# Capital Budgeting Techniques

# Techniques of Capital Budgeting:

1. **Traditional Methods (Non-Discounting Techniques)**
    1. Pay-back period Method
    2. Accounting Rate of Return
2. **Modern Methods (Discounting Techniques)**
    1. Net Present Value Method
    2. Profitability Index method
    3. Internal Rate of Return Method
    4. Terminal Value Method
    5. Discounted Pay-back Period Method

# Payback Period Method

1. This method is the simplest and most widely used method.
2. Payback period is the time required to recover the initial investment.
3. A firm is always interested in knowing the amount of time required to recover its investment.
4. It is based on the concept of cash flow and is a non-discounting technique.

# Formula for Calculating Payback period

**1. When Cash inflows are even/equal**

When cash inflow of all year is equal, we use the following formula

**Payback period =** $\dfrac{\text{Initial Investment}}{\text{Annual Cah Inflow}}$

**2. When cash inflows are uneven**

When cash inflows of each year is different we use the formula below

**Payback Period** = $E + \dfrac{B}{C}$

Where,

E = Year immediately Preceding to year of recovery

B = Amount left to be recovered

C = Cash inflow during the year of final recovery

Note: Before using these values we must find cumulative cash inflows

# Decision Criteria

1. If there is only one project in consideration, it would be selected only if it has a payback period as per managements expectation.
2. In case of more that one project, a project with lower payback period should be selected.

# Merits of Payback Period Method

1. It is easy to calculate and simple to understand.
2. It is useful in case of those industries where there is a lot of uncertainty and instability because it lays emphasis on the speedy recovery of investment.
3. Many firms want to recover their investment as quickly as possible. This method is more appropriate for them to know how quickly they could get their investments back.
4. It Measures liquidity of the investment.

# Demerits of Payback period method

1. **This method neglects cash flows occurring after the payback period:** This method does not consider the amount of profit earned after the recovery of the cost of investment. Some projects may have higher cash inflows after the payback period.
2. This method does not consider the time value of money.
3. This method does not consider the risk associated with the project.
4. This method ignores interest factor which is considered very important in taking sound investment decision.

1. **Post Payback period:** The duration in excess of payback period till economic life of a project.

   **Post Payback period = Economic life – payback period**

2. **Post Payback Profitability:** The amount of profit, which a project could earn after the recovery of initial investment is called as payback profitability.

   **Post Payback Profitability = Total Earning from project – Payback amount**

3. **Post Payback profitability index:** Percentage of extra earning over initial investment (payback amount).

   **Post Payback profitability index** $= \frac{Post\ Payback\ Profit}{Initial\ Investment} \times 100$

# ACCOUNTING RATE OF RETURN

This method is also called as financial statement method or unadjusted rate of return method. It has two variations

**1. Return on Investment (ROI):** When initial investment is taken into account for calculation it is called ROI.

$$\text{Return on Investment (ROI)} = \frac{OS - \frac{NI}{n}}{NI} \times 100$$

**2. Average Rate of Return (ARR):** When Average investment is taken for calculation it is called ARR.

$$\text{Average Rate of Return (ARR)} = \frac{OS - \frac{NI}{n}}{\frac{NI}{2}} \times 100$$

**Where,**

OS = Operating Saving ( same as cash inflow or Profit after tax but before dep)

NI = Initial Investment

N = Economic Life of the machine

$\frac{NI}{n}$ = Depreciation

$\frac{NI}{2}$ = Average Investment

Calculation of Average Investment $\frac{NI}{2}$ =

$$\frac{Initial\ Investment + installation\ charges - scrap}{2} + Working\ capital + Scrap$$

Note:

1. Since **Profit after tax** is taken for calculation of ARR and ROI. We have to deduct the amount of depreciation from Operating saving. that's why we have used the formula $OS - \frac{NI}{n}$ .In other words, we can simply say that $\boldsymbol{OS - \frac{NI}{n}}$ **= Profit after tax.**
2. If **profit after tax** is given in the question, there is no need to deduct depreciation. The profit after tax amount should be used directly as $\boldsymbol{OS - \frac{NI}{n}}$.
3. The profit after tax or OS **should be averaged** for calculation.

# Decision Criteria

1. In case of many projects, a project with **higher ARR or NOI** will be selected.
2. In case of only one project, it would be selected if it earns **more than companies predetermined required rate of return.**

# Advantages of Accounting Rate of Return Method

1. It is simple and easy to calculate.
2. It takes into account all the savings over the entire period of investment.
3. It is based on accounting profit rather than cash inflow. Accounting profit can be easily obtained from financial statements.
4. It measures the benefit in percentage which makes it easier to compare with other projects.
5. This method helps to distinguish between projects where the timing of savings is approximately the same.

# Disadvantages of Accounting Rate of Return Method

1. This method ignores the time value of money.
2. Like Payback period, this method also ignores risk factor.
3. This method is based on accounting profits rather than cash flows. In order to maximize the wealth of shareholders, cash flows should be taken for calculation
4. This method ignores the size of investment. Sometimes ARR may be the same for different projects but some of them may involve huge cash flows.

# Net Present Value Method

1. The NPV Method is a discounted cash flow technique.
2. This method compares cash inflows and cash outflows occurring at different time period.
3. The major characteristic of this method is that it takes into account the time value of money and all cash inflows and outflows are converted to present value.

# Calculation of NPV involves following steps

1. **Cash inflows and outflows** are determined.
2. A **discount rate or cut-off rate** is determined. This rate is also called as cost of capital, required rate of return, the target rate of return, hurdle rate etc.
3. With the help of this rate of return, present value of cash inflows are calculated. For this purpose, **Present Value Factor** should be calculated at a given rate with the help of this formula **PVF =** $\frac{1}{(1+r)n}$ or it could be taken from the PVF Table.
4. Cash inflows of each year is then **multiplied** with Present Value Factor (P.V.F.)
5. Discounted **cash inflow of all years is added**. In this way, the Present Value of all Cash inflow is obtained.
6. Finally, NPV is calculated by deducting PV of cash outflow from PV of cash inflows

**NPV = P.V. of cash inflows –PV of cash outflows**

**Note:**

1. If **working capital released** and **salvage value** is given in the question, it must be **discounted** with the PVF of last year and must be **added** as a cash inflow in the last years.
2. The initial outflow is not required to be discounted because it is already a present outflow. But if there is any further cash outflow in the following years like **overhauling charges, maintenance charges** etc. that should be **discounted** at PV factor of that year and should be **added** to cash outflow.

# Decision Criteria

1. If there is only one project under consideration

| | |
|---|---|
| If NPV is Positive | Accept |
| If NPV is Negative | Reject |
| If NPV is 0 | Indifferent |

2. If there are more than one project, the project with higher NPV should be selected.

# Merits of Net Present Value

1. This method recognizes the time value of money. Cash inflows arising at different time interval are discounted to present values.
2. This method recognizes risk involved in the project with the help of discounting rate.
3. This method is best for mutually exclusive projects where only one project is to be selected among many.
4. This method is considered best for wealth maximization of shareholders as it is based on cash inflow rather than accounting profit.
5. It considers total benefits arising out of project till the end of the project.

# Demerits of Net Present Value Method

1. It requires difficult calculation.
2. The NPV technique requires the predetermination of required rate of return, which itself is a difficult job. If that rate is not correctly taken, then the whole exercise of NPV may give wrong result.
3. It does not provide a measure of projects own rate of return, rather it evaluates a proposal against an external variable i.e. minimum rate of return.
4. This method may not provide satisfactory results in case of projects having different amount of investment and different economic life.

# Profitability Index

This method is also known as Benefit-Cost Ratio Method. It is based on Net Present Value method and calculates the benefit on per rupee investment.

$$\text{Profitability Index} = \frac{\textbf{\textit{PV of Cash Inflow}}}{\textbf{\textit{PV of Cash Outflow}}}$$

**Decision Criteria**

1. If there is only one project
   - If PI is more than 1 — Accept
   - If PI is less than 1 — Reject
   - If PI is 0 — Indifferent
2. If there are more than one project, the project with higher NPV should be selected.

# Merits

1. It is superior to NPV method.
2. It gives due consideration to the time value of money and cost involved in the project.
3. PI techniques gives better result in case of projects having different outlays.
4. In PI all cash flows are considered including working capital used and released, salvage value is also considered.
5. This method is considered best for wealth maximization of shareholders as it is based on cash inflow rather than accounting profit.
6. It considers total benefits arising out of project till the end of the project.
7. The discount rate applied for discounting the cash flows is actually the minimum required rate of return. This minimum rate of return incorporates both the pure return as well as the premium required to set-off th risk.

# Internal Rate of Return (IRR)

1. IRR is also known as Time-adjusted rate of return.
2. IRR is the rate at which NPV of a project becomes zero.
3. In other words, we could say that IRR is the rate at which present value of cash inflows and present value of cash outflows will be equal.
4. In this technique, unlike net present value, we are not given a discount rate. The discount rate is to be ascertained by trial and error procedure.

# Calculation of IRR when savings are even

1. Calculate PV Factor by using the below formula ( by co-incidence, it is payback period)
2. PVF = $\frac{\textbf{\textit{Intial Investment}}}{\textbf{\textit{Annual Cash Inflow}}}$
3. Search for a value nearest to PVF from PVAF table for given number of years.
4. One value should be higher and one value should be lower to PVF.
5. Take discount rates of those higher and lower PVF.
6. Calculate present values of cash inflows with the help of these discount rates.
7. Apply the following formula

$$\textbf{IRR} = \textbf{\textit{Lower Rate}} + \frac{\textbf{\textit{NPV at Lower Rate} – \textit{PV Factor}}}{\textbf{\textit{NPV at Lower Rate} – \textit{NPV at Higher Rate}}} \times \textbf{\textit{Higher rate} – \textit{Lower rate}}$$

# Calculation of IRR when savings are even

- The above procedure which is applied for calculation of even saving is also applied here. But the formula will change

$$\text{IRR} = \textit{Lower Rate} + \frac{\textit{NPV at Lower Rate}}{\textit{NPV at Lower Rate} - \textit{NPV at Higher Rate}} \times \textit{Higher rate} - \textit{Lower rate}$$

# Important thing to remember:

1. This method is based on trial and error. We should keep in mind that we need two rates, one rate higher to PV Factor and another rate lower to PV factor and then we need to calculate NPVs at those rates. NPV at one rate should be negative and NPV at one rate should be positive.
2. We should also keep in mind
    - Lower the rate, higher the NPV
    - Higher the rate, lower the NPV
3. Suppose NPV is Negative at 10% discount rate. Now, we need another NPV which should be Positive. So, going by the above rule, we should now calculate NPV at a rate which is lower to 10%. We should continue lowering the rate till we do not get a positive NPV. Generally difference of two percent is considered good. So, here we could get a positive NPV at 8% discount rate.
4. If two rates are given in the question, we simply need to calculate the NPV at both the rates and apply those values in the formula. (This is much better haha)

# Merits of IRR

- It takes into account time value of money. Thus, cash inflows occurring at different time interval are adjusted with appropriate discount rate.
- It is profit oriented concept and helps in selecting those proposals which are expected to earn more than minimum required rate of return.
- In IRR all cash flows are considered including working capital used and released, salvage value is also considered.
- It is based on cash flow.

# Demerits of IRR

1. It involves complicated trial and calculation.
2. It makes an implied assumption that the future cash inflows of a proposal are reinvested at a rate equal to IRR. This assumption is not true as the firms are able to reinvest only at a rate available in the market.
3. Many times it may yield multiple rates.

# Terminal Value Method

1. This method is based on the assumption that cash inflows of each year is reinvested in another in another outlet at a certain rate of return till the economic life of the project
2. Cash inflows of last year is not re-invested.
3. So, cash inflows of each year is compounded with the help of formula of compounding : FV = $PV\ (1 + R)^n$ Where PV is Rs.1
4. Then this FV is multiplied with each years cash inflow.
5. Total compounded value of annual cash inflow is obtained and then it is discounted to get the present value of compounded annual cash inflow
6. Then it is compared with initial outflow to get the terminal value.

# Decision Criteria

| | |
|---|---|
| If IRR > Cost of Capital | Accept |
| If IRR <Cost of Capital | Reject |

# Discounted Payback Period

1. This method is an improvement over traditional payback period method.
2. It is a combination of payback period method and discounted cash flow technique.
3. In this method cash inflows of a project are discounted to get their present value.
4. Once the present value of cash inflows is calculated, the procedure to calculate PBP remains the same as traditional PBP method.