Net ProfitTotal Cost×100ROI = \frac{Net\ Profit}{Total\ Cost} × 100ROI=Total CostNet Profit×100

Example

Net Profit = ₹ 2,00,000

Total Cost = ₹ 8,00,000

ROI=2,00,0008,00,000×100

ROI = \frac{2,00,000}{8,00,000} × 100

ROI=8,00,0002,00,000×100 ROI=25%

ROI = 25\%ROI=25%

Interpretation

Higher ROI indicates better project profitability.

5. Net Present Value (NPV)

Definition

NPV calculates the **present value of future cash flows** by considering the time value of money.

Money received in the future is worth less than money received today.

Formula

NPV=∑Cash Inflow(1+r)t−Initial Investment

NPV = \sum \frac{Cash\ Inflow}{(1+r)^t} - Initial\ Investment

NPV=∑(1+r)tCash Inflow−Initial Investment

Where:

r = Discount rate

t = Time period

Decision Rule

- NPV > 0 → Accept project
- NPV < 0 → Reject project

Advantages

- Most reliable evaluation technique
- Considers time value of money
- Accurate financial analysis

6. Internal Rate of Return (IRR)

Definition

IRR is the **discount rate at which NPV becomes zero**.

It represents the **actual rate of return** of the project.

Decision Rule

- IRR > Required rate → Accept project
- IRR < Required rate → Reject project

Example

If required return = 10%

Project IRR = 15%

Since IRR > Required return → Accept project

Importance

- Helps compare multiple projects
- Measures true profitability

Comparison of Techniques

Technique	Purpose	Decision Criteria
Net Profit	Total gain	Positive profit
Payback Period	Investment recovery time	Shorter is better
ROI	Profitability percentage	Higher is better
NPV	Present value of profit	Positive value

Technique	Purpose	Decision Criteria
IRR	Rate of return	Higher than required rate

Problem 1: Net Present Value (NPV)

Question

A software company plans to invest ₹ 10,00,000 in a new ERP system.

Expected net cash inflows:

Year	Cash Inflow (₹)
1	3,00,000
2	4,00,000
3	4,00,000
4	3,00,000

Discount rate = 10%

Calculate NPV and state whether the project should be accepted.

Step 1: Formula

NPV=∑Cash Inflow(1+r)t−Initial Investment

NPV = \sum \frac{Cash\ Inflow}{(1+r)^t} - Initial\ Investment

NPV=∑(1+r)tCash Inflow−Initial Investment

Where:

r = 10% = 0.10

t = Year

Step 2: Present Value Factors (10%)

Year	PV Factor (10%)
1	0.909
2	0.826
3	0.751
4	0.683

Step 3: Calculate Present Value of Each Year

Year	Cash Inflow	PV Factor	Present Value
1	3,00,000	0.909	2,72,700
2	4,00,000	0.826	3,30,400

Year	Cash Inflow	PV Factor	Present Value
3	4,00,000	0.751	3,00,400
4	3,00,000	0.683	2,04,900

Step 4: Total Present Value

Total PV=2,72,700+3,30,400+3,00,400+2,04,900

Total\ PV = 2,72,700 + 3,30,400 + 3,00,400 2,04,900

Total PV=2,72,700+3,30,400+3,00,400+2,04,900

Total PV=11,08,400Total\ PV = 11,08,400

Total PV=11,08,400

Step 5: Calculate NPV

NPV=11,08,400−10,00,000NPV = 11,08,400 - 10,00,000NPV=11,08,400−10,00,000

NPV=1,08,400NPV = 1,08,400NPV=1,08,400

Since NPV is positive (₹ 1,08,400), the project is financially feasible and should be accepted.

Problem 2: Internal Rate of Return (IRR)

Question

Initial Investment = ₹ 5,00,000

Annual Cash Inflow = ₹ 1,50,000

Project Life = 5 years

Calculate IRR using trial-and-error method.

Step 1: IRR Concept

IRR is the rate at which:

NPV=0NPV = 0NPV=0

Step 2: Use Present Value of Annuity Formula

Investment=Annual Cash Inflow×PVA

F(r,n)Investment = Annual\ Cash\ Inflow ×

PVAF(r,n)Investment=Annual Cash Inflow×PVAF(r,n)

5,00,000=1,50,000×PVAF(r,5)5,00,000 = 1,50,000 × PVAF(r,

5)5,00,000=1,50,000×PVAF(r,5) PVAF=5,00,0001,50,000PVAF =

\frac{5,00,000}{1,50,000}PVAF=1,50,0005,00,000 PVAF=3.33PVAF = 3.33PVAF=3.33

Step 3: Check PVAF Table (5 Years)

Rate	PVAF (5 years)
12%	3.605

Rate	PVAF (5 years)
15%	3.352
16%	3.274

We need 3.33

It lies between 15% and 16%

Step 4: Interpolation (Approximation)

IRR≈15%+(3.352−3.33)(3.352−3.274)×1%IRR ≈ 15\% + \frac{(3.352 - 3.33)}{(3.352 - 3.274)} × 1\%IRR≈15%+(3.352−3.274)(3.352−3.33)×1% =15+0.0220.078= 15 + \frac{0.022}{0.078}=15+0.0780.022 =15+0.28= 15 + 0.28=15+0.28 IRR≈15.3%IRR ≈ 15.3\%IRR≈15.3%

Conclusion

IRR ≈ 15.3%

If required rate of return is 10%, since IRR > 10%, the project should be accepted.

Risk Evaluation

Introduction

Risk evaluation is the process of **assessing identified risks to determine their significance and priority**. After identifying risks, the project manager must evaluate:

- How likely the risk is to occur
- What impact it will have
- Whether it is worth taking preventive action

Risk evaluation helps in making **informed decisions** about risk mitigation and resource allocation.

1. Risk Identification and Ranking

Risk Identification

Risk identification involves systematically identifying potential events that could negatively affect the project.

Common Sources of Risk:

- Technical risks (new or untested technology)
- Schedule risks (tight deadlines)
- Cost risks (budget overrun)
- Resource risks (lack of skilled staff)
- Organizational risks (management changes)

Techniques for Identification:

- Brainstorming
- Checklists
- Past project analysis
- Expert judgment

Risk Ranking (Risk Prioritization)

Once risks are identified, they are ranked based on:

1. Probability of Occurrence

Likelihood that the risk will happen.

2. Impact (Severity)

Degree of damage if the risk occurs.

Risk Exposure

Risk Exposure (RE) is calculated as:

Risk Exposure=Probability×ImpactRisk\ Exposure = Probability ×

ImpactRisk Exposure=Probability×Impact

Example:

Probability = 0.4

Impact = ₹ 1,00,000

RE=0.4×1,00,000=₹40,000RE = 0.4 × 1,00,000 = ₹ 40,000RE=0.4×1,00,000=₹40,000

Higher Risk Exposure → Higher Priority

Importance of Ranking

- Focuses attention on critical risks
- Efficient allocation of resources
- Avoids over-managing minor risks

2. Cost–Benefit Analysis in Risk Evaluation

After ranking risks, the project manager must decide:

Concept

Compare:

- Cost of Risk Mitigation

  vs

- Expected Loss from Risk

Example

Risk Exposure = ₹ 40,000

Cost of prevention = ₹ 20,000

Since:

20,000<40,00020,000 < 40,00020,000<40,000

Mitigation is economically justified.

Decision Rule

If:

Cost of Control<Expected LossCost\ of\ Control < Expected\ LossCost of Control<Expected Loss

→ Implement risk mitigation.

Otherwise:

→ Accept risk.

Importance

- Avoids unnecessary spending
- Ensures rational decision-making
- Supports quantitative risk management

3. Risk Profile Analysis

Definition

Risk Profile Analysis involves examining the **pattern and distribution of risks across the project lifecycle**.

It helps to understand:

- When risks are highest
- Which phases are most vulnerable

Key Features

- Early stages → High uncertainty
- Development phase → Technical risks
- Testing phase → Quality risks
- Deployment → Operational risks

Risk Profile Graph

Typically shows:

- X-axis → Project timeline
- Y-axis → Level of risk

Risk usually:

- High at the beginning

- Reduces as project progresses
- May increase during integration/testing

Importance

- Helps in planning monitoring efforts
- Improves timing of mitigation strategies
- Provides visual understanding of risk trends

4. Using Decision Trees

Definition

A Decision Tree is a graphical tool used to analyze decisions involving uncertainty and risk.

It helps evaluate:

- Alternative courses of action
- Probable outcomes
- Expected monetary value (EMV)

Structure of Decision Tree

1. Decision Node (□)
2. Chance Node (○)
3. Branches (Possible outcomes)
4. Payoffs (Financial outcomes)

Expected Monetary Value (EMV)

EMV=Probability×OutcomeEMV = Probability × OutcomeEMV=Probability×Outcome

Example

Option A:

- Success (0.6 probability) → ₹ 1,00,000
- Failure (0.4 probability) → -₹ 30,000

EMV=(0.6×1,00,000)+(0.4×−30,000)EMV = (0.6 × 1,00,000) + (0.4 × -30,000)EMV=(0.6×1,00,000)+(0.4×−30,000) =60,000−12,000= 60,000 - 12,000=60,000−12,000 =₹48,000= ₹ 48,000=₹48,000

Choose the option with highest EMV.

Advantages of Decision Trees

- Structured evaluation of alternatives
- Supports quantitative decision-making
- Visual representation of risk

Summary Table

Technique	Purpose	Key Concept
Risk Identification & Ranking	Prioritize risks	Probability × Impact
Cost–Benefit Analysis	Justify mitigation	Compare cost vs expected loss
Risk Profile Analysis	Study risk over time	Risk variation across phases
Decision Trees	Evaluate alternatives	Expected Monetary Value

Part 1: Numerical Problems on Decision Trees

Problem 1: Choosing Between Two Development Strategies

A company must choose between:

Option A: Develop In-house

- Success probability = 0.7 → Profit = ₹ 5,00,000
- Failure probability = 0.3 → Loss = ₹ 2,00,000

Option B: Outsource

- Success probability = 0.8 → Profit = ₹ 4,00,000
- Failure probability = 0.2 → Loss = ₹ 1,00,000

Which option should be selected using EMV?

Step 1: EMV Formula

EMV=(Probability of Success×Profit)+(Probability of Failure×Loss)EMV = (Probability\ of\ Success × Profit) + (Probability\ of\ Failure × Loss)EMV=(Probability of Success×Profit)+(Probability of Failure×Loss)

Step 2: Calculate EMV

Option A:

EMV(A)=(0.7×5,00,000)+(0.3×−2,00,000)EMV(A) = (0.7 × 5,00,000) + (0.3 × -2,00,000)EMV(A)=(0.7×5,00,000)+(0.3×−2,00,000) =3,50,000−60,000= 3,50,000 - 60,000=3,50,000−60,000 =₹2,90,000= ₹ 2,90,000=₹2,90,000

Option B:

EMV(B)=(0.8×4,00,000)+(0.2×−1,00,000)EMV(B) = (0.8 × 4,00,000) + (0.2 × -1,00,000)EMV(B)=(0.8×4,00,000)+(0.2×−1,00,000) =3,20,000−20,000= 3,20,000 - 20,000=3,20,000−20,000 =₹3,00,000= ₹ 3,00,000=₹3,00,000

Step 3: Decision

Since:

EMV(B)>EMV(A)EMV(B) > EMV(A)EMV(B)>EMV(A)

₹ 3,00,000 > ₹ 2,90,000

Problem 2: Decision with Research Option

A company can:

1. Start development immediately
2. Conduct feasibility study (cost ₹ 50,000)

If developed directly:

- Success (0.6) → ₹ 6,00,000
- Failure (0.4) → -₹ 3,00,000

Calculate EMV of direct development.

Solution

EMV=(0.6×6,00,000)+(0.4×−3,00,000)EMV = (0.6 × 6,00,000) + (0.4 × -3,00,000)EMV=(0.6×6,00,000)+(0.4×−3,00,000) =3,60,000−1,20,000= 3,60,000 - 1,20,000=3,60,000−1,20,000 =₹2,40,000= ₹ 2,40,000=₹2,40,000

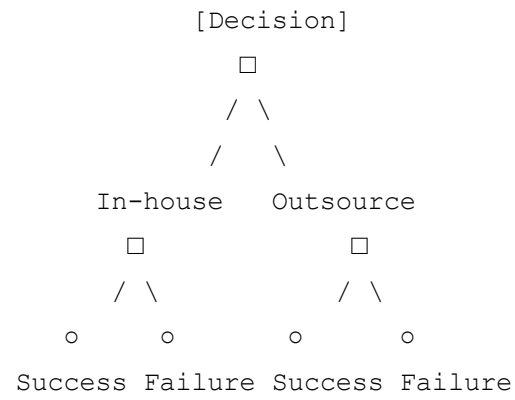
If feasibility study improves success probability to 0.8:

EMV=(0.8×6,00,000)+(0.2×−3,00,000)EMV = (0.8 × 6,00,000) + (0.2 × -3,00,000)EMV=(0.8×6,00,000)+(0.2×−3,00,000) =4,80,000−60,000= 4,80,000 - 60,000=4,80,000−60,000 =₹4,20,000= ₹ 4,20,000=₹4,20,000

After deducting study cost:

4,20,000−50,000=₹3,70,0004,20,000 - 50,000 = ₹ 3,70,0004,20,000−50,000=₹3,70,000

How to Draw Decision Tree



- □ = Decision node
- ○ = Chance node
- Write probabilities and payoffs on branches