Economics

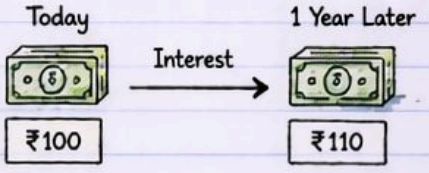
Module-2 Notes

by pyqfort.com

Contents Covered:

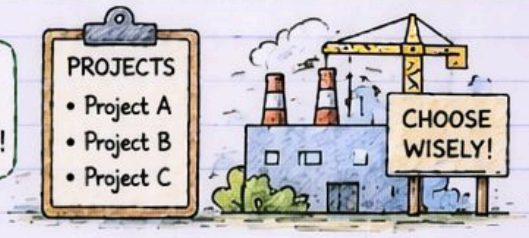
- **Time Value of Money (TVM)**

₹100 Today is Worth More than ₹100 Tomorrow!



- **Capital Budgeting and it's Techniques**

Deciding where to Invest for Maximum Returns!



- **Traditional Techniques**

Simple & Easy Methods!

Payback Period

How quickly we get our money back!

Accounting Rate of Return (ARR)

Uses Accounting Profits to find Return!

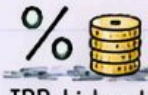
- **Modern Techniques**

Consider Time Value of Money!

Net Present Value (NPV)

Positive NPV? Good Investment!

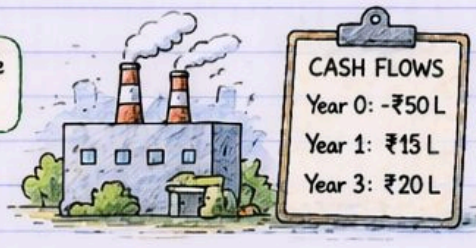
Internal Rate of Return (IRR)



IRR higher than Required Return? Then Accept!

- **Case Study: Investment in a Plant**

A Real-Life Example!



Should we Invest? Let's Find Out!

- **Discounted Payback Period**

Payback Period that Considers the Time Value of Money!

Year	Cash Inflow	Discount Factor	Present Value
1	₹ 20,000	0.91	₹ 18,200
2	₹ 25,000	0.83	₹ 20,750
3	₹ 30,000	0.75	₹ 22,500

Add Present Values until Investment is Recovered!

Discounted Payback = 2.4 Years

Time Value of Money (TVM) - Intro

- **What is TVM?**

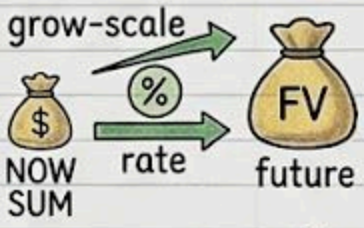
The Time Value of Money (TVM) is a crucial stating that a sum of money is worth more *now* than the same amount in the future due to its potential earning earning capacity.

This principle underlies concepts of interest rates, present value, and future value, making it a cornerstone of financial decision-making.

- **Key Components of TVM:**

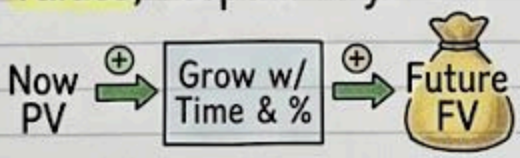
1. **Present Value (PV):**
   The Current worth of a future sum of money that will be received or paid in the future, discounted at a specific interest rate.

2. **Future Value (FV):**
   The value of a current sum of money at a future date, based on a specified growth rate or interest rate.

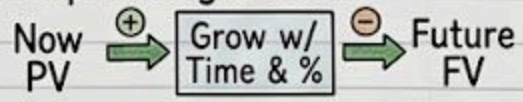


3. **Interest Rates:**
   The rate at which money grows over time, either as returns on investments or as the cost of borrowing.

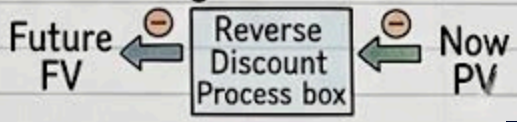
4. **Compounding and Discounting:**
   The processes used to calculate future and present values, respectively.



Compounding Process:



Discounting Process:



Role of Time Value of Money (TVM) in Economics

1. Investment Decisions:

Capital Allocation: TVM is central to resource allocation decisions. In economics, investments today are valued higher than investments in the future, as today's capital can earn interest, dividends, or other returns. TVM helps businesses and governments decide the optimal allocation of resources, ensuring investments that generate more value today are prioritized.

Evaluation of Projects: TVM is essential in evaluating long-term projects. Methods like Net Present Value (NPV) and Internal Rate of Return (IRR) rely on TVM to assess whether the future cash flows of a project justify the initial investment, ensuring that economic decisions maximize wealth.

2. Savings and Consumption:

Intertemporal Choices: TVM influences how individuals and governments make decisions regarding savings and consumption. It helps people decide how much to save today in order to have enough resources for future consumption. Similarly, in economics, TVM is used to how consumers adjust their consumption over time in response to changing interest rates rates or economic policies.

3. Inflation Consideration:

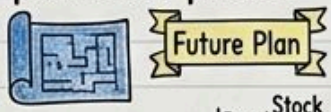
Impact of Inflation: TVM also accounts for the erosion of money's value due to inflation. As inflation increases, the purchasing power of money decreases over time. Economists use TVM to adjust future cash flows or income streams for inflation to ensure that decisions are made based on the true value of money over time.

4. Interest Rates and Cost of Capital:

Determining Interest Rates: TVM is crucial in the determination of interest rates, as lenders charge interest to compensate for the lost opportunity of using money today. TVM helps in understanding how different interest rates affect borrowing and lending behavior in the economy, as well as the cost of capital for businesses and governments.

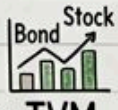
5. Economic Planning and Policy Making:

Long-term Planning: In economic policymaking, such as government spending, pension funds, and infrastructure investments, TVM helps assess the future value of government projects and financial commitments. By considering the time value, governments can plan fiscal policies that ensure long-term economic stability and growth.



6. Financial and Capital Markets:

Valuation of Assets and Securities: TVM is also applied in the valuation of financial instruments such as bonds, stocks, and annuities. Discounting future cash flows using TVM principles allows investors to determine the present value of securities, influencing their investment decisions.

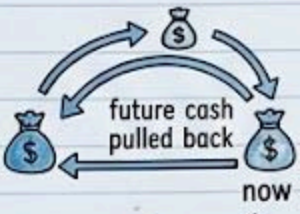


Example:

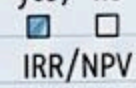
- Present Value Example: If you have the choice to receive $1,000 today or $1,000 a year from now, receiving it today is preferable because you can invest it and earn interest. If the interest rate is 5%, $1,000 today will grow to $1,050 in a year. $1,000 today → $1,050 a year later.

Applications of Time Value of Money (TVM)

1. Investment Appraisal



- Meaning: Evaluates long-term investment projects by discounting future cash inflows to their present value.
- Ensures investments only made in projects that generate value above the cost of capital.
- Example: Capital budgeting methods like Net Present Value (NPV) & Internal Rate of Return (IRR) rely on TVM to assess profitability.



2. Loan and Mortgage Calculation

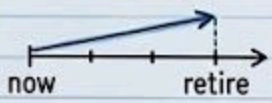
- Meaning: Determines loan repayments or the total cost of borrowing by accounting for interest rate and time.
- Calculates the present value of future loan payments and compares different loan offers.
- Example: When applying for a mortgage, TVM helps calculate monthly payments required.

3. Valuation of Financial Instruments

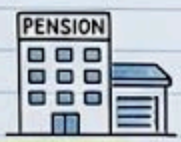
- Meaning: Determines the value of financial assets such as bonds, stocks, or annuities.
- Calculates the present value of future interest payments and its face value.
- Example: The price of a bond is calculated by discounting its future coupon payments and face value back to the present.

4. Retirement Planning

- Meaning: Calculates how much individuals need to save & invest today to meet future retirement goals.
- Example: Using TVM, determines the annual investment needed annually to reach a target corpus by retirement.



5. Annuities and Pension Planning



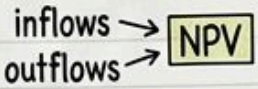
- Meaning: Crucial in calculating the present value of annuities or pension plans, providing periodic future payments.
- Example: A company calculates the present value of the future payouts it must make to employees.

Summary: TVM is widely used across all areas of finance for essential calculations.

TVM Relevance in Decision Making

A sum of money today is worth more than the same sum in the future, due to its earning capacity. Money has the potential to earn interest or generate returns returns over time. Value of money decreases as time passes. relevance in decision-making is crucial.

1. Investment Appraisal
   - Net Present Value (NPV): TVM central to NPV method, widely used for assessing profitability.
     - compares present value of project's expected cash inflows and outflows.
     - discounting future cash flows.
     - higher NPV is considered better.



   - Internal Rate of Return (IRR): Critical decision-making tool.
     - rate at which NPV of cash flows equals zero.
     - TVM ensures future cash flows discounted at appropriate rate.
     - projects with higher IRR values generally preferred.

2. Capital Budgeting
   - Payback Period: TVM helps calculate discounted payback period.
     - considers time required to recover initial investment.
     - shorter payback period preferred.

   - Profitability Index (PI): ratio of discounted cash inflows to initial investment.
     - PI greater than 1 indicates a profitable investment.

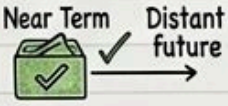
$$\frac{\text{[cite: Disc. Inflows]}}{\text{[cite: Initial Investment]}} > 1 \rightarrow \text{profitable}$$

3. Loan and Financing Decisions
   - Loan Repayment: TVM is crucial for loan repayments, interest, loan schedules.
     - Comparing different options.
     - choosing the least cost in present terms.

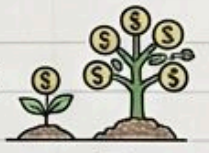
   - Cost of Capital: determines cost of capital (debt or equity).
     - Enables better capital structure decisions.

4. Risk and Uncertainty Evaluation
   - Discounting Future Risks: In uncertainty, TVM evaluates future risks/rewards.
     - future cash flows discounted to their present value for assessment.
     - future money less certain & valuable.

5. Comparing Alternatives
   - Comparing Investment Options: compare projects at different times.
     - project with cash inflows sooner preferred (higher present value).
   - Cost-Benefit Analysis: quantifying impact of future outcomes on present.
     - better comparisons for choices.



6. Retirement and Savings Planning
   - Accumulation of Wealth: compounding effect (earlier contributions grow significantly).
     - understand how today's savings grow over time.
   - Savings Goals: assesses how much to save now to reach a target.
     - understanding interest rates, inflation, effect of time.



7. Inflation and Purchasing Power
   - Effect of Inflation: TVM accounts for inflation (erodes purchasing power).
     - future amounts are worth less.
     - Adjusting ensures more accurate comparisons.

'Capital Budgeting Intro'

1. **Meaning & Goal:**
   - Process of planning and evaluating long-term investments or projects that require significant capital expenditure.
   - Analyze potential investment opportunities to determine if they are worthwhile.
   - Goal: Make decisions that maximize a company's value and profitability.

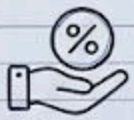
2. **Process of Capital Budgeting (Overview):**
   - How businesses evaluate and make decisions about long-term investments or projects.
   - Considers business's strategic objectives and financial constraints.
   - Follows a structured approach with several steps.

3. **Steps in the Capital Budgeting Process:**

   1. **Project Identification:**
      - Identify investment opportunities (new projects, expansion, etc.) that align the company's long-term strategic goals and objectives.

   2. **Project Evaluation and Cash Flow Estimation:**
      - Evaluate potential benefits by estimating the future cash flows (revenues, costs, taxes, depreciation).
      - Cash flows must consider inflation, changing market conditions, and possible risks.

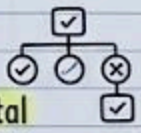
   3. **Determining the Discount Rate:**
      - Often the company's cost of capital (required rate of return).
      - Calculate future cash flows in today's terms.



   4. **Applying Capital Budgeting Techniques:**
      - Use financial techniques for evaluation.
      - Common Methods:
        * Net Present Value (NPV):
        * Internal Rate of Return (IRR):
        * Payback Period:
        * Profitability Index (PI):

   5. **Risk Analysis:**
      - Assess associated risks (sensitivity, scenario, break-even analysis).
      - Gauge risk level of risk.

   6. **Decision Making:**
      - Select the projects that offer the best combination of return and risk.
      - Expected return (NPV, IRR, etc.) exceeds the company's cost of capital within the company's budget and long-term plans.



   7. **Implementation of the Project:**
      - Allocate necessary resources and start project execution, construction, hiring, etc.).

   8. **Monitoring and Post-Implementation Review:**
      - Continuous monitoring; analyze performance discrepancies.
      - Post-implementation review helps assess success and provides future insights.

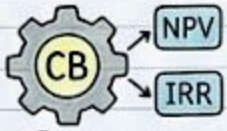
Example & Importance of Capital Budgeting

EXAMPLE: New Production Plant (Manufacturing)

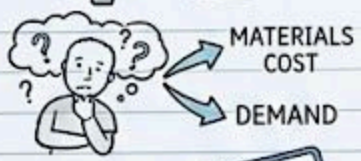
1. **Identify Project**: Constructing a new plant
   - to croning an expand production capacity
   - The process involve
2. **Estimate Cash Flows**: Estimating the additional revenue
   - along with operational costs and taxes

3. **Determine Discount Rate**: Using company's weighted averaged average cost of capital (WACC)
   - calculate a sufficient NPV

4. **CB Techniques**: Calculating NPV and IRR
   - evaluation in sufficient



5. **Risk Analysis**: Performing sensitivity analysis
   - to see how changes in or raw material costs or demand and profitability



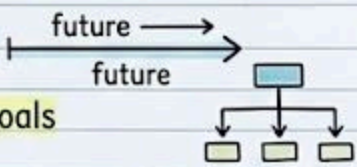
6. **Decision Making**:
   - calcul analysis of positive NPV
   - IRR exceeds required rate of return

7. **Implementation**: Allocating resources to construction
   - construction

8. **Monitoring**: Tracking performance and post-construction
   - meets the expected financial outcomes.

IMPORTANCE OF CAPITAL BUDGETING

1. **Long-Term Decision Making**:
   - Capital budgets helps long-term effects on their financial health & align with strategic goals contribute to sustainable growth.

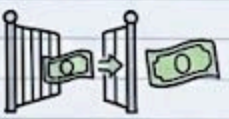


2. **Resource Allocation**:
   - Allocate allocate scarce resources effectively
   - maximize the returns and funds invested in projects offer the highest potential.

3. **Risk Management**:
   - identifies and mitigates risks associated manageable risks and have acceptable returns.

4. **Profitability & Value Max.**
   - maximize profitability and shareholder value. contribute to increaseg market value.

5. **Budget Control**:
   - Controls expenditure + feasible and value-generating projects are undertaken.



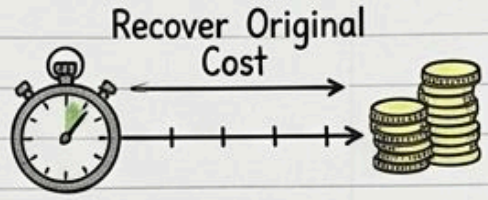
6. **Strategic Planning**:
   - projects are aligned with the company's vision and objectives, ensuring long-term success.

Different Techniques of Capital Budgeting

Various techniques are broadly classified into two categories: Traditional Techniques and Modern Techniques.

1. Traditional Techniques:

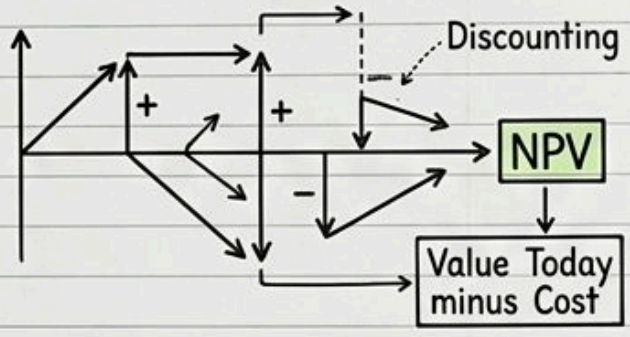
- Payback Period Method: Measures time to recover the initial investment.



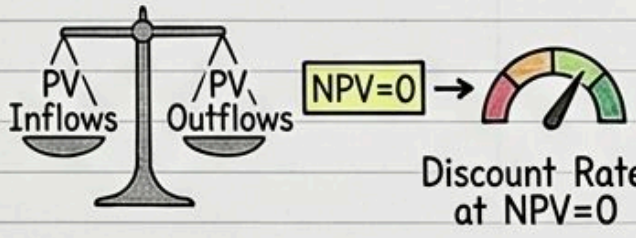
- Accounting Rate of Return (ARR): Measures return generated by an investment based on accounting profits, as a % of initial investment.

2. Modern Techniques:

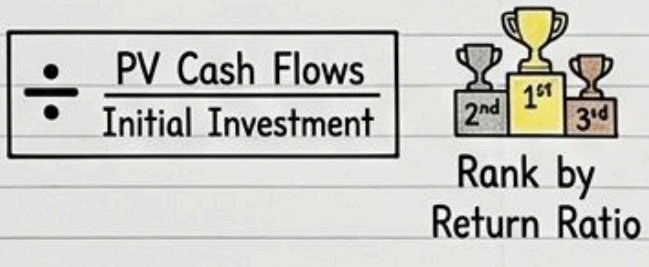
1. Net Present Value (NPV): calculates present value of future cash flows, discounted at the cost of capital, and subtracts initial investment.



2. Internal Rate of Return (IRR): The discount rate where project NPV equals zero.



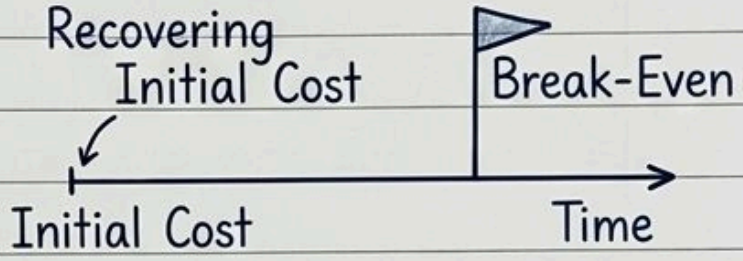
3. Profitability Index (PI): Ratio of present value of future cash flows to the initial investment, used for ranking projects.



4. Modified Internal Rate of Return (MIRR): A variation of IRR that resolves some shortcomings, particularly reinvestment assumptions.

Payback Period Intro

A capital budgeting method used to evaluate the time needed for an investment to recover its initial cost through the cash inflows it generates. [cite]. In simpler terms, it is the period of time required for an investor to break even on the initial investment. [cite: text source].

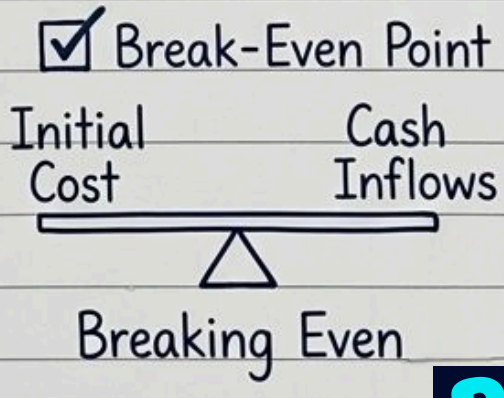


Key Features:

- Objective: To determine how quickly an investment will pay back its original cost. [cite: text source]
- Calculation: Initial Investment ÷ Annual Cash Inflows. [cite.]

$$\left(\frac{\text{Initial Investment}}{\text{Annual Cash Inflows}}\right) = \boxed{\text{Payback Period}}$$

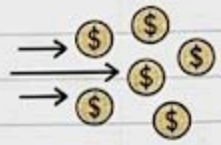
It is a simple method to assess how long it will take for a project or investment to break even. [cite: sowal source].



Payback Period: Calculation & Limitations

I. Calculation Method (for even cash flows):

1. Identify the initial investment (I_0).



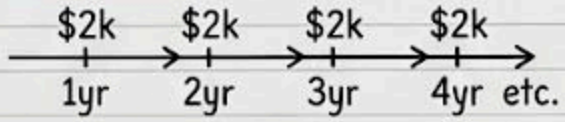
2. Estimate the annual cash inflows (CF) the investment is expected to generate.

3. Divide the initial investment by the annual cash inflow to get the payback period.

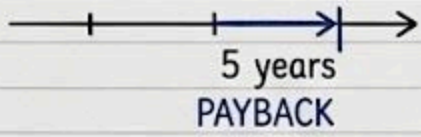
$$\text{Payback Period} = \frac{\text{Initial Investment}}{\text{Annual Cash Inflow}}$$

II. Example:

- Initial Investment: $10,000
- Annual Cash Inflow: $2,000

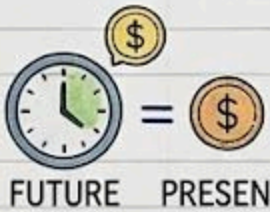


- Calculation: $\frac{10{,}000}{2{,}000} = [5 \text{ years}]$



III. Limitations:

- It doesn't consider the time value of money (i.e., future cash flows are treated as equal to present cash flows).



- It ignores cash flows that occur after the payback period.

- It doesn't assess profitability or return on investment beyond the payback period.

Accounting Rate of Return (ARR)

1. ARR is a capital budgeting technique used to evaluate the profitability of an investment project by comparing the average annual accounting profit (after depreciation) to the initial investment cost. It provides a simple measure of the expected return over a period of time, based on accounting data rather than cash flows.

2. Formula:

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

Where:

- Average Annual Accounting Profit is the average of net profits proifits (after depreciation and taxes) expected.
- Initial Investment is the total capital required for the project.

3. Example:
A company invests $100,000 and expects average annual profit of $15,000.
Calculation:

$$ARR = \frac{15{,}000}{100{,}000} \times 100 = 15\%$$

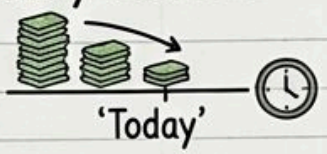
So, the ARR for this investment is 15%.

4. Advantages of ARR:
   - Simplicity: Easy to calculate and understand, uses familiar business data.
   - Comparison: Allows easy comparison to identify the most profitable project.
   - Focus on Profitability: Highlights profitability relative to cost.

5. Limitations of ARR:
   - Ignores Time Value of Money: significant drawback for long-term projects.
   - Based on Accounting Profit: uses profit rather than cash flows, which might not show actual economic return.
   - No Consideration of Risk: doesn't account for risk, which impacts actual returns.

1. NPV Method Intro (Net Present Value)

- An investment appraisal technique for assessing profitability.
- Measures the difference between the present value (PV) of expected future cash inflows and the initial investment. (future cash pile − initial cash pile) = NPV
- Process Summary: Future cash flows are discounted to their present value using a specific discount rate. Discount rate typically reflects cost of capital or desired rate of return.



Formula:

$$NPV = \sum \frac{CF_t}{(1+r)^t} - I_0$$

Where:
[cite: CF_t] = Cash flow in year [t]
[cite: r] = Discount rate (e.g., cost of capital)
[cite: t] = Year
[cite: I_0] = Initial investment

Decision Rules:
- >0: (Positive NPV) = Accept - considered profitable.
- <0: (Negative NPV) = Reject

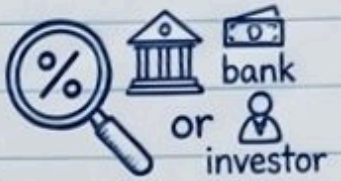
Advantages of NPV:
- Accurately accounts for Time Value of Money (TVM).
- Helps in maximizing shareholder wealth.
- Clear decision criteria ($+ accept, - reject$).

Disadvantages of NPV:
- Heavily dependent on accurate predictions of hard-to-forecast future cash flows, especially in uncertain times.
- Very sensitive to the discount rate chosen, which can vary.

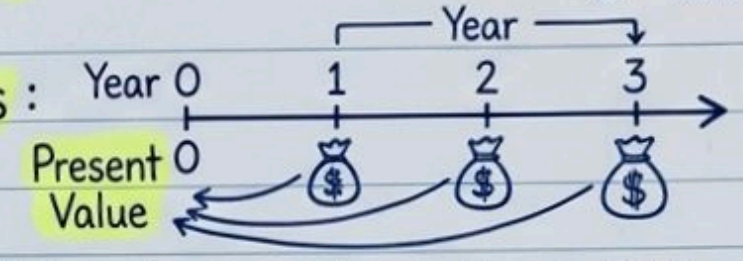
Real-World Concept Summary: A company (e.g., Amazon) uses NPV to ensure a new asset's initial cost (like an Amazon warehouse) is justified by disointed future sales.

Steps in NPV Calculation:

1. **Estimate Future Cash Flows**: Forecast expected cash inflows from the project. This can be revenue from sales or cost savings etc.



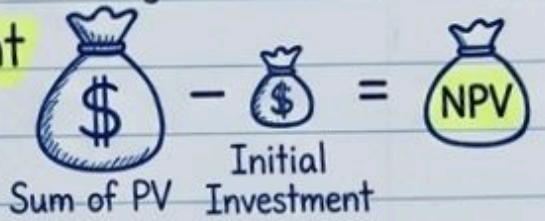
2. **Determine the Discount Rate**: Identify an appropriate rate. Usually the company's cost of capital or the required return for investors.



3. **Calculate the Present Value of Future Cash Flows**: Discount each future flow back to its Present Value.

*Concept = Discounting backwards (PV formula)

4. **Subtract the Initial Investment**: Once sum of PV is calculated, Subtract the Initial Investment made at the beginning of the project.



Decision Rule:

- If NPV > 0, Accept the project (Positive net value).
- If NPV < 0, Reject the project (Negative net value).
- If NPV = 0, neither adds nor destroys value; Further analysis needed

Case Study: Investment in a New Manufacturing Plant

1. Case Study Context:

- Evaluate whether to build a new manufacturing plant to expand capacity.
- Key data points:
  - Initial Investment: $1,000,000.
  - Discount Rate (cost of capital): 8%
  - Expected cash flows (over 5 years):

Year 1	Year 2	Year 3	Year 4	Year 5
$300,000	$350,000	$400,000	$450,000	$500,000

2. The Calculation Process (Step-by-Step):

- Steps 1 & 2: Estimate cash flows and determine discount rate (done).
- Step 3: Calculate Present Value of each cash flow using PV = $\frac{CF}{(1+r)^t}$
  $PV = CF / (1+r)^t$ (Show a summary table]

Year	Cash Flow (CF)	PV of CF (using 8% discount factor)
1	300,000	277, 778
2	350,000	300, 426
3	400,000	317, 345
4	450,000	331, 070
5	500,000	340, 214

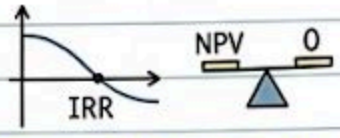
- Step 4: Sum the above to get Total Present Value of Cash Inflows*: $1, 566, 833.
- Step 5: Subtract Initial Investment to find NPV.
  NPV = Total PV - Initial Investment
  NPV = $1, 566, 833 - $1, 000, 000 = $566, 833.

3. Decision Rule & Conclusion:

- Rule: If NPV is positive, proceed. If NPV is negative, reject. ✓ vs ✗
- Outcome: Since the NPV is a positive NPV ($566,833), the investment is justified.
- Value Addition: The project adds significant value to the company.
- Financial Viability: The NPV method helps assess financial viability.

IRR Method Intro_

① Internal Rate of Return (IRR) Definition:



- IRR is the discount rate at which a project's Net Present Value (NPV) becomes zero.
- In other words, it's the rate where the present value of future cash inflows equals the initial investment.

- Represents the expected annual return generated by the project.

② Formula:

$$NPV = 0 = \sum_t \frac{CF_t}{(1+IRR)^t} - I_0$$

Where:

- CF_t = Cash Flow in year t
- IRR = Internal Rate of Return
- t = Year
- I_0 = Initial Investment

③ Decision Rule:

Accept if IRR > Required Rate of Return (Cost of Capital).
Reject if IRR < Required Rate of Return.

④ Example:

* Suppose a project with Initial Investment ($100,000) and $30,000 annual cash inflows for 5 years.
  ↳ Solved IRR ≈ 14.5%.

- Scenario 1: Required return = 10%. Accept since 14.5% > 10%.
- Scenario 2: Required return = 15%. Reject since 14.5% < 15%.

⑤ Google Case Study (Illustrative Note):

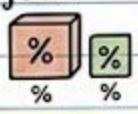
Google uses IRR to evaluate projects like new data centers. Higher IRR projects are prioritized.

⑥ Advantages vs. Disadvantages:

Advantages

* Easy to understand & interpret (single rate).

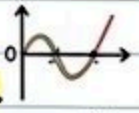
* Good for comparing projects of different sizes & timeframes.



* Straightforward decision rule.

Disadvantages

* Multiple IRRs possible for non-conventional cash flows.



* Doesn't provide an absolute value like NPV.

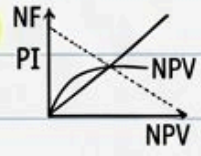
* Unrealistic reinvestment assumption (reinvested at IRR rate).

Profitability Index (PI) Method Intro

The Profitability Index (PI), also known as the Benefit-Cost Ratio (BCR), is a capital budgeting tool used to evaluate the profitability and attractiveness of an investment.

It lelps decide which projects are best when you have budget constraints.

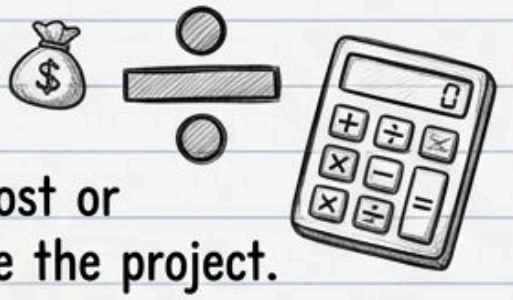
The PI method is closely related to the Net Present Value (NPV) method but gives you a handy ratio that is easier to interpret for value per unit of investment.



Formula for Profitability Index (PI):

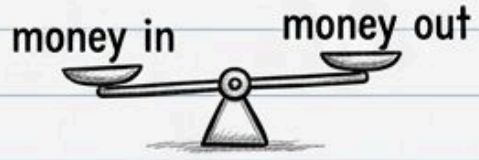
$$PI = \frac{\text{Present Value of Future Cash Inflows}}{\text{Initial Investment}}$$

- Present Value (PV) of Future Cash Inflows refers to the discounted value.
- Initial Investment is the total cost or investment required to undertake the project.



Interpretation of PI:

- PI > 1 : PROFITABLE.
- PI = 1 : BREAK-EVEN.



- PI < 1 : NOT PROFITABLE.

Example, Advantages, and Disadvantages of PI

1. Example PI Calculation

- Suppose a project has:
  - Rs. 100,000 initial investment
  - Future cash inflows for 3 years (Rs. 50k, 60k, 70k)
  - a 10% discount rate

Step 1: PV of Year 1-3 Inflows:

Yr 1: [cite: $50k/(1+0.10)^1$] = Rs. 45,454.55
Yr 2: [cite: $60k/(1+0.10)^2$] = Rs. 49,586.78
Yr 3: [cite: $70k/(1+0.10)^3$] = Rs. 52,829.67

Step 2: Sum PV:

Total 44 ,541.55 + 49,586.78 + 52,897 = 147,871.00
Total Present Value = Rs. 147,871.00

$$\sum_{k=+1}$$

Step 3: Calculate PI:

$$PI = \left[\text{cite: } \frac{147,871.00}{100,000}\right] = 1.4787$$

Conclusion: PI > 1 → Profitability

2. Advantages of PI Method

A. Comparing Projects

B. Time Value of Money (TVM)

C. Easy to Interpret

$$I = \frac{\text{PV Cash Inflows/Inv}}{}$$

D. Ranking Projects

3. Disadvantages of PI Method

A. Not for Mutually Exclusive Projects

B. No Absolute Profitability:

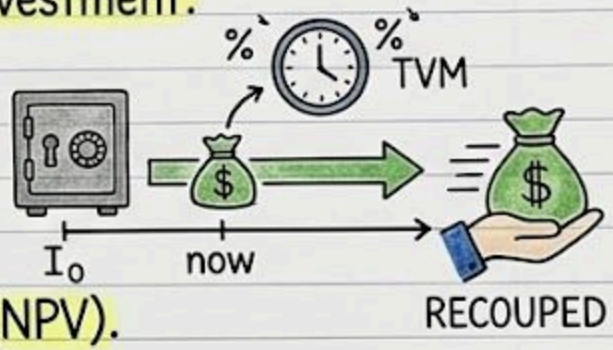
C. Sensitive to Cash Flow Estimations.

Discounted Payback Period (DPP)

1. **The Key Statement:**

> "Discounted payback ensures that you don't accept an investment with negative NPV, but it can't stop you from rejecting projects with a positive NPV."

2. **DPP Method (The Basics):**
   - Calculates the time needed to recover the initial investment.
   - Done in present value terms.
   - Considers the Time Value of Money (TVM).
   - Modification of traditional payback period.
   - Focuses on how quickly (speed) the initial investment is recouped.
   - Does NOT directly calculate the Net Present Value (NPV).



3. **Positive NPV Projects Could Be Rejected:**
   - Sole focus is on speed of recovery.
   - If the project requires a longer time, it might exceed a predefined payback threshold.
   - This is a key limitation!
   - A project with a slower but larger (+) NPV is still desirable.