



Capital Budgeting Techniques

Capital Budgeting Evaluation techniques

Traditional Techniques

- ▶ Payback period
- ▶ Accounting rate of Return (ARR)

Modern techniques

- ▶ Net Present Value (NPV)
- ▶ Profitability Index (PI)
- ▶ Internal Rate of return (IRR)
- ▶ Discounted payback period
- ▶ Terminal value
- ▶ Modified IRR (MIRR)

Accounting rate of Return (ARR)

- ▶ Accounting rate of Return (ARR): ARR Method is based on Return on investment concept.
- ▶ Computation of ARR

When the profit after tax to be earned every year are equal

$$\text{ARR} = (\text{Annual profit (after tax)} / \text{Average investment in the project}) * 100$$

When the profit after tax to be earned every year are different

$$\text{ARR} = (\text{Average Annual profit (after tax)} / \text{Average investment in the project}) * 100$$

Note:

Average Annual profit (After tax) = Sum of the annual profit (After tax) for the whole life/ life span of the project in years

Average Investment = Initial cost of the project + Installation expenses

Average Investment = $1/2(\text{Initial cost} + \text{Installation cost} - \text{SV}) + \text{SV} + \text{Additional wc}$

Accounting rate of Return (ARR)

ARR

Accept/ Reject Rule

IF $ARR >$ Pre specified or desired rate of return
ACCEPT THE PROJECT

IF $ARR <$ Pre specified or desired rate of return
REJECT THE PROJECT

Payback period

Payback Period Method

- ▶ Payback Period is the length of time required to recover the initial investment made in a project.
- ▶ Payback Period is the duration of time required to equal the cumulative cash inflows to its cash outflows.

Calculation of Pay back period

when equal cash inflows are generated every year

Payback period: initial investment/ Annual cash inflow

| Initial Cash Outflow or Initial Investment | Life | Annual Cash Inflows |
|--|---------|---------------------|
| 50000 | 5 years | 12500 |
| Payback Period= 50000/12500= 4 years | | |

Payback period

Calculation of Pay back period

when unequal cash inflows are generated every year which means there is mixed stream of cash inflows.

Payback Period = No. of years immediately preceding the year of recovery+ (Balance amount to be recovered in the year of final recovery/Cash inflow in the year of the final recovery)

Example Calculate payback period

| | 0 | 1 | 2 | 3 | 4 | 5 |
|---------|-------|-------|-------|-------|------|------|
| Outflow | 40000 | | | | | |
| Inflows | | 10000 | 12000 | 10000 | 7000 | 5000 |

Payback period

Computation of Cumulative cash Inflow

| Years | Cash inflows | Cumulative |
|-------|--------------|------------|
| 1 | 10000 | 10000 |
| 2 | 12000 | 22000 |
| 3 | 10000 | 32000 |
| 4 | 7000 | 39000 |
| 5 | 5000 | |

Payback period= 4+ balance amount left to be recovered in the
year of final recovery/cash inflow of the year of the final recovery
= 4+ 1000/5000
=4.2 years

Payback period

Payback Period

Accept/ Reject Rule

IF Payback Period < Predetermined or desired Payback Period
ACCEPT THE PROJECT

IF Payback Period > Pre specified or desired Payback period
REJECT THE PROJECT

Net Present Value (NPV)

Net Present Value (NPV)

NPV is the difference between the PV of cash inflows and PV of cash outflows of a project.

$$NPV = \sum_{i=1}^n \frac{Cash\ Flow_i}{(1 + r)^i} - Initial\ Investment$$

Net Present Value (NPV)

Accept/ Reject Rule

When $NPV > 0$ OR positive

ACCEPT THE PROJECT

When $NPV < 0$ OR Negative

REJECT THE PROJECT

Profitability Index

- ▶ Profitability Index: it is the ratio of present value of all cash inflows associated with a project to the present value of its cash outflows.

$$PI = \frac{PV_{CASH\ INFLOWS}}{PV_{CASH\ OUTFLOWS}}$$

- ▶ Accept/Reject Rule

When $PI > 1$ Accept

When $PI < 1$ Reject

Internal Rate of Return

- ▶ IRR is defined as the discount rate which equates the present value of expected net cash inflows from an investment proposal to the present value of its initial cash outflows.

$$0 = CF_0 + \frac{CF_1}{(1 + IRR)} + \frac{CF_2}{(1 + IRR)^2} + \frac{CF_3}{(1 + IRR)^3} + \dots + \frac{CF_n}{(1 + IRR)^n}$$

Or

$$0 = NPV = \sum_{n=0}^N \frac{CF_n}{(1 + IRR)^n}$$

Where:

CF_0 = Initial Investment / Outlay

$CF_1, CF_2, CF_3 \dots CF_n$ = Cash flows

n = Each Period

N = Holding Period

NPV = Net Present Value

IRR = Internal Rate of Return

Internal Rate of Return

Hence at IRR

- ▶ $\text{PV of Net Cash inflows} - \text{PV of Cash outflows} = 0$
- ▶ FURTHER IRR is defined as

$\text{PV of Net cash inflows} / \text{PV of cash Outflows} = 1$

- ▶ IRR can be defined as the discount rate at which NPV of an Investment is Zero.
- ▶ IRR can be defined as the discount rate or rate of return at which PI index or Benefit Cost ratio is equal to 1.

Internal Rate of Return

Steps for computing IRR when Annual net cash inflows are equal:

- ▶ Calculate Payback period of the project

Payback period: $\text{initial investment} / \text{Annual cash inflow}$

- ▶ Find the discount factors closest to payback period value against the life period row of the project and interest rate thereof.
- ▶ Look at annuity table and find two values one smaller and other greater than calculated payback period.
- ▶ Find Interest rate corresponding to these two values and apply formula

Internal rate of return

(iv) Determine the actual IRR by interpolation using the following formula:

$$\text{IRR} = r + \left(\frac{\text{DF}_r - \text{PB}}{\text{DF}_{rL} - \text{DF}_{rH}} \right) \times \Delta r$$

Where,

- r = Either of the two interest rates (r_L or r_H)
- DF_r = Discount factor at r (Either DF_{rL} or DF_{rH})
- PB = Payback period
- DF_{rL} = Discounting factor at lower interest rate
- DF_{rH} = Discounting factor at higher interest rate
- Δr = Difference in interest rates ($r_H - r_L$)

Internal Rate of Return

- ▶ When Annual Net Cash inflows are unequal
- ▶ Calculate average annual cash flow to determine the fake annuity and fake payback period.
- ▶ Fake Payback period = $\text{Initial Investment} / \text{Average annual CFAT}$
- ▶ Find the discount factors closest to fake payback period value against the life period row of the project and interest rate thereof.
- ▶ Look at annuity table and find two values one smaller and other greater than calculated fake payback period.
- ▶ Find Interest rate corresponding to these two values and apply formula

Internal Rate of Return

(ii) IRR of the project can be calculated through interpolation by using the following formula:

$$IRR = r + \left(\frac{NPV_r}{NPV_{rL} - NPV_{rH}} \right) \times \Delta r$$

Or

$$= r + \left(\frac{NPV_r}{\Delta NPV} \right) \times \Delta r$$

Where, r = Either of the two interest rates (r_L or r_H)

NPV_r = Net present value of the project at ' r ' rate of interest

NPV_{rL} = Net present value of the project at lower interest rate (where the NPV is positive)

NPV_{rH} = Net present value of the project at higher interest rate (where the NPV is negative)

ΔNPV = Difference of NPVs of the project at r_L and r_H ($NPV_{rL} - NPV_{rH}$)

Δr = Difference in interest rates ($r_H - r_L$)

Internal Rate of Return

Internal Rate of Return(IRR)

Accept/ Reject Rule

IF $IRR > \text{required rate of return or cost of capital}$
ACCEPT THE PROJECT

IF $IRR < \text{required rate of return or cost of capital}$
REJECT THE PROJECT

Discounted Payback period

- ▶ One of the limitation of traditional payback period is that it ignore the time value of money.
- ▶ It gives equal weightage to all cash flows occurring at different points of time.
- ▶ Under discounted payback period, cash flows are discounted at a certain rate to find out their present values.
- ▶ Discounted payback period will be computed by using present value of cash inflows to recover the initial cost that is present value of cash outflows.

Terminal Value Method

- ▶ The terminal value method is an improvement over the net present value method of making capital investment decisions.
- ▶ Under this method, it is assumed that each of the future cash flows is immediately reinvested in another project at a certain (hurdle) rate of return until the termination of the project.
- ▶ In other words, the net cash flows and outlays are compounded forward rather than discounting them backward as followed in net present value (NPV) method.

Modified IRR

- ▶ the modified internal rate of return (MIRR) assumes that positive cash flows are reinvested at the firm's cost of capital and that the initial outlays are financed at the firm's financing cost.
- ▶ By contrast, the traditional IRR assumes the Cash flows from a project are reinvested at the IRR itself.
- ▶ The MIRR, therefore, more accurately reflects the cost and profitability of a project.