# 19 Investment appraisal

This chapter covers syllabus section 3.2

On completing this chapter you should be able to:

- understand what investment means, why appraising investment projects is essential and the information needed for investment appraisal
- assess why forecasting future cash flows adds uncertainty to investment appraisal
- apply and analyse the payback method of investment appraisal
- apply and analyse the average rate of return method of investment appraisal
- analyse the importance of qualitative or non-numerical factors in many investment decisions
- (H) understand discounted cash flows and apply and analyse the net present value method of investment appraisal.

## SETTING THE SCENE

### Glasgow NHS invests in RFID to reduce costs

Greater Glasgow and Clyde NHS has invested in a wireless networking project in one of its hospitals. It tracks medical equipment with RFID (radio frequency identification) tags. The scheme will cost £70 000 and 1500 items of medical equipment will eventually be tagged. According to NHS clinical scientist, Jason Britton, the hospital loses between £20 000 and £40 000 a year in wasted time looking for misplaced equipment such as defibrillators, infusion pumps and blood pressure monitors. 'Devices can get lost in the system for years before they are discovered,' he said. With RFID, a central office will know exactly where each of the tagged items is in the hospital. Doctors will be able to locate the equipment quickly, so improving the level of patient care. The investment should pay back within two to three years.

*Source: www.silicon.com*

### Nigerian Water privatisation appears to be a good investment

The privatisation scheme selected by the Nigerian government for water supply involved private firms buying 20-year contracts to build and operate water-supply services to regions of the country. These were risky investments for private sector businesses as it was unclear how much consumers would be prepared to pay for clean water supplies. An analysis of the likely profitability of these projects concluded that:

- profit in today's values might be around $67 million
- the average rate of return should be close to 28%
- the payback period would be approximately 3.8 years.

*Source: http://wedc.lboro.ac.uk*

# 19 Investment appraisal

**Points to think about:**

- Both of these investment projects were expected to earn returns greater than the original cost. Why might it be difficult to forecast future returns from an investment?
- Both articles refer to the time to 'pay back' the investment cost. Why do you think this might be important?

## Introduction

Investment means purchasing capital goods – such as equipment, vehicles and new buildings – and improving existing fixed assets. Many investment decisions involve significant strategic issues – such as relocation of premises or the adoption of computer-assisted engineering methods. Other investment plans are less important to the overall performance of the business – such as replacing worn-out photocopiers. Relatively minor investment decisions will not be analysed to the same degree of detail as more substantial decisions on capital expenditure.

## What is investment appraisal?

**KEY TERM**

**investment appraisal** evaluating the profitability or desirability of an investment project

Investment appraisal is undertaken by using quantitative techniques that assess the financial feasibility of the project. Non-financial issues can also be significant and therefore qualitative appraisal of a project might also be very important. In some businesses, especially those dominated by the founding entrepreneur, formal investment appraisal may not be applied. Instead, the owner may develop a 'feel' for what is likely to be most successful and go ahead with that project even though no formal analysis has been undertaken. The use of such 'intuitive' or 'hunch' methods of taking investment decisions cannot be easily explained or justified – unless they turn out to be very successful.

### QUANTITATIVE INVESTMENT APPRAISAL

Quantitative investment appraisal requires the following information:

- the initial capital cost of the investment, including any installation costs
- the estimated life expectancy – how many years can returns be expected from the investment?
- the residual value of the investment – at the end of their useful lives will the assets be sold, earning additional net returns?
- the forecasted net returns or net cash flows from the project – these are the expected returns from the investment less the annual running cost.

Methods of quantitative investment appraisal include:

- payback period
- average rate of return
- net present value using discounted cash flows. (H)

### Forecasting cash flows in an uncertain environment

All of the techniques used to appraise investment projects require forecasts to be made of future cash flows. These figures are referred to as 'net cash flows'.

**KEY TERM**

**annual forecasted net cash flow** forecasted cash inflow – forecasted cash outflows

We assume for the IB examinations, rather simplistically, that the cash inflows are the same as the annual revenues earned from the project and the cash outflows are the annual operating costs.

These net cash-flow figures can then be compared with those of other projects and with the initial cost of the investment. Forecasting cash flows is not easy and is rarely likely to be 100% accurate. With long-term investments, forecasts several years ahead have to be made and there will be increased chances of external factors reducing the accuracy of the figures. For instance, when appraising

the construction of a new airport, forecasts of cash flows many years ahead are likely to be required. Revenue forecasts may be affected by external factors such as:

- an economic recession could reduce both business and tourist traffic through the airport
- increases in oil prices could make air travel more expensive than expected, again reducing revenue totals
- the construction of a new high-speed rail link within the country might encourage some travellers to switch to this form of transport.

These future uncertainties cannot be removed from investment appraisal calculations. The possibility of uncertain and unpredicted events making cash-flow forecasts inaccurate must, however, be constantly borne in mind by managers. All investment decisions involve some risk due to this uncertainty.

### ACTIVITY 19.1

**Cash-flow uncertainties**

**15 marks, 18 minutes**

For each of the following investment projects explain **one** reason why there is likely to be some uncertainty about the future net cash-flow forecasts earned by them:

**a** a project to construct a factory to make large and expensive luxury cars [3]

**b** an investment in a new computerised banking system offering customers new services using state-of-the-art equipment that has not yet been thoroughly tested [3]

**c** cash-flow forecasts for a new sports centre that are based on a small market research sample of the local population [3]

**d** the building of a new toll motorway between two cities [3]

**e** the construction of an oil-fired power station. [3]

## QUANTITATIVE TECHNIQUES OF INVESTMENT APPRAISAL

### Payback method

**KEY TERM**

**payback period** length of time it takes for the net cash inflows to pay back the original capital cost of the investment

If a project costs $2 million and is expected to pay back $500 000 per year, the payback period will be four years. This can then be compared with the payback on alternative investments. It is normal to refer to 'year 0' as the time period in which the investment is made. The cash flow at this time is therefore negative – shown by a bracketed amount – see Table 19.1. This shows the forecasted annual net cash flows and cumulative cash flows. This latter figure shows the 'running total' of cash flows and becomes less and less negative as further cash inflows are received. Notice that in year 3 it becomes positive – so the initial capital cost has been paid back during this year. But when during this year? If we assume that the cash flows are received evenly throughout the year (this may not be the case, of course), then payback will be at the end of the fourth month of the third year. How do we know this? At the end of year 2, $50 000 is needed to pay back the remainder of the initial investment. A total of $150 000 is expected during year 3; $50 000 is a third of $150 000 and one-third of a year is the end of month 4. To find out this exact month use this formula:

$$\frac{\text{additional cash inflow needed}}{\text{annual cash flow in year 3}} \times 12 \text{ months}$$

$$= \frac{\$50000}{\$150000} \times 12 \text{ months} = 4 \text{ months}$$

| Year | Annual net cash flows ($) | Cumulative cash flows ($) |
|---|---|---|
| 0 | (500 000) | (500 000) |
| 1 | 300 000 | (200 000) |
| 2 | 150 000 | (50 000) |
| 3 | 150 000 | 100 000 |
| 4 | 100 000 (including residual value) | 200 000 |

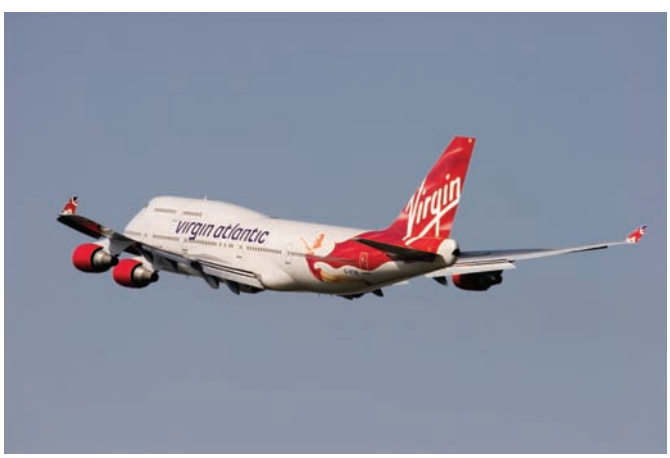
***Table 19.1*** *Cash flows of an investment*

#### *Importance of payback of a project*

Managers can compare the payback period of a particular project with other alternative projects so as to put them in rank order. Alternatively, the payback period can be compared with a 'cut-off' time period that the business may have decided on – for example, it may not accept any project proposal that pays back after five years.

- A business may have borrowed the finance for the investment and a long payback period will increase interest payments.
- Even if the finance was obtained internally, the capital has an opportunity cost of other purposes for which

it could be used. The speedier the payback, the more quickly the capital is made available for other projects.
- The longer into the future before a project pays back the capital invested in it, the more uncertain the whole investment becomes. The changes in the external environment that could occur to make a project unprofitable are likely to be much greater over ten years than over two.
- Some managers are 'risk averse' – they want to reduce risk to a minimum so a quick payback reduces uncertainties for these managers.
- Cash flows received in the future have less real value than cash flows today, owing to inflation. The more quickly money is returned to an investing company, the higher will be its real value.




*Virgin Atlantic invested £200 000 in a new technology communication system which provides direct contact with potential customers, giving details about special fare offers. The system earned extra cash flow of £200 000 in three months – a very rapid payback.*

***Evaluation of payback method***

The payback method is often used as a quick check on the viability of a project or as a means of comparing projects. However, it is rarely used in isolation from the other investment appraisal methods (see Table 19.2).

### Average rate of return (ARR)

**KEY TERM**

**average rate of return (ARR)** measures the annual profitability of an investment as a percentage of the initial investment

$$\text{ARR (\%)} = \frac{\text{annual profit (net cash flow)}}{\text{initial capital cost}} \times 100$$

This may also be referred to as the accounting rate of return. If it can be shown that Project A returns, on average, 8% per year while Project B returns 12% per year, then the decision between the alternative investments will be an easier one to make. For simplicity, we will assume that the net cash flows equal the annual profitability.

Table 19.3 shows the expected cash flows from a business investment into a fleet of new fuel-efficient vehicles. The inflows for years 1 to 3 are the annual cost savings made. In year 4, the expected proceeds from selling the vehicles are included.

| Year | Net cash flow |
|---|---|
| 0 | ($5 million) |
| 1 | $2 million |
| 2 | $2 million |
| 3 | $2 million |
| 4 | $3 million (including residual value) |

***Table 19.3*** *Net cash flows for fleet investment*

| Advantages | Disadvantages |
|---|---|
| • It is quick and easy to calculate.<br>• The results are easily understood by managers.<br>• The emphasis on speed of return of cash flows gives the benefit of concentrating on the more accurate short-term forecasts of the project's profitability.<br>• The result can be used to eliminate or 'screen out' projects that give returns too far into the future.<br>• It is particularly useful for businesses where liquidity is of greater significance than overall profitability. | • It does not measure the overall profitability of a project – indeed, it ignores all of the cash flows after the payback period. It may be possible for an investment to give a really rapid return of capital but then to offer no other cash inflows.<br>• This concentration on the short term may lead businesses to reject very profitable investments just because they take some time to repay the capital.<br>• It does not consider the timing of the cash flows during the payback period – this will become clearer when the principle of discounting is examined in the other two appraisal methods (average rate of return and net present value). |

***Table 19.2*** *Payback method – advantages and disadvantages*

The four stages in calculating ARR:

| | | |
|---|---|---|
| **1** | Add up all positive cash flows | = $9 million |
| **2** | Subtract cost of investment | = $9 million – $5 million<br>= $4 million (this is total profit) |
| **3** | Divide by life span | = $4 million/4 = $1 million (this is annual profit) |
| **4** | Calculate the % return to find the ARR | = $1 million/$5 million × 100 = 20% |

What does this result mean? It indicates to the business that, on average over the life span of the investment, it can expect an annual return of 20% on its investment. This could be compared with:

- the ARR on other projects
- the minimum expected return set by the business – known as the criterion rate. In the example above, if the business refused to accept any project with a return of less than 15%, the new vehicle fleet would satisfy this criterion
- the annual interest rate on loans – if the ARR is less than the interest rate, it will not be worthwhile taking a loan to invest in the project.

**KEY TERM**

**criterion rate or level** the minimum level (maximum for payback period) set by management for investment appraisal results for a project to be accepted

### *Evaluation of average rate of return*

ARR is a widely used measure for appraising projects, but it is best considered together with payback results. The two results then allow consideration of both profits and cash-flow timings (see Table 19.4).

## ACTIVITY 19.2

Read the case study below and then answer the questions that follow.

**Textile company plans investment**

A textile business is planning an investment programme to overcome a problem of demand exceeding capacity. It is considering two alternative projects involving new machinery. The initial outlays and future cash outflows are given below. Project Y machinery is forecast to have a life expectancy of just four years.

| Year | Project X | Project Y |
|---|---|---|
| 1 | ($50 000) | ($80 000) |
| 2 | $25 000 | $45 000 |
| 3 | $20 000 | $35 000 |
| 4 | $20 000 | $17 000 |
| 5 | $15 000 | $15 000 |
| 6 | $10 000 | – |

**33 marks, 65 minutes**

1 Calculate the payback for both projects. **[6]**

2 Explain which project should be selected if payback is the only criterion used – and why. **[6]**

3 Calculate ARR for both projects. **[6]**

4 The business has a cut-off or criterion rate of 11% for all new projects. Would either project be acceptable with this restriction? **[3]**

5 Taking both the results of payback and ARR together, which project would you advise the business to invest in and why? **[7]**

6 What additional information would help you advise the business on the more suitable project? **[5]**

| Advantages | Disadvantages |
|---|---|
| • It uses all of the cash flows – unlike the payback method.<br>• It focuses on profitability, which is the central objective of many business decisions.<br>• The result is easily understood and easy to compare with other projects that may be competing for the limited investment funds available.<br>• The result can be quickly assessed against the predetermined criterion rate of the business. | • It ignores the timing of the cash flows. This could result in two projects having similar ARR results, but one could pay back much more quickly than the other.<br>• As all cash inflows are included, the later cash flows, which are less likely to be accurate, are incorporated into the calculation.<br>• The time value of money is ignored as the cash flows have not been discounted – this concept is considered in the section on net present value. |

***Table 19.4*** *Average rate of return – advantages and disadvantages*

# 19 Investment appraisal

*Gezhouba Dam, China – most major projects are evaluated using investment appraisal*

## H HIGHER LEVEL

### Discounting future cash flows

If you have worked through Activity 19.2 you will realise that managers may be uncertain which project to invest in if the two methods of investment appraisal used give conflicting results: if project A is estimated to pay back at the end of year 3 at an ARR of 15%, should this be preferred to project B with a payback of four years but an ARR of 17%?

Managers need another investment appraisal method, which solves this problem of trying to compare projects with different returns and payback periods. This additional method considers both the size of cash flows and the timing of them. It does this by discounting cash flows. If the effects of inflation are ignored, most people would rather accept a payment of $1000 today instead of a payment of $1000 in one year's time. Which would you choose? The payment today is preferred for three reasons:

- It can be spent immediately and the benefits of this expenditure can be obtained immediately. There is no waiting involved.
- The $1000 could be saved at the current rate of interest. The total of cash plus interest will be greater than the offer of $1000 in one year's time.
- The cash today is certain, but the future cash offer is always open to uncertainty.

This is called taking the 'time value of money' into consideration. Discounting is the process of reducing the value of future cash flows to give them their value in today's terms. How much less is future cash worth compared to today's money? The answer depends on the rate of interest. If $1000 received today can be saved at 10%, then it will grow to $1100 in one year's time. Therefore, $1100 in one year's time has the same value as $1000 today at 10% interest. This value of $1000 is called the present value of $1100 received in one year's time. Discounting calculates the present values of future cash flows so that investment projects can be compared with each other by considering today's value of their returns.

#### *Discounting – how is it done?*

The present value of a future sum of money depends on two factors:

- the higher the interest rate, the less value future cash has in today's money
- the longer into the future cash is received, the less value it has today.

These two variables – interest rates and time – are used to calculate discount factors. You do not have to calculate these – they are available in discount tables and an extract of one is given in Table 19.5. To use the discount factors to obtain present values of future cash flows, multiply the appropriate discount factor by the cash flow. For example, $3000 is expected in three years' time. The current rate of interest is 10%. The discount factor to be used is 0.75 – this means that $1 received in three years' time is worth the same as 75p today. This discount factor is multiplied by $3000 and the present value is $2250.

| Year | 6% | 8% | 10% | 12% | 16% | 20% |
|---|---|---|---|---|---|---|
| 1 | 0.94 | 0.93 | 0.91 | 0.89 | 0.86 | 0.83 |
| 2 | 0.89 | 0.86 | 0.83 | 0.79 | 0.74 | 0.69 |
| 3 | 0.84 | 0.79 | 0.75 | 0.71 | 0.64 | 0.58 |
| 4 | 0.79 | 0.74 | 0.68 | 0.64 | 0.55 | 0.48 |
| 5 | 0.75 | 0.68 | 0.62 | 0.57 | 0.48 | 0.40 |
| 6 | 0.71 | 0.63 | 0.56 | 0.51 | 0.41 | 0.33 |

***Table 19.5*** *Extract from discounted cash flow table*

### Net present value (NPV)

**KEY TERM**

**net present value (NPV)** today's value of the estimated cash flows resulting from an investment

This method once again uses discounted cash flows. It is calculated by subtracting the capital cost of the investment from the total discounted cash flows. The three stages in calculating NPV:

1 Multiply discount factors by the cash flows. Cash flows in year 0 are never discounted as they are today's values already.
2 Add the discounted cash flows.
3 Subtract the capital cost to give the NPV.

The working is clearly displayed in Table 19.6. The initial cost of the investment is a current cost paid out in year 0. Current cash flows are not discounted.

| Year | Cash flow | Discount factors @ 8% | Discounted cash flows (DCF) |
|---|---|---|---|
| 0 | ($10 000) | 1 | ($10 000) |
| 1 | $5 000 | 0.93 | $4 650 |
| 2 | $4 000 | 0.86 | $3 440 |
| 3 | $3 000 | 0.79 | $2 370 |
| 4 | $2 000 | 0.74 | $1 480 |

***Table 19.6*** *Discounted cash flows*

Net present value is now calculated.

total discounted cash flows = $11 940
original investment = ($10 000)
NPV = $1 940

This result means that the project earns $1940 in today's money values. So, if the finance needed can be borrowed at an interest rate of less than 8%, the investment will be profitable. What would happen to NPV if the discount rate was raised, perhaps because interest rates have increased? This will reduce NPV as future cash flows are worth even less when they are discounted at a higher rate. The choice of discount rate is, therefore, crucial to the assessment of projects using this method of appraisal.

Usually, businesses will choose a rate of discount that reflects the interest cost of borrowing the capital to finance the investment. Even if the finance is raised internally, the rate of interest should still be used to discount future returns. This is because of the opportunity cost of internal finance – it could be left on deposit in a bank to earn interest. An alternative approach to selecting the discount rate to be used is for a business to adopt a cut-off or criterion rate. The business would use this to discount the returns on a project and, if the net present value is positive, the investment could go ahead.

***Evaluation of net present value***

Net present value is a widely used technique of investment appraisal in industry, but, as it does not give an actual percentage rate of return, it is often considered together with the internal rate of return percentage, which is not an IB specification topic (see Table 19.7).

| Advantages | Disadvantages |
|---|---|
| • It considers both the timing of cash flows and the size of them in arriving at an appraisal.<br>• The rate of discount can be varied to allow for different economic circumstances. For instance, it could be increased if there was a general expectation that interest rates were about to rise.<br>• It considers the time value of money and takes the opportunity cost of money into account. | • It is reasonably complex to calculate and to explain – especially to non-numerate managers!<br>• The final result depends greatly on the rate of discount used, and expectations about interest rates may be inaccurate.<br>• Net present values can be compared with other projects, but only if the initial capital cost is the same. This is because the method does not provide a percentage rate of return on the investment (internal rate of return). |

***Table 19.7*** *Net present value – advantages and disadvantages*

**EXAM TIP**

When calculating investment appraisal methods, set out your working carefully, using the same type of tables used in this chapter.

## ACTIVITY 19.3

**Discounting cash flows**

**19 marks, 28 minutes**

1 Calculate the present-day values of the following cash flows:
   a $10 000 expected in four years' time at prevailing rate of interest of 10%
   b $2000 expected in six years' time at prevailing rate of interest of 16%
   c $6000 expected in one year's time at prevailing rate of interest of 20%. [6]

2 The following net cash flows have been forecasted by a manufacturer for a major purchase:

| Year | Net cash flows ($) |
|---|---|
| 0 | (15 000) |
| 1 | 8 000 |
| 2 | 10 000 |
| 3 | 5 000 |
| 4 | 5 000 |

**a** Calculate the payback period. [3]
**b** Calculate the average rate of return (ARR). [4]
**c** Discount all cash flows at a rate of discount of 10%. [3]
**d** Calculate the net present value. [3]

The discounted cash flows of an investment project at varying rates of interest are shown in Table 19.8. As the discount rate increases, so the net present value declines until a negative value is eventually reached.

| Year | Net cash flows | DCF @ 8% | DCF @ 12% | DCF @ 20% |
|---|---|---|---|---|
| 0 | ($35 000) | ($35 000) | ($35 000) | ($35 000) |
| 1 | $15 000 | $13 950 | $13 350 | $12 450 |
| 2 | $15 000 | $12 900 | $12 000 | $10 350 |
| 3 | $10 000 | $7 900 | $7 100 | $5 800 |
| 4 | $10 000 | $7 400 | $6 400 | $4 800 |
| NPV | | $7 150 | $3 850 | ($1 600) |

***Table 19.8*** *Discounted cash flows at varying rates of interest*

## ACTIVITY 19.4

**Net present value**

**12 marks, 21 minutes**

Using the data in Table 19.8:
- recalculate the net present value at a discount rate of 20% [4]
- explain why the net present value is negative [2]
- explain why the project would not be viable if the business had to borrow finance at 20%. [2]

If the criterion rate used by the business for new investments is 10%, would this project have a positive net present value, and would it therefore be acceptable? [4]

H

### QUALITATIVE INVESTMENT APPRAISAL

Investment appraisal techniques provide numerical data, which are important in taking decisions. However, no manager can afford to ignore other factors which cannot be expressed in a numerical form but may have a crucial bearing on a decision. These are referred to as qualitative factors and include the following:

- The impact on the environment and the local community. Bad publicity stemming from the announcement of some proposed investment plans may dissuade managers from going ahead with a project because of the long-run impact on image and sales. An example is the dispute over the building of a third runway at London's Heathrow airport.
- Planning permission. Certain projects may not receive planning permission if they are against the interests of local communities. Local planners weigh up the social costs and benefits of a planned project. Community members will often have a direct role through a public enquiry or may set up a pressure group to make their views known and try to achieve a particular outcome.
- Aims and objectives of the business. The decision to close bank branches and replace them with internet and telephone banking services involves considerable capital expenditure – as well as the potential for long-term savings. Managers may, however, be reluctant to pursue these investment policies if there is concern that the aim of giving excellent and personal customer service is being threatened. Similarly, the decision to replace large numbers of workers with labour-saving machinery may be reversed if the negative impact on human relations within the business appears to be too great.
- Risk. Different managers are prepared to accept different degrees of risk. No amount of positive quantitative data will convince some managers, perhaps as a result of previous experience, to accept a project that involves a considerable chance of failure.

**EXAM TIP**

Unless the question asks **only** for an analysis of numerical or quantitative factors, your answers to investment appraisal questions should include an assessment of qualitative factors too.

**THEORY OF KNOWLEDGE**

Business forecasting has always been a key part of managing an organisation. Forecasting, however, was traditionally based less on comprehensive data and more on management intuition and common sense. Now business forecasting has become

much more scientific, with a variety of theories, methods and techniques designed for forecasting certain types of data. The growth of IT and the internet has led to a major expansion in the use of forecasting. Projecting the right levels of goods to buy or products to produce now means using sophisticated software and electronic networks using complex data and advanced mathematical algorithms tailored to an organisation's particular market conditions and line of business.

a Using techniques you have learned in the course analyse how business people go about knowing the possible future consequences of their decisions.
b Discuss the usefulness of the forecasting techniques for business people.
c To what extent is business decision-making more about intuition as opposed to scientific forecasting?

## OVER TO YOU

### REVISION CHECKLIST

1 Give **three** examples of new projects that a supermarket could invest in.
2 List **four** types of information usually required to undertake quantitative investment appraisal.
3 What is meant by the 'annual net cash flow' from an investment project?
4 Examine **two** reasons why the forecast annual net cash flows for an investment in a new clothes shop could prove to be inaccurate.
5 Explain what a 'payback of two years and six months' means for an investment project.
6 State **three** reasons why a manager might select an investment project with a short payback period.
7 Explain any **one** of the reasons you identified in question 6.
8 Write down the formula for calculating the 'average rate of return' for an investment project.
9 Explain why a manager would prefer, other things being equal, to select an investment project with an ARR of 12% rather than one with an ARR of 8%.
10 What does a 'criterion rate of return' mean?
11 Explain why qualitative factors might be significant to an investment decision to replace bank branches with an internet banking service.
12 Explain how environmental considerations could affect an investment decision.
13 Explain why a business's objectives could influence an investment decision to open a factory in a low-income developing country.
(H) 14 Why is discounting of future net cash flows often used in investment appraisal?
(H) 15 Explain what a 'net present value of $4500' means.
(H) 16 Explain what happens to the net present value of a project when the discount rate is increased – and why.

### REVISION ACTIVITY

Read the case study below and then answer the questions that follow.

**Location investment decision**

A shoe shop owner is planning to open another branch and has to decide between two new locations that involve large capital investment – the business cannot afford both of them. He has forecasted the following annual net cash flows for these two locations. These forecasts are based on market research and cost estimates. The cash flows are as follows:

| Year | Location A | Location B |
|---|---|---|
| 0 | ($12 000) | ($12 000) |
| 1 | $3 000 | $6 000 |
| 2 | $4 000 | $5 000 |
| 3 | $5 000 | $3 000 |
| 4 | $6 000 | $2 000 |
| 5 | $5 000 | $5 000 |

**36 marks, 65 minutes**

1 Calculate the simple payback period for both projects and comment on your results. [4]

2 Calculate the ARR for both projects. [4]

3 Explain why the manager might find it difficult, in the light of your results, to make a choice between these two projects. [4]

(H) 4 Using the discount factors on page 190, calculate the net present value of both locations at:
a 10% discount and
b 20% discount. [6]

[continues]

(H) 5 Comment on your results to question 4. [4]

6 Using all of your results, recommend to the manager which location you consider should be selected, on the basis of quantitative data. [8]

7 How reliable are these cash-flow forecasts likely to be? [6]

## INVESTING TO STAY COMPETITIVE

Asia Print plc is a large printing firm offering a range of services to industry, such as printed catalogues, leaflets and brochures. It operates in a very competitive market as it is relatively easy for new firms to join using the latest computer software 'page-making' packages. In an effort to maintain market share, the directors of Asia Print plc are considering several new investment projects. The two most promising schemes are:

**Project Y** – a newly designed highly automated printing press with fast changeover facilities and full colour ability. Direct internet links with customers would allow for rapid input of new material to be printed. Two highly trained operatives will be required and this would mean six redundancies from existing staff.

**Project Z** – a semi-automated machine with a more limited range of facilities but with proven reliability. Existing staff could operate this machine but there would be three redundancies. It is very noisy and local residents might complain.

The finance director was asked to undertake an investment appraisal of these two machines. He had gathered the following data. Each additional unit produced would be sold for an average of $1.25, but there would be additional variable costs of $0.5 per unit. In addition, the annual operational cost of the two machines is expected to be $1 million for Y and $0.5 million for Z. The introduction of either machine would involve considerable disruption to existing production. Staff would have to be selected and trained for project Y and the trade union is very worried about potential job cuts. The residual value of Y is expected to be $1 million and of Z, $0.5 million.

| | Project Y | Project Z |
|---|---|---|
| Purchase price ($m) | 20 | 12 |
| Expected life expectancy | 5 years | 4 years |
| Forecast annual sales (million units) | 8 | 6 |

### EXAM PRACTICE QUESTION

Read the case study and then answer the questions that follow.

**25 marks, 45 minutes**

1 Define the following terms:
   a residual value
   b expected life expectancy. [4]

2 Explain how Asia Print might have forecast future annual sales. [6]

3 Calculate for each project:
   a the payback period
   b the average annual rate of return (ARR). [8]

4 On the basis of your results and any other relevant factors, discuss which project Asia Print should choose. [7]