Introduction to Capital Budgeting

Capital budgeting is a critical process in financial management that involves evaluating and selecting long-term investment projects that will generate value for a company. This decision-making process helps organizations allocate their limited resources to the most promising and profitable opportunities, ultimately driving growth and achieving their strategic objectives.

Importance of Capital Budgeting Decisions

1   **Optimizing Resource Allocation**

Capital budgeting ensures that a company's limited funds are directe towards the most promising investment projects, maximizing the return on investment and driving long-term profitability.

2   **Assessing Project Viability**

The capital budgeting process involves a thorough evaluation of potential projects, enabling organizations to make informed decisions and reduce the risk of investing in unprofitable ventures.

3   **Aligning with Strategic Goals**

By carefully selecting investment projects, capital budgeting helps companies align their short-term decisions with their long-term strategic objectives, ensuring sustainable growth and competitive advantage.

Challenges with capital Budgeting Decision

Capital budgeting involves making long-term investment decisions, such as whether to invest in new projects, equipment, or other assets. While it's a critical process for businesses, there are several common problems that can arise:

1. Estimating Cash Flows

•**Inaccurate Projections**: Predicting future cash flows is inherently uncertain. Overestimating revenues or underestimating costs can lead to poor investment decisions.

•**Inflation and Price Changes**: Failing to account for inflation or changes in prices over time can distort cash flow estimates.

2. Risk and Uncertainty

•**Market Risk**: Changes in market conditions, such as competition, economic downturns, or shifts in consumer preferences, can impact the viability of a project.

•**Project-Specific Risks**: These include uncertainties related to the project's execution, such as construction delays, technological failures, or regulatory changes.

3. Cost of Capital

•**Incorrect Discount Rate**: Using an incorrect discount rate when calculating the present value of future cash flows can lead to incorrect investment decisions. This could be due to an improper assessment of the company's cost of capital or risk premium.

•**Overestimating Benefits**: Companies may overestimate the benefits of a project by using a lower discount rate, making a project seem more attractive than it actually is.

4.Capital Rationing

•**Limited Resources**: Companies often face constraints on the amount of capital they can invest. This can lead to suboptimal decisions, such as investing in smaller, less profitable projects rather than in larger, more profitable ones.

5.Time Horizon Issues

•**Short-Term Focus**: Companies may prioritize projects with quick payoffs rather than those

Types of Investment Projects

Investment projects can be categorized based on their purpose, nature, and the strategic goals they serve within an organization. Here are some common types of investment projects:

1. Expansion Projects

•**Purpose**: These projects aim to expand the company's operations by increasing capacity or entering new markets.

•**Examples**: Building a new manufacturing plant, expanding an existing facility, launching a new product line, or entering a new geographic market.

2. Replacement and Modernization Projects

•**Purpose**: These projects involve replacing old or obsolete assets with new ones to maintain or improve operational efficiency.

•**Examples**: Replacing outdated machinery, upgrading technology systems, or renovating facilities to improve energy efficiency.

3. New Product or Market Development Projects

•**Purpose**: These projects focus on developing and introducing new products or services, or entering new markets.

•**Examples**: Research and development (R&D) projects for new product innovation, launching a new service, or expanding into a new demographic segment.

4. Cost Reduction Projects

•**Purpose**: These projects aim to reduce operational costs by improving efficiency, cutting waste, or automating processes.

•**Examples**: Implementing energy-saving measures, automating manual processes, or reengineering workflows to eliminate inefficiencies.

5. Regulatory Compliance Projects

•**Purpose**: These projects are undertaken to comply with legal, regulatory, or environmental

Independent Projects (Accept/Reject Decisions)

•**Definition**: Independent project decisions involve evaluating projects that do not affect or depend on other projects. Each project is assessed on its own merits, and the decision to accept or reject one project does not impact the decision to accept or reject another.

•**Key Points:**
  • Projects are evaluated individually based on criteria like net present value (NPV), internal rate of return (IRR), or payback period.
  • A company may accept all projects that meet its investment criteria, as they are not mutually exclusive.

•**Example**: A company may decide to upgrade its IT infrastructure and, separately, purchase new manufacturing equipment. If both projects are deemed profitable, both can be accepted independently of each other.

2. Mutually Exclusive Projects

•**Definition**: Mutually exclusive project decisions involve choosing between two or more projects where the selection of one project excludes the others from being pursued. These projects typically serve the same purpose, and only one can be selected.

•**Key Points:**
  • The decision is based on a comparative analysis of each project's profitability and strategic fit.
  • Common evaluation methods include comparing NPVs, IRRs, and payback periods to determine the most favorable option.

•**Example**: A company might have to choose between building a new factory in either Location A or Location B. Since the company can only afford to build one factory, it must choose the location that offers the highest potential return.

3.Contingent Decisions

•Definition: Contingent investment decisions involve projects that are dependent on the outcome of another project. The decision to proceed with a contingent project is conditional upon the success, failure, or completion of another project.

•Key Points:
  • These decisions often involve sequential investments, where the outcome of the first project directly influences the next step.
  • The risk is higher because the success of the contingent project depends on the successful completion of the preceding project.

•Example: A company might decide to develop a new product (Project A) with a contingent decision to expand production facilities (Project B) if the product launch is successful. The expansion (Project B) will only proceed if Project A meets certain sales targets.

4. Capital Rationing Decisions

•Definition: Capital rationing decisions occur when a company has limited financial resources and must choose the best combination of projects to maximize returns. The company imposes a budget constraint, even if there are multiple profitable projects available.

•Key Points:
  • The goal is to allocate available capital to the most valuable projects while staying within the budget limit.
  • Companies prioritize projects based on profitability metrics like NPV, IRR, or profitability index (PI) to determine which projects to fund.
  • There are two types of capital rationing:
    • **Hard Capital Rationing:** Imposed by external factors like market conditions, lending restrictions, or availability of funds.
    • **Soft Capital Rationing:** Imposed internally by the company's management to maintain control over capital expenditures.

Capital Budgeting Process

1. **Estimation of cost and Benefits of an Investment Proposal**: The first and the most important task required to be performed by finance manager in capital budgeting is to estimate the costs and benefits associated with an investment proposal. The costs of the proposal may include the cost of purchase and installation of assets under a project. The benefits may arise in the form of increased revenue or savings costs.

2. **Estimation of the minimum required rate of return**: The estimation of the minimum required rate of return to judge the desirability of an investment decision is another important step in the capital decision making procedure.

3. **Application of a suitable capital budgeting Technique**: After estimating the relevant data that costs and benefits of various proposals, minimum required rate of return, the next step is to apply a suitable capital budgeting technique to select the best alternative.

Capital flows refers to the difference between rupee received and rupee paid out.

The cash flows for the purpose of capital Budgeting can be mainly estimated under the following three headings

1) Initial cash Outflow or Initial Investment
2) Subsequent Annual Net cash inflows for the life
3) Terminal Cash inflows

Principles of cash flow estimation

1) Separation principle: It implies that only operating cash flows are to be considered and not the financial cash flows such as int on debentures as it will be taken care in financial costs that is through cost of capital.

2) Incremental Principle: It says that the relevant and incremental cash flows are to be considered. Sunk costs should be ignored. Consider only incremental cash flows. Include opportunity costs of physical facilities. Estimate working capital requirement properly.

3) Post Tax principle: All cashflows must be on post tax basis.

Estimation of Relevant cash flows

1. Estimation of Initial cash Outflow

        Cost of new Asset(s)
    + Installation charges
     + Any other capital Expenditure
     +/- Increase / Decrease in net working capital
      Total of Initial cash outflow

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2. Estimation of Annual Net Operating cash Inflows

        Cash flow/ Profit before depreciation and Tax (PBDT)
            -Depreciation
      Profit before tax (PBT)
        Less Tax
       Profit after tax (PAT or EAT)
          + Depreciation (non-cash expenditure)
           + Interest payment (1-t)
           (Only when PAT has been calculated after providing for interest charges)
            - Any major repair or capital expenditure
          +/-Decrease/Increase in net working capital

         Annual net operating cash inflows

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3. Estimation of terminal cash inflow

          Annual net operating cash inflow
            +Release of investment in working capital

Question1: SR Ltd has earned a profit before tax (PBT) of Rs 10,00,000 for the year ending 31st march 2010 from an investment project. The company has provided a depreciation of Rs 2,00,000 and has paid Rs 1,00,000 as financing cost (Interest payment) for the project. The company is 40% tax bracket. Estimate the project's operating cash inflow for the year.

Question2 : Following is the income statement of a project, on the basis of which calculate t

Net sales Revenue			4,75,000
- Cost of goods sold		2,00,000	
-General expenses		1,00,000	
-Depreciation		50,000	3,50,000
Profit before interest			1,25,000
-interest			25,000
Profit before tax			1,00,000
-Tax @40%			40,000
Profit after tax			60,000

Question: RS Ltd. Is considering an investment in a machine which will cost Rs 2,00,000. The cost of installation will amount to Rs 50,000. The increase in working capital will be Rs 1,40,000. The machinery is expected to provide cash inflows before depreciation and taxes of Rs 1,00,000 for a period of five years after which it can be sold for Rs 50,000. The firm is in tax bracket of 40% and uses straight line method of depreciation. Calculate all the cash flows associated with the machine.

Question. PQR LTD is evaluating an investment proposal with following information. Calculate the rel

	Rs
Cost of Machine	18,00,000
Installation charges	1,00,000
Life of Machine	5Years
Salvage value	1,50,000
Increase in working capital	1,00,000
Annual profit before depreciation and tax	6,00,000
Tax	40%

Question From the following information find out initial, subsequent annual and terminal

Cost of machine	Rs 5,25,000
Salvage value	Rs 30,000
Installation charges	Rs 5,000
Life of machine	5 years
Expected Annual sales(in units)	10,000
Sales price per unit	Rs 40
Variable cost per unit	Rs 16
Tax rate	50%

Question: ABC Ltd. Has prepared following income statement pertaining to an investment proposal. Calculate cash flows

Net Sales	8,00,000
Less: Cost of goods sold 3,00,000	
Less; operating Expenses 40,000	
Less: Depreciation 60,000	4,00,000
Profit before interest and Tax	4,00,000
Less interest	30,000
Profit before Tax	3,70,000
Less tax @40%	1,48,000
Profit after tax	2,22,000

Estimation of relevant cash flows for replacement decisions

1.Estimation of initial incremental cash outflow

    Cost of new Assets

   +Installation charges (new assets)

   +Any other capital expenditure(new asset)

    +/- Increase/Decrease in net working capital

     -Net proceeds from the sale of old assets

    +/- Taxes paid/saved due to capital gain/loss

      sale of old asset

    Initial incremental cash outflow

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2.Estimation of Annual incremental cash inflows

   +Net increase in operating income before depreciation

   (Increase in operating revenue – increase in operating cost)

 -/+ Increase/decrease in incremental depreciation

  + Net Increase in the Income before tax (EBT)

   -/+ Net increase/ Decrease in taxes

  + Net Increase in Income after tax (EAT)

 +/- Net increase/ decrease in net working capital

    Annual incremental cash inflow

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3. Estimation of terminal incremental cash inflow

    Annual incremental cash inflow

  + Release of net working capital

  + Salvage value of (new asset-old asset)

 -/+ Incremental tax paid / saved due to capital gain/loss on sale/Scrap of machines

Question: VS LTd is having a machine whose book value is Rs 60,000. It is proposed to be replaced by a machine costing Rs 1,40,000. Find the cash outflow of the new machine when the old machine is sold for
(1)Rs 50,000 (2) 60,000 (3) 80,000. Tax rate is 40%.

Question: Deepak Ltd. Purchased a machine two years ago at a cost of Rs 28,000. At that time machine was estimated to have 7 years life. Its annual cash operating cost Rs 22,000. Finance manager wants to replace it with a new machine having annual cash operating expenses of Rs 15,000. Cost of the new machine is Rs 30,000 and its estimated life is 5 years with zero scrap value. Present scrap value of old machine is Rs 16,000. Straight line method of depreciation is used by the company. Tax rate of is 40%. Calculate incremental cashflow of the replacement.

Question: ABC and Co. is considering a proposal to replace one of its plants costing Rs 60,000 and having written down value of Rs 24,000. The remaining economic life of the plant is 4years after which it will have no salvage value. However, if sold today it has a salvage value of Rs 20,000. The new machine costing Rs1,30,000 is also expected to have a life of 4years with a scrap value of Rs 18,000. The new machine, due to its technological superiority, is expected to contribute additional annual benefits (before deprecation and tax) of Rs 60,000. Find out the cash flows associated with this decision given that the tax rate applicable to the firm is 40%. (The capital gain or loss may be taken as not subject to tax.)

Question: XYZ is interested in assessing the cash flows associated with the replacement of an old machine by a new machine. The old machine bought a few years ago has a book value of

Payback Period Method (Non-discounti

Definition

The Payback Period method is a capital budgeting technique that calculates the amount of time it takes for a project to recoup its initial investment through the generation of future cash inflows.

Advantages

The Payback Period method is simple to understand and calculate, and it can be useful in evaluating the liquidity of a project and its risk profile.

Limitations

The Payback Period method does not consider the time value of money and may not accurately reflect a project's long-term profitability, making it less suitable for evaluating longer-term investments.

Decision Rule

Projects with a shorter payback period are generally preferred, as they allow the company to recoup its initial investment more quickly and reduce the associated risk.

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

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

2. When cash inflows are uneven

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

$$\text{Payback Period} = E + \frac{B}{C}$$

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

Question: An investment proposal requires an initial cash outflow of Rs 50,000 and expected to generate Rs 12,500 annually for 6 years. Calculate Discounted payback period when discount rate is 10% per annum.
(A=5.37 years)

Question: A project requires an outflow of Rs 40,000 and the expected inflows generated from the project are Rs 10,000, Rs12,000, Rs 10,000, Rs 9,000 Rs 8,000 and 12,000 . Calculate Discounted payback period when the discount rate is 12%
(A= 5.67years)

Question: A proposal requires a cash outflow of Rs 1,00,000 and is expected to generate cash inflows of Rs 20,000 p.a for 6 years.

(A=5 years)
Question: A proposal requires a cash outflow of Rs 18,500 and is expected to generate cash inflows of Rs 8,000, Rs 6,000, Rs 4000, Rs 2,000 and Rs 2000 over next 5 years respectively.
(A=3.25 years)

ARR (Accounting Rate of Return) is a financial metric used to evaluate the profitability of an investment or project. It represents the ratio of the average annual accounting profit (net income) generated by an investment to the initial investment cost. ARR is commonly used in capital budgeting to compare the potential returns of different projects or investments.

Components of ARR:

1.Average Annual Accounting Profit: This is the average net income that the investment generates each year. It is typically calculated after deducting all operating expenses, depreciation, taxes, and other costs.

2.Initial Investment: This refers to the total cost required to start the investment or

ARR Formula:

$$ARR = \left(\frac{\text{Average Annual Accounting Profit}}{\text{Initial Investment}} \right) \times 100$$

Example Calculation:

Suppose a company is considering an investment that costs $100,000. The project is expected to generate annual profits of $20,000 over 5 years. The average annual accounting profit would be:

$$\text{Average Annual Profit} = \frac{20,000 \times 5}{5} = 20,000$$

The ARR would be calculated as:

$$ARR = \left(\frac{20,000}{100,000} \right) \times 100 = 20\%$$

Key Points About ARR:

1.Simple and Easy to Understand: ARR provides a quick estimate of the profitability of an investment, making it easy to compare multiple projects.

2.Ignores Time Value of Money: Unlike other metrics like Net Present Value (NPV) or Internal Rate of Return (IRR), ARR does not consider the time value of money. It treats all profits equally, regardless of when they are received.

3.Focus on Accounting Profit: ARR uses accounting profits, which include non-cash expenses like depreciation. This can sometimes give a distorted view of the actual cash flow generated by the investment.

4.Comparison Tool: Businesses often use ARR to compare the profitability of different projects or investments, but it should not be the sole criterion due to its limitations.

Limitations:

•**Doesn't Consider Cash Flows**: Since ARR focuses on accounting profits, it may not accurately reflect the actual cash inflows and outflows of the project.

•**Ignores Risk**: ARR doesn't account for the risk associated with the investment, which can be crucial in decision-making.

•**No Time Value Consideration**: Since it ignores the time value of money, ARR might not provide a complete picture of the investment's profitability over time.

In summary, while ARR is a useful and straightforward tool for evaluating investment profitability, it should be used alongside other metrics that consider cash flows, risk, and the time value of money for more informed decision-making.

Discounted payback period

The discounted payback period is similar to the traditional payback period except that it uses discounted cashflows. It is defined as "The no of years needed to recover the initial cash outlay from the discounted free cash flows.

Accept/Reject criteria

Discounted payback < firm's maximum desired payback   Accept

Discounted payback > firm's maximum desired payback   Reject

Merits
1.**Time Value of Money:**
The DPP accounts for the time value of money, meaning future cash flows are discounted to reflect their worth in present-day terms. This makes the measure more accurate than the traditional payback period.

2. **Simplicity:**
Though it includes discounting, DPP is still a relatively straightforward method to calculate and interpret, making it easy to use in practice, especially when compared to more complex techniques like Net Present Value (NPV) or Internal Rate of Return (IRR).

Limitations of Discounted Payback Period:
1.**Ignores Cash Flows Beyond Payback Period:**
Like the simple payback period, DPP does not consider cash flows that occur after the payback period has been reached, which can lead to poor decision-making if a project has substantial cash flows after this period.

1 No Direct Profitability Measure:

Discounted Payback period

Question: An investment proposal requires an initial cash outflow of Rs 50,000 and expected to generate Rs 12,500 annually for 5 years. Calculate payback period.
(A=4 year)

Question: A project requires an outflow of Rs 40,000 and the expected inflows generated from the project are Rs 10,000, Rs12,000, Rs 10,000, Rs 7,000 and Rs 5,000. Calculate payback period.
(A=4.2 years)

Question: A proposal requires a cash outflow of Rs 1,00,000 and is expected to generate cash inflows of Rs 20,000 p.a for 6 years.

(A=5 years)

Question: A proposal requires a cash outflow of Rs 18,500 and is expected to generate cash inflows of Rs 8,000, Rs 6,000, Rs 4000, Rs 2,000 and Rs 2000 over next 5 years respectively.
(A=3.25 years)

Net present value

Net Present Value (NPV) is a fundamental financial metric used in capital budgeting to assess the profitability of an investment or project. It represents the difference between the present value of cash inflows and the present value of cash outflows over a period of time. NPV helps determine whether a project or investment will generate more value than the cost incurred.

Components of NPV:

1.Cash Inflows: The money expected to be received from the investment over time, such as revenues, savings, or any other benefits.

$$NPV = \sum \left(\frac{\text{Cash Inflows}_t}{(1+r)^t} \right) - \text{Initial Investment}$$

Where:

- Cash Inflows_t = Cash inflows at time t
- r = Discount rate
- t = Time period

Steps to Calculate NPV:

1. **Estimate Cash Flows**: Forecast the expected cash inflows and outflows for each period (usually in years) during the life of the project.

2. **Choose a Discount Rate**: Determine the discount rate to apply, which could be the company's cost of capital, required rate of return, or a rate that reflects the investment's risk.

3. **Calculate Present Values**: Discount each of the cash inflows and outflows back to their present values using the discount rate.

4. **Sum the Present Values**: Add up all the discounted cash inflows and subtract the initial investment to find the NPV.

Example Calculation:

Assume a project requires an initial investment of $100,000 and is expected to generate the following cash inflows over three years: $40,000, $50,000, and $60,000. If the discount rate is 10%, the NPV would be calculated as follows:

$$NPV = \frac{40,000}{(1+0.10)^1} + \frac{50,000}{(1+0.10)^2} + \frac{60,000}{(1+0.10)^3} - 100,000$$

$$NPV = \frac{40,000}{1.10} + \frac{50,000}{1.21} + \frac{60,000}{1.331} - 100,000$$

$$NPV = 36,364 + 41,322 + 45,082 - 100,000$$

$$NPV = 122,768 - 100,000$$

$$NPV = 22,768$$

In this case, the NPV is $22,768, meaning the project is expected to generate a net positive value of $22,768 after accounting for the cost of capita ↓

Interpretation of NPV:

•**Positive NPV:** If NPV > 0, the investment is expected to generate more value than its cost, making it a potentially profitable venture.

•**Negative NPV:** If NPV < 0, the investment is expected to generate less value than its cost, indicating it might not be worthwhile.

•**Zero NPV:** If NPV = 0, the investment is expected to break even, generating exactly the return required to cover its cost.

Advantages of NPV:

•**Considers Time Value of Money:** NPV takes into account the time value of money, making it a more accurate measure of an investment's profitability over time.

•**Focuses on Cash Flows:** NPV is based on cash flows rather than accounting profits, providing a clearer picture of the investment's financial impact.

•**Risk and Return:** By using a discount rate that reflects the project's risk, NPV can provide a risk-adjusted measure of value.

Limitations of NPV:

•**Estimations Required:** NPV relies on estimates of future cash flows and the discount rate, which can be uncertain and subjective.

•**Complexity:** For projects with complex cash flows or long time horizons, calculating NPV can be challenging and may require sophisticated financial modeling.

•**Doesn't Measure Scale:** NPV doesn't provide a sense of the scale of the investment, so it should be used in conjunction with other metrics like Internal Rate of Return (IRR) or Payback Period.

In summary, NPV is a powerful tool for evaluating the profitability of investments, as it considers both the timing and magnitude of cash flows while accounting for risk. It is widely

Question A company is considering investing in a new project that requires an initial investment of Rs 150,000. The project is expected to generate the following cash inflows over the next four years:
•Year 1: Rs 50,000
•Year 2: Rs 55,000
•Year 3: Rs 60,000
•Year 4: Rs 70,000
The company's required rate of return (discount rate) is 10%.
Calculate the NPV of the project. Based on your calculation, should the company proceed with the investment?

Question: Let an investment project requires an initial investment of Rs 1,00,000. It has annual cash inflows of Rs 80,000 and Rs 75,000 for its 2 year's life. Find the NPV of the project at 10% , 15% and 20% discount rates.

Year	1	2	3	4	5
EBIDT	30,000	35,000	40,000	45,000	50,000

Question: ABC Ltd is planning to start a project which requires an initial outlay of Rs.1,00,000 on the purchase of a machine having a life of 5 years. It is expected to generate year ending profit (Before Depreciation and taxes) of Rs 50,000, Rs 30,000, Rs 20,000, Rs 30,000 and Rs 40,000 from the end of first year to the end of fifth year. Assuming that the company pays income tax @40% and uses staright line method of depreciation with no salvage value, you are required to compute:

(i) Pay back period
(ii) Average rate of return
(iii) Discounted payback and NPV (discount rate is 10%)
   (A=3.62 years and 16.8%,   4.56 yrs, 8668)

Questi_____ are available each c

Year	Machine A	Machine B
1	15,000	5,000
2	20,000	15,000
3	25,000	20,000
4	15,000	30,000
5	10,000	20,000

You are required to indicate which machines would be profitable using
(i) Pay back Method   (ii) Return on investment method   (iii) NPV when discount rate is 12%)

Question: A choice is to be made between two proposals which require an equal investment of Rs 50,000 each and are expected to generate net cash inflows as under:

Year	Project A	Project B
1	25,000	10,000
2	15,000	12,000
3	10,000	18,000
4	NIL	25,000
5	12,000	8,000
6	6,000	4,000

Which project should be chosen under:
(a) Payback period   (b) Average rate of return method

Question : A company is considering to purchase a machine. Two machines A and B are available each costing Rs 10,00,000. In comparing the profitability of machine a discount rate of 10% is to be

Year	Machine A	Machine B
1	3,00,000	1,00,000
2	4,00,000	3,00,00
3	5,00,000	4,00,000
4	3,00,000	6,00,000
5	2,00,000	4,00,000

You are required to indicate which machines would be profitable using the following methods of ranking proposals:

(i)ARR method
(ii)Net present Value method
   ARR: 68% and 72%

10,65,700 and 10,55,300

Profitability Index

The **Profitability Index (PI)**, also known as the **Benefit-Cost Ratio**, is a financial metric that helps assess the attractiveness of an investment or project. It is calculated by dividing the present value of future cash inflows by the initial investment cost.

Formula:

$$PI = \frac{\text{Present Value of Future Cash Flows}}{\text{Initial Investment}}$$

Interpretation:

- If **PI > 1**: The project is considered profitable, as it generates more value than its cost.

- If **PI = 1**: The project breaks even, meaning it neither gains nor loses value.

- If **PI < 1**: The project is unprofitable, as the costs outweigh the benefits.

Merits of Profitability Index:

1.Time Value of Money:

PI considers the time value of money by using discounted cash flows, ensuring that future returns are accurately represented in today's terms.

2.Clear Investment Decision Criterion:

A PI greater than 1 indicates a profitable investment, making it an easy-to-understand rule for deciding whether to proceed with a project.

3.Relative Measure:

Unlike Net Present Value (NPV), which provides an absolute measure of profitability, PI expresses profitability as a ratio, making it easier to compare projects of different scales.

4.Ranking of Projects:

PI is useful in capital rationing scenarios where a company must choose between multiple investment opportunities with limited resources. Projects with a higher PI are prioritized, leading to more efficient capital allocation.

5.Incorporates Risk Adjustments:

By adjusting the discount rate, the PI can reflect different levels of risk, helping in evaluating projects with varying degrees of uncertainty.

Limitations of Profitability Index:

1.Ignores Scale of Investment:

PI does not consider the actual size of the investment. For example, a small project with a high PI might be ranked higher than a large project with a lower PI, even if the larger project delivers significantly higher absolute profits.

2.Relies on Discount Rate:

Similar to other discounted cash flow techniques, PI is sensitive to the choice of the discount rate. Small changes in the discount rate can result in large differences in the calculated PI.

3.Potential for Misleading Comparisons:

In cases where two projects have the same PI, the one with a smaller initial investment might be incorrectly deemed more attractive, even though the absolute gains of the other project may be higher.

4.Complexity in Estimating Cash Flows:

Accurate forecasting of future cash flows is challenging, and any errors in these estimates can lead to an incorrect profitability index.

Question: A company is considering the replacement of an existing machine. It is faced with two alternatives either to buy machine A which is like the existing machine or to buy machine B which is more expensive and has higher capacity. The earnings after taxes (in thousands of Rs.) at the present level of operations are as follows:

Year	Machine A	Machine B
0	-50	-80
1	-	20
2	10	28
3	40	32
4	28	34
5	18	30

Cost of capital is 10%. Calculate:
(a) Net present Value   (b) Profitability Index

Question: FH Hospital is considering to purchase a CT-Scan machine .Presently the hospital is outsourcing the CT-scan machine and is earning commission of Rs 15,000 per month (net of tax). The following details are given regarding the machine:

Cost of CT scan Machine	15,00,000
Operating cost per annum (excluding Dep)	2,25,000
Expected revenue per annum	7,90,000
Salvage value of the machine (after 5 years)	3,00,000
Expected life of the machine	5 years

Assuming tax rate @30%, whether it would be profitable for the hospital to purchase the machine ? Give your recommendation under:
 (i)Net present Value method when discount rate is 12% (ii) Profitability Index Method

Internal Rate of Return (IRR) is a financial metric used to evaluate the profitability of an investment. It represents the discount rate at which the net present value (NPV) of all cash flows (both incoming and outgoing) from a particular project or investment equals zero. In simpler terms, the IRR is the interest rate that makes the sum of the present value of the future cash flows equal to the initial investment. The higher the IRR, the more desirable the project or investment.

Key points about IRR:

•**Decision Rule**: In capital budgeting, if the IRR exceeds the required rate of return or cost of capital, the investment is considered good; otherwise, it may be rejected.

Formula: The ___ rs as it does not have ___

$$IRR = r_a + \frac{NPV_a}{(NPV_a - NPV_b)}(r_b - r_a)$$

Where

r_a = lower discount rate chosen

r_b = higher discount rate chosen

NPV_a = NPV at r_a

NPV_b = NPV at r_b

Question: Cost of a project is Rs 39,000 and it is expected to generate cash inflows of Rs 12,500 annually for 5years. Calculate the IRR of the project.

Question SR Ltd is considering investing in a project requiring a capital outlay of Rs 1,00,000. Forecast for earning after tax but before depreciation are given below. Further the company uses straight line method of depreciation. Project's salvage value is zero. Calculate internal rate of return and advice the company whether to invest in the project if desirable rate of return on its investment is 20%.

Year	Earnings after tax but before depreciation
1	20,000
2	20,000
3	NIL
4	20,000
5	20,000

Question: Rs Ltd is considering investing in a project requiring a capital Outlay of Rs 1,00,000. Its estimated CFAT for its 5year life are as follows: Calculate internal rate of return

Year	1	2	3	4	5
CFAT	60,000	50,000	40,000	10,000	5,000

Question :There are two projects A and B . Both the projects are of one year Duration. The following data is given below . Further the cost of capital is 10%. Evaluate these projects using NPV and IRR.

	Cash outflow	Cash inflow
Project A	30,000	40,000
Project B	20,000	25,000

RST Ltd is considering investing in a project requiring a cash outlay of Rs 1,00,000.
Forecast for CFAT is as follows

Year	CFAT
1	60,000
2	50,000
3	40,000
4	30,000
5	20,000

Find the discount 10%:
(A=2.14 years)

Question : SR Ltd is considering an investment proposal requiring initial investment of Rs 50,000. The estimated life of the project is 5 years and no salvage value. The company uses straight line method of depreciation and same is allowed for tax purpose. The tax rate is 35%. The estimated profit before depreciation and Tax (PBDT) from the investment proposal are as follows:

Year	Profit Before Depreciation and Tax (PBDT)
1	11,000
2	20,000
3	18,000
4	15,000
5	12,000

Calculate the following :
(i) Payback period (ii) Average rate of return (iii) Net present value @10% discount
   Rate (iv) Profitability Index at 10% discount rate

(v) Internal Rate of return

Reasons for Conflict in Ranking between NPV and IRR:

1.Scale of Investment:

NPV is an absolute measure, while IRR is a relative measure. A large project may have a high NPV but a lower IRR, while a smaller project could have a higher IRR but a lower NPV.

2.Timing of Cash Flows:

Projects with different cash flow patterns may have different rankings based on NPV and IRR. If a project has larger cash inflows in the early years, it may have a higher IRR, but the NPV method might favor a project with larger total inflows, even if they occur later.

3.Mutually Exclusive Projects:

When comparing mutually exclusive projects (you can only pick one), NPV and IRR might rank projects differently. NPV considers the value added to wealth, while IRR simply measures return relative to the project's size.

4.Reinvestment Rate Assumption:

NPV assumes that cash flows are reinvested at the cost of capital, while IRR assumes they are reinvested at the IRR itself. If the IRR is significantly higher than the cost of capital, the assumption may lead to overly optimistic project evaluations.