Chapter 9
STRATEGIC DECISION MAKING

Key Learning Objectives

By the time you have finished studying this chapter, you should be able to:

- understand the concept of discounting;
- calculate net present value and internal rate of return;
- apply non-discounting methods;
- understand the importance of taxation and inflation to strategic decision making;
- apply sensitivity analysis.

The Nature of Strategic Decision Making

Strategic planning and strategic decision making look ahead to several years into the future. They are concerned with the organisation's major products and services and related aspects of marketing, manufacturing, service delivery, and research and development. Strategic decisions almost invariably result in long-term financial costs and benefits and may require significant investment.

Examples of strategic decision making from a range of organisations are as follows:

- A university is located in an area with a declining and ageing population, with the result that its potential student base is declining. It is looking at several ways of dealing with this problem, one of which involves building on-campus student accommodation in order to attract students from more distant locations. This would require significant investment by the university in constructing the accommodation, but it is expected that this would result in future rental income and an increase in its student population.
- An airline has a long and profitable history of flying long-haul routes. Due to the growth in world terrorism, it is considering moving into the European short-haul market by leasing a fleet of aeroplanes. This market has grown significantly in the last decade, and looks as if it will continue to grow. However, the airline is aware that this sector is highly competitive, highly efficient and operating in a low-cost way that is alien to it.

- An engineering company is assessing the profitability of producing a new product. This will involve acquiring a new machine. The company will need to take account of the cost of the machine, the projected operating costs, the projected revenues from the sale of the product, and the expected lives of the machine and the market for the product.
- A company currently pays mileage travel allowances to its staff. It is evaluating leasing a fleet of cars and requiring its employees to use these cars for company business. In this case, the company will need to collect the costs of mileage allowances, estimate the annual leasing and operating costs of a fleet of vehicles, and estimate the additional costs or savings of the venture.

As can be seen, strategic decisions are long-term in nature and usually involve investment, costs and revenues. This chapter will focus on the appraisal of these investment decisions.

Steps in Project Appraisal

The first step is to specify the scope and objectives of the project. Scope relates to the breadth and coverage of the project. Its objectives should be directly related to the strategic decisions taken within the company. Each of the examples of strategic decision making listed above directly leads to a clearer definition of a project's scope and objectives.

The second is to identify the relevant cash flows for project appraisal. Chapter 2 introduced the concept of relevant cost (see also Chapter 8). Recall that relevant costs may be distinguished by the following three characteristics:

- They are decision-specific in that if the decision changes the costs change.
- They are future costs. From a decision perspective, past costs are sunk costs and they should have no influence on the current decision. Sunk costs include past expenditure on machinery, the book cost of materials held in stock and the depreciation of past capital expenditure.
- They are differential costs. Common costs, that is, costs that would be incurred in any event, should have no influence on the decision. Examples of common costs include fixed overheads, fixed overhead apportionments and labour costs when there is spare capacity.

Relevant cash flows include the following:

- Incremental costs and revenues that are attributable to the decision that has been made.
- Financing costs: in order to undertake capital expenditure such as the construction of student accommodation, the organisation will need to obtain finance. The costs of finance, in the form of interest costs, represent a relevant cost. Alternatively, if the organisation finances the project from its own resources, the interest forgone due to the financing activity represents an opportunity cost and is relevant.

Table 9.1 Data for projects A, B and C

Project	Project A		Project B		Project C	
Years hence	Cash flows £	Net profits £	Cash flows £	Net profits £	Cash flows £	Net profits £
0	–1000		–1000		–2000	
1	600	350	500	250	600	350
2	400	150	400	150	600	350
3	300	50	600	350	600	350
4	300	50	700	450	1600	350
Other information						
Residual values	0		0		1000	
Annual depreciation over 4 year's life of each project	= investment/4 = £1000/4 = £250 per year		= investment/4 = £1000/4 = £250 per year		= net investment/4 = £(2000 – 1000)/4 = £250 per year	

- The timing of returns that arise from the project is also relevant. Returns that arise at an early date are worth more than the same returns received at a later date.
- Working capital changes should be brought into the appraisal if these change as a result of the project. For example, the project may require an increase in debtors or a build-up in stocks of raw materials, and these represent relevant cash flows.
- Taxation effects: the investment may attract tax allowances that have the effect of reducing the taxation paid by the company. Any additional profits generated by the project will be subject to taxation.
- Future inflation is likely to affect costs and revenues in different ways and will need to be taken into account.

The third stage is to select and apply at least one method of appraisal. We will consider the following four methods: net present value; internal rate of return; pay back; and accounting rate of return. The first two are discounted cash flow methods; the second two are non-discounting methods.

In order to help explain and demonstrate these four methods, we will use the data contained in Table 9.1. As may be seen, there are three projects, A, B and C. The first column indicates the number of years hence. Year 0 always represents now and this is often when the initial investment in the project occurs, year 1 is 1 year after, year 2 is 2 years after and so on.

For each project there are two columns. The first column represents the project's cash flows. The second represents the annual net profits, which differ from the cash flows because they allow for depreciation on the original investment. The table indicates that there is no residual value in the case of project A and B and the annual depreciation is £250, with the result that the annual profits are £250 less than the cash flows. Project C

has a residual value of £1000 so its annual depreciation is also £250. In year 4, project C's cash flows include the £1000 residual value.

After applying one or more of the investment appraisal techniques, the fourth step is to make sense of the results. In order to do this, one needs to understand the basis, the strengths and limitations of each technique and any limitations in the underlying data.

Finally, the decision maker needs to make a decision based on the above information. At this point, qualitative issues will also be considered and possibly tactical and strategic issues relating to the organisation's planning processes.

Project Appraisal Using Discounted Cash-Flow Methods

Compounding, Discounting and Present Value

Both compounding and discounting involve the use of an appropriate rate of interest or rate of return. Generally, keeping the rate of interest constant, the longer you invest, the greater the total accumulated interest will be. We will now look in more detail at the use of the rate of interest, first dealing with compounding and then with discounting.

Compound interest occurs when the interest is applied to the principal (the sum invested) plus the accrued interest. At the end of the first period, the interest is calculated on the principal only. At the end of the second period, interest is calculated on the principal plus interest earned in the first period. Thus, if £100 is invested at 10% compound, at the end of the first year the interest earned is £10, and the principal becomes £110. At the end of the second year, the interest earned is 10% × £110, and the principal is now £121. This can be generalised so that one can calculate the future value, if there is a constant interest rate, by the following formula:

$$FV = P(1 + r)^n$$

where FV is future value, P is the principal, r is the rate of interest per period, and n the number of periods. So, if we invest £100 at 10% for 5 years, it will be worth

$$FV = 100(1 + 0.1)^5 = 100 \times 1.6105 = £161.05.$$

Discounting is the opposite of compounding. Discounting involves finding the present values of future cash flows. We have just seen that, when invested at 10% compound interest, £100 at year 0 produces £110 in one year's time. We can say that an investor is indifferent between receiving £100 now (year 0) or £110 in one year's time or £121 in two years' time and so on, because he can invest £100 at 10% to produce each of these amounts. The person who invests £100 at year 0 will require more than £100 in future, the exact amount depending on the time period and the rate of interest. The concept that £1 in the future is worth less than £1 today is termed the *time value of money*. In project

appraisal, this is an important concept as, typically, projects will have cash flows that continue well into the future. In these situations, future cash flows cannot simply be added together. They must first all be discounted to present values.

In order to discount future cash flows to present values, we first rearrange the future value formula to obtain the present value (PV):

$$PV = FV \times \frac{1}{(1+r)^n}.$$

Here $1/(1+r)^n$ is termed the *discount factor* and r is termed the *discount rate*. In Table 9.2 we demonstrate the use of the formula to find the present value of future cash flows when the discount rate is 10%.

As can be seen, discounting is the inverse of compounding. To save calculating the discount factor every time, they are precalculated and appear in Table 9A.1 in the Appendix at the end of this chapter. An extract from Table 9A.1 is presented in Table 9.3

Looking at Table 9.3, we can read off the appropriate discount factor once we know the periods hence and the discount rate. So, the discount factor for 5 years hence when the discount rate is 7% is 0.713. The present value of the sum of £4500 to be paid or received in 5 years' time with a discount rate of 7% is $0.713 \times £4{,}500 = £3208$.

Net Present Value

Net present value (NPV) is a discounted cash-flow method of investment appraisal. It involves discounting future cash flows to present values. The sum of the present value of

Table 9.2 Present value calculations for a discount rate of 10%

	Year 0	Year 1	Year 2	Year 3
Discount factor	Present values	Future values		
$1/(1+r)^n$	$FV \times 1/(1+r)^n$			
$1/(1+0.1)^1 = 0.909$	$110 \times 0.909 = 100$	110		
$1/(1+0.1)^2 = 0.826$	$121 \times 0.826 = 100$		121	
$1/(1+0.1)^3 = 0.751$	$133.1 \times 0.751 = 100$			133.1

Table 9.3 Discount factors for one to five periods and discount rates up to 10%

Periods	1%	2%	3%	4%	5%	6%	7%	8%	9%	10%
1	0.990	0.980	0.971	0.962	0.952	0.943	0.935	0.926	0.917	0.909
2	0.980	0.961	0.943	0.925	0.907	0.890	0.873	0.857	0.842	0.826
3	0.971	0.942	0.916	0.889	0.864	0.840	0.816	0.794	0.772	0.751
4	0.961	0.924	0.888	0.855	0.823	0.792	0.763	0.735	0.708	0.683
5	0.951	0.906	0.863	0.822	0.784	0.747	0.713	0.681	0.650	0.621

future cash flows less the initial investment gives the NPV of the project. If the discount rate represents the company's cost of finance, then the NPV represents the returns to the company's shareholders over and above the costs of finance; in consequence, we may say that a positive NPV contributes to the wealth of the shareholders.

The decision rule in the case of NPV is to accept only those projects providing a positive NPV. (A negative NPV indicates that the project is not even covering the costs of finance.) If a number of competing projects have positive NPVs, and only one can be selected, these are termed mutually exclusive projects. For example, there may be an area of land and one can build either a school or a sewage farm on the site! In the case of mutually exclusive projects, the rule is to select the project with the highest positive NPV.

Table 9.4 shows the calculation of the NPVs of projects A, B and C using the data from Table 9.1. NCF stands for the net cash flow in each year. This is the cash receipts for the year less the cash payments. PV stands for present value. The discount rate is 10% and the discount factors have all been obtained from Table 9.3.

All cash flows have been discounted to year 0 by multiplying the annual NCF by the discount factor in the second column. For example, for project A, 2 years hence, the annual NCF of £400 has been discounted by multiplying it by the year 2 discount factor 0.826.

As can be seen, the NPV for project A is £305. The investment at year 0 represents a negative cash flow and the figure of £1000 is the net total allowing for the negative cash flow of £1000. All projects have positive NPVs and should therefore be accepted. If only one project can be chosen, this would be project B as it has the highest NPV.

Annuities

An annuity is a series of equal and consecutive cash flows. They may be flows of payments or flows of receipts. In Table 9.4, Project C's net cash flows in years 1, 2 and 3 represent an annuity of £600. There exist discount tables for annuities and these are contained in Table 9A.2 in the Appendix at the end of this chapter. An extract is provided in Table 9.5.

Table 9.4 Project net present values

		Project					
		A		B		C	
Years hence	Discount factor	NCF	PV	NCF	PV	NCF	PV
0	1.0000	–1000	–1000	–1000	–1000	–2000	–2000
1	0.909	600	545	500	455	600	545
2	0.826	400	330	400	330	600	496
3	0.751	300	225	600	451	600	451
4	0.683	300	205	700	478	1600	1093
NPV			305		714		585
Select					B		

Table 9.5 Present value of annuity

Periods	1%	2%	3%	4%	5%	6%	7%	8%	9%	10%
1	0.990	0.980	0.971	0.962	0.952	0.943	0.935	0.926	0.917	0.909
2	1.970	1.942	1.913	1.886	1.859	1.833	1.808	1.783	1.759	1.736
3	2.941	2.884	2.829	2.775	2.723	2.673	2.624	2.577	2.531	2.487
4	3.902	3.808	3.717	3.630	3.546	3.465	3.387	3.312	3.240	3.170
5	4.853	4.713	4.580	4.452	4.329	4.212	4.100	3.993	3.890	3.791

Annuity tables enable us to take a short cut when calculating NPVs. The PV of an annuity is the amount of the annual net cash flow × the annuity factor. For example, a project is expected to produce net cash flows of £2000 per year for each of the next five years. The discount rate is 6%. The present value of this annuity will be: 4.212 × £2000 = £8424. (where 4.212 is the PV annuity factor for 5 years at 6%).

The Advantages of NPV

- It explicitly takes into account the time value of money because it is based on discounted cash flows, recognising that £1 in the future is worth less than £1 today.
- By considering cash flows, NPV is not affected by the company's accounting policies, unlike net profit. For example, net profit is influenced by the company's policies on stock valuation, depreciation and overhead apportionment. Regardless of changes in any of these, the cash flows will remain unchanged.
- NPV takes explicit account of the costs of raising finance via its discounting process. A positive NPV therefore reflects the increase in shareholder wealth that should occur if the project is undertaken.

The Disadvantages of NPV

- In practice it may be difficult to determine the discount rate. This should relate to the cost of finance (or cost of capital, as it is usually known), but calculating the costs of the different elements of finance (e.g. share capital and loans) is difficult.
- The NPV is an absolute figure and it does not allow for the size of the project. For example, in the case of two mutually exclusive projects, NPV would recommend acceptance of a £1 million project with a NPV of £1250 over a £1000 project with a NPV of £500.

Our concern here is very much with the financial bottom line (the net present value), but Lumijarvi (1991) indicates that as long as projects meet the financial criteria, they then have to be sold to senior management based upon their strategic value and use of modern technology. A summary of this article appears at the end of the chapter.

The Impact of the Discount Rate on NPV

Figure 9.1 below shows the NPV for a project with an investment in year 0 followed by net cash inflows in future years. As may be seen, the NPV falls as the discount rate increases. This is because the increasing discount rate results in a decrease in the present value of future cash flows because the discount factor gets smaller as the discount factor increases; the factors in Table 9.3 demonstrate this. When the discount rate is 0, the NPV is simply the net result of subtracting the total cash outflows from the total cash inflows. The figure indicates the importance of using the correct discount rate. If it is too low, NPV will be overstated and possibly the wrong projects will be accepted. If the discount rate is too high, then projects of value to the company will be rejected.

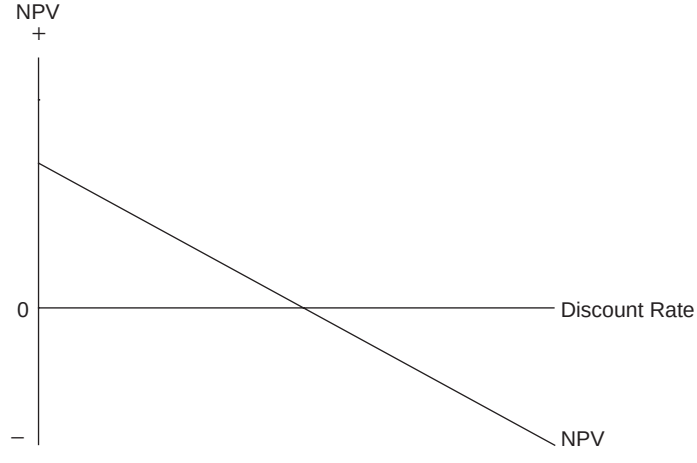

Figure 9.1 The impact of changes in discount rate on NPV

The Internal Rate of Return

The internal rate of return (IRR) is the discount rate that gives a zero NPV. The primary decision rule with IRR is to accept only projects with an IRR greater than the discount rate. If there are mutually exclusive projects each with IRR greater than the discount rate, the rule is to select the project with the highest IRR.

The underlying reason for the primary decision rule is that if the IRR exceeds the discount rate (or cost of capital), the project must be generating a higher return than the discount rate. From a different perspective, the IRR can be regarded as the highest cost of capital that the project could afford to have and still yield benefit to the shareholders.

The IRR can be calculated easily using a computer spreadsheet that will normally include an IRR function. Without a computer spreadsheet, the IRR must be estimated by calculating two NPVs at different discount rates. One of the NPVs should be negative, and this will require discounting at a higher discount rate in order to produce a negative

NPV. Once we have two NPVs, one positive and one negative, we then apply the following formula to estimate the IRR:

$$IRR = DRA + (DRA - DRB)\ \frac{NPVA}{NPVA - NPVB}.$$

Here *DRA* is the first discount rate used to appraise the project, producing a positive NPV; *DRB* is the second discount rate used to appraise the project, producing a negative NPV; *NPVA* is the positive NPV obtained when using *DRA*; and *NPVB* is the negative NPV obtained when using *DRB*.

Let us estimate the IRR for project A. Let *DRA* = 10%, so that *NPVA* = +305, and let *DRB* = 30%, so that *NPVB* = – 60. Then

$$\text{IRR} = 10\% + (30\% - 10\%)\frac{305}{305 + 60}$$

$$= 10\% + 16.71\% = 26.71\%.$$

Similarly, the IRR for project B is 38% and for project C is 21%. Calculation of IRR is an estimate and the narrower the gap between *DRA* and *DRB*, the more accurate the estimate. A computer spreadsheet for example will give a value of 25.81% for A. Each project is acceptable as each IRR exceeds the discount rate of 10% used in Table 9.4. If the projects are mutually exclusive, project B should be selected as its IRR is the highest of the three projects.

The Advantages of IRR

- Like NPV, it deals with discounted cash flows and is based upon the time value of money.
- Although the manual calculation of the IRR is more time-consuming than the NPV, the percentage nature of the IRR may make it more acceptable.
- The cost of capital is required for use as the discount rate with NPV but, as has been indicated, its calculation is difficult. Calculation of the IRR does not require a precise cost of capital discount rate and a project's IRR can be compared with an approximation of the cost of capital, avoiding dispute about the precise discount rate to use. The board can decide whether the IRR is sufficiently above the approximate cost of capital for the project to be acceptable.
- The difference between the IRR and the cost of capital indicates the additional return for risk that the project provides.

The Disadvantages of IRR

- If there are negative annual net cash flows later than year 0, this may lead to more than one possible IRR. In this situation IRR must be used with great care.
- If a company has to rank mutually exclusive projects, choosing the project with the highest IRR may result in a suboptimal outcome. (Lumby and Jones, 2003, Chapter 6).

Non-Discounting Methods of Project Appraisal

Payback

Payback is a cash-based technique. The payback period is defined as the number of years required for the annual net cash flows to equal the initial investment in a project. Alternatively, we can look for a cumulative net cash flow of 0. The cumulative net cash flows for projects A, B and C are shown in Table 9.6. By the end of year 2, project A's initial investment is recovered by its net cash flows. In the case of project B, payback occurs between the end of year 2 and the end of year 3. At the end of year 2 we need an additional £100 to payback If we assume that the year 3 cash flows of £600 accrue evenly through the year, then to payback we need 100/600 of year 3 cash flows, which we may assume to take (100/600 × 12 months = 2 months) For project C, payback occurs between the end of year 3 and the end of year 4. The £1600 in year 4 includes £1000 that accrues at the end of the project and £600 that we assume accrues evenly through the year. Therefore, payback in year 4 is at (200/600 × 12 months = 4 months).

Some companies use a 'target payback' approach in which they specify a maximum payback period that projects must meet if they are to be accepted.

The Advantages of Payback

- The underlying concept and the results of applying the technique are very easy to understand.
- It is quick and simple to use.
- It implicitly takes account of uncertainty that characterises the future. The further in the future that a company has to forecast, the more uncertain its forecasts will be. A project with a shorter payback will involve less uncertainty in relation to the forecasting of future cash flows.

Table 9.6 Cumulative NCFs for projects A, B and C (from Table 9.1)

	Project A		Project B		Project C	
Year	Annual NCF	Cumulative NCF	Annual NCF	Cumulative NCF	Annual NCF	Cumulative NCF
0	–1000	–1000	–1000	–1000	–2000	–2000
1	600	–400	500	–500	600	–1400
2	400	0	400	–100	600	–800
3	300		600	+500	600	–200
4	300		700		1600	+1400

Table 9.7 Discounted payback

Year	Cash flow	PV at 10%	Cumulative PV
0	–1000	–1000	–1000
1	600	545	–455
2	400	330	–125
3	300	225	+100
4	300	205	+305

The Disadvantages of Payback

- The payback method ignores the cash flows that occur after the end of the payback period. From our earlier calculations, project A will be selected as it has the shortest payback period, but project B has higher total net cash flows than project A. Project B's total net cash flows amount to £1200 whilst project A's amount to £600. This weakness of payback is in stark contrast to both NPV and IRR that consider *all* cash flows generated by projects.
- It ignores the time value of money. This can be overcome by the use of *discounted payback* in which the cash flows are discounted prior to calculating the payback period.

The discounted payback period for project A is calculated as shown in Table 9.7, giving an estimate of 2 years plus $125/225 \times 12$ months = 6.7 months.

Discounting is particularly useful when cash flows are distant, whereas payback emphasises the early years of the project, so there is an inherent conflict in the technique. Also, discounting assumes that the cash flows occur at the end of the year whereas payback assumes that they flow evenly through the year.

Accounting Rate of Return

The three investment appraisal techniques considered so far, NPV, IRR and payback, are all based on the cash flows generated by the project. Unlike these, the accounting rate of return (ARR) is based on accounting profits.

Accounting profits are based upon a range of concepts, and one effect of these is to convert cash into profits. Examples of accounting concepts at work are as follows:

- At the start of the project, fixed assets are acquired which will result in a cash outflow. However, the cost of such assets is not immediately charged to the profit and loss account of the business. Instead the fixed assets are disclosed on the balance sheet and an annual depreciation charge is made to the profit and loss account over the life of the fixed asset. In the case of land, no depreciation charge is made.
- Payments for raw materials result in a cash outflow for the business, However, the cost of purchases is not charged as an expense to the profit and loss account of the business until the stock is sold. Sales are recognised when the sale is made and not when cash changes hands.

The ARR may be defined as

$$\text{ARR} = \frac{\text{Average annual profit from an investment}}{\text{Average investment}} \times 100$$

Where

$$\text{Average investment} = \frac{\text{Initial investment} + \text{Scrap value}}{2}$$

The average investment represents the average value of the asset in the accounts of the company. At the commencement of the project, the accounts will include the original cost and at the end of the project the they will include the scrap value. To obtain the average of two figures we add them together and divide by 2.

The decision rule with ARR is to accept a project if the ARR equals or exceeds the company's target ARR. If projects are mutually exclusive, the rule is to select the project with the highest ARR, as long as the ARR equals or exceeds the company's target ARR.

We can use the profit data in Table 9.1 to calculate the average profits and average investment for each project as follows. For project A,

$$\text{Average profits} = \frac{350 + 150 + 50 + 50}{4} = £150,$$

$$\text{Average investment} = \frac{1000 + 0}{2} = £500,$$

$$\text{ARR} = \frac{150}{500} \times 100 = 30\%.$$

For project B,

$$\text{Average profits} = \frac{250 + 150 + 350 + 450}{4} = £300,$$

$$\text{Average investment} = \frac{1000 + 0}{2} = £1500,$$

$$\text{ARR} = \frac{300}{500} \times 100 = 60\%.$$

For project C,

$$\text{Average profits} = \frac{350 + 350 + 350 + 350}{4} = £350$$

$$\text{Average investment} = \frac{2000 + 1000}{2} = £1{,}500$$

$$\text{ARR} = \frac{350}{1{,}500} \times 100 = 23\%.$$

In this case, project B will be selected as it has the highest ARR. Both NPV and IRR selected project B.

The Advantages of ARR

- The main advantage is that by using profit figures, projects are appraised by a technique that is closely related to the return on capital employed (or return on investment) by which companies are frequently evaluated.
- It results in a percentage figure that is familiar to business people.

The Disadvantages of ARR

- The main weakness is that the technique, by averaging, ignores the time value of money. Profits in year 4 are treated as having the same value as profits in year 1.
- It makes use of accounting profits rather than cash flows. Accounting profits have been subjected to the application of accounting concepts, whereas cash flows represent power over resources.

The Impact of Taxation on Project Appraisal

In the real world taxation affects project appraisal in several ways. First, companies in the UK are required to pay corporation tax on their profits. So a project that generates profits will incur corporation tax. The amount of taxation must be estimated in the appraisal and then built into the cash flows or profits in the project appraisal.

Secondly, a company pays corporation tax approximately 9 months after the company's accounting year-end. Because of this, it is usual to assume that the taxation is payable in cash one year in arrears.

Thirdly, at the end of the project's life and the disposal of the asset there may be an additional taxation implication. During the project's life a company will claim capital allowances on the assets. These allowances are a legitimate expense in calculating taxable profit and they have the effect of reducing taxable profit and, therefore, the amount of taxation that the company will pay. There are different rates of allowance and they give relief on the difference between the cost and the estimated sales proceeds of the asset on disposal. When the asset is disposed of and the actual sale proceeds are known, the company will calculate whether it has claimed too much or too little in capital allowances. If too much, it will need to make an additional tax payment (termed a balancing charge). If it has claimed too little, it will be entitled to claim further CA (termed a balancing allowance).

Inflation and Project Appraisal

Inflation occurs when there is a general increase in prices; it is measured by an index such as the Retail Price Index (RPI). At the time of writing, inflation is low, between 2% and 3%. Inflation impacts on project appraisal in two ways. First, inflation affects interest rates by increasing rates by the amount of expected inflation. Therefore, higher inflation will mean higher costs of finance and these will have to be incorporated into the discount rate. Secondly, it makes forecasting future cash flows more difficult because they will be affected by inflation. Revenues and costs may well be influenced by inflation in different ways, and it is highly unlikely that inflation will impact on a project precisely in line with changes in the RPI.

There are two main approaches to dealing with inflation in project appraisal.

- *Method 1* uses a real discount rate and projects future cash flows at base year prices with no inflation. A real discount rate is one from which the inflationary effect has been removed. With this approach, inflation is removed from the discount rate and from future cash flows by projecting all cash flows at current prices. In this approach we are using 'real' cash flows and a 'real' interest rate, the term 'real' indicating that inflation has been removed. Inflation is removed from interest rates by the following formula:

$$\frac{1 + \text{Interest rate}}{1 + \text{Inflation}} - 1$$

- *Method 2* uses the current costs of finance and then projects cash flows at expected money prices in future years. This approach starts from the premise that current costs of finance contain an allowance for future inflation. Therefore discounts rates are related to the current costs of capital. This approach allows for forecasts of future costs and revenues to be inflated at different rates.

The following example illustrates these two approaches. A company operates a repairs and maintenance division that is served by a series of diversified local depots. These have experienced difficulty in meeting the demands of the repairs and maintenance division in recent months. A consultant has been approached to investigate the situation and to make recommendations.

The consultant has come up with the following way of effecting improvements. The company is recommended to purchase stores handling equipment. This would require an immediate payment of £220,000 and annual maintenance and operating charges of £40,000 at year 0, subsequently subject to inflation of 5% per year. The equipment is expected to have a four-year life.

The company would like to carry out an appraisal of the option over a four-year period. Its current cost of capital is 16% and the RPI is expected to increase at 5% for the foreseeable future.

First calculate the real discount rate = $\frac{1.16 - 1}{1.05}$ = .105 = 10.5%

Then discount at current prices using a rate of 10.5%

Method 2
Forecast future costs including inflationary increases
Discount at the current cost of capital.

Method 1

Yr	NCF £000s	Factor 0.105	0.105 PV
0	220	1	220
1	40	0.904977	36.1991
2	40	0.818984	32.75936
3	40	0.741162	29.64648
4	40	0.670735	26.82939
			345.4343

Method 2

Yr	NCF £000s	Factor 0.16	0.16 PV
0	220	1	220
1	42	0.862069	36.2069
2	44.1	0.743163	32.77348
3	46.305	0.640658	29.66565
4	48.62025	0.552291	26.85253
			345.4986

As may be seen from the illustration, the two methods produce virtually identical results in terms of the projects net present values. Method 2 has a slightly higher cost by £64, but this difference is due to rounding. Drury and Tayles (1997) found that a high proportion of companies in a UK study failed to deal with inflation correctly. A summary of that article follows at the end of this chapter.

Sensitivity Analysis (or 'what if?' analysis)

Sensitivity analysis represents a non-probabilistic approach to allowing for risk and uncertainty in project appraisal. In consequence, it can be used in situations where information about probabilities is absent. It can also be used in parallel with techniques using probabilities. Sensitivity analysis examines how sensitive the net present value is to changes in key variables, such as increases in capital costs at the commencement of the

project, increases and decreases in projected sales volumes, and increases and decreases in variable costs. The methodology of sensitivity analysis is as follows:

1. Specify a base case or most expected situation. This is the most likely scenario and acts as a core against which the net present values arising from changes in key variables can be compared.
2. Ask a series of 'what if' questions that explore the effect of changes in the key variables. For example, what if sales fall 5% or 10% below base case or rise 5% or 10% above? The NPV is recalculated for each of these 'what if' questions. For this stage of sensitivity analysis a computer spreadsheet is essential.
3. Up to this point, one variable has been changed at a time. This next stage involves changing several variables, for example, what if output increases, selling price falls and fixed costs increase?
4. At this point we evaluate the sensitivity of the project's NPV to changes in the key variables.
5. Make a decision.

Let us examine an example. Suppose that base-case cash-flow projections (in millions of pounds) are as follows:

Investment (year 0)	800
Annual revenue items	(years 1–10)
Sales	400
Variable costs	200
Fixed costs	40

The cost of capital is 10%.

In Table 9.8, each variable is changed in isolation. In each case the change is 10% above or below the expected outcomes. From this table it is straightforward to see what happens over a range of values of a single variable. For example, as annual revenue changes from £360 million to £400 million and £440 million, net present value goes from –£63 million to £183 million and £429 million, respectively.

Table 9.8 Sensitivity analysis

	Outcomes (£m)			NPVs (£m)		
	Pessimistic	**Expected**	**Optimistic**	**Pessimistic**	**Expected**	**Optimistic**
Annual revenues	360	400	440	–63	+183	+429
Annual variable costs	220	200	180	+60	+183	+306
Annual fixed costs	44	40	36	+158	+183	+208

Table 9.9 Two-way analysis of net present value (£ millions)

Annual revenue (£m)	Variable costs 220	£(m) 200	180
360	–186	–63	+60
400	+60	+183	+306
440	+306	+429	+552

To see what happens when we vary two variables, we need to draw up a two-way table. For example, Table 9.9 shows how NPV changes when both annual revenue and variable costs vary.

The Pivot Approach to Sensitivity Analysis

A complementary approach, termed the pivot approach, is to ask by how much a variable must change before the NPV becomes zero. In other words, what level of change can a project sustain and still break even, or what level of change is necessary to turn an acceptable project into an unacceptable project?

The procedure for undertaking this approach is:

1. Find the NPV of the project with the original estimates.
2. For each variable in the NPV calculation (capital cost, revenues, operating costs, discount rate and so on) calculate by how much the variable must change before the NPV becomes zero. This is done independently for each variable.

Table 9.10 illustrates the procedure for capital costs and annual sales for our example. Such a table indicates the variables that the project is most sensitive to. The pivot approach provides more information for the decision maker about an important area of risk in a project. From an operational perspective, it may indicate those variables on which more management time may be worth spending. For example, Table 9.10 shows that the project's NPV is particularly sensitive to annual sales, so that more resources may need to be put into marketing the product, year after year. The table shows that if capital costs increase by 23% over budget this will result in a zero NPV. Recognition of this will highlight to management of the construction phase the importance of completion within budget.

The Value of Sensitivity Analysis

The technique is transparent and readily understood by all. The output of sensitivity analysis may have operational value in allowing managers to resource those variables that are seen to be most critical in terms of their impact on NPV. A range of organisations use the technique; for example, the National Health Service requires it for all project appraisals. We have seen with pivot analysis how it can alert managers to the critical variables in the management of a project. Finally, in the all-pervasive computer environment, it is ideally suited to a spreadsheet package, which takes the cost and drudgery out of the

Table 9.10 The pivot approach

Variable	Expected value (£m)	Expected NPV (£m)	Maximum change in variable to give a zero NPV (£m)	Maximum % change in variable
Capital cost	800	183	+183	+22.875
Sales	400 per year	183	–29.8 per year	–7.45

constant recalculations, and which has facilities to display the information in ways that bring out its significant features; for example, with the use of charts.

On the downside, it increases the amount of information available to the decision maker but does not give a single figure signal as to whether the project is acceptable or not. The basic variant changes one variable at a time, which may limit its usefulness, but we have seen that changes in a number of variables can also be built in.

Non-Financial Appraisal

Desiderata Analysis

The above approaches are purely financial and may need to be supplemented with other techniques in non-profit organisations. One way of dealing with non-financial issues is through the use of desiderata analysis, which was introduced in Chapter 8.

With reference to project appraisal, desiderata analysis has the following methodology:

1. A multi-disciplinary team establishes the desirable features (desiderata) required from a project.
2. The team also assigns weights of importance to the desiderata, with the more desirable outcomes receiving greatest weight.
3. Each option is scored (e.g. from –4 to +4) in terms of meeting the various desiderata.
4. The resultant weighted scores are summed in a table to establish the best option.

An illustration is provided in the following table:

		Option 1		Option 2	
Desiderata	Weights	Score	Score × weight	Score	Score × weight
D1	0.4	–2	–0.8	+2	0.8
D2	0.3	+2	0.6	+2	0.6
D3	0.2	+4	0.8	–4	–0.8
D4	0.1	+4	0.4	+2	0.2
Totals	1.0		1.0		0.8

In the table, Option 1 scores a total of 1 and is therefore preferred to Option 2 with a weighted score of 0.8.

The advantages of the desiderata approach are as follows:

- Provided that the staff involved are located in relatively close proximity to each other, it is quick to implement.
- It has low costs, the most significant of which is that of staff time in meeting to determine desiderata and the scoring of options.
- It fosters co-operation as the scoring teams are usually multi-disciplinary, crossing departmental boundaries.
- It produces an auditable trail of the non-financial issues that have been considered in the analysis.

The approach also has some disadvantages:

- The process is, of course, subjective.
- It does provide a recommendation of the 'best' project but this cannot be integrated into the financial analysis. It must be considered by decision makers alongside the results of the financial appraisal.
- Total scores may conceal significant differences between options, so it is important that a full summary of discussions and scoring accompanies the results of the exercise.

There is an opportunity to undertake desiderata analysis in the second case study at the end of this chapter.

Cost–Benefit Analysis

Cost-benefit analysis (CBA) not only looks at the direct costs of an option but also explicitly values indirect costs and social factors. It adds together these costs and benefits and applies discounted cash-flow methods to them.

It was first used in the UK to appraise construction of the M1 motorway and London's Victoria underground line. Later it was used in analysing the costs and benefits of a third London airport. It is used in a day-to-day fashion in appraising schemes for motorway extensions and widening, river crossings, etc.

To provide an illustration, if CBA were used to appraise a proposal for adding an extra lane to a motorway, then it would consider the following costs and benefits:

- The direct costs, which would consist of the costs of the land, the construction costs and the annual maintenance costs resulting from the extra lane.
- The benefits to road users in terms of fuel savings and time savings. These benefits do not have market prices and so ways of valuing them have been created. Fuel savings would occur because traffic might move at a more fuel-efficient rate or because the motorway could carry more cars and reduce total journey time. Time

savings would be estimated based upon the estimated speed of the traffic; they could be valued at different rates depending on whether they are work time or leisure time activities. A new motorway lane will itself generate traffic, and such generated traffic time savings are also input but may be weighted less than existing traffic. These benefits are valued in money terms. They are regarded as benefits of the project as they owe their existence to the project.

- Finally, the costs and benefits would be projected over a lengthy time period and discounted back to the present day.

The advantages of CBA are as follows:

- It estimates the market prices of non-traded costs and benefits and adds these to direct costs to produce a 'bottom line' figure. Desiderata analysis is unable to do this.
- It takes account of the time value of money by discounting to these value flows to obtain an overall NPV for each option.
- CBA attempts to take a global perspective and visualise the whole problem.
- It has developed innovative approaches to the valuation of intangibles such as time savings and the costs of noise pollution.

The disadvantages of CBA are:

- It can take a very long time to complete and it can be very expensive – especially for one-off projects. In this respect it is unlike desiderata analysis. Where the type of analysis can be repeated many times, as with major road schemes, then it becomes a much more manageable and cost-effective technique.
- It is argued that the measurable drives out the immeasurable. Because things such as amenity cannot be valued, they are relegated to footnotes and the focus of attention is located firmly on the value flows and the NPV.

Conclusions

This chapter has shown that:

- The scale of many projects gives them strategic significance.
- In project appraisal the duration of the project is a significant factor, and because of this the idea of the time value of money and discounting is very important.
- There are two discounted cash-flow techniques, net present value and internal rate of return. Both make use of cash flows and of discounting.
- There are two other techniques. Payback is cash-based and emphasises the short-term payback of the project. Accounting rate of return is based upon accounting profits rather than cash flows.
- Taxation impinges on project appraisal because a project will produce profits that will be taxed. The taxes need to be included as cash outflows.

- Inflation is also significant because of the duration of projects, and there are two approaches for dealing with this: the real interest approach and the money interest approach.
- Sensitivity analysis is a valuable tool for dealing with project risk. It does not use probabilities. It may be used contemporaneously with probabilistic approaches.
- Desiderata analysis and cost–benefit analysis represent ways of dealing systematically with non-financial issues.

Summary

There are many examples of projects of a strategic nature. These projects are long-term, extending over several years, and usually involve investments, costs and revenues. After identifying the scope and objectives of the project, the next step is to identify the relevant cash flows for project appraisal. Great care must be taken at this stage to include all relevant cash flows and to exclude those that are not relevant. Following this, the chapter considered different methods of project appraisal and concluded that the best methods were those based upon discounted cash flow – net present value and internal rate of return. Discounted cash flow is considered to be the best technique because it emphasises cash flows rather than profits (which can be manipulated), it considers all cash flows, it allows for the timing of those cash flows and uses the appropriate discount rate. The chapter also considered payback, a very simple cash-based technique that emphasises the short term, and the accounting rate of return that bases its appraisal on accounting profits.

Taxation can have an important influence on the net present value of a project because a company will have to pay corporation tax on its profits and will gain capital allowances on its investment. Because projects may last many years, it is important to take account of inflation, and the chapter discussed two ways of doing so. Finally, the chapter considered the usefulness of sensitivity analysis, a method of looking at a range of outcomes from a project with the objective of better informing the decision maker.

Recommended Further Reading

Drury C. and Tayles M. (1997) 'The misapplication of capital investment appraisal techniques', *Management Decision*, 35(2): 86–93.

This study is based upon a questionnaire mailed to qualified management accountants in 866 UK manufacturing companies with average annual sales in excess of £10 million. The authors achieved a questionnaire response of 35% (305 usable replies).

The questionnaire responses indicate that payback is the most popular technique in small organisations and discounted cash-flow techniques the most popular in large organisations. The vast majority of organisations used a combination of methods. Small organisations rank payback as the most important technique and large organisations the internal rate of return.

Small firms rate 'intuitive management judgement' highly in project appraisal, whereas this is not the case in large organisations where formal management committees may consider projects for approval. The staff of small firms are more likely to base their individual judgements on knowledge of the business.

A significant percentage of firms use the accounting rate of return, and the authors indicate that the only justification for this is the project's impact on reported profits. Top management may consider these to be significant to the capital markets, whilst the remuneration of top managers may be tied to annual net profit.

The authors stress the importance of the correct treatment of inflation in project appraisal. They indicate that there are two approaches to dealing with inflation: using a real discount rate with cash flows expressed in real terms; and using a money discount rate with cash flows adjusted for future inflation. The latter approach is preferable because expenses and revenues inflate at different rates. The survey discovered that only 53 out of 195 companies (27%) treated inflation correctly in appraisal.

The article also considers the discount rates used by firms. It confirms earlier studies that have found firms to be using excessively high discount rates, thereby leading to underinvestment. A possible explanation for this is that senior managers wish to counteract the tendency to inflate systematically the forecast returns from projects. Additionally, a company is exposed to greater risk than a well-diversified portfolio and the discount factor may reflect this. Finally, it is also suggested that, managers may wrongly use return on investment as a guide to a appropriate discount rate.

The authors consider the appraisal of investments in advanced manufacturing technologies and find no evidence to support claims that for such projects companies set shorter payback periods and/or apply higher discount rates. It is proposed that any underinvestment in such technology may be primarily because of the difficulty of valuing the benefits of such investments.

The authors conclude that managers should take care to ensure that they use appraisal techniques correctly. They recommend that discount rates for appraisal should be established in corporate headquarters. They also conclude that corporate management should provide clear guidelines on how inflation should be allowed for in appraisal.

Lumijarvi, O.P. (1991) 'Selling of capital investments to top management', *Management Accounting Research*, 2: 171–188.

This article indicates a weakness with survey techniques based on questionnaire completion relating to the capital appraisal techniques employed by companies. In environments where investment funds are scarce, questionnaires tell us little about the ways in which lower levels of management influence more senior managers to approve their projects. This study is based upon a field study in one organisation of how subordinates attempt to influence senior managers who are decision makers with respect to acceptance or rejection of projects. The company is Scandinavia Corp., one of the largest companies in Finland. It has five divisions and the field study concentrates on three of them: Pulp and Paper, Metal and Packing, and Service. The company appraises projects using internal rate of return and payback.

The results of the study indicate that lower levels of management attempt to 'sell' their investments to senior decision makers in order to obtain approval for their projects. Nine interviewees out of ten said that their investments have to be sold to senior managers such as the heads of divisions. The interviews emphasised that projects were unlikely to be accepted unless the support of the division head was obtained, often well in advance of putting a proposal forward.

The arguments made by managers in their lobbying of senior staff can be categorised as follows:

- Economic arguments: the basic argument is that the project is profitable. Profitability was particularly important if the division's profitability was poor. However, several senior managers indicated that profitability was rarely the most important factor, although it was emphasised that a minimum level of profitability had to be achieved – an internal rate of return of 15%.
- Strategic arguments: within Scandinavia Corp. it is essential that a project fits into an agreed strategy or will permit a planned strategy to be implemented. Strategic arguments have more influence than economic arguments.
- Non-financial reasons, such as employment, may also be used to sell strategies although it is observed that these are rarely used in Scandinavia Corp.
- Production technology arguments such as that the project represents new technology. These arguments were employed frequently and were rated as 'very effective' by the decision maker.

Selling projects took place in formal selling occasions such as (a series of) meetings and also on informal occasions such as trips and phone calls. Where a manager made a personal visit to a decision maker, this could have considerable influence. Once the decision-maker is committed, both the proposer and the decision maker sell and promote the project. The field study finds that submitted proposals are likely to be approved. This is because the proposer will have already sold the idea to the division head, and together they will have sold the idea to other senior executives. Only after the decision makers give their commitment to the project are projects submitted formally for approval.

Case Study: Branchester United

Branchester United is a professional rugby club in the Kingdom of Karibya. The season has recently ended and the club has finished in eighth position in the Kingdom's 20-club Premier Division.

The club was formed into a PLC three years ago when the game first became professional in Karibya. Prior to this the players were semi-professionals and played rugby football on a part-time basis. The last three years have been a period of upheaval, with two of the newly professionalised clubs going into liquidation. Indeed,

some commentators consider that the impact of professionalism has been disastrous for the game.

The club's city centre ground has a capacity of only 20,000, which is considered too small for a Premiership club. The ground is easy to access by public transport, although car parking can be difficult on Saturdays when the team are playing at home. The site represents prime building land and is owned by the local authority and leased to the club. The lease has 11 years to run after the end of the current season.

The club has recently been awarded a Heritage grant of £20 million towards the cost of building a new stadium on the outskirts of the city at the Old Grove. One condition of the grant is that the club must leave the current ground at the end of the 2004/2005 season and move to the new ground. Assurances have been received that the new ground could be constructed by the start of the 2005/2006 season (1 July 2005) if a start is made in the next month. The lease agreement with the local authority would then cease at the end of the 2004/2005 season. As soon as the club vacates the current ground, construction of a Heritage Mall will commence. The new stadium would cost £40 million. A sliding roof would be constructed for an extra £10 million.

The new location has several advantages for the club. There would be ample car parking and there would be reserved spaces for the club's directors and key sponsors. The pitch would be surrounded by a running track and the seats would be rolled forward when rugby is being played. Its capacity would be 30,000 for athletics and 40,000 for rugby. The sliding roof would allow rugby to be played in the depths of winter – in the past games have had to be cancelled due to snow and freezing conditions. Finally, the sliding roof would permit pop concerts and other types of entertainment to be put on.

The club has two star players, Andy Mixon and Ryan Donaldson. Leeds Castle has offered £10 million for Mixon and Crystal Glass Corinthians have offered £12 million for Donaldson. The directors have issued a press statement indicating that they propose to sell both players in order to part finance the new stadium, with a further £8 million being borrowed over 20 years at 8%. They are convinced of the benefits of the sliding roof. However, the supporters club is incensed by news of the decision to sell players and a letter from its Chairman is attached as Annex 1 at the end of this case study.

The directors include Charles Proshare, an expert in financial theory. He has advocated in a recent TV interview keeping Donaldson, borrowing £10 million and financing £10 million from reserves. He strongly advises against the issue of shares. An article in the *Karibyan Financial Daily* has claimed that the lack of player sales during 2003/2004 has held back Branchester United's planned stadium development (Annex 2). Proshare dismisses this assertion and has indicated that the company has £8 million cash on short-term deposit. He is supported by the head coach, who has stated that Branchester's coaching policy has provided from its own environment world-class players such as Mixon and Donaldson. He has indicated that he has three very able youngsters with world-class potential currently playing in the reserves. All three will be promoted to the first team squad when Mixon and Donaldson are sold.

The club plays on average 24 home days per year and is entitled to a valuable share of Premiership television proceeds as a Premiership club. Its recent performances and average ticket prices are as follows:

Year	Attendances (000s)	Stadium revenues (£m)	TV revenues (£m)	League position	Net profit before tax (£m)	Dividends per share (p)	Share price (£)	Average ticket price (£)
2000/01	450	4.5	0.56	2	1.2			10
2001/02	450	5.4	1.2	3	1.5	7	3	12
2002/03	419	5.45	1.4	7	7.3	5	2.8	13
2003/04	404	5.25	1.8	8	0.8	4	2	13

The detailed profit and loss statement for the year ended 30 June 2004 is as follows:

	£000	£000
Revenues		
Stadium (attendances plus net concessions)	5250	
TV revenues	1800	
Sponsorship	110	
Sales of players	50	
		7210
Expenses		
Stadium expenses	180	
Stadium rent	50	
Club management and coaching staff	450	
Playing staff (30 players)	2,750	
Advertising	385	
Travel and hotels	170	
Vehicle costs	25	
Interest	2,400	
	6410	
Net profit before tax		800
Corporation tax (25%)		200
Net profit after tax		600
Dividends: 10 million ordinary shares at 4 pence per share		400

Transfers to reserves	200

The company's current financial structure is as follows:

	Book value	Market value
	£	£
10 million £1 ordinary shares, fully paid	10,000,000	20,000,000
Share premium account	10,000,000	
Reserves	1,024,000	
Loans (8%)	30,000,000	30,000,000

The company's cost of capital for project appraisal is 20%.

Tenders to build the stadium before the start of the 2005/2006 season have been received from three specialist construction companies; the cheapest of these is Stadium All Stars, which has quoted capital costs as follows:

	£000
Land	5,000
Building	20,000
Fixtures and furnishings	13,000
	38,000
Sliding roof	10,000
	48,000

Branchester RFC will also have to pay planning fees of £2 million; of this, £1.2 million has already been spent. Construction costs and all fees will be fully capitalised.

The company will be able to claim capital allowances at the rate of 4% on a straight-line basis over a 25-year period on the whole of the capital costs (including fees). The company pays corporation tax at the rate of 25%. All tax payments are made one year in arrears. It is estimated that the stadium will be completed on 1 July 2005, the first day of the 2005/06 financial year.

Estimates of revenues and costs relating to the new stadium are contained in Annex 3.

After completion of the building and fitting-out of the stadium there will have to be a fortnight of safety testing so that the stadium will be awarded a Health and Safety Certificate for the start of the 2005/2006 season. The certificate will cost £5,000 and does not attract capital allowances.

A specialist stadium surveyor has just been contacted with reference to the detailed appraisal of the stadium. The surveyor has reported that the proposed stadium should be

appraised over a 10-year period, commencing 1 July 2005, in order that it may be compared with the existing stadium. Additionally, the report states that it is usual in stadium appraisals to consider the capital costs, the net revenues of the proposed stadium, and the net revenues of the existing stadium.

1. Using Branchester's cost of capital of 20%, calculate the net present value of the new stadium. State and explain any assumptions that you need to make.
2. Making use of the results of your net present value analysis and the other information (both financial and non-financial), examine whether Branchester United should go ahead and move to the new stadium.

ANNEX 1

BRANCHESTER UNITED RFC SUPPORTERS CLUB (BUSC)

10 May 2004

The Board of Directors

Branchester United RFC

Dear Sir,

I am writing on behalf of the BUSC about the disclosure that Andy Mixon and Ryan Donaldson are to be sold for a total of £20 million. Mixon is probably the best and most dynamic forward we have, and his presence in the team will be essential if we are to avoid relegation next year. Donaldson is a superb attacking full back, first choice in that position for Karibya, and his transfer would cost enormously in attack, defence and goal kicking. Rather than sell the two of them we should be looking to purchase other players to strengthen our squad and progress back up the table to where we were four years ago.

I understand that the sale is to finance the new stadium. This is another thing that concerns the supporters. The existing stadium is well suited for public transport, and many supporters can walk to the ground. What does the club propose to do about these supporters, many of whom have season tickets?

Since the game went professional, prices have increased. The price of a season ticket has increased from £100 to £250 in just three years. Yet the quality of the rugby football has not improved. Please bear in mind that there is lots of other entertainment available on a Saturday afternoon and next season, Leeds Castle, the Premiership champions, will offer a box-office television service on cable and satellite for all their Saturday and midweek home games. The new stadium will have increased capacity – but what is the percentage occupancy of the existing ground, as I noticed lots of empty seats last season?

In conclusion, we request the directors to consider the views of the supporters, the game's true fans.

James McAttee
Chairman

ANNEX 2

FROM THE KARIBYAN FINANCIAL DAILY, 11 MAY 2004

Branchester United yesterday announced reduced estimated post-tax profits because of reduced revenues from player sales. Profits were estimated at £800,000, compared with £7.3 millions last year.

There were no high-profile player sales in the period while the figures for 1998/99 included a significant profit on the sale of Brian Davies to Blackburn Bulldogs. Profits from player sales shrank from £6.34 million to £50,000.

Gate receipts have fallen but media revenues from satellite and cable have increased as more of Branchester's games were broadcast. Next season the picture is likely to be less rosy because of the box office viewing capability to be offered by Leeds Castle.

Branchester United has announced that it is to build a 40,000 seat stadium on a 12.5 acre site at the Old Grove starting in June 2004, with completion in June 2005. It has been offered a Heritage Commission grant of £20 million towards the construction.

Planning permission for the new stadium has been received but the company said it was waiting for an archaeological team to finish work on the proposed site, which is close to an ancient Saxon settlement.

Pre-tax profits per share are estimated at 8 pence, compared with 73 pence last year. Dividends are cut to 4 pence and the share price has fallen by 28% in the past year, closing yesterday at £2.

ANNEX 3

DETAILED ESTIMATES FOR THE NEW STADIUM

Annual running costs

Office staff	£45,000
Security	£45,000
Stadium management	£97,000

Business rates	£15,000
Equipment depreciation	£2,300
Maintenance	£32,000
Electricity	£12,500
Heating	£6,500
Motoring expenses	£8,500
Marketing	£25,000

It will also cost a total of £5,000 each time the sliding roof is closed and then reopened. This is expected to occur on 20 days per year.

Annual gate receipts

Season-ticket holders: 5,500 @ £275
Other paying spectators (19 home Premiership games plus 8[a] home Cup games plus 4 European[b] league games)

Per home match:

Probability	spectators	Ave. ticket price
0.3	25,000	£15.00
0.5	20,000	£15.00
0.2	15,000	£15.00

Notes:
[a] Assumes that the club will get through to the quarter finals of the competition.
[b] Assumes that the club will finish in the top four of the Premier Division in 2004/2005.

Other annual receipts

Concerts: $12 \times$ £5,000
Bars and cafeterias concessions
Sales: Drinks $100{,}000 \times$ £4.50
Snacks: $50{,}000 \times$ £2.60
Running costs £375,500

Athletics meetings: 10 meetings per year are projected with an average expected audience of 27,500 and an average ticket price of £15.

Case Study: Social Services Agency

The Social Services Agency in Toptown is a branch of the Department of Homeland Affairs. The Agency is currently investigating the possibility of moving from its current office accommodation to larger premises. The number of staff has grown significantly in the last five years from 56 to 103, and the Agency has had to rent two small houses in the near vicinity to provide working space for the extra staff. Many of the additional staff are peripatetic as they are responsible for visiting clients and monitoring projects being undertaken by the local authority on behalf of the Agency.

The current building was acquired several years ago for £560,000, but it is now worth £1.2 million. It is situated in the centre of town near other civic buildings. However, the commercial market is oversupplied in the area and it is not considered a good time to sell the property. The property provides 3500 square feet and, if vacated, would be let for £12 per square foot per year payable annually in advance. The other two houses are both on short three-month tenancies and are let to the Agency for £3600 and £5400 per year, respectively. In total, they provide an additional 900 square feet. The current building has a number of small fixed rooms and lacks flexibility. Both new buildings will offer open plan accommodation and be much more flexible.

There are two options for the new accommodation. One option is to rent 8000 square feet of office space in a new development at Baytown, comprising a large building about 4 miles towards the coast. There are several offices to choose from in the complex and all have plentiful parking, but the location is inconvenient for public transport. The new office would be rented at £9.50 per square foot per year, payable annually in advance. This block is suitable for accommodation immediately and if this option is chosen, the Agency will move to the new accommodation immediately.

The other alternative is to purchase a block in an older part of town, Trafford. The block comprises the ground floor and three upper floors. The ground floor and the top floor are both occupied at present and will continue to be so. The middle two floors are very spacious and offer 9000 square feet of office space. The total rents payable by the tenants amount to £70,000 per year payable annually in advance. The building is expected to cost £900,000, plus a further £650,000 on refurbishment and £110,000 on fees. The refurbishment would take a year, with £900,000 acquisition cost spent at the start of the project and refurbishment and fees payable in one year's time when the building would be occupied. There is an option to incorporate air conditioning which will add £120,000 to the refurbishment costs, and it has been agreed to proceed with this option. The older part of town is well served with public transport and High Street is very busy. Many of the Agency's clients live in this part of town. There is parking for 40 cars incorporated into the area at the rear of the office block. The current tenants will continue to use five of those spaces. The agency would move into the block in one year's time.

Removal costs will amount to £25,000 for either option. Annual building running costs for all buildings included within this appraisal are estimated at £9.04 per square metre per year payable annually in arrears.

It has been estimated that annual car expense payments to staff will be as follows: current, £18,000; Baytown, £27,000; Trafford, £13,500. These may be assumed to be paid annually in arrears.

British Council of Offices has found in recent years that the average gross floor area per person is 8 square metres and this is considered acceptable. Gross floor area includes non-productive space such as corridors, stairwells and meeting rooms.

A meeting of a multi-disciplinary stakeholder group (consisting of three managers and three case officers) identified five qualitative factors for consideration in the appraisal, and weighted them to reflect this:

Factor	Weighting	Reasoning
Public transport service	3	To facilitate access by clients and staff who do not have cars
Adequate car parking	3	Notwithstanding the desire to promote public transport, it is recognised that all peripatetic staff bring a car to work
Efficient working	3	The current office set-up involves the staff being split in three offices and this weakens the service provided. It also leads to a loss in time in travelling between offices
Minimal environmental impact	2	In accordance with central government's objectives to reduce vehicle emissions
A modern office environment	2	To allow ready communication, flexible organisation, air conditioning and internet-ready accommodation

The Agency's scoring methodology is as follows:

Basis	Score
Meets desiderata exactly	4
Meets desiderata well	2
Meets desiderata adequately	0
Satisfies desiderata inadequately	−2
Does not satisfy desiderata at all	−4

Two appraisal guidelines are in force:

- The Agency appraises schemes using a 6% real discount rate.
- The office accommodation scheme is to be appraised over 20 years. The Trafford scheme may be assumed to have a residual value of £1.7million in 20 years' time (in current monetary values).

1. Calculate the net present values of both options.
2. Complete the desiderata table for both options, explaining your reasons for project scoring.
3. Prepare a short briefing note (500 words) for the Agency's chief executive in which you bring together your conclusions about both schemes and make a clear recommendation.

Questions

1. A company is considering the following investment projects. Both would involve purchasing machinery with a life of 5 years.

   - **Project 1** would generate annual cash flows of £150,000; the machinery would cost £350,000 and have a scrap value of £45,000.
   - **Project 2** would generate annual cash flows of £250,000; the machinery would costs £800,000 and have a scrap value of £350,000.

The company's discount rate is 12%. Assume that the annual cash flows arise on the anniversaries of the initial outlay.

Calculate the net present value and payback for each project and state which project the company should accept and why.

2. A firm can buy a new printer for £2,000 payable immediately. The new printer would make cash savings for the firm of £2,000 in the first year of operation, £4,000 in the second year and £2,000 in the fifth year.

The firm makes no savings from the printer in the third and fourth year of its life, and will need to spend £4,000 on it in year 3 because of expensive repairs. The machine is scrapped at the end of 5 years, but there is no scrap value.

As an alternative to outright purchase, the firm could hire a printer, paying £1000 per annum, in advance, for the 5 years. The firm would still expect to make the same costs and savings as in outright purchase, but the hire company would meet the repair cost of year 3.

If the going rate of interest is 10%, using net present value, advise the firm as to which of the two methods (buy or hire) should be used to obtain the printer.

3. Trigger PLC is a manufacturer of computer components and a decision is required on a proposal to invest £1,800,000 on a new machine in order to move into a new market for components. The financial details are as follows:

Initial investment:	£1,800,000
Life of project:	10 years
Net cash flows:	
years 1–6	£500,000 per year
years 7–10	£300,000 per year
Residual value	£500,000

The company has a target rate of return of 11% and a payback criterion of 4 years.

(a) Calculate the payback period.
(b) Calculate the project's net present value.
(c) Advise the company on whether it should proceed with the project. Provide reasons for your advice.

4. A company is considering an investment of £1.4 million in a project that has a seven-year life. The company has estimated its discount rate at 12%. Details of the sales and costs arising from this project are as follows:

Sales volume:	250,000 units per annum
Sales price:	£4 per unit
Costs	
Direct materials (4 kg at £0.40 per kg)	£1.60 per unit
Direct labour (0.1 hour at £8 per hour)	£0.80 per unit
Overhead	£330,000 per annum

Note that the annual overhead includes £200,000 per year depreciation on the asset. It also includes apportioned fixed overheads of a further £50,000 per year.

(a) Calculate the net present value of the project. Provide a commentary on the discounting process and on the net present value that you have calculated.
(b) Carry out a sensitivity anlaysis on five variables of this project, including the life of the project and the discount rate. Identify what you consider to be the most critical variable and advise management what they should do, if anything, before adopting this project.

Table 9A.1 **Present value of future cash flows**

	Discount rate																			
No. of periods	**1%**	**2%**	**3%**	**4%**	**5%**	**6%**	**7%**	**8%**	**9%**	**10%**	**11%**	**12%**	**13%**	**14%**	**15%**	**16%**	**17%**	**18%**	**19%**	**20%**
1	0.990	0.980	0.971	0.962	0.952	0.943	0.935	0.926	0.917	0.909	0.901	0.893	0.885	0.877	0.870	0.862	0.855	0.847	0.840	0.833
2	0.980	0.961	0.943	0.925	0.907	0.890	0.873	0.857	0.842	0.826	0.812	0.797	0.783	0.769	0.756	0.743	0.731	0.718	0.706	0.694
3	0.971	0.942	0.915	0.889	0.864	0.840	0.816	0.794	0.772	0.751	0.731	0.712	0.693	0.675	0.658	0.641	0.624	0.609	0.593	0.579
4	0.961	0.924	0.888	0.855	0.823	0.792	0.763	0.735	0.708	0.683	0.659	0.636	0.613	0.592	0.572	0.552	0.534	0.516	0.499	0.482
5	0.951	0.906	0.863	0.822	0.784	0.747	0.713	0.681	0.650	0.621	0.593	0.567	0.543	0.519	0.497	0.476	0.456	0.437	0.419	0.402
6	0.942	0.888	0.837	0.790	0.746	0.705	0.666	0.630	0.596	0.564	0.535	0.507	0.480	0.456	0.432	0.410	0.390	0.370	0.352	0.335
7	0.933	0.871	0.813	0.760	0.711	0.665	0.623	0.583	0.547	0.513	0.482	0.452	0.425	0.400	0.376	0.354	0.333	0.314	0.296	0.279
8	0.923	0.853	0.789	0.731	0.677	0.627	0.582	0.540	0.502	0.467	0.434	0.404	0.376	0.351	0.327	0.305	0.285	0.266	0.249	0.233
9	0.914	0.837	0.766	0.703	0.645	0.592	0.544	0.500	0.460	0.424	0.391	0.361	0.333	0.308	0.284	0.263	0.243	0.225	0.209	0.194
10	0.905	0.820	0.744	0.676	0.614	0.558	0.508	0.463	0.422	0.386	0.352	0.322	0.295	0.270	0.247	0.227	0.208	0.191	0.176	0.162
11	0.896	0.804	0.722	0.650	0.585	0.527	0.475	0.429	0.388	0.350	0.317	0.287	0.261	0.237	0.215	0.195	0.178	0.162	0.148	0.135
12	0.887	0.788	0.701	0.625	0.557	0.497	0.444	0.397	0.356	0.319	0.286	0.257	0.231	0.208	0.187	0.168	0.152	0.137	0.124	0.112
13	0.879	0.773	0.681	0.601	0.530	0.469	0.415	0.368	0.326	0.290	0.258	0.229	0.204	0.182	0.163	0.145	0.130	0.116	0.104	0.093
14	0.870	0.758	0.661	0.577	0.505	0.442	0.388	0.340	0.299	0.263	0.232	0.205	0.181	0.160	0.141	0.125	0.111	0.099	0.088	0.078
15	0.861	0.743	0.642	0.555	0.481	0.417	0.362	0.315	0.275	0.239	0.209	0.183	0.160	0.140	0.123	0.108	0.095	0.084	0.074	0.065
16	0.853	0.728	0.623	0.534	0.458	0.394	0.339	0.292	0.252	0.218	0.188	0.163	0.141	0.123	0.107	0.093	0.081	0.071	0.062	0.054
17	0.844	0.714	0.605	0.513	0.436	0.371	0.317	0.270	0.231	0.198	0.170	0.146	0.125	0.108	0.093	0.080	0.069	0.060	0.052	0.045
18	0.836	0.700	0.587	0.494	0.416	0.350	0.296	0.250	0.212	0.180	0.153	0.130	0.111	0.095	0.081	0.069	0.059	0.051	0.044	0.038
19	0.828	0.686	0.570	0.475	0.396	0.331	0.277	0.232	0.194	0.164	0.138	0.116	0.098	0.083	0.070	0.060	0.051	0.043	0.037	0.031
20	0.820	0.673	0.554	0.456	0.377	0.312	0.258	0.215	0.178	0.149	0.124	0.104	0.087	0.073	0.061	0.051	0.043	0.037	0.031	0.026

Table 9A.2 **Present value of annuities**

	Discount rate																			
No. of Periods	**1%**	**2%**	**3%**	**4%**	**5%**	**6%**	**7%**	**8%**	**9%**	**10%**	**11%**	**12%**	**13%**	**14%**	**15%**	**16%**	**17%**	**18%**	**19%**	**20%**
1	0.990	0.980	0.971	0.962	0.952	0.943	0.935	0.926	0.917	0.909	0.901	0.893	0.885	0.877	0.870	0.862	0.855	0.847	0.840	0.833
2	1.970	1.942	1.913	1.886	1.859	1.833	1.808	1.783	1.759	1.736	1.713	1.690	1.668	1.647	1.626	1.605	1.585	1.566	1.547	1.528
3	2.941	2.884	2.829	2.775	2.723	2.673	2.624	2.577	2.531	2.487	2.444	2.402	2.361	2.322	2.283	2.246	2.210	2.174	2.140	2.106
4	3.902	3.808	3.717	3.630	3.546	3.465	3.387	3.312	3.240	3.170	3.102	3.037	2.974	2.914	2.855	2.798	2.743	2.690	2.639	2.589
5	4.853	4.713	4.580	4.452	4.329	4.212	4.100	3.993	3.890	3.791	3.696	3.605	3.517	3.433	3.352	3.274	3.199	3.127	3.058	2.991
6	5.795	5.601	5.417	5.242	5.076	4.917	4.767	4.623	4.486	4.355	4.231	4.111	3.998	3.889	3.784	3.685	3.589	3.498	3.410	3.326
7	6.728	6.472	6.230	6.002	5.786	5.582	5.389	5.206	5.033	4.868	4.712	4.564	4.423	4.288	4.160	4.039	3.922	3.812	3.706	3.605
8	7.652	7.325	7.020	6.733	6.463	6.210	5.971	5.747	5.535	5.335	5.146	4.968	4.799	4.639	4.487	4.344	4.207	4.078	3.954	3.837
9	8.566	8.162	7.786	7.435	7.108	6.802	6.515	6.247	5.995	5.759	5.537	5.328	5.132	4.946	4.772	4.607	4.451	4.303	4.163	4.031
10	9.471	8.983	8.530	8.111	7.722	7.360	7.024	6.710	6.418	6.145	5.889	5.650	5.426	5.216	5.019	4.833	4.659	4.494	4.339	4.192
11	10.37	9.787	9.253	8.760	8.306	7.887	7.499	7.139	6.805	6.495	6.207	5.938	5.687	5.453	5.234	5.029	4.836	4.656	4.486	4.327
12	11.26	10.58	9.954	9.385	8.863	8.384	7.943	7.536	7.161	6.814	6.492	6.194	5.918	5.660	5.421	5.197	4.988	4.793	4.611	4.439
13	12.13	11.35	10.63	9.986	9.394	8.853	8.358	7.904	7.487	7.103	6.750	6.424	6.122	5.842	5.583	5.342	5.118	4.910	4.715	4.533
14	13.00	12.11	11.30	10.56	9.899	9.295	8.745	8.244	7.786	7.367	6.982	6.628	6.302	6.002	5.724	5.468	5.229	5.008	4.802	4.611
15	13.87	12.85	11.94	11.12	10.38	9.712	9.108	8.559	8.061	7.606	7.191	6.811	6.462	6.142	5.847	5.575	5.324	5.092	4.876	4.675
16	14.72	13.58	12.56	11.65	10.84	10.11	9.447	8.851	8.313	7.824	7.379	6.974	6.604	6.265	5.954	5.668	5.405	5.162	4.938	4.730
17	15.56	14.29	13.17	12.17	11.27	10.48	9.763	9.122	8.544	8.022	7.549	7.120	6.729	6.373	6.047	5.749	5.475	5.222	4.990	4.775
18	16.40	14.99	13.75	12.66	11.69	10.83	10.06	9.372	8.756	8.201	7.702	7.250	6.840	6.467	6.128	5.818	5.534	5.273	5.033	4.812
19	17.23	15.68	14.32	13.13	12.09	11.16	10.34	9.604	8.950	8.365	7.839	7.366	6.938	6.550	6.198	5.877	5.584	5.316	5.070	4.843
20	18.05	16.35	14.88	13.59	12.46	11.47	10.59	9.818	9.129	8.514	7.963	7.469	7.025	6.623	6.259	5.929	5.628	5.353	5.101	4.870