

UNIT 4

Software Evaluation and Costing

(8 Hours) — Software Project Management (CACS407)

NOTE: These notes may contain errors. Please verify important points, definitions and calculations with your textbook and teacher before relying on them.

4.1 Project Evaluation

Project evaluation (feasibility analysis) is the process of deciding whether a proposed project is worth doing, and which of several competing projects should be selected. It is done *before* a major commitment of resources, and repeated at stages of the project. Evaluation considers three broad views:

Assessment	Question answered
Strategic	Does the project fit the long-term goals and strategy of the organization?
Technical	Can it be built with the available technology and skills?
Economic (cost-benefit)	Will the benefits exceed the costs, and by how much?

4.2 Strategic Assessment

Strategic assessment checks how well a project supports the organization's objectives, mission and long-term plans. It is usually carried out by senior management using the organization's **strategic plan**.

- Is the project consistent with the **corporate strategy** and information systems strategy?
- Does it support a **business need** (increase market share, reduce cost, comply with law)?
- Which **stakeholders** are affected, and will they support it?
- Is it a **program** (several related projects) or a stand-alone project?
- What is the **business case**, i.e. benefit to the organization versus cost and risk?

Example 4.1 — Strategic fit

A bank's strategy is to increase digital transactions. A mobile banking application directly supports this strategy, while a new in-house payroll system with no customer benefit would have a weaker strategic fit.

4.3 Technical Assessment

Technical assessment studies whether the required functionality can be delivered with the proposed hardware and software, within the constraints of the organization's existing environment.

- Availability and maturity of the **technology** (new/unproven technology increases risk).
- Skills of the **development team** and availability of training or hiring.
- **Integration** with existing systems, data and infrastructure.
- **Performance, security, scalability** and other non-functional requirements.
- Technical risks and the cost of the solution (hardware, licences, support).

4.4 Cost-Benefit Analysis (CBA)

Cost-benefit analysis is the main economic evaluation. It compares the total expected **costs** with the total expected **benefits** over the life of the system. It has three steps:

- **Identify and estimate** all costs and benefits, in money terms, over the project's life.
- **Express** the costs and benefits in common units (rupees), at a common time (using discounting).
- **Evaluate** using a technique such as net profit, payback period, ROI, NPV or IRR.

4.4.1 Types of costs

Cost type	Examples
Development costs	Salaries of analysts and developers, tools, training.
Setup costs	Hardware, network, installation, data conversion, staff training.
Operational costs	Maintenance, support, licences, electricity, upgrades.

4.4.2 Types of benefits

Benefit type	Examples
Direct	Increased sales, savings in staff time, reduced paperwork.
Indirect/assessable	Better decisions through reporting, better customer service.

Benefit type	Examples
Intangible	Improved image, employee satisfaction, learning, goodwill (hard to measure in money).

4.5 Cash Flow Forecasting

Cash flow forecasting estimates the timing and amount of money going out (costs) and coming in (benefits) over the life of the project. Costs are usually concentrated at the start while income comes later, so the forecast is vital to show that the organization can finance the project.

- **Cash flow** in a year = income – expenditure of that year.
- **Net cash flow** is the sum of the yearly cash flows; the cumulative total shows when the project 'pays back'.
- Forecast uncertainty is high for later years; assumptions must be written down.
- The timing matters: Rs. 1 today is worth more than Rs. 1 after a year (time value of money).

Example 4.2 — Cash flow table (Rs.)

Two projects with an initial outlay in year 0 and returns in years 1 to 5. The yearly cash flows are:

Year	Project 1	Project 2
0	-100,000	-120,000
1	10,000	30,000
2	10,000	30,000
3	10,000	30,000
4	20,000	30,000
5	100,000	30,000
Net total	50,000	30,000

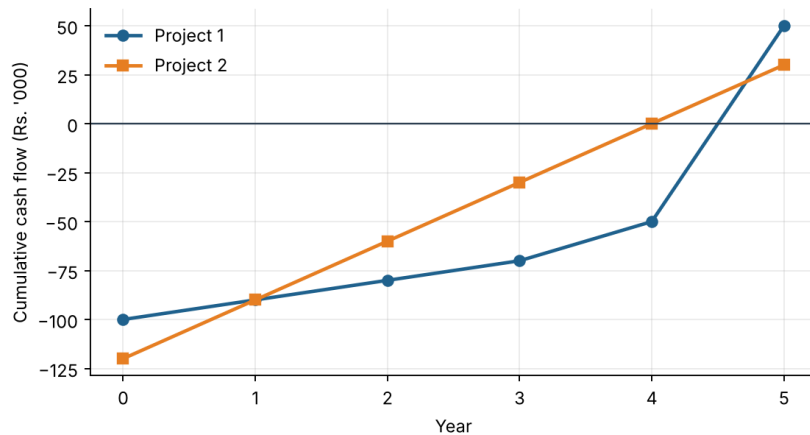


Figure 4.1 — Cumulative cash flow (payback is where a line crosses zero)

4.6 Cost-Benefit Evaluation Techniques

4.6.1 Net profit

Net profit = total income – total costs over the life of the project. Project 1 above: Rs. 50,000; Project 2: Rs. 30,000. It is simple but ignores the *timing* of cash flows and the size of the investment.

4.6.2 Payback period

The **payback period** is the time taken for the cumulative net cash flow to become zero (for the initial investment to be recovered). A shorter payback is preferred. It is simple and favours liquidity, but ignores cash flows after the payback date and ignores the time value of money.

Payback for Example 4.2

Project 1: cumulative flow after years 1–4 is –90,000; –80,000; –70,000; –50,000, then +100,000 in year 5. Payback = $4 + 50,000/100,000 = 4.5$ years.

Project 2: each year brings 30,000, so payback = $120,000 / 30,000 = 4.0$ years.

4.6.3 Return on Investment (ROI) / Accounting Rate of Return

ROI = (Average annual profit ÷ Total investment) × 100%, where average annual profit = net profit ÷ number of years.

ROI for Example 4.2

Project 1: average annual profit = $50,000/5 = 10,000$; ROI = $10,000/100,000 = 10.0\%$.

Project 2: average annual profit = $30,000/5 = 6,000$; ROI = $6,000/120,000 = 5.0\%$.

Note: ROI is easy to compute but, like net profit and payback, ignores the time value of money.

4.6.4 Net Present Value (NPV)

NPV discounts each future cash flow to its value today, using a **discount rate r** (the opportunity cost of capital). **Present value = Cash flow in year $t \div (1 + r)^t$** , and **NPV = Σ PV** (including the year-0 outlay as a negative). A project with **NPV > 0** adds value; among alternatives the higher NPV is preferred.

Example 4.3 — NPV at 10%

Using the cash flows of Example 4.2 and a discount rate of 10%:

Year	P1 cash flow	Discount factor	P1 PV	P2 cash flow	P2 PV
0	-100,000	1.0000	-100,000	-120,000	-120,000
1	10,000	0.9091	9,091	30,000	27,273
2	10,000	0.8264	8,264	30,000	24,793
3	10,000	0.7513	7,513	30,000	22,539
4	20,000	0.6830	13,660	30,000	20,490
5	100,000	0.6209	62,092	30,000	18,628
NPV			621		-6,276

Result

NPV(Project 1) = **Rs. 621**; NPV(Project 2) = **Rs. -6,276**.

Project 1 has a positive NPV, so it adds value at a 10% rate. Project 2 has a negative NPV, so it should be rejected at 10%, even though its payback period (4.0 years) is shorter than Project 1's (4.5 years). This shows why time value of money matters.

4.6.5 Internal Rate of Return (IRR)

IRR is the discount rate at which the NPV of the project is exactly **zero**. It is found by trial and error (or with a spreadsheet's IRR function). A project is acceptable if its IRR is greater than the required rate of return (cost of capital); a higher IRR is better.

IRR for Example 4.2

Project 1: IRR $\approx$ 10.2%; Project 2: IRR $\approx$ 7.9%.

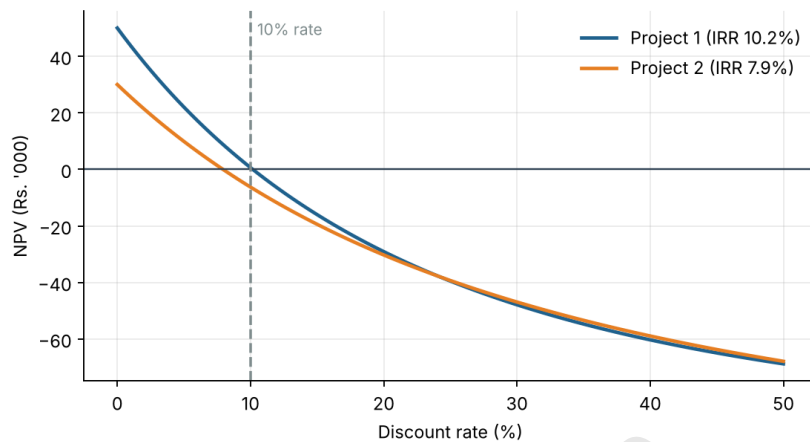


Figure 4.2 — NPV profile: the point where each curve crosses zero is that project's IRR

Note: NPV and IRR may rank projects differently. When they do, NPV is generally considered the more reliable criterion, because it measures the absolute value added.

4.6.6 Summary of techniques

Technique	Time value?	Decision rule
Net profit	No	Positive; larger is better
Payback period	No	Shorter is better
ROI	No	Higher is better
NPV	Yes	NPV > 0; higher is better
IRR	Yes	IRR > cost of capital; higher is better

4.7 Risk Evaluation

Every estimate of cost and benefit is uncertain. Risk evaluation tries to measure that uncertainty so that risky projects are not accepted blindly.

- **Risk identification and ranking** — list risks and rank by probability and impact.
- **Risk-adjusted discount rate** — add a premium to the discount rate for riskier projects.
- **Sensitivity analysis** — change one assumption (for example the discount rate or the delay in delivery) and see how strongly the NPV changes.
- **Expected monetary value (EMV)** — weight outcomes by their probabilities.

- **Decision trees** — map choices and uncertain outcomes and choose the path with the best expected value.
- **Risk profile** — graph the range of outcomes and their likelihood.

Example 4.4 — Expected monetary value

A project has three possible net outcomes: large success (probability 0.2) with Rs. 200,000, moderate success (0.5) with Rs. 80,000, and failure (0.3) with a loss of Rs. 60,000. Find the expected value.

Solution

$EMV = 0.2 \times 200,000 + 0.5 \times 80,000 + 0.3 \times (-60,000) = 40,000 + 40,000 - 18,000 = \text{Rs. } 62,000.$

The EMV is positive, but a 30% chance of loss should still be considered by management.

4.8 Selection of an Appropriate Report

The results of evaluation are communicated to decision makers as a **feasibility report / business case**. The report type should suit the audience (executives want a short summary; technical staff want details).

- Executive summary and recommendation.
- Background, objectives and scope of the project.
- Options considered (including 'do nothing').
- Strategic, technical and economic assessments.
- Costs, benefits, cash flow forecast and results of NPV/IRR/payback.
- Risks and their management, assumptions and constraints.
- Implementation plan and conclusion.

Note: Where several projects compete, a weighted scoring (ranking) table against agreed criteria is often added to the report.

4.9 Project Approach

Before detailed planning, the manager must choose how the project will be carried out: the technology, the life-cycle (process) model and the development methods.

4.9.1 Choosing technologies

- Select between **in-house development**, **package (off-the-shelf) purchase**, **outsourcing**, or open source solutions.
- Choose the programming language, database, platform and tools based on the problem, skills and cost.
- Consider maturity, vendor support, licence cost, performance, security and future maintainability.
- A project dealing with unfamiliar technology needs additional time for learning and prototyping.

4.9.2 Choice of process model

The process model structures the life cycle. The choice depends on how well requirements and technology are understood, the project's size and risk, and the customer's need for early delivery.

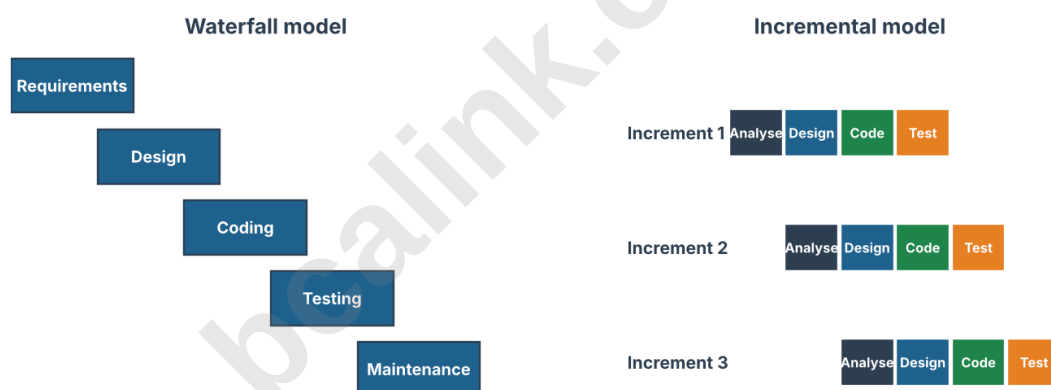


Figure 4.3 — Waterfall (sequential) and incremental (repeated) models

Model	Main idea	Suitable when
Waterfall	Phases done in sequence with sign-off at each.	Requirements are stable and clear; low technical risk.
Prototyping	Quick working models to clarify requirements.	Requirements unclear; user interface heavy.
Incremental	System delivered in a series of increments.	Early partial delivery wanted; moderate uncertainty.
Spiral	Iterations with explicit risk analysis at every loop.	Large, high-risk projects.

Model	Main idea	Suitable when
Agile (Scrum, XP)	Short iterations, continuous customer feedback.	Requirements change often; small, co-located teams.

4.9.3 Structured methods

Structured methods are systematic techniques for analysis and design that give a standard set of notations and steps. Examples include structured analysis (data flow diagrams, ER diagrams) with structured design, and object-oriented methods (UML). Their benefit is better communication, consistency and quality; they need training and tool support, and may be heavier than needed for very small projects.

Key Takeaways

- ✓ Evaluation asks three questions: strategic fit, technical feasibility and economic value.
- ✓ Cash flow forecasts show timing of costs and benefits; discounting recognises the time value of money.
- ✓ Payback, ROI and net profit are simple but ignore time value; NPV and IRR account for it.
- ✓ $NPV = \sum CF_t / (1+r)^t$; accept if $NPV > 0$. IRR is the rate at which $NPV = 0$.
- ✓ Risk is assessed by sensitivity analysis, expected monetary value, decision trees and risk-adjusted rates.
- ✓ Project approach: choose technology, process model (waterfall, incremental, spiral, agile) and structured methods to match the project.

— End of Unit 4 —