Investment Appraisal

Specification requirement— Payback, average rate of return (ARR) and discounted cash flow (DCF), net present value (NPV). Quantitative and qualitative factors affecting decision making.

What is investment?

Investment means the purchase of capital goods. Capital goods are goods that are used to produce other goods.

Investment can be:

- **autonomous** - the replacement of worn out goods,
- or **induced** - new investment arising from expansion.

Examples of why firms will invest include:

- replace worn out capital equipment
- expansion
- reaction to competitors
- availability of new technology

Investment Appraisal

Investment appraisal is used to look at a potential capital investment by a firm and measure it's potential value to the firm.
There is more than one method of Investment Appraisal, and each different method allows the potential return on the investment to be examined in a different way.

Methods of Investment Appraisal

There are 3 methods of investment appraisal. They are:

- **Payback**
- **Annual or average rate of return**
- **Net Present Value**
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Payback.

The payback method of investment appraisal is used to compare projects that may be competing for a business's available investment capital. With the payback method, the project that returns the initial cost of the investment first is chosen.

If a project costs £20,000 and net cash flows generated by the project are £10,000 a year, it is easy to see that the project pays back the cost of the initial investment after 2 years. The payback method is especially useful if technology is changing rapidly, e.g. in IT based businesses, or where cash flow and liquidity is important.

Method of calculation of payback.

The payback period is the amount of time taken for the net cash flow resulting from an investment to match (=), the initial cost of the investment.

A business is comparing two alternative investment projects. Project 1, an investment in new machinery costs £90,000, Project 2, purchase of a retail outlet costs £110,000. The expected net cash flows from each project are shown on page 2.

Remember that payback will select the project that repays the initial outlay first.

To calculate the payback period for each investment we:

1. Create a table for each investment alternative. Give the table headings. Column

one, headed annual cash flow, column 2 headed total or cumulative cash flow.

	Project 1	Project 2
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

Project 1

	Annual Cash Flow	Total Cash Flow
Year 1	£20,000	£20,000
Year 2	£30,000	£50,000
Year 3	£40,000	£90,000
Year 4	£20,000	£110,000
Year 5	£20,000	£130,000

Project 2

	Annual Cash Flow	Total Cash Flow
Year 1	£10,000	£10,000
Year 2	£20,000	£30,000
Year 3	£40,000	£70,000
Year 4	£60,000	£130,000
Year 5	£50,000	£180,000

2. Fill in figures for annual cash flow, then figures for cumulative. To calculate the cumulative figure add each the total for the year to the total for previous years. So if cash flow in year one is £30,000 and year two is £50,000, then the cumulative totals for year on will be £30,000, and for year 2 £80,000 (30,000 + 50,000)

3. See if any of the cumulative totals equal the initial cost of the investment, if they do then you have the pay back period. For example, if the initial investment was £80,000 and the cumulative total for year 2 is also £80,000 then the project payback period is 2 years.

In our example above we see that Project 1 has an initial investment cost of £90,000 and that this matches the cumulative cash flow at the end of year 3.

We can therefore say that the payback period for Project 1 is 3 years.

It can happen though, as is the case with Project 2. that none of the cumulative totals exactly equals the initial cost of the investment, in this case use the following method, (4).

4. a) Find the 2 years that payback falls between. 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.
b) Find the monthly cash flow for the final year; divide cash flow for the year by 12. When we have this monthly cash flow figure we divide it into the balance remaining to be paid back during the year. (a).
c) Add your answer b), 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 pay back period in years and months.

Initial cost of Project 2 is £110,000. Annual and cumulative net cash flows are:

Project 2

	Annual Cash Flow	Total Cash Flow
Year 1	£10,000	£10,000
Year 2	£20,000	£30,000
Year 3	£40,000	£70,000
Year 4	£60,000	£130,000
Year 5	£50,000	£180,000

Payback occurs between years 3 and 4

£110,000 falls between £70,000 and £130,000.

The balance outstanding at the start of year is £40,000 **£110,000 - £70,000.**

The monthly flow of cash during the year is £5000 **£60,000 Divided by 12**

So months to payback is the balance outstanding at start of year is:
£40,000 divided by £5000 =   8 months

Total payback time is 3 years 8 months.

For Project 1, the payback period is 3 years

**For Project 2,
the payback period is 3 years 8 months**

The business would therefore choose Project 1.

Advantages of Payback method
- Simple to use.
- Assists with managing cash flow, good method to use when cash flow is a problem
- Effective when technology is fast changing

- Good method to use to judge projects when there is high potential inflation in the future

Disadvantages of Payback method
- Ignores flows of cash over the lifetime of the project.
- Ignores total profitability.

Annual or Average Rate of Return (ARR)

Using the ARR method of investment appraisal the project that has the highest annual rate of return is chosen.

Because of different costs of investments, different net cash flows, different timing of flows etc, it is often difficult to decide between alternative projects. The ARR method allows the calculation of a % rate of return for a project. This allows easy comparison between competing projects, and a judgement can be made whether a project is worthwhile. If for example the ARR figure for a project is 10%, this may be judged as too low, especially if the cost of borrowing, or returns from investing cash are near to this figure.

Calculating ARR

The Average Rate of Return, is the average annual % return the investment made gives to the business. The % rate of return is found by comparing average annual cash flows with initial cost of the investment. Using this method we select the investment with the highest % annual return.

Method

1. Total the net cash flows for the life of the project, remember to add any scrap value,

resale or residual value for an investment if one is given.

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

3. Calculate the average net cash flow per annum by dividing the answer to step 2, by the number of years the project runs for.

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

If we use the same figures as we did for the Payback method.

Project 1

	Annual Cash Flow	Total Cash Flow
Year 1	£20,000	£20,000
Year 2	£30,000	£50,000
Year 3	£40,000	£90,000
Year 4	£20,000	£110,000
Year 5	£20,000	£130,000

Project 2

	Annual Cash Flow	Total Cash Flow
Year 1	£10,000	£10,000
Year 2	£20,000	£30,000
Year 3	£40,000	£70,000
Year 4	£60,000	£130,000
Year 5	£50,000	£180,000

1.

Total net cash flow for Project 1 = £130,000

Total net cash flow for Project 1 = £180,000

2.

Project 1.   £130,000 – £90,000 = £40,000

Project 2.   £180,000 – £120,000 = £60,000

3. Project 1 £40,000 divided by 5 years = £8,000

Project 2.   £60,000 divided by 5 years = £12,000

4.

Project
1.
$$\frac{8,000}{90,000} \times \frac{100}{1} = 8.88\%$$

Project
2.
$$\frac{12,000}{120,000} \times \frac{100}{1} = 10\%$$

In this case Project 2 with an ARR of 10% would be chosen over Project 1 with an ARR of 8.88%.

Advantages of ARR method.
- Allows for all flows of cash over the life-time of the investment.
- Easy to compare different projects.
- Allows comparison with costs of borrowing for investment.

Disadvantages
- Does not allow for effects of inflation.

NPV or Discounted Cash Flow

Using Net Present Value method of investment appraisal the project that has the highest 'real return' is chosen.

In this case 'real return' means net cash flows adjusted for the effects of changing value of money over time. Inflation reduces the value of money that will be received some time in

the future. The longer businesses have to wait for flows of cash to be generated from investments, the lower the value of the flow in real, or today's terms.

If inflation is at 5%, then £100 received in a years time will be worth just over £95 in real terms, this is because inflation has reduced the real value, or spending power of the money. We can see that as more years pass, the more inflation adds up, so the lower and lower the real value. In fact with inflation at 5%, real value of money is halved in 14 years, with inflation at 10% real value of money is halved with 7 years. So firms must allow for the effects of inflation on the value of future cash flows.

Calculating discounted cash flow.

Using this method we adjust (discount) net cash flows for the likely effects of inflation. We do this because inflation reduces the real value of money. £100 received in a years time will have less buying power than £100 in your hand now, how much less will depend upon the level of inflation. Current inflation rates in the UK are around 3%, this is a low figure compared to inflation over the last 25 years. In 1977 inflation was around 24%, and during the 1980's inflation was been between 8% and 12% .

Above right are examples of Discount Tables which adjust for inflation rates of 2.5% and 5%. These tables are used to adjust net cash flows into real values.

If a firm expects a future inflation rate of 5%, and expects an investment project to give an annual return of £10,000 over 5 years. The firm can discount this net cash

Discount tables for 2.5% and 5%

	2.5%	5%
Year 1	.976	.952
Year 2	.952	.907
Year 3	.929	.864
Year 4	.906	.823
Year 5	.884	.784
Year 6	.862	.746
Year 7	.841	.711
Year 8	.821	.677
Year 9	.801	.645
Year 10	.781	.614

flow, using the discount table, as so calculate the real value of the predicted cash flow.

The method used to find NPV of any investment project is :
1. Firstly apply discount factor to cash flow. The discount factors are given in a table and these adjust future cash flows for the effects of inflation. In exam questions the examiner may provide just one table e.g. discount factors for 5% inflation, if this is the case just apply these, or alternatively the examiner may provide more than one table, e.g. discount factors for 5% inflation and 10% inflation. If this is the case we will normally be required to use just one of the tables. Which one to use may be left to our judgement or the choice may be indicated in the case study.

To apply the discount factors to the cash flow simply multiply the cash flow for a year by the discount factor for that year.

If given a scrap or second hand value for an investment add this to the final years cash flow, and discount this by the relevant factor for the year.

	Net Cash Flow	Discount Factor	Discounted (real), cash flow
Year 1	£10,000	.952	£9,520
Year 2	£10,000	.907	£9,070
Year 3	£10,000	.864	£8,640
Year 4	£10,000	.823	£8,230
Year 5	£10,000	.784	£7,840

2. Total the discounted cash flows.

3. Take away the initial cost of the investment - the answer you have is the NPV of the project.

4. Do not simply choose the project with the highest NPV. Some investments will cost less than others, so you should allow for this.

Advantages of NPV method

- Allows for effects of inflation.
- Adjust future cash flows to a 'present value'.

Disadvantages of NPV method

- Inflation is often unpredictable.
- The longer into the future we go the less reliable the discount factor

Investment appraisal also forces managers to examine all aspects of proposed investments - the figures used in investment appraisal can only be calculated by looking at costs of running the project, potential sales from the project, and the likely selling price of goods produced must be determined. In short investment appraisal forces managers to take an objective view of all financial aspects of potential investments.

Questions where you have to use more than one method of Investment Appraisal.

In many exam questions on investment appraisal the candidate will be asked to use more than one method of investment appraisal. Your final choice of project under these conditions might not be straight forward. One project may have a shorter payback or better ARR, whilst another project might have a higher NPV. In these circumstances we must make sure that we consider the type of investment.
Is it high tech? - a short payback may be required.
Is cash flow important or not important? This may rule in or out short payback .
Is inflation likely to be stable, can we trust NPV figures?

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 factors include:

- **Impact on staff.** Can staff handle the changes brought about by investment, can they be trained to use new technology?.
- **Impact on existing products.** Will managers concentrate on new products / investment to the detriment of existing output?

- **The state of the economy.** Is the economy booming? Or is a recession, which is likely to reduce demand, on the way?
- **Action of competitors** Are they investing, improving their products?
- **Availability of new technology.** New technology is one of the main factors that encourages further investment.
- **Confidence of managers.** Optimistic managers are more likely to invest.

Notes.