SOFTWARE PROJECT MANAGEMENT
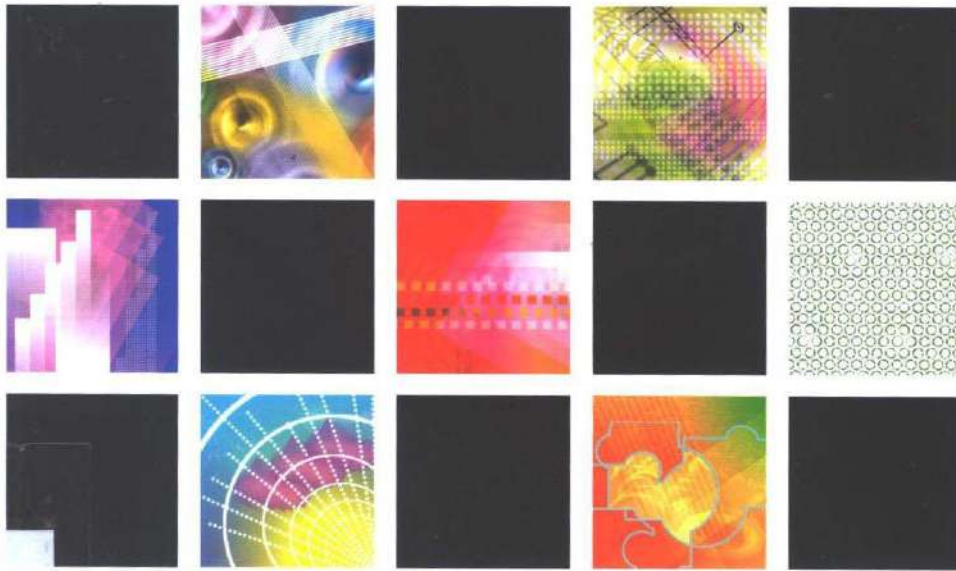
FOURTH EDITION
Bob Hughes & Mike Cotterell

Chapter 3

Programme Management and Project Evaluation

3.10 Cost-Benefit Analysis

- Cost/benefit analysis, comparing
  - Expected costs
  - Expected benefits
- Issues
  - Estimating costs
  - Estimating benefits
- Use of financial models to evaluate

3.10 Cost-Benefit Analysis
Two Steps

- Identifying and estimating all of the costs and benefits of carrying out the project and operating the delivered application

- Expressing the costs and benefits in common units

3.10 Cost-Benefit Analysis
Cost Estimation

- Estimate costs to compare with benefits/other investment options
- Overall estimation based on
  - Estimation of required activities (structure)
  - Estimation for each activity
  - Estimation of installation/setup cost
  - Estimation of operational cost
- Difficult, as a lot of these are `estimates'; estimation errors cascade

3.10 Cost-Benefit Analysis
Cost Category

- Development costs
- Setup costs
- Operational costs

3.10 Cost-Benefit Analysis
Development Costs

- Salaries (base, incentives, and bonuses)
- Equipment for development
  - Hardware
  - Software

3.10 Cost-Benefit Analysis
Setup Cost

- Hardware and software infrastructure

- Recruitment/staff training

- Installation and conversion costs

3.10 Cost-Benefit Analysis
Operational Costs

- Costs of operating the system once it has been installed
  - Support costs
  - Hosting costs
  - Licensing costs
  - Maintenance costs
  - Backup costs

3.10 Cost-Benefit Analysis
Benefit Estimation

- Estimate benefits of new system based on
  - Estimation of cost savings and money generation when deployed
  - Value of information obtained for objective driven project
  - Value of intangibles

3.10 Cost Benefits Analysis
Benefits Types

- Direct benefits

- Indirect benefits

- Intangible benefits

3.10 Cost Benefits Analysis
Direct Benefits

- Directly accountable to new system
  - Cost savings (e.g., less staff, less paper, quicker turnaround)
  - Money generation (e.g., new revenue stream, new markets)

- Measurable after system is operational

- Have to be estimated for cost/benefit analysis

3.10 Cost Benefits Analysis
Indirect Benefits

- Secondary benefits of new system
    - Examples: Better work flow, increased flexibility
- Somewhat quantifiable after the system is operational
- Have to be estimated for cost/benefit analysis

3.10 Cost Benefits Analysis
Intangible Benefits

- Positive side effects of new system
- External system (e.g., increase branding, entry to new markets)
- Internal system (increased interest in job for users, enabler for other systems)
- Often very specific to a project; not measurable even after a system is operational
- Part of strategic decision rather than cost/benefit analysis

3.11 Cash Flow Forecasting

- Indicates when expenditure and income will take place
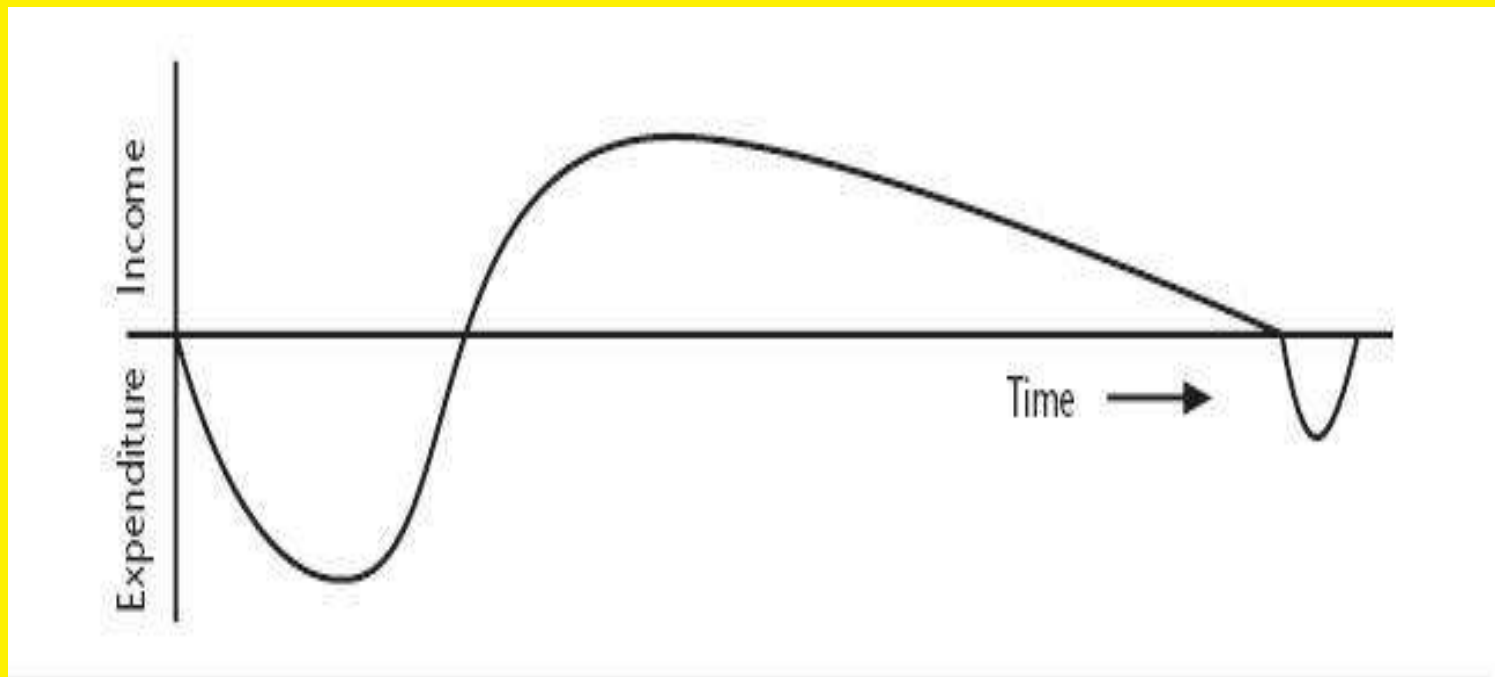
3.11 Cash Flow Forecasting
Cash Flow Analysis

- Typically there are outgoing payments initially and then incoming payments
- There might be additional costs at the end of the project life
- Cash flow considerations
  - Is initial funding for the project available?
  - Is timing of incoming/outgoing cash flow in line with financial plans?
  - If cash flow is critical, forecasting should be done quarterly or monthly
- Risky/expensive projects might be funded using venture capital

3.11 Cash Flow Forecasting
Example of Cash Flow Forecasts

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

3.12 Cost-Benefit Evaluation Techniques [1/2]

- Costs and benefits have to be expressed using the same scale to be comparable

- Usually expressed in payments at certain times (cash flow table)

- Payments at different points in time are not comparable based only on the amount

3.12 Cost-Benefit Evaluation Techniques [2/2]

- Time of payment should be considered

- Techniques
  - Net profit
  - Payback period
  - Return on investment
  - Net present value
  - Internal rate of return

3.12 Cost-Benefit Evaluation Techniques Net Profit

- Difference between total cost and total income

- Pros: Easy to calculate

- Cons
  - Does not show profit relative to size investment (e.g., consider Project 2)
  - Does not consider timing of payments (e.g., compare Projects 1 and 3)

- Not very useful other than for "back of envelope" evaluations

3.12 Cost-Benefit Evaluation Techniques Payback Period

- Time taken to break even

- Pros
  - Easy to calculate
  - Gives some idea of cash flow impact

- Cons: Ignores overall profitability

- Not very useful by itself, but a good measure for cash flow impact

3.12 Cost-Benefit Evaluation Techniques Return On Investment [1/2]

- Also known as the *accounting rate of return* (ARR)

- Provides a way of comparing the net profitability to the investment required

- The common formula
  - ROI = (average annual profit/total investment) X 100

3.12 Cost-Benefit Evaluation Techniques Return On Investment [2/2]

- Pros: Easy to calculate

- Cons
    - Does not consider the timing of payments
    - Misleading: does not consider bank interest rates

- Not very useful other than for "back of envelope" evaluations

3.12 Cost-Benefit Evaluation Techniques Net Present Value [1/5]

- A project evaluation technique that takes into account the profitability of a project and the timing of the cash flows that are produced

- Sum of all incoming and outgoing payments, discounted using an interest rate, to a fixed point in time (the present)

3.12 Cost-Benefit Evaluation Techniques Net Present Value [2/5]

- Present value = (value in year t)/(1+r)^t
  - r is the discount rate
  - t is the number of years into the future that the cash flow occurs

3.12 Cost-Benefit Evaluation Techniques Net Present Value [3/5]

- $(1+r)^t$ is known as discount factor
- In the case of 10% rate and one year
  - Discount factor = $1/(1+0.10)$ = 0.9091
- In the case of 10% rate and two years
  - Discount factor = $1/(1.10 \times 1.10)$ = 0.8294

3.12 Cost-Benefit Evaluation Techniques Net Present Value [4/5]

Year	Cash Flow	Discount Factor (10%)	Discounted Cash Flow
0	-100,000	1	-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	0.683	13,660
5	100,000	0.6209	62,090
		NPV	618

3.12 Cost-Benefit Evaluation Techniques Net Present Value [5/5]

- Pros
  - Takes into account profitability
  - Considers timing of payments
  - Considers economic situation through discount rate
- Cons: Discount rate can be difficult to choose
- Standard measure to compare different options
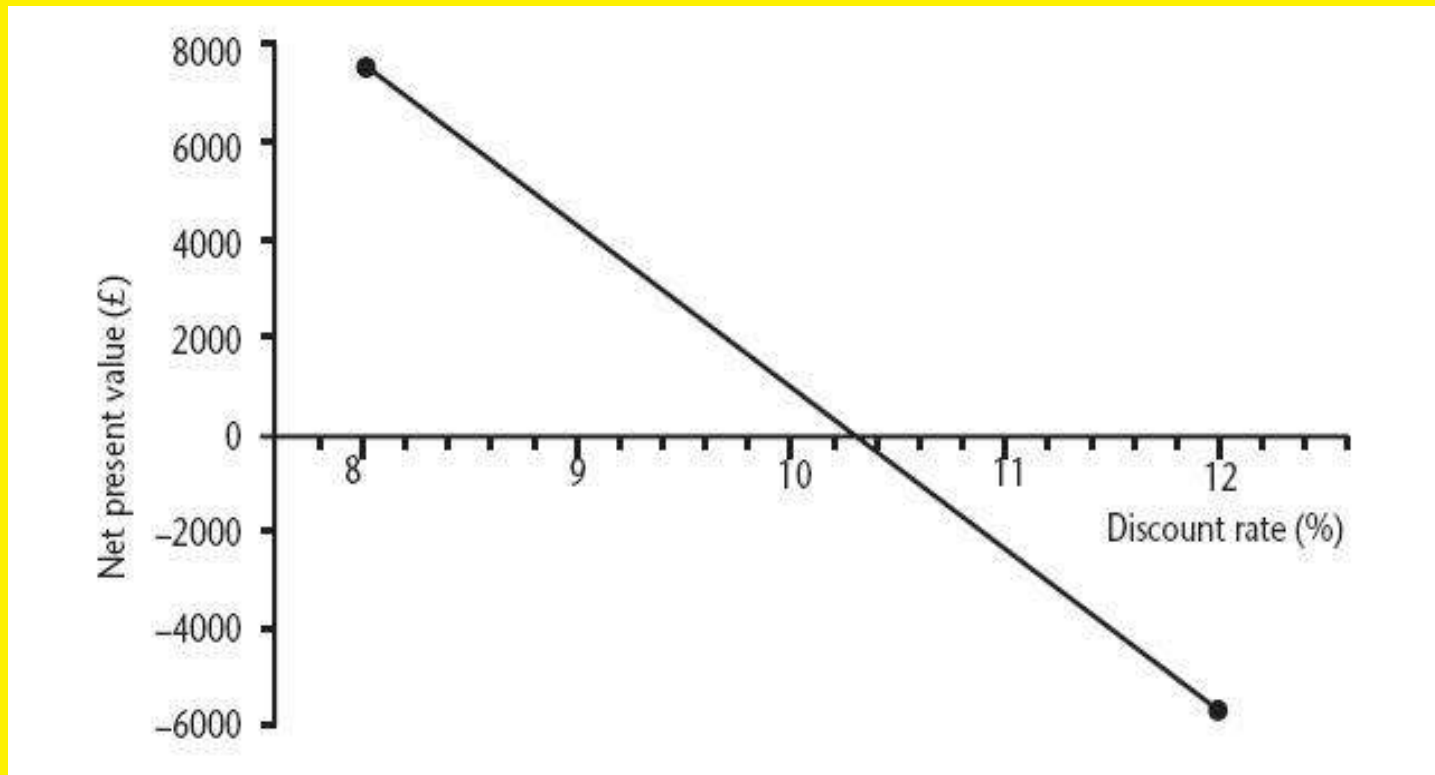
3.12 Cost-Benefit Evaluation Techniques Internal Rate of Return [1/4]

- 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 to calculate IRR

- May be estimated by plotting a series of guesses

3.12 Cost-Benefit Evaluation Techniques Internal Rate of Return [3/4]

- Pros
  - Calculates figure which is easily comparable to interest rates
- Cons: Difficult to calculate (iterative)
- Standard way to compare projects

3.12 Cost-Benefit Evaluation Techniques Internal Rate of Return [4/4]

- Given two NPVs, one positive the other negative, estimate IRR as:
    - IRR = int1 - npv1 * ((int2-int1)/(npv2-npv1))
    - Calculate NPV at this rate
    - Use estimated rate as one data point in next iteration

3.14 Conclusions [1/4]

- Project must be evaluated on strategic, technical and economic ground

- Many projects are not justifiable on their own, but as part of a broader programme of projects that implement an organization's strategy

- Not all benefits can be precisely quantified in financial values

3.14 Conclusions [2/4]

- Economic assessment involves the identification of all costs and income over the lifetime of the system, including its development and operation and checking that the total value of benefits exceed total expenditure

- The uncertainty surrounding estimates of future returns lowers their real value measured now

3.14 Conclusions [3/4]

- Money received in the future is worth less than the same amount of money in hand now, which may be invested to earn interest

- Discounted cash flow techniques may be used to evaluate the present value of future cash flow taking account of interest rates and uncertainty

3.14 Conclusions [4/4]

- Cost-benefit analysis techniques and decision trees provide tools for evaluating expected outcomes and choosing between alternatives strategies