## What is Capital Budgeting?

- A **capital budgeting decision** may be defined as the firm's decision to invest its current funds most efficiently in the long-term assets in anticipation of an expected flow of benefits over a series of years.

# Nature of Investment Decisions

- The **investment decisions** of a firm are generally known as the **capital budgeting, or capital expenditure decisions.**

- The firm's investment decisions would generally include **expansion**, **acquisition**, **modernisation** and **replacement** of the long-term assets. Sale of a division or business (**divestment**) is also as an investment decision.

## Features of Investment Decisions

- The exchange of current funds for future benefits.
- The funds are invested in long-term assets.
- The future benefits will occur to the firm over a series of years.

# Importance of Investment Decisions

- Growth
- Risk
- Funding
- Irreversibility
- Complexity

# Types of Investment Decisions

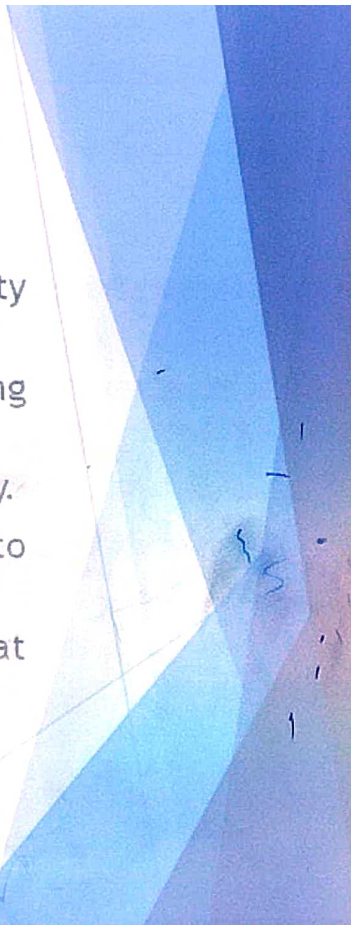
- One classification is as follows:
  - Expansion of existing business
  - Expansion of new business
  - Replacement and modernisation
- Yet another useful way to classify investments is as follows:
  - Mutually exclusive investments
  - Independent investments
  - Contingent investments

## Investment Evaluation Criteria

- Three steps are involved in the evaluation of an investment:
  1. Estimation of cash flows
  2. Estimation of the required rate of return (the opportunity cost of capital)
  3. Application of a decision rule for making the choice

# Investment Decision Rule

- It should maximise the shareholders' wealth.
- It should consider all cash flows to determine the true profitability of the project.
- It should provide for an objective and unambiguous way of separating good projects from bad projects.
- It should help ranking of projects according to their true profitability.
- It should recognise the fact that bigger cash flows are preferable to smaller ones and early cash flows are preferable to later ones.
- It should help to choose among mutually exclusive projects that project which maximises the shareholders' wealth.



# Evaluation Criteria

- 1. *Discounted Cash Flow (DCF) Criteria*
  - Net Present Value (NPV)
  - Internal Rate of Return (IRR)
  - Profitability Index (PI)
- 2. *Non-discounted Cash Flow Criteria*
  - Payback Period (PB)
  - Discounted payback period (DPB)
  - Accounting Rate of Return (ARR)

# Net Present Value Method

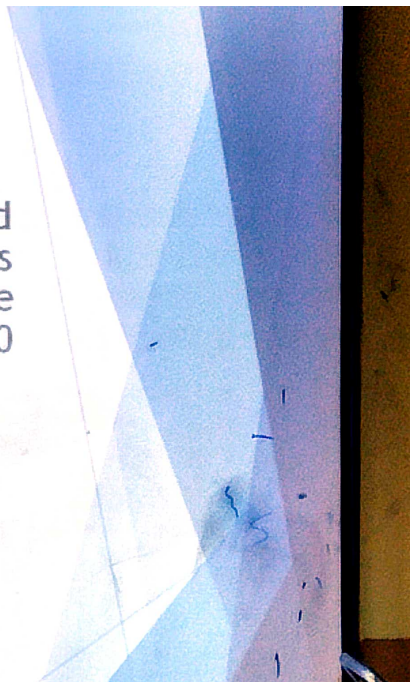
- The formula for the net present value can be written as follows:

$$NPV = \left[ \frac{C_1}{(1+k)} + \frac{C_2}{(1+k)^2} + \frac{C_3}{(1+k)^3} + \cdots + \frac{C_n}{(1+k)^n} \right] - C_0$$

$$NPV = \sum_{t=1}^{n} \frac{C_t}{(1+k)^t} - C_0$$

# Calculating Net Present Value

- Assume that Project *X* costs Rs 2,500 now and is expected to generate year-end cash inflows of Rs 900, Rs 800, Rs 700, Rs 600 and Rs 500 in years 1 through 5. The opportunity cost of the capital may be assumed to be 10 per cent.



# Why is NPV Important?

- Positive net present value of an investment represents the maximum amount a firm would be ready to pay for purchasing the opportunity of making investment, or the amount at which the firm would be willing to sell the right to invest without being financially worse-off.

- The net present value can also be interpreted to represent the amount the firm could raise at the required rate of return, in addition to the initial cash outlay, to distribute immediately to its shareholders and by the end of the projects' life, to have paid off all the capital raised and return on it.

# Acceptance Rule

- Accept the project when NPV is positive NPV > 0
- Reject the project when NPV is negative NPV < 0
- May accept the project when NPV is zero NPV = 0

*The NPV method can be used to select between mutually exclusive projects; the one with the higher NPV should be selected.*

# Evaluation of the NPV Method

- NPV is most acceptable investment rule for the following reasons:
  - Time value
  - Measure of true profitability
  - Value-additivity
  - Shareholder value
- **Limitations:**
  - Involved cash flow estimation
  - Discount rate difficult to determine
  - Mutually exclusive projects
  - Ranking of projects

## Example : 1

The following are the net cash flows of an investment project:

| *Cash Flows (₹)* | | |
|---|---|---|
| $C_0$ | $C_1$ | $C_2$ |
| −5,400 | +3,600 | +14,400 |

- Calculate the net present value of the project at discount rates of 0, 10, 40, 50 and 100 per cent.

# 1(b) INTERNAL RATE OF RETURN METHOD

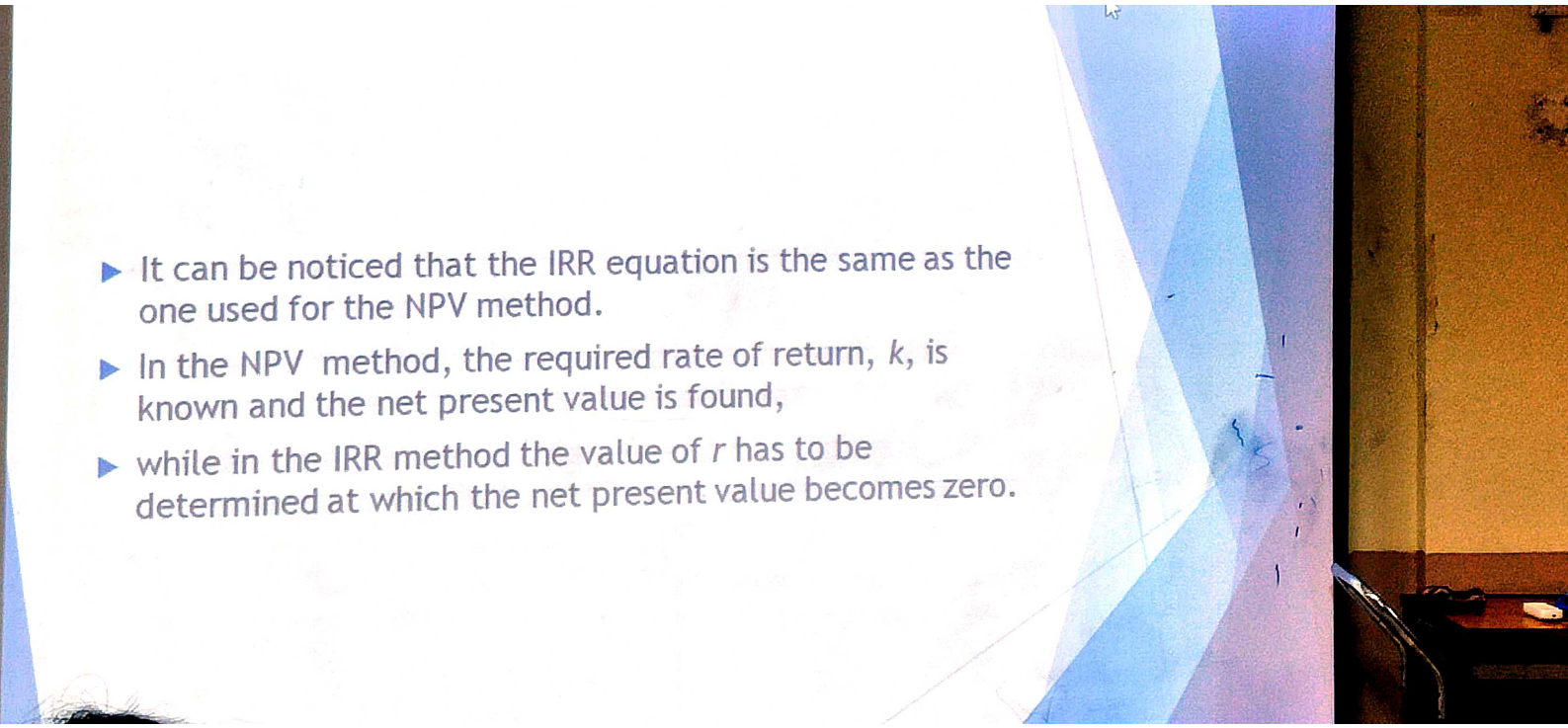
- The internal rate of return (IRR) method is another discounted cash flow technique, which takes account of the magnitude and timing of cash flows
- The internal rate of return (IRR) is the rate that equates the investment outlay with the present value of cash inflow received after one period. This also implies that the rate of return is the discount rate which makes NPV = 0.

$$C_0 = \frac{C_1}{(1+r)} + \frac{C_2}{(1+r)^2} + \frac{C_3}{(1+r)^3} + \cdots + \frac{C_n}{(1+r)^n}$$

$$C_0 = \sum_{t=1}^{n} \frac{C_t}{(1+r)^t}$$

$$\sum_{t=1}^{n} \frac{C_t}{(1+r)^t} - C_0 = 0$$

- It can be noticed that the IRR equation is the same as the one used for the NPV method.
- In the NPV method, the required rate of return, $k$, is known and the net present value is found,
- while in the IRR method the value of $r$ has to be determined at which the net present value becomes zero.



# CALCULATION OF IRR

- **Uneven Cash Flows:** Calculating IRR by Trial and Error
  - The approach is to select any discount rate to compute the present value of cash inflows. If the calculated present value of the expected cash inflow is lower than the present value of cash outflows, a lower rate should be tried. On the other hand, a higher value should be tried if the present value of inflows is higher than the present value of outflows. This process will be repeated unless the net present value becomes zero.

# Example

- A project costs Rs.16,000 and is expected to generate cash inflows of Rs.8,000, Rs.7,000 and Rs.6,000 at the end of each year for next 3 years.
- We know that IRR is the rate at which project will have a zero NPV. As a first step, we try (arbitrarily) a 20 per cent discount rate. The project's NPV at 20 per cent is:

$$\begin{aligned} \text{NPV} &= -₹16{,}000 + ₹8{,}000(\text{PVF}_{1,\,0.20}) + ₹7{,}000(\text{PVF}_{2,\,0.20}) \\ &\quad + ₹6{,}000(\text{PVF}_{3,\,0.20}) \\ &= -₹16{,}000 + ₹8{,}000 \times 0.833 + ₹7{,}000 \times 0.694 \\ &\quad + ₹6{,}000 \times 0.579 \\ &= -₹16{,}000 + ₹14{,}996 = -₹1{,}004 \end{aligned}$$

- A negative NPV of Rs.1,004 at 20 per cent indicates that the project's true rate of return is lower than 20 per cent. Let us try 16 per cent as the discount rate.

- The 15% discount rate the project's NPV is :

$$\begin{aligned}NPV &= -₹16{,}000 + ₹8{,}000(PVF_{1,0.15}) + ₹7{,}000(PVF_{2,0.15}) \\ &\quad + ₹6{,}000(PVF_{3,0.15}) \\ &= -₹16{,}000 + ₹8{,}000 \times 0.870 + ₹7{,}000 \times 0.756 \\ &\quad + ₹6{,}000 \times 0.658 \\ &= -₹16{,}000 + ₹16{,}200 = ₹200\end{aligned}$$

- When we select 15 per cent as the trial rate, we find that the project's NPV is Rs.200. Thus the true rate of return should lie between 15-16 per cent.
- We can find out a close approximation of the rate of return by the method of linear interpolation as follows:

| | | *Difference* |
|---|---|---|
| PV required | ₹ 16,000 | |
| | | 200 |
| PV at lower rate, 15% | 16,200 | |
| | | 257 |
| PV at higher rate, 16% | 15,943 | |

$r = 15\% + (16\% - 15\%)200/257$

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# CALCULATION OF IRR

- **Level Cash Flows**
- Let us assume that an investment would cost Rs.20,000 and provide annual cash inflow of Rs.5,430 for 6 years. If the opportunity cost of capital is 10 per cent, what is the investment's NPV?
- The Rs.5,430 is an annuity for 6 years. The NPV can be found as follows:

| 1 | NPV Profile | | |
|---|---|---|---|
| 2 | *Cash Flow (₹)* | *Discount rate* | *NPV (₹)* |
| 3 | −20000 | 0% | 12,580 |
| 4 | 5430 | 5% | 7,561 |
| 5 | 5430 | 10% | 3,649 |
| 6 | 5430 | 15% | 550 |
| 7 | 5430 | 16% | 0 |
| 8 | 5430 | 20% | (1,942) |
| 9 | 5430 | 25% | (3,974) |

- The IRR of the investment can be found out as follows

$$NPV = -₹20,000 + ₹5,430(PVFA_{6,r}) = 0$$

$$₹20,000 = ₹5,430(PVFA_{6,r})$$

$$PVFA_{6,r} = \frac{₹20,000}{₹5,430} = 3.683$$

VIKAS

# Acceptance Rule

- Accept the project when $r > k$
- Reject the project when $r < k$
- May accept the project when $r = k$
- In case of independent projects, IRR and NPV rules will give the same results if the firm has no shortage of funds.

# Evaluation of IRR Method

- IRR method has following merits:
  - ✓ Time value
  - ✓ Profitability measure
  - ✓ Acceptance rule
  - ✓ Shareholder value

# PROFITABILITY INDEX

- Profitability index is the ratio of the present value of cash inflows, at the required rate of return, to the initial cash outflow of the investment.
- The formula for calculating benefit-cost ratio or profitability index is as follows:

$$PI = \frac{\text{PV of cash inflows}}{\text{Initial cash outlay}} = \frac{PV(C_t)}{C_0}$$

$$= \sum_{t=1}^{n} \frac{C_t}{(1+k)^t} \div C_0$$