3.8 Investment appraisal

Average rate of return (ARR)

Average rate of return (ARR) is an investment appraisal technique that expresses the annual forecast returns as a percentage of the initial capital cost. 'Return' is another term for net cash flow. Businesses can easily compare different investments using this calculation. Generally, businesses will prefer investments with a higher rate of return.

Calculating the average rate of return

The formula for calculating average rate of return is as follows:

$$\textbf{Average rate of return (ARR)} = \frac{\textbf{(total returns} - \textbf{capital cost)} \div \textbf{years of use}}{\textbf{capital cost}} \times \textbf{100}$$

Exam tip

You will be given the ARR formula the IB exam, in the formula booklet.

This formula can be broken down into three steps:

- **Step 1.** Calculate the total net cash flow (returns) over the lifetime of the investment minus the capital cost.
- **Step 2.** Divide the result from Step 1 by the number of years of the project.
- **Step 3.** Divide the result from Step 2 by the project's initial investment cost. Convert this number into a percentage by multiplying by 100.

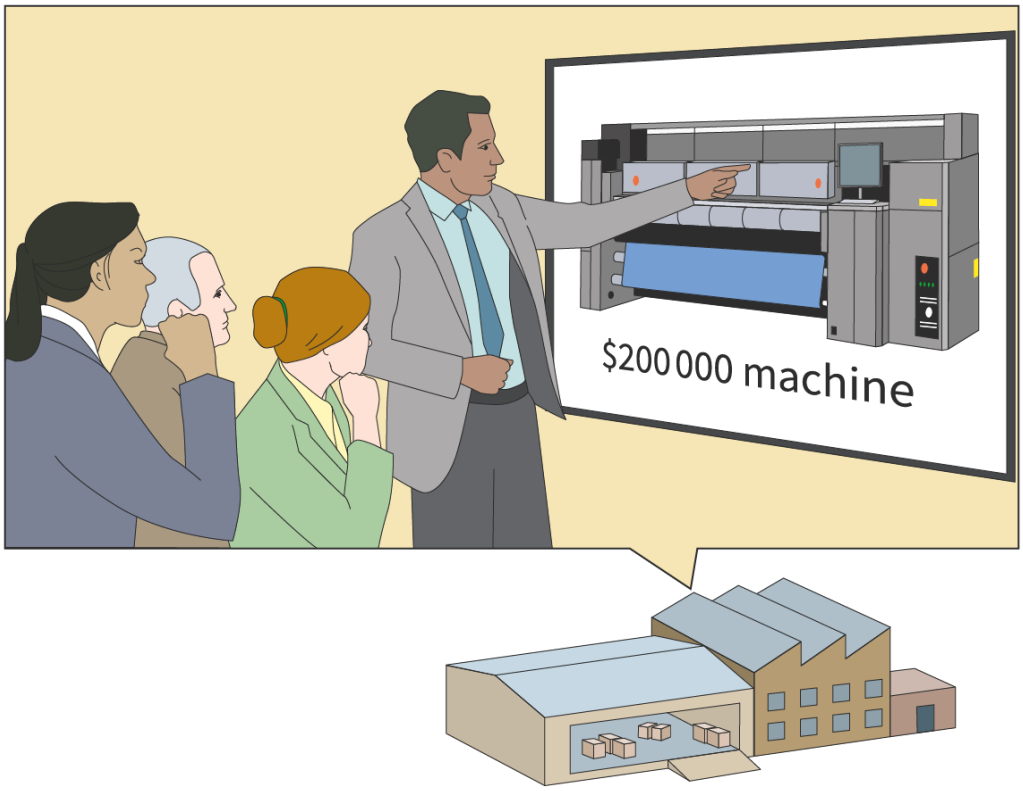

Figure 1. The average rate of return (ARR) investment appraisal method can help evaluate the investment.

Step 1: Calculate the total net cash flow (returns) over the lifetime of the investment

The following calculations are made using the same example from Section 3.8.1 (/study/app/y12-business-management-a-hl-may-2024/sid-351-cid-174702/book/payback-period-id-39325), of a manufacturing company that is considering the purchase of a new $200 000 machine. The company is expecting to use the machine for four years. **Table 1** shows the information from net cash flows that were used for the payback period. However, the capital cost in Year 0 has been taken out so that the formula as given in the IB formula sheet can be used.

Table 1. The expected cash flows of a $200 000 investment.

Year	Cash inflow ($)	Cash outflow ($)	Net cash flow ($)
1	80000	20000	60000
2	140000	60000	80000

Year	Cash inflow ($)	Cash outflow ($)	Net cash flow ($)
3	240000	120000	120000
4	360000	200000	160000
		Total net cash flow (total returns)	420000

The total returns are $420 000 and the capital cost is $200 000, so the first part of the ARR equation, in brackets, would be ($220 000).

$$\textbf{Average rate of return (ARR)} = \frac{\textbf{(total returns} - \textbf{capital cost)} \div \textbf{years of use}}{\textbf{capital cost}} \times \textbf{100}$$

Step 2: Divide the result by the number of years in use

The $220 000 calculated in the first step is the total predicted return from the investment over its lifetime of four years after subtracting out the capital cost. However, the average rate of return (ARR) expresses the rate of return for one year. Therefore, you need to divide the total lifetime return of the investment by the number of years that the investment is in use.

$$\text{Average annual return} = \frac{\text{total return over the lifetime of the investment}}{\text{number of years}}$$

$$= \frac{\$220\,000}{4 \text{ years}}$$

$$= \$55\,000 \text{ per year}$$

So this is the value in the numerator of the ARR equation.

Step 3: Divide the result by the initial investment cost of the project

Finally, you need to express this average return per year as a percentage of the initial investment cost, as shown here:

$$\textbf{Average rate of return} = \frac{\textbf{average annual return}}{\textbf{investment cost}} \times \textbf{100}$$

$$\text{Average rate of return} = \frac{\$55\,000}{\$200\,000} \times 100$$

$$= 27.5\%$$

Making connections

You have converted data into percentages many times in your other academic courses. Remember that to convert into percentages, you should multiply by 100.

Interpreting the ARR

In Subtopic 3.5 (/study/app/y12-business-management-a-hl-may-2024/sid-351-cid-174702/book/the-big-picture-id-39042), you were introduced to profitability ratios. Average rate of return is another way of considering investment profitability. A business may have a minimum average rate of return that it expects investments to achieve. If an investment returns less, then the business may not consider it. Businesses can also compare multiple investment options in order to select those with the highest rates of return.

One comparison that a business can always make is the interest it might receive from holding its money in a bank account. For example, if the same amount money used to purchase a machine (in this example) was deposited in a bank, it may earn a 7% annual return. Compared with a bank, the investment in a machine seems like a very good idea. However, this also has to be compared with all other potential business opportunities. In other words, one would need to look at the opportunity cost of an investment. If another project is predicted to have a higher average rate of return, then that project should be given preference.

Finally, you need to take risk into account. As in the example, the 7% return from interest on a bank account is a low return but with very low risk. This is compared with the 27.5% return from the investment, which likely comes with a greater risk. The business needs to decide whether or not it wants to take on this risk. A decision tree (Section 3.3.4 (/study/app/y12-business-management-a-hl-may-2024/sid-351-cid-174702/book/tool-decision-tree-id-39304)) is a tool that can help the business to visualise and calculate different outcomes.