3.8 Investment appraisal

Payback period

The payback period is used to work out the number of years and months it will take for the investment of a business to pay for itself. The payback period attempts to answer the question, 'how long will it be before we get our money back?'

To do this, the business will estimate future cash flow each year. It then determines the month and year in which the cash flows will finally cover the investment cost.

Calculating the payback period

Calculating the payback period of an investment involves the concept of net cash flow, which you learned about in Subtopic 3.7 (/study/app/y12-business-management-a-hl-may-2024/sid-351-cid-174702/book/the-big-picture-id-39317). Net cash flow is how much cash is left at the end of a period, after all cash outflows have been subtracted. It is calculated using the following formula:

Net cash flow = cash inflow – cash outflow

When the cumulative (total) net cash flows are equal to the initial investment cost, the business has reached the payback period.

Consider the following example of a manufacturing company that is thinking about purchasing a new $200 000 machine.

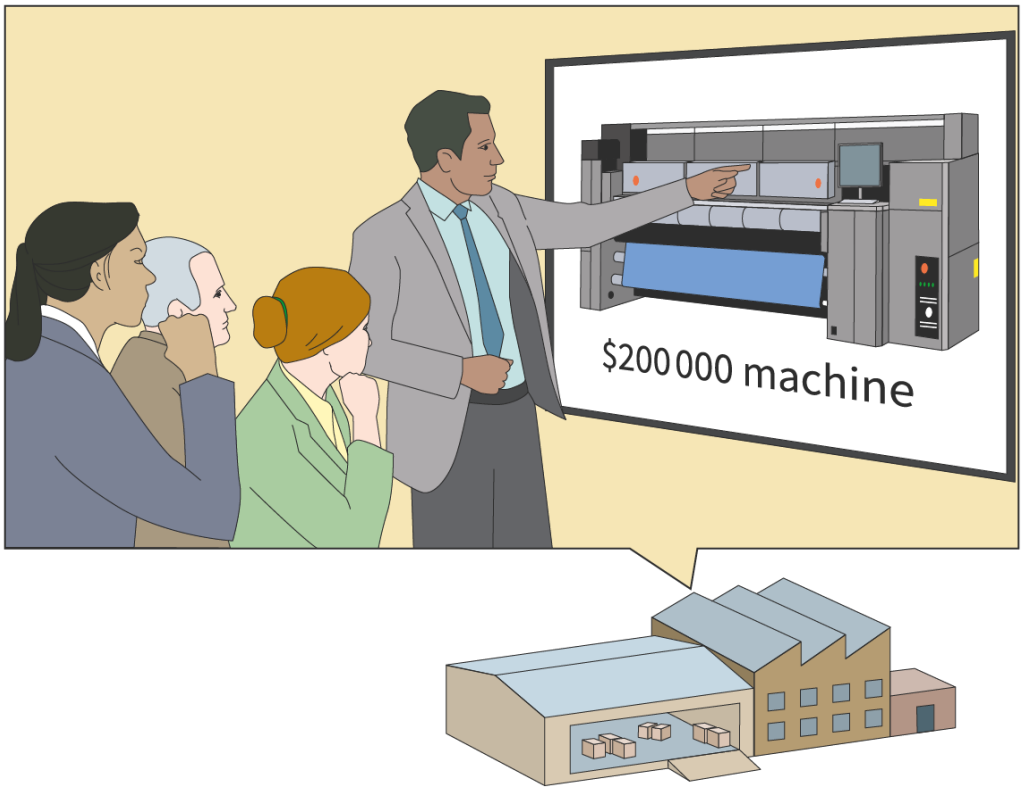

Figure 1. The payback period can help evaluate the investment.

If the business estimates that its annual future cash flows from the products produced by the machine will be $50 000, then it will take four years to return the initial investment of $200 000 ($200 000 divided by $50 000 is four).

Step 1: Calculate the net cash flow for each year

Table 1 lists the expected cash inflows and cash outflows the company is likely to experience if it were to purchase the new $200 000 machine.

In all investment appraisal calculations, Year 0 is where the initial investment cost is recorded. In **Table 1**, you can see the initial investment of $200 000 in Year 0. Cash inflows are always $0 in Year 0, so the net flow in Year 0 is always $0 minus the initial investment cost. In this case, the net flow for Year 0 is –$200 000.

Table 1. The expected cash flows of a $200 000 investment. (A negative figure is indicated by putting it in brackets.)

Year	Cash inflow	Cash outflow	Net cash flow	Cumulative net flow

Year	Cash inflow	Cash outflow	Net cash flow	Cumulative net flow
0	$0	($200000)	($200000)	($200000)
1	$80000	($20000)		
2	$140000	($60000)		
3	$240000	($120000)		
4	$360000	($200000)		

During the first year of operating the machine, there will be both cash inflows and cash outflows from the machine. These are the revenues (cash inflows) that the business earns from the machine's production and the operating costs (cash outflows) of the machine.

The net cash flow is calculated as follows and then added to the table, as shown in **Table 2**.

Net cash flow in year 1 = cash inflow − cash outflow = $80 000 − $20 000 = $60 000

Net cash flow in year 2 = $140 000 − $60 000 = $80 000

Net cash flow in year 3 = $240 000 − $120 000 = $120 000

Net cash flow in year 4 = $360 000 − $200 000 = $160 000

Table 2. The expected cash flows of a $200000 investment (net cash flows added). (A negative figure is indicated by putting it in brackets.)

Year	Cash inflow	Cash outflow	Net cash flow	Cumulative net flow
0	$0	($200000)	($200000)	($200000)

Year	Cash inflow	Cash outflow	Net cash flow	Cumulative net flow
1	$80 000	($20 000)	$60 000	
2	$140 000	($60 000)	$80 000	
3	$240 000	($120 000)	$120 000	
4	$360 000	($200 000)	$160 000	

Step 2: Calculating cumulative net cash flows

In order to work out how long it will take to pay back the $200 000 investment, the business will need to sum the net cash flows over time. Then the business can see how many years and months it will take before the investment cost is covered by the net cash flows. Starting with –$200 000 and adding the net cash flows each year, the business can work out how long it will take to cover the initial $200 000 investment amount. This is called working out the cumulative net flow. It is given by the following formula:

Cumulative net flow = cumulative net flow in previous year + net flow of current year

The cumulative net cash flows are calculated as follows and then added to the table, as shown in **Table 3**.

Cumulative net flow in Year 1 = -$200 000 + $60 000 = ($140 000)

Cumulative net flow in Year 2 = -$140 000 + $80 000 = ($60 000)

Cumulative net flow in Year 3 = -$60 000 + $120 000 = $60 000

Cumulative net flow in Year 4 = $60 000 + $160 000 = $220 000

You can see that, by Year 3, the cumulative net flow will be positive. This is seen when you add the net cash flow from Year 2 to the cumulative net cash flow from Year 3 (–$60 000 + $120 000). So you know that the investment will have been paid back at

some point during Year 3.

Table 3. The expected cash flows of a $200000 investment (cumulative net flows added). (A negative figure is indicated by putting it in brackets.)

Year	Cash inflow	Cash outflow	Net cash flow	Cumulative net flow
0	$0	($200000)	($200000)	($200000)
1	$80000	($20000)	$60000	($140000)
2	$140000	($60000)	$80000	($60000)
3	$240000	($120000)	$120000	$60000
4	$360000	($200000)	$160000	$220000

Exam tip

If your ability to carry out an investment appraisal is tested in an examination, you will be given the investment project's cash inflow and cash outflows only. You will be expected to calculate the net flow and cumulative net flow. Do this by setting your work out as in the table above.

Step 3: Calculating the payback period

To find the payback period, you simply need to look down the final column in **Table 3**. In Year 2, you can see that the cumulative net cash flow is still negative ($60 000). However, in Year 3 this figure turns positive. This means that the payback period has occurred at some point during Year 3.

However, the business would like to know how many months into Year 3 it will take to finally pay back the investment. To find the exact payback period, the following formula is used:

$$\textbf{Payback period} = \frac{\textbf{amount left to pay}}{\textbf{net cash flow in that year}} \times 12$$

Using the example above, you can see that, in Year 3, the cumulative cash flow turned positive. Up to this point, the business had a net cash flow of $60 000 from using the machine in Year 1 and $80 000 in Year 2. This together makes $140 000. So how much of the investment cost is left to pay after Year 2? The business would need another $60 000 to make a total of $200 000. Using the formula:

$$\text{Payback period} = \frac{\text{amount left to pay}}{\text{net cash flow in that year}} \times 12$$

$$= \frac{\$60\,000}{\$120\,000} \times 12$$

$$= 6 \text{ months}$$

This means that the payback period for the investment is 2 years and 6 months.

Generally, a business will prefer investments that have shorter payback periods as they bring positive net cash flows more quickly and are less risky.

Exam tip

In the exam, you may be asked to express the payback period in days, weeks or months. To do this, simply adapt the formula to express the value relative to 52 weeks or 365 days in a year as follows:

- $\frac{\$60\,000}{\$120\,000} \times 12 = 6$ months
- $\frac{\$60\,000}{\$120\,000} \times 52 = 26$ weeks
- $\frac{\$60\,000}{\$120\,000} \times 365 = 182.5$ days

Note that the formula for the payback period is **not** provided in the exam formula booklet.

Evaluation of the payback period method

This method gives a simplistic view and only relies on cash flow forecasts, which are estimates. The benefit of the method is its simplicity.

However, there are a number of limitations of this investment appraisal method. Firstly, it ignores the long-term profitability of an investment. A more desirable investment may be overlooked as it has a longer payback period. Secondly, it assumes that future cash flows have the same value as those of today. However, inflation reduces the value of money in the future. So a business would have to account for this when calculating future cash flows. (HL students will learn how to do this later in this subtopic.) And thirdly, different businesses will weigh up the payback period differently in decision-making. Social enterprises may not prioritise the length of the payback period. They may give more weight to qualitative data, such as the social or environmental impact.