Main investment appraisal methods
The five main investment appraisal criteria methods

accounting rate of return (ARR)

payback
discounted payback

discounted cash flow (DCF)

net present value (NPV)

internal rate of return (IRR)
interpolation of the internal rate of return (IRR)
extrapolation of the internal rate of return (IRR)
Session Summary

advantages and disadvantages of the five investment appraisal methods

other factors affecting investment decisions

risk and uncertainty and decision-making – sensitivity analysis

project appraisal factors used in sensitivity analysis

control of capital investment projects
Learning Objectives (1)

- outline the key principles underlying investment selection criteria
- outline the strengths and weaknesses of the five investment appraisal criteria
- explain what is meant by discounted cash flow (DCF)
- consider investment selection using the appraisal criteria of net present value (NPV) and internal rate of return (IRR)
Learning Objectives (2)

- explain the effects of inflation, working capital requirements, length and timing of projects, taxation, and risk and uncertainty on investment criteria calculations

- evaluate the impact of risk and the use of sensitivity analysis in decision-making

- consider the ways in which capital projects may be controlled and reviewed

- appreciate the importance of the project post-completion audit
What is an Investment?

an investment requires expenditure on something today that is expected to provide a benefit in the future.

the decision to make an investment is extremely important because it implies

the expectation that expenditure today will generate future cash gains in real terms

that greatly exceed the funds spent today
The Five Main Investment Appraisal Criteria Methods

- discounted payback
- internal rate of return (IRR)
- net present value (NPV)
- payback
- accounting rate of return (ARR)
Accounting Rate of Return (ARR)

ARR = \frac{\text{average accounting profit over the project}}{\text{initial investment}} \times 100\%
the number of years it takes the cash inflows from a capital investment project to equal the cash outflows
CASH IS IMPORTANT

- real funds flows can be seen in cash but not in accounting profit
- interest charges become payable as soon as money is made available, for example, from a lender to a borrower, not when an agreement is made or a contract is signed
TIME VALUE OF MONEY

receipt of 100 TL today has greater value than receipt of 100 TL in one year's time

there are two reasons for this
reason 1

money could have been alternatively invested in say risk-free Government gilt-edged securities

the actual rate of interest that will have to be paid will be higher than the Government rate, to include a risk premium - neither companies nor individuals are risk-free borrowers
Key Principles Underlying Investment Selection Criteria (4)

reason 2

purchasing power will have been lost over a year due to inflation

generally, the higher the risk of the investment, the higher the return the investor will expect from it
Future Values of 100 TL using a Discount Rate of 5% Per Annum
the principles underlying the investment appraisal techniques that use the DCF method are cash flow (as opposed to profit), and the time value of money of the five main criteria used to appraise investments, net present value (NPV), internal rate of return (IRR), and discounted payback are discounted cash flow (DCF) techniques

the technique of discounted cash flow discounts the projected net cash flows of a capital project to ascertain its present value, using an appropriate discount rate, or cost of capital
Net Present Value (NPV)

NPV is today’s value of the difference between cash inflows and outflows projected at future dates, attributable to capital investments or long-term projects.
the IRR calculates the exact rate of return that a project is expected to achieve, which is the discount rate used that results in a zero net present value (NPV) of the difference between cash inflows and outflows
Interpolation of the Internal Rate of Return (IRR)

using the algebraic relationships derived from the similar triangles

\[
\frac{5,000}{x} = \frac{50,000}{(10 - x)}
\]

\[
5,000(10 - x) = 50,000x
\]

divide both sides of the equation by 1,000

\[
50 - 5x = 50x
\]

\[
50 = 50x + 5x
\]

\[
50 = 55x
\]

\[
x = \frac{50}{55} = 0.91
\]

\[
IRR = 20\% - 0.91\% = 19.09\%
\]
Extrapolation of the Internal Rate of Return (IRR)

using the algebraic relationships derived from the similar triangles

\[
\frac{20,000}{x} = \frac{50,000}{(5 + x)} \\
20,000(5 + x) = 50,000x
\]

divide both sides of the equation by 1,000

\[
100 + 20x = 50x \\
100 = 50x - 20x \\
100 = 30x \\
x = \frac{100}{30} = 3.33 \\
IRR = 15\% + 3.33\% = 18.33\%
the discounted payback method requires a discount rate to be chosen to calculate the present values of cash flows and then the payback is the number of years required to repay the original investment
<table>
<thead>
<tr>
<th><strong>accounting rate of return (ARR)</strong></th>
<th><strong>definition</strong></th>
<th><strong>advantages</strong></th>
<th><strong>disadvantages</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td>Average accounting profit over the life of the project divided by the initial or average investment.</td>
<td>quick and easy to calculate and simple to use</td>
<td>based on accounting profit rather than cash flows</td>
<td></td>
</tr>
<tr>
<td></td>
<td>the concept of a % return is a familiar one</td>
<td>a relative measure and so no account is taken of the size of the project</td>
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<tr>
<td></td>
<td>very similar to ROCE</td>
<td>ignores timing of cash flows and the cost of capital</td>
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<td>The point where the cumulative value of a project’s cash flows becomes positive.</td>
<td>easily understood</td>
<td>ignores the timing of cash flows</td>
<td></td>
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<td></td>
<td>considers liquidity</td>
<td>ignores cash flows that occur after the payback point</td>
<td></td>
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<tr>
<td></td>
<td>looks only at relevant cash flows</td>
<td>ignores the cost of capital, i.e. the time value of money</td>
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<td>The total present values of each of a project’s cash flows, using a present value discount factor.</td>
<td>uses relevant cash flows</td>
<td>its use requires an estimate of the cost of capital</td>
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<td>allows for the time value of money</td>
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<td>absolute measure and therefore useful, for example, for comparison of the change in shareholder wealth</td>
<td></td>
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<td>it is additive which means that if the cash flow is doubled then the NPV is doubled</td>
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<td>The discount factor at which the NPV of a project becomes zero.</td>
<td>does not need an estimate of the cost of capital</td>
<td>it is a relative rate of return and so no account is taken of the size of the project</td>
<td></td>
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<td></td>
<td>because the result is stated as a % it is easily understood</td>
<td>its use may rank projects incorrectly</td>
<td></td>
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<td>as cash flows change signs –ve to +ve or vice versa throughout the project there may be more than one IRR</td>
<td>it is difficult to use if changes in the cost of capital are forecast</td>
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<td>The point where the cumulative value of a project’s discounted cash flows becomes positive.</td>
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Additional factors impacting on investment criteria calculations are:

the effect of inflation on the cost of capital

working capital requirements

length of project

taxation

risk and uncertainty
There may be a number of risks associated with each of the variables included in a capital investment appraisal decision:

- estimates of initial costs
- uncertainty about the timing and values of future cash revenues and costs
- the length of project
- variations in the discount rate
sensitivity analysis may be used to assess the risk associated with a capital investment project
Project Appraisal Factors Used in Sensitivity Analysis

- discount rate
- timing of cash flows
- initial cost
- length of project
- revenues (volumes)
- cash costs (values)
- revenues (cash values)
- cash costs (volumes)

sensitivity of investment appraisal
To establish the appropriate levels of control, and to ensure that projects run to plan the following are absolute essentials

- the appointment of a good project manager with the appropriate level of responsibility and authority
- regular project reviews
The End

Questions