Investment Decisions

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.*
- Decisions like the change in the methods of sales distribution, or an advertisement campaign or a research and development programme have long-term implications for the firm's expenditures and benefits, and therefore, they should also be evaluated as investment decisions.

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.
- 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:

- Estimation of cash flows
- Estimation of the required rate of return (the opportunity cost of capital)
- 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.
- It should be a criterion which is applicable to any conceivable investment project independent of others.

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

- Cash flows of the investment project should be forecasted based on realistic assumptions.
- Appropriate discount rate should be identified to discount the forecasted cash flows.
- Present value of cash flows should be calculated using the opportunity cost of capital as the discount rate.
- Net present value should be found out by subtracting present value of cash outflows from present value of cash inflows. The project should be accepted if NPV is positive(i.e.,NPV>0).

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.

$$\text{NPV} = \frac{\text{Rs } 900}{(1+0.10)^1} + \frac{\text{Rs } 800}{(1+0.10)^2} + \frac{\text{Rs } 700}{(1+0.10)^3} + \frac{\text{Rs } 600}{(1+0.10)^4} + \frac{\text{Rs } 500}{(1+0.10)^5} - \text{Rs } 2{,}500$$

$$= [\text{Rs } 900(\text{PVF}_{1,\,0.10}) + \text{Rs } 800(\text{PVF}_{2,\,0.10}) + \text{Rs } 700(\text{PVF}_{3,\,0.10}) + \text{Rs } 600(\text{PVF}_{4,\,0.10}) + \text{Rs } 500(\text{PVF}_{5,\,0.10})] - \text{Rs } 2{,}500$$

$$= [\text{Rs } 900 \times 0.909 + \text{Rs } 800 \times 0.826 + \text{Rs } 700 \times 0.751 + \text{Rs } 600 \times 0.683 + \text{Rs } 500 \times 0.620] - \text{Rs } 2{,}500$$

$$= \text{Rs } 2{,}725 - \text{Rs } 2{,}500 = +\text{Rs } 225$$

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- additively
- Shareholder value

Limitations:

- Involved cash flow estimation
- Discount rate difficult to determine
- Mutually exclusive projects
- Ranking of projects

Internal Rate of Return Method

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.

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

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

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

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.

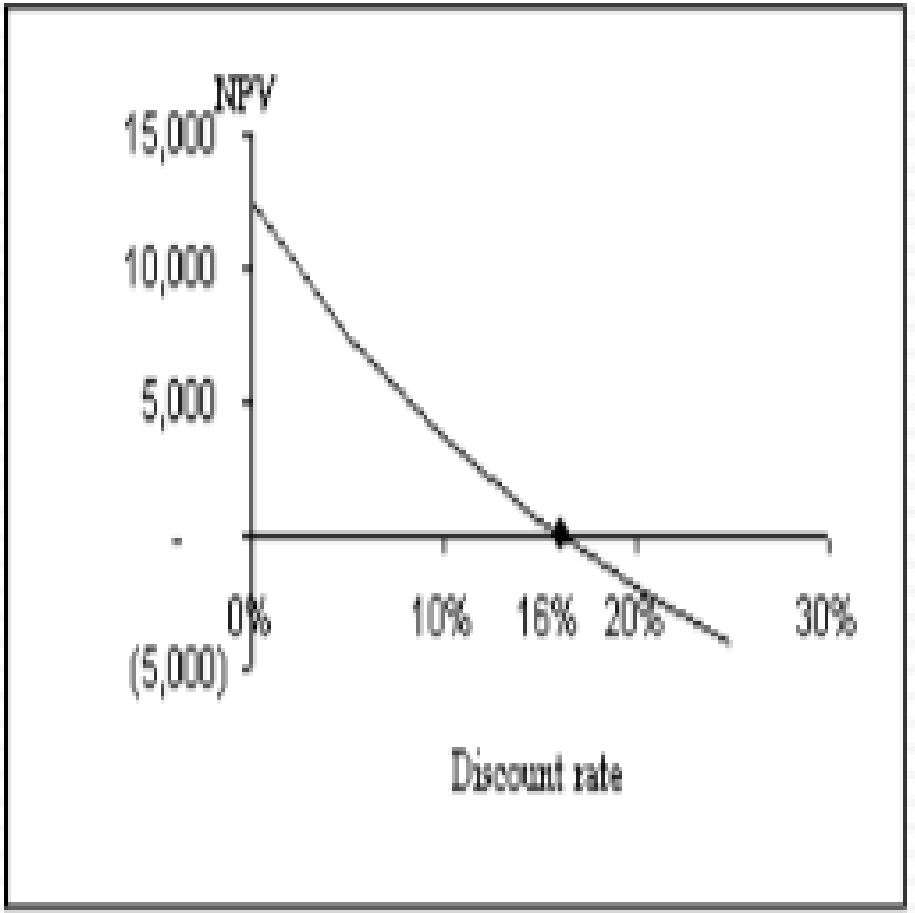
CALCULATION OF IRR

- Let us assume that an investment would cost Rs 20,000 and provide annual cash inflow of Rs 5,430 for 6 years
- The IRR of the investment can be found out as follows:
- NPV = -Rs 20,000+Rs 5,430($PVAF_{6,r}$)=0
- Rs 20,000 = Rs 5,430($PVAF_{6,r}$)
- $PVAF_{6,r}$ = Rs 20,000/5,430
  =3.683

NPV Profile and IRR

NPV Profile

	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)



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
- IRR method may suffer from
  - Multiple rates
  - Mutually exclusive projects
  - Value additivity

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:

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

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

The initial cash outlay of a project is Rs 100,000 and it can generate cash inflow of Rs 40,000, Rs 30,000, Rs 50,000 and Rs 20,000 in year 1 through 4. Assume a 10 percent rate of discount. The PV of cash inflows at 10 percent discount rate is:

$$\begin{aligned}
PV &= \text{Rs } 40{,}000(PVF_{1,0.10}) + \text{Rs } 30{,}000(PVF_{2,0.10}) \\
&\quad + \text{Rs } 50{,}000(PVF_{3,0.10}) + \text{Rs } 20{,}000(PVF_{4,0.10}) \\
&= \text{Rs } 40{,}000 \times 0.909 + \text{Rs } 30{,}000 \times 0.826 \\
&\quad + \text{Rs } 50{,}000 \times 0.751 + \text{Rs } 20{,}000 \times 0.68 \\
NPV &= \text{Rs } 112{,}350 - \text{Rs } 100{,}000 = \text{Rs } 12{,}350
\end{aligned}$$

$$PI = \frac{\text{Rs } 112{,}350}{\text{Rs } 100{,}000} = 1.1235.$$

Acceptance Rule

- The following are the PI acceptance rules:
- Accept the project when PI is greater than one. PI>1
- Reject the project when PI is less than one . PI<1
- May accept the project when PI is equal to one. PI=1
- The project with positive NPV will have PI greater than one. PI less than means that the project's NPV is negative.

Evaluation of PI Method

- Time value: It recognises the time value of money.
- Value maximization: It is consistent with the shareholder value maximisation principle. A project with PI greater than one will have positive NPV and if accepted, it will increase shareholders 'wealth.
- Relative profitability : In the PI method, since the present value of cash inflows is divided by the initial cash outflow, it is a relative measure of a project's profitability.
- Like NPV method, PI criterion also requires calculation of cash flows and estimate of the discount rate. In practice, estimation of cash flows and discount rate pose problems.

Payback

- Payback is the number of years required to recover the original cash outlay invested in a project.
- If the project generates constant annual cash inflows, the payback period can be computed by dividing cash outlay by the annual cash inflow.

  Payback = Initial Investment/ Annual Cash Inflow $=C_0 / C$
- Assume that a project requires an outlay of Rs 50,000 and yields annual cash inflow of Rs 12,500 for 7 years. The payback period for the project is:
- 50,000/12,500 = 4 years

- The project would be accepted if its pay back period is less than the maximum or standard payback period set by management.
- As a ranking method, it gives highest ranking to the project, which has the shortest payback period and lowest ranking to the project with highest payback period.

Payback..

- Unequal cash flows: In case of unequal cash inflows, the pay back period can be found out by adding up the cash inflows until the total is equal to the initial cash outlay.
- Suppose that a project requires a cash outlay of Rs 20,000, and generates cash inflows of Rs 8,000; Rs 7,000; Rs 4,000; and Rs 3,000 during the next 4 years. What is the project's payback? 3years+12×(1,000/3,000)months 3years+4months

Evaluation of Payback

Certain virtues:

- Simplicity
- Cost effective
- Short-term effects
- Risk shield
- Liquidity

Serious limitations:

- Cash flows after payback
- Cash flows ignored
- Cash flow patterns
- Administrative difficulties
- Inconsistent with shareholder value