Chapter 9
Investment appraisal

Businesses will often invest money in order to meet their objectives - these may include sales growth, increase profitability, expansion to new markets, relocation or training its existing workforce. Whatever the reason, a business will at some time have to spend money in an attempt to take the business forward. A business may also need to invest just to keep up with its competitors, they may have no choice but to invest otherwise they may well fall behind and start losing customers.

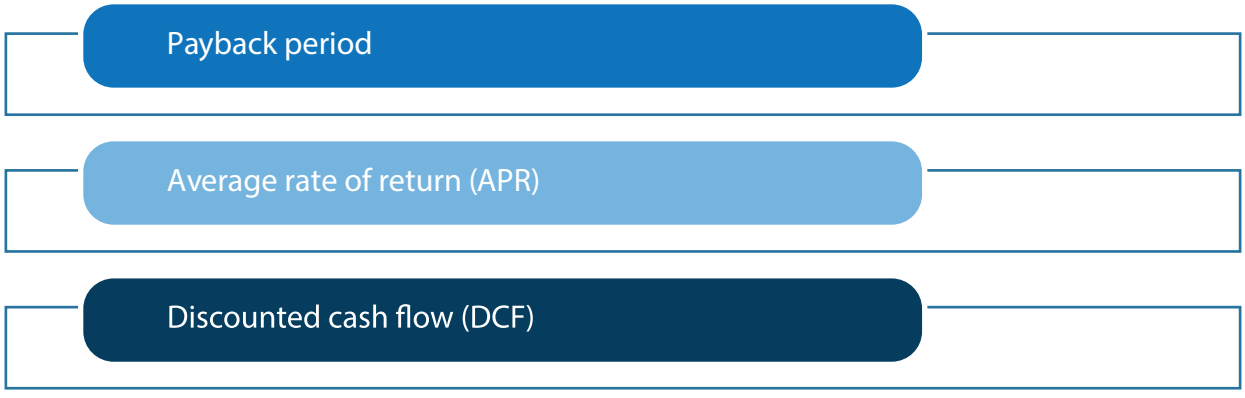
Businesses invest in capital goods – goods used in the direct or indirect production of other goods e.g. lorries, computers, new machinery and buildings. They can also invest in research and development and aspects in human resource management such as financial motivational methods and quality improvement programmes.

The investment made can be autonomous (for the replacement of worn out goods) or induced (new investment arising from expansion). Investment can also arise from the availability of new technology.

Large amounts of money are often invested in the hope that this will give a profitable return on the investment, however, there is risk with investment as there is no certainty that the investment will result in increased profits and could even result in a reduction of future revenue. For this reason businesses will carry our research and gather data to help them decide on what investment is the most likely to be the most profitable and how long it will take to get the initial money invested back.

Investment appraisal is a technique used to evaluate planned investment by a business and measure its potential value to the business.

There are a number of different investment appraisal methods used to compare projects that may be competing for a business's investment capital.



Payback period

The payback period is the time it takes for the project to pay back the initial outlay.

For example, if a project costs £20 000 and the net cash flows generated by the project are £10 000 each year, the project costs will be covered after two years. So the payback period is 2 years.

When there are a number of different investment options for a business, the payback period method will select the one that returns the initial cost of the investment in the shortest time frame. In other words, this is the amount of time taken for the net cash flow resulting from an investment to match or equal the initial cost of the investment.

Worked example

A business is comparing two alternative capital investment projects that will help to achieve its objective of increasing productive efficiency. Both involve updating machinery - Option 1 will cost £90 000 and Option 2 will cost £110 000. The expected Net Cash Flows (NCFs) for each are shown below.

	Option 1 NCF Cost £90 000	Option 2 NCF Cost £110 000
Year 1	£20 000	£10 000
Year 2	£30 000	£20 000
Year 3	£40 000	£40 000
Year 4	£20 000	£60 000
Year 5	£20 000	£50 000

Remember that with the payback method, the project that is selected is the one that repays the initial outlay first. To calculate the payback period for each investment, we add the cumulative cash flow figures to the table, as shown below:

	Option 1 NCF Cost £90 000	Cumulative Cash Flow	Option 2 NCF Cost £110 000	Cumulative Cash Flow
Year 1	£20 000	£20 000	£10 000	£10 000
Year 2	£30 000	£50 000	£20 000	£30 000
Year 3	£40 000	£90 000	£40 000	£70 000
Year 4	£20 000	£110 000	£60 000	£130 000
Year 5	£20 000	£130 000	£50 000	£180 000

We can see that for Option 1 the £90 000 cost equals the cumulative cash flow at the end of Year 3, so the project has a payback period of 3 years. It can happen though, as is the case with Option 2, that none of the cumulative totals exactly equals the initial cost of the investment. The payback period is therefore not an exact amount of years, but instead years and months. If this occurs use the following method to find out how many months of the year it takes to fully pay the cost of investment:

Find the 2 years that payback falls between.

Payback occurs between years 3 and 4 as £110 000 falls between £70 000 and £130 000

Take the total or cumulative cash flow figure for the earlier year of these 2 years, and take it away from the initial cost of the investment. The figure remaining is the balance of the initial investment that is paid back during this final year.

The balance of the initial investment outstanding at the start of year is:
£110 000 - £70 000 = £40 000

Find the monthly cash flow for the final year - divide cash flow for the year by 12.

The monthly flow of cash during the year is £60 000 divided by 12 = £5 000

When we have this monthly cash flow figure we divide it into the balance remaining to be paid back during the year.

£40 000 divided by monthly NCF of £5 000 = 8 months

Add your answer i.e. the months that it takes to payback the balance remaining at the start of the year, to the earlier year of the 2 that payback falls between, and you have your payback period in years and months.

3 years plus the 8 months, so the total payback time is 3 years 8 months

So the payback period for Option 1 is 3 years and the payback period for Option 2 is 3 years and 8 months. Option 1 would be chosen as it has the shortest payback time. However if you look at the total (cumulative) cash flow at the end of the 5 years then Option 2 gives the higher return. This is one drawback with this method of investment appraisal.

Advantages of using payback period	Disadvantages of using payback period
• Simple to use • Easy to calculate • Effective to use when technology is changing at a fast rate, such as hi tech projects, in order to recover the cost of investment as quickly as possible • Helps with managing cash flow	• Ignores flows of cash over the lifetime of the project • Ignores total profitability, the focus is just on the speed to which the initial outlay is repaid

Average rate of return (ARR)

The average rate of return method measures the average net return every year with the cost of the investment. The ARR is expressed as a percentage allowing for a straight forward comparison between different investment options. The option/project that has the highest average rate of return is chosen.

Worked example
Using the same investment options as the payback period method:

	Option 1 NCF Cost £90 000	Cumulative Cash Flow	Option 2 NCF Cost £110 000	Cumulative Cash Flow
Year 1	£20 000	£20 000	£10 000	£10 000
Year 2	£30 000	£50 000	£20 000	£30 000
Year 3	£40 000	£90 000	£40 000	£70 000
Year 4	£20 000	£110 000	£60 000	£130 000
Year 5	£20 000	£130 000	£50 000	£180 000

The stages below demonstrate how to calculate the ARR:

Stage 1

Calculate the total cumulative cash flow.

Option 1 £130 000
Option 2 £180 000

Take away the initial cost of the investment from net cash flow total.

Option 1 £130 000 - £90 000 = £40 000
Option 2 £180 000 - £110 000 = £ 70 000

Stage 2

Calculate the average profit per annum by dividing the figures in stage 1 by the number of years the project runs for.

Option 1 £40 000/ 5 years = £8 000

Option 2 £ 70 000/ 5 years = £14 000

Stage 3

Divide the average net cash flow per annum by the initial cost of the project, and multiply by 100. You now have the ARR %.

Use the following formula:

$$\frac{\text{Average profit per annum}}{\text{Initial investment cost}} \times 100 = \text{ARR (\%)}$$

Option 1 $\frac{\text{£8 000}}{\text{£90 000}}$ **x 100 = 8.8%**

Option 2 $\frac{\text{£14 000}}{\text{£110 000}}$ **x 100 = 12.72%**

Option 2 would be chosen as it has the higher ARR.

In addition to using the ARR to compare capital investment options, ARR can also be used to compare with keeping the money in the bank and comparing against interest rates. In the example above it is unlikely that the interest rate offered by a bank would be anywhere near 12.72%, however if the ARR was around 1- 4% then it might be wiser to keep the money in the bank.

Advantages of using ARR	Disadvantages of using ARR
Shows the profitability of the option/project Includes all the project's cash flows Easy to compare different projects Allows comparison with costs of borrowing for investment	Ignores the timing of the cash flow Does not allow for effects of inflation on values of future cash flows

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Discounted cash flow (DCF)

The discounted cash flow method of investment appraisal takes into account the time value of money (i.e. the realisation that the value of money changes over time).

The discounted cash flow method calculates the **net present value** (NPV) of alternative options/projects. The NPV is the value of future money if you had it now (takes into account inflation and the potential for earning interest on investment capital or cost of finance on raising investment capital). In other words money in the future is worth less than the same amount today.

Worked example

Using the same investment options as the payback period method and ARR:

	Option 1 NCF Cost £90 000	Cumulative Cash Flow	Option 2 NCF Cost £110 000	Cumulative Cash Flow
Year 1	£20 000	£20 000	£10 000	£10 000
Year 2	£30 000	£50 000	£20 000	£30 000
Year 3	£40 000	£90 000	£40 000	£70 000
Year 4	£20 000	£110 000	£60 000	£130 000
Year 5	£20 000	£130 000	£50 000	£180 000

A discount factor is given (which is based on bank interest rates). These are normally given in tables to show how much future values will be discounted to give its present value. The further into the future the earnings go the lower the discount factor will be. The table below shows the discount factors over 5 years at a rate of discount of 5%.

Discount Factor 5%	
Year 1	.952
Year 2	.907
Year 3	.864
Year 4	.823
Year 5	.784

To apply the discount factors to the two possible options we need to use the net cash flows (NCF):

	Option 1 NCF Cost £90 000	Option 2 NCF Cost £110 000
Year 1	£20 000	£10 000
Year 2	£30 000	£20 000
Year 3	£40 000	£40 000
Year 4	£20 000	£60 000
Year 5	£20 000	£50 000

Multiply the cash flow for each year by the discount factor for that year:

	Option 1 NCF Cost £90 000	Present Value	Option 2 NCF Cost £110 000	Present Value	Discount Factor
Year 1	£20 000	£19 040	£10 000	£9 520	**.952**
Year 2	£30 000	£27 210	£20 000	£18 140	**.907**
Year 3	£40 000	£34 560	£40 000	£34 560	**.864**
Year 4	£20 000	£16 460	£60 000	£49 380	**.823**
Year 5	£20 000	£15 680	£50 000	£39 200	**.784**

Total the discounted cash flows in order to calculate the total present value of the cash flow.

Calculate the net present value by subtracting the initial investment:

	Option 1 NCF Cost £90 000	Present Value	Option 2 NCF Cost £110 000	Present Value	Discount Factor
Year 1	£20 000	£19 040	£10 000	£9 520	**.952**
Year 2	£30 000	£27 210	£20 000	£18 140	**.907**
Year 3	£40 000	£34 560	£40 000	£34 560	**.864**
Year 4	£20 000	£16 460	£60 000	£49 380	**.823**
Year 5	£20 000	£15 680	£50 000	£39 200	**.784**
Total present value		£112 950		£150 800	
Net present value		£22 950		£40 800	

Option 2 would be chosen as the net present value is higher.

In addition to the net present value we can also calculate the NPV as a percentage of the initial cost:

Option 1 is £22 950/90 000 x 100 = 25.5%

Option 2 is £40 800/110 000 x100 = 37.09%

It is also possible to calculate the NPV per year as a percentage of the initial cost.

Calculate the NPV (minus the initial cost) per year, which is the NPV divided by the number of years:

Option 1 is £22 950/5 = £4 590
Option 2 is £40 800/5 = £8 160

Then to calculate the NPV per year as a percentage of the initial cost:

Option 1 is £4 590/90 000 x 100 = 5.1%
Option 2 is £8 160/110 000 x 100 = 7.41%

In the example above both options result in a positive NPV. However, it is possible to end up with a negative NPV - this means that the investment option is unprofitable which means that the business could get a better return by saving the money in a savings account. A business should only invest in a project if it gives a positive NPV.

Advantages of using DCF and NPV	Disadvantages of using DCF and NPV
• Allows for future earnings to be adjusted to present values • Easy to compare different projects • Allows for impact of inflation on value of future cash flows • Discounts can be changed to take into account changes in the economic and financial climate • Allows for effect of risk on estimated future cash flows	• It is difficult to calculate • Discount factors could be incorrect which makes the NPV inaccurate • Difficult to set discount factors far into the future, the longer into the future we go the less reliable the discount factor

Using investment appraisal methods

It is often appropriate to use more than one method of investment appraisal to judge the better option for investment. Deciding on what option to take might not be straight forward. One option may have a shorter payback or better ARR, whilst another option might have a higher DCF. In these circumstances further points need to be considered, such as:

- Is the investment high-tech? If so, a short payback may be required since technology is fast evolving.
- Is short term cash flow important? This may rule in or out short payback times.
- Is inflation likely to be stable? Will the NPV figures be reliable?
- How much risk is involved?

Qualitative factors affecting investment appraisal decisions

Although investment appraisal forces a complete financial analysis of any proposed investment, there are other factors that also need to be considered before a decision to invest is made. These include:

- Impact on staff. Can staff handle the changes brought about by investment? Can staff be trained to use new technology? Will there be redundancies as a result of the investment?
- Impact on existing products. Will managers concentrate on new products/ investment to the detriment of existing output?
- Does the investment match the strategy and objectives of the business?
- The state of the economy. Is the economy booming? Or is there a recession, which is likely to reduce demand, on the way?
- Action of competitors. Are they investing/ improving their products?
- Does the investment have any ethical considerations? Would the investment damage the environment?
- Is there sufficient funding available to invest in the project? Would the investment put the business at risk by reducing cash flow or increasing borrowing?
- Availability of new technology. New technology is one of the main factors that encourage further investment.
- Confidence of managers. Optimistic managers are more likely to invest.

Discussion themes

Why do businesses invest? Give three examples of business investment.

What is investment appraisal? Why do businesses carry this out?

Outline how the following three investment methods are used by businesses:

- Payback period
- Average rate of return
- Discounted cash flow and net present value

Edgar Wallis Ltd. is a transport company with a small fleet of five lorries and a warehouse on an industrial estate on the border between England and Wales. The company specialises in collecting goods from manufacturers and delivering them to its customers, mostly major retail businesses, throughout Wales and the Midlands.

The increase in the sale of goods over the internet in recent years has opened up a new market for the company. Instead of delivering in bulk to stores, more and more of its business involves delivering goods directly to the homes of customers.

In order to satisfy this new demand, the company ideally needs both to upgrade its warehouse and to purchase another lorry. By upgrading the warehouse it will be able to respond more quickly to customer demands, keeping one section for trade customers and the other section for home deliveries. At the moment, some deliveries are late because they have not been loaded onto the correct lorry.

By having an extra lorry, the company will be able to make more home deliveries and cover a wider area. This should enable it to gain new customers. Also, by upgrading its fleet of lorries the company will make savings on fuel costs.

Unfortunately, in the current economic climate, the company's bank is unwilling to lend it sufficient money this financial year to pay for both the warehouse upgrade and the new lorry.

A decision has to be made as to which of these two options to select.

Bill Winston, the company accountant, has looked into the problem and has come up with the following information. See tables on the following page:

Purchasing a new lorry

Table 1

Year	Estimated Annual Return (£s)
1	15 000
2	15 000
3	20 000
4	20 000
5	25 000

Initial cost = £45 000

Upgrading the warehouse

Table 2

Year	Estimated Annual Return (£s)
1	20 000
2	20 000
3	15 000
4	10 000
5	10 000

Initial cost = £40 000

The discount rate used by Edgar Wallis Ltd is 5 %, as shown in the table below:

Table 3

Year	Present value of £1 at 5%
1	£0.95
2	£0.90
3	£0.86
4	£0.82
5	£0.78

Using the payback and net present value methods of investment appraisal, and the other qualitative information provided, advise the company as to whether it should buy a new lorry or upgrade the warehouse.

Explain how the following qualitative factors may influence investment decisions:

- Ethical
- Business objectives
- Human resource issues

With the use of investment appraisal techniques, there is no need for a business to consider the qualitative aspects of making investment decisions. Discuss this statement.