Cost benefit analysis (CBA)

You need to:

- Identify all the costs which could be:
    - Development costs: include salaries
    - Set-up: cost of putting system into place
    - Operational cost: cost of operating the system once installed

- Identify the value of benefits

- Check benefits are greater than costs

Benefits

- Direct Benefits – these accrue directly from the operation of the system. Reduction in salary bills through the introduction of new, computerized system.

- Assessable indirect benefits – these are generally secondary benefits, such as increased accuracy through the introduction of a more user-friendly screen design where we might be able to estimate the reduction in errors and thus the cost of the system.

- Intangible benefits – these are generally longer term or benefits that are considered very difficult to quantify. Enhanced job interest lead to reduced staff turnover.

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

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

Return on investment (ROI)

ROI = $\dfrac{\underline{\text{Average annual profit}}}{\text{Total investment}}$ X 100

In the previous example

- average annual profit
  = 50,000/5
  = 10,000

- ROI = 10,000/100,000 X 100   =
10%

Net present value

Would you rather I gave you £100 today or in 12 months time?

If I gave you £100 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 £100 in a year's time?

This figure is the *net present value* of £100 in one year's time

Net Present Value

The equivalence of £91 now and £100 in a year's time means we are discounting the future income by approximately 10% – that is, we would need an extra 10% to make it worthwhile waiting for a year. An alternative way of considering the equivalence of the two is to consider that, if we received £91 now and invested for a year at an annual interest rate of 10%, it would be worth £100 in a year's time. The annual rate by which we discount future earnings is known as the *discount rate* – 10% in the above example.

Net Present Value

Present value $=$ value in the year $t/(1+r)^t$

- r is the interest rate (e.g. 10% is 0.10)
- t is the number of years

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 = $1/(1+0.10) = 0.9091$

In the case of 10% rate and two years

Discount factor = $1/(1.10 \times 1.10) = 0.8294$

Applying discount factors

Year	Cash-flow	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
		NPV	618

Net Present Value

NPV is the sum of the discounted cash flows for all the years of the 'project' (note that in NPV terms the lifetime of the completed application is included in the 'project')

The figure of £618 means that £618 more would be made than if the money were simply invested at 10%. An NPV of £0 would be the same amount of profit would be generated as investing at 10%.

Exercise

Calculate the net present value for each of the projects A, B and C shown in Table 3.5 using each of the discount rates 8%, 10% and 12%.

Exercise

Table 3.5　*Three estimated project cash flows*

Year	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

Exercise

year		DR (8%)		DR (10%)	
0	-8000	1	-8000	1	-8000
1	4000	0.926	3704	0.909	3636
2	4000	0.857	3429	0.826	3306
3	2000	0.794	1588	0.751	1503
4	1000	0.735	735	0.683	683
5	500	0.681	340.3	0.621	310.5
6	500	0.63	315.1	0.564	282.2
		NPV	2111		1720