

MODULE 1

Introduction to the subject: Micro and Macro **Economics**, Relationship between Science, Engineering, Technology and Economic Development. Production Possibility Curve, Nature of Economic Laws.

MODULE 2

Time Value of Money: concepts and application. Capital budgeting; Traditional and modern methods, Payback period method, IRR, ARR, NPV, PI (with the help of case studies)

MODULE 3

Meaning of Demand, Law of Demand, Elasticity of Demand; meaning, factors effecting it and its practical application and importance. Demand forecasting (a brief explanation)

MODULE 4

Meaning of Production and factors of production, Law of variable proportions and returns to scale. Internal and external economies and diseconomies of scale. Concepts of cost of production, different types of costs; accounting cost, sunk cost, marginal cost, Opportunity cost. Break even analysis, Make or Buy decision (case study). Relevance of Depreciation towards industry.

MODULE 5

Meaning of market, types of market, perfect competition, Monopoly, Monopolistic, Oligopoly. (main features). Supply and law of supply, Role of demand and supply in price determination.

MODULE 6

Indian Economy, nature and characteristics. Basic concepts; fiscal and monetary policy, LPG, Inflation, Sensex, GATT, WTO and IMF. Difference between Central bank and Commercial banks

TEXT/ REFERENCES BOOKS

1. Jain T.R., "*Economics for Engineers*", VK Publication
2. Chopra P. N., "*Principle of Economics*", Kalyani Publishers
3. Dewett K. K., "*Modern economic theory*", S. Chand
4. H. L. Ahuja., "*Modern economic theory*", S. Chand
5. Dutt Rudar & Sundhram K. P. M., "*Indian Economy*"
6. Mishra S. K., "*Modern Micro Economics*", Pragati Publications
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8. Gupta Shashi K., "*Management Accounting*", Kalyani Publication



Time Value of Money

Basic Ideas of Time Value of Money- Concept

The Core Question of Finance

Congratulations!!!

You have won a cash prize! There are two optional payment schedules:

A - receive Rs.100,000 *now*

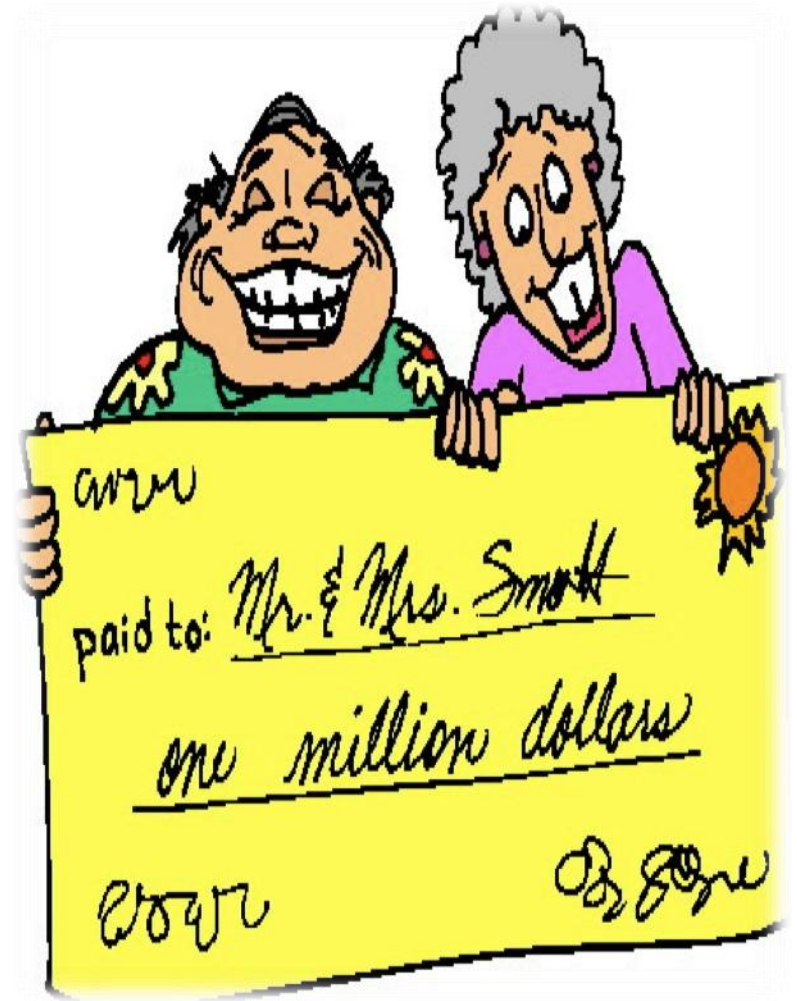
B - receive Rs.100,000 in *five years*.

Which option would you choose?

'A bird in hand is worth two in the bush

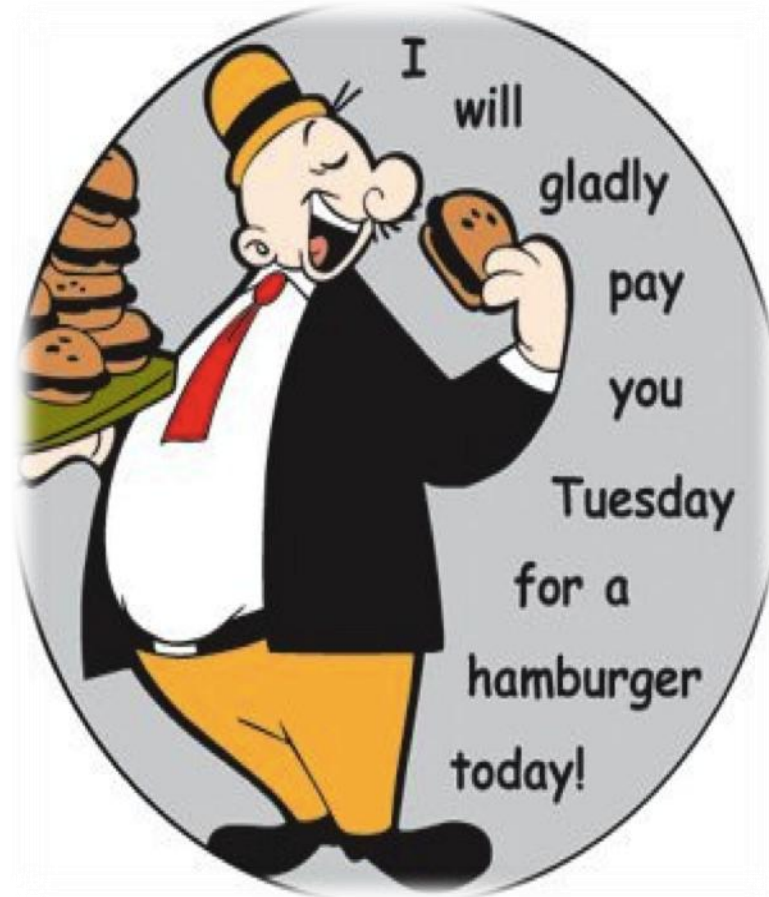
Money received sooner rather than later allows one to use the funds for investment or consumption purposes. This concept is referred to as the TIME VALUE OF MONEY!!

TIME allows one the *opportunity* to postpone consumption and earn **INTEREST**.



Time Value of Money Concept

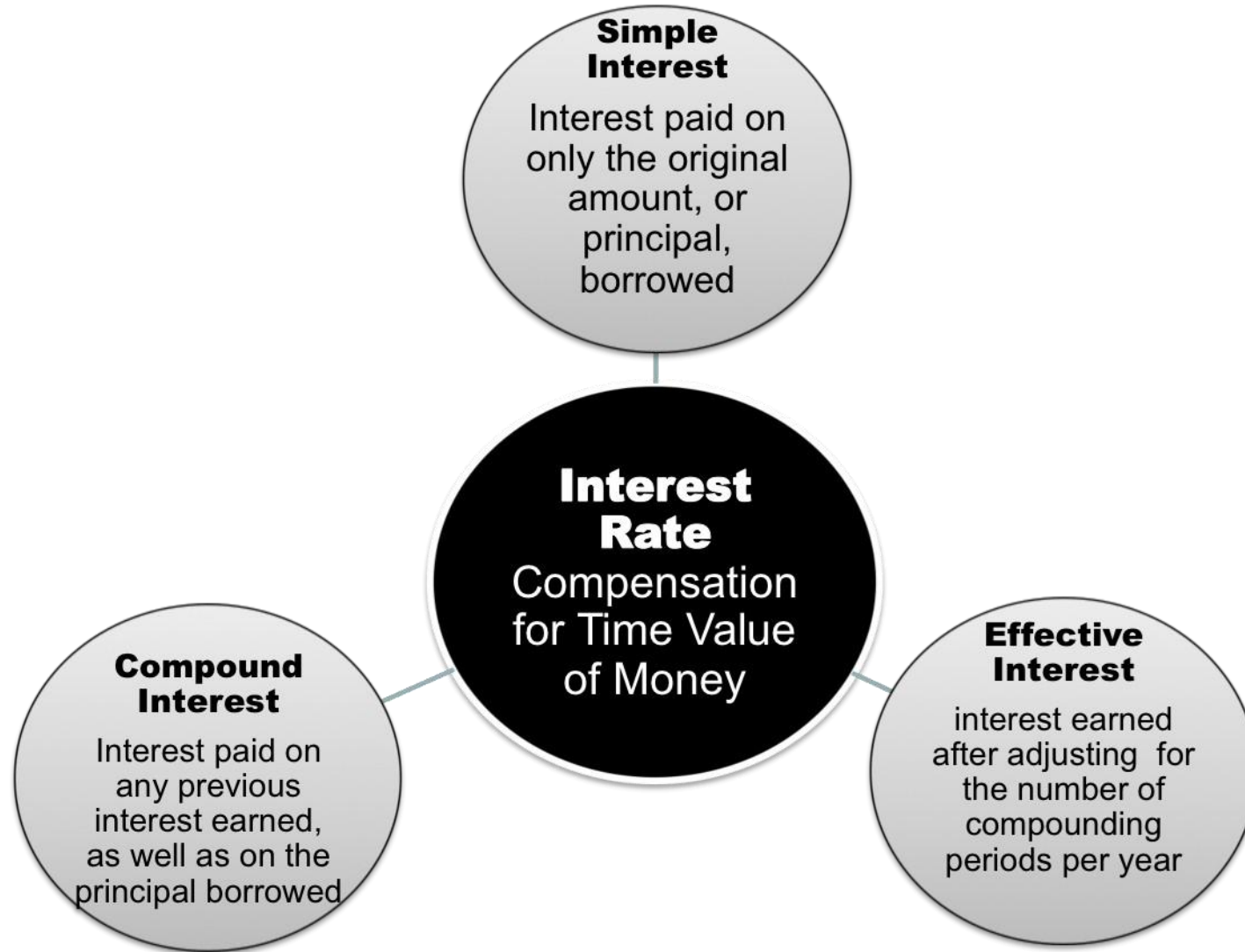
- The time value of money (TVM) is the idea that money available at the present time is worth more than the same amount in the future due to its potential earning capacity.
- This core principle of finance holds that, provided money can earn interest, any amount of money is worth more the sooner it is received.
- In simple terms the concept implies that money today is always better than money tomorrow.



Why Time Value of Money Exists- Reasons

1. Risk and Uncertainty – As we know future is never certain and we can't determine the risk involved in future because outflow of cash is in our hand as payment whereas there is no certainty for future cash inflows.
2. Inflation - In an inflationary economy, the money received today, has more purchasing power than the money to be received in future. In other words, a rupee today represents a greater real purchasing power than a rupee in future.
3. Consumption - Individuals generally prefer current consumption to future consumption.
4. Investment opportunities - An investor can profitably use the received money today to get higher return tomorrow or after a certain period of time.

Interest Rates



The Time Value of Money

- The Interest Rate
- Simple Interest
- Compound Interest
- Present Value
- Future Value

Applications of TVM

- **In Investment Decisions** - Small businesses often have limited resources to invest in business operations, activities and expansion. One of the factors we have to look at is how to invest, is the time value of money.
- **In Capital Budgeting Decisions** - When a business chooses to invest money in a project - such as an expansion, a strategic acquisition or just the purchase of a new piece of equipment -- it may be years before that project begins producing a positive cash flow. The business needs to know whether those future cash flows are worth the upfront investment.
- **Applied in present and future value calculations;** Time Value of Money (TVM) is an important concept in financial management. It can be used to compare investment alternatives and to solve problems involving loans, leases, savings.
- **Bond Valuation**
- **Stock Valuation**
- **Accept/Reject decisions for Project Management**
- **Financial Analysis of Firms**

Capital Budgeting

Decisions of Financial Management

1. Financing Decision
2. Dividend Decision
3. Investment Decision



Long term Decision	Short term Decision
(Capital Budgeting)	(Working Capital
Management)	

Meaning of Capital Budgeting

- **Capital budgeting**, and **investment appraisal**, is the planning process used to determine whether an organization's **long term investments** such as new machinery, replacement of machinery, new plants, new products, and research development projects are worth the funding of cash through the firm's capitalization structure (debt, equity or retained earnings).
- It is the process of allocating resources for major capital, or investment, expenditures. One of the primary goals of capital budgeting investments is to increase the value of the firm to the shareholders.
- It is process of deciding whether to invest or not to invest in a particular asset, the benefit of which will be available over a period of time.
- **Capital budgeting is a process of evaluating investments and huge expenses in order to obtain the best returns on investment.**

Types of Projects or Long term Investment Decision

- New Projects
- Expansion Projects
- Diversification Projects
- Replacement and Modernisation Projects
- Research and Development Projects

Significance of Capital Budgeting

- Long term Decision
- Irreversible Decision
- Huge Investments
- Growth
- Selecting profitable projects
- Capital expenditure control
- Finding the right sources for funds

Types of Capital Budgeting Decision

- Accept-Reject Investment Decisions
- Mutually Exclusive Investments Decisions
- Capital Rationing Investment Decisions

Accept-Reject Investment Decisions

- It means that firm should evaluate whether the project is accepted or rejected for the purpose of investment.
- For evaluating a project all those project which yield a rate of return greater than a certain required rate of return or cost of capital is accepted and the rest are rejected.

Mutually Exclusive Investments Decisions

- Mutually exclusive projects are projects, which compete with other projects in such a way that the acceptance of one will exclude the acceptance of the other projects.
- The acceptance of this “best” alternative automatically eliminates the other alternatives.

Capital Rationing Investment Decisions

This situation arises, when the various profitable investment proposals compete for limited funds at a time. Company selects a combination of profitable proposals that will earn higher profits by ranking them in descending order of their profit earning capacity.

Process of Capital Budgeting

- Searching of Investment Opportunities
- Evaluation or Analysis
- Selection of Project
- Financing the Project
- Execution or Implementation
- Review of the Project

Methods of Capital Budgeting or Evaluation Criteria

Traditional Methods or Non Discounted Cash Flow Method

1. Payback Period

2. Accounting Rate of Return Method

Discounted Cash Flow Method or Modern Method

1. Net Present Value Method

2. Profitability Index Method

3. Internal Rate of Return Method

These methods use the incremental cash flows from each potential investment, or *project*. Techniques based on accounting earnings and accounting rules are sometimes used - though economists consider this to be improper - such as the *accounting rate of return*, and "return on investment." Simplified and hybrid methods are used as well, such as *payback period* and *discounted payback period*.

Payback Period

Payback period is the time required to recover the initial cost of an investment. It is the number of years it would take to get back the initial investment made for a project. Therefore, as a technique of capital budgeting, the payback period will be used to compare projects and derive the number of years it takes to get back the initial investment. The project with the least number of years usually is selected.

Decision Criteria: Lesser the payback period is better for acceptance of the project.

Salient features of Payback period method

- Payback period is a simple calculation of time for the initial investment to return.
- It ignores the time value of money. All other techniques of capital budgeting consider the concept of time value of money. Time value of money means that a rupee today is more valuable than a rupee tomorrow. So other techniques discount the future inflows and arrive at discounted flows.
- It is used in combination with other techniques of capital budgeting. Owing to its simplicity the payback period cannot be the only technique used for deciding the project to be selected.

Payback Period

Pay back period method

- Even Cash Flows
- Un Even Cash Flows

Refers to the “Time period” in which the money invested will come back

1. In the case of constant or even annual cash inflows

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

Q.1. A Project costing Rs. 5,00,000 which generate cash flow of Rs.1,00,000 each year for next 7 years. Calculate Payback Period ?

(5 years)

2. In the case of Uneven or Unequal Cash Inflows

$$\text{Payback period} = \text{Years before full recovery} + \frac{\text{Unrecovered cost at start of the year}}{\text{Cash flow during the year}}$$

Q.2. X Ltd. is considering two projects. Each project require an investment of Rs. 10,000. The firms cost of capital is 10%. The net cash flows from investment in two projects A and B are as follows:

Years	1	2	3	4	5
Project	5,000	4,000	3,000	1,000	-
A	1,000	2,000	3,000	4,000	50,000

Project B

The company has fixed 3 years pay back period as the cut-off point. State which project should be accepted. (2.33 and 4 years)

Step 1: We must pick the year in which the outflows have become positive. In other words, the year with the last negative outflow has to be selected. So, in this case, it will be year two.

Step 2: Divide the total cumulative flow in the year in which the cash flows became positive by the total flow of the consecutive year.

So that is: $1/3 = 0.33$

Step 3: Step 1 + Step 2 = The payback period is 2.33 years.

Capital Budgeting

- Pay back period method (Un Even Cash Flows)

Year	Cash Flow	Cumulative Cash Inflow
0	-20000	
1	6000	6000
2	8000	14000
3	5000	19000
4	4000	23000
5	4000	27000

- What is the payback period
- 3 full year + .25 year = 3.25 years

Capital Budgeting

- Pay back period method (Un Even Cash Flows)

	Machine A	Machine B
Initial Investment	9000	18000
Estimated Life	4 years	5 years
Estimated saving in scrap	500	800
Estimated saving in wages	6000	8000
Additional Cost of maintenance	800	1000
Additional Cost of Supervision	1200	1800

- Which Machine will be selected based on PB method

Capital Budgeting

- Pay back period method (Un Even Cash Flows)

	Machine A	Machine B
Estimated saving in scrap	500	800
Estimated saving in wages	6000	8000
Total Savings	6500	8800
Additional Cost of Supervision	1200	1800
Additional Cost of maintenance	800	1000
Total Cost	2000	2800
Net Cash Inflow	4500	6000
PB	$9000/4500 = 2$	$18000/6000 = 3$

Merits of Payback Period

Payback method is the simplest method to analyze different project/investments. It is based on the principle of liquidity. The project that provides a faster return of investment is chosen. More liquidity means more availability of funds to invest in more projects. It is used by the management to get a quick analysis of the project.

Payback method is used by individuals also to analyze investment decisions. It is based on a very simple need to get back at least how much has been spent. In fact, even as individuals when we invest in shares, mutual funds our first question is always about the time period within which we will get back our invested money. So, it is simple and very easy to understand.

1. Easy and Simple Method.
2. Liquidity is emphasized.
3. Useful in Case of Uncertainty.

Capital Budgeting

- Demerits of Payback Period
 - Ignores the returns generated after the payback period

Project A (-10,000)	Project B(-10,000)
4000	3000
4000	3000
2000	3000
	3000
	3000
PB = 3 years	PB = 3.33 years

Capital Budgeting

- Demerits of Payback Period
 - Ignores the Time Value of Money

Project A (-30,000)	Project B(-30,000)
10000	2000
10000	4000
10000	24000
PB = 3 years	PB = 3 years

- Which one is better?
- A is better as the money is recovered faster in A

Limitations of Payback Period

- 1.It ignores cash flows after payback period.
- 2.It does not consider time value of money.
- 3.It overlook cost of capital or interest factor.
- 4.It Ignore the risk of future cash flows.

Investment Evaluation Criteria

Three steps are involved in the evaluation of an investment:

1. Estimation of cash flows
2. Estimation of the required rate of return (the opportunity cost of capital)
3. Application of a decision rule for making the choice

Calculation of Cash Outflow or Initial Investment

Purchase Price of Asset
Add: Installation, Freight costs
Add: Working Capital required
Initial Investment	

Calculation of CFAT

Proforma of Cash Inflows After Taxes (CFAT)

Particular	<i>Amount (Rs.)</i>
Sales Revenue	xxx
Less: Variable Cost	xxx
Contribution	xxx
Less: Fixed Cost	xxx
Earning Before Depreciation and Taxes (EBDT)	xxx
Less: Depreciation	xxx
Earning Before Taxes (EBT)	xxx
Less: Taxes	xxx
Earning After Tax (EAT)	xxx
Add: Depreciation	xxx
Cash Flows After Tax (CFAT)	xxx

Profitability Statement (in cost reduction decision)

A) Estimated Savings

Estimated Savings in direct wages

Estimated Savings in Scrap value

Total Savings (a)

B) Estimated Additional

Costs Additional cost of

Maintenance Additional cost

of Supervision Cost of

material

Additional Depreciation

(b) Net Savings before tax (a-b)

Less Income tax

Net Savings after tax

Add Additional Depreciation

Cash Inflows

Capital Budgeting

- Discounted Cash Flow Techniques
 - Considered to be the best method to evaluate the investment proposals
 - The cash inflows and outflows are calculated
 - These cash inflows and outflows are then discounted at an appropriate discount rate
 - The difference between the discounted cash inflow and discounted cash outflow is calculated

Net Present Value (NPV)

In NPV technique the profitability of investment proposal is measured through the difference between the cash inflows generated out of the cash outflows or the investments made in the project.

Net Present Value = PVCI – PVCO

PVCI = Present value of cash inflows

PVCO= Present value of cash outflow

Decision Criteria

1. If the net present value is greater than zero, the proposal has to be accepted.
2. If the net present value is less than zero, the proposal has to be rejected.

Capital Budgeting: Net Present Value

- How to calculate

Net Present Value = $\sum \text{discounted Cash inflows} - \sum \text{discounted Cash Outflows}$

$$\text{NPV} = \sum_{t=1}^n \frac{\text{CF}_t}{(1+k)^t} - \text{CF}_0.$$

CF_0 = Initial cost or Initial investment, which includes the total amount paid at the beginning of the project to set it in motion.

CF_t = The amount of cash flow generated on each time period.

k or r = The discount rate at which the cash flow's present value is estimated.

t or n = the time period at which the cash flow occurs.

The result will be a positive or negative amount that will indicate the project's profitability.

Capital Budgeting

- Accept/Reject Criterion
 - Single Project
 - $NPV > 0$, IF NPV is positive then select
 - Multiple Project
 - Accept the one with the maximum NPV

Example: Projects L and S

- ❖ Both projects require a return of 10%. Expected net cash flow

Year	<u>Project L</u>	<u>Project S</u>
0	(RS100)	(RS 100)
1	10	70
2	60	50
3	80	20

Discount Factor: $1/(1+r)^n$

What's Project L's NPV?

Project L:



Discount Factor: $1/(1+r)^n$

E.g. $DF = 1/(1+10/100)^1 = 0.909$

$DF = 1/(1+10/100)^2 = 0.8264$

9.09

49.59

60.11

18.79 = NPV_L

NPV_S = Rs 19.98.

Capital Budgeting

- Example

There are 3 mutually exclusive projects. All the three are expected to cost RS 2,50,000 and have an estimated life of 5, 4 and 3 years respectively. The company's required rate of return is 10%. The anticipated cash inflow after tax for the three plants are as follows. Which Plant should be accepted

Year	Plant I	Plant II	Plant III
1	80,000	1,10,000	1,30,000
2	60,000	90,000	1,10,000
3	60,000	85,000	20,000
4	60,000	35,000	-
5	1,80,000	-	-

Capital Budgeting

- Find out the Total PV of cash flows for all the three plants

Year	Plant I	Plant II	Plant III
1	80,000X.909	1,10,000 x .909	1,30,000 x.909
2	60,000x .826	90,000x .826	1,10,000x.826
3	60,000 x .751	85,000 x.751	20,000x.751
4	60,000 x .683	35,000x .683	-
5	1,80,000 x .621	-	-
Total PV	3,20,100	2,62,070	2,24,050
NPV	70,100	12070	-25950

Capital Budgeting

- A company Ltd is considering the purchase of a new machine. Two alternative machines have been suggested, each having an initial cost of Rs 4,00,000 and requiring an additional working capital Rs. 20,000 at the end of 1 year. Earnings after tax are expected to be as follows. The company has a required rate of return of 10%. Which machine would be bought. Use NPV method

Year	A	B
1	40,000	1,20,000
2	1,20,000	1,60,000
3	1,60,000	2,00,000
4	2,40,000	1,20,000
5	1,60,000	80,000

Capital Budgeting

1. Find the Total PV of all the cash inflows for both the machines
2. Find the Total PV of all the cash outflows for both the machines
3. Subtract the 1 from 2 to get the NPV
4. One with the Greater NPV is selected

Year	A(PV of the cash inflows)	B(PV of the cash inflows)
1	40,000X.91	1,20,000X.91
2	1,20,000X.826	1,60,000X.826
3	1,60,000 X.751	2,00,000X.751
4	2,40,000X.683	1,20,000X.683
5	1,60,000X.621	80,000X.621
	5,18,920	5,23,080

Capital Budgeting

1. Find the Total PV of all the cash **outflows** for both the machines
2. Total Present value of the cash out flow = PV of the outflow at the beginning + the PV of the cash outflow in the future
3. = 4,00,000 + PV of the working capital expenditure after 1 year
4. = 4,00,000 + 0.909X20,000 = 4,18,200
5. **NPV A = 5,18,400 - 4,18,200 = 1,00,200**
6. **NPV B = 5,23,200 - 4,18,200 = 1,05,000**

Profitability Index or Benefit- Cost ratio

Profitability Index measures the present value of returns derived from per rupee invested. It shows the relationship between the benefits and cost of the project and therefore it is called as Benefit-cost ratio.

$$PI = \frac{\text{Present Value of Cash inflow}}{\text{Present Value of Cash outflow}}$$

Meaning:

It is a relative measure and can be defined as the ratio which is obtained by dividing the present value of future cash inflows by the present value of cash outlays. Mathematically¹⁰,

$$PI = \frac{\text{Present value of cash inflow}}{\text{Initial cash outlay}} = \frac{PV(C_t)}{C_0} = \sum_{t=1}^n \frac{C_t}{(1+K)^t} \div C_0$$

Decision Criteria :

- 1.If the profitability index is greater than 1, accept the proposal.
- 2.If the profitability index is less than 1, reject the proposal.

Profitability Index Method Formula

Use the following formula where PV = the present value of the future cash flows in question.

**Profitability Index = (PV of future cash flows) ÷
Initial investment**

Or = (NPV + Initial investment) ÷ Initial Investment

NPV stands for the Net Present Value of the initial investment.

Profitability Index Calculation

Example: Suppose a company is considering a project requiring an **initial investment of \$1 million**. The project is expected to generate a total **present value of cash inflows of \$1.3 million**.

$$PI = \frac{1.3 \text{ million}}{1 \text{ million}} = 1.3$$

- **Interpretation:** Since $PI > 1$, this project is profitable, yielding \$1.3 for every dollar invested. Thus, the company should consider pursuing this investment.

Q.5 The initial cash outflow of a project of Rs 1,00,000 and it generates cash inflows of 40,000,30,000,50,000 and 20,000 . Assume a 10% rate of discount. Calculate NPV and Profitability Index.

(1,12,350 and 1.12)

Year	A(PV of the cash inflows)
1	40,000X.909=36,360
2	30,000X.826=24,780
3	50,000 X.751=37,550
4	20,000X.683=13660
	1,12,350

	Project X	Project Y
Initial Investment	1,00,000	40,000
PV of cash inflow	2,00,000	1,00,000
NPV	1,00,000	60,000
PI	2	2.5

Which project is better?

According to NPV project X is better while according to PI project Y is better but the objective of the firm is wealth maximization so we select project X, but in case of capital rationing Project Y should be select.

Merits of NPV

- Consider time value of money.
- Consider all cash flows over the entire project life.
- It helps to make a comparative assessment of different projects.

Limitation of NPV

- The application or usage of this method requires the knowledge of rate of cost of capital. If cost of capital is unknown, this method cannot be used.
- Determining an appropriate discount rate is difficult in this method.
- This method does not indicate the rate of return which is expected to be earned.
- This method may fail to give satisfactory answers when the projects are requiring different level of amount of investment and with different economic life of the project.

Merits of PI

- It consider time value of money.
- It considers all cash inflows.
- It is recommended for use particularly when there is shortage of funds, because it correctly ranks the proposals.
- It makes right decision in the case of different amount of cash outflow of different project.

Limitations of PI

- May lead to incorrect decisions in comparisons of mutually exclusive investments.
- Cost of capital is required to calculate PI.

Methods of Capital Budgeting or Evaluation Criteria

Traditional Methods or Non Discounted Cash Flow Method

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2. Accounting Rate of Return Method

Discounted Cash Flow Method or Modern Method

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2. Profitability Index Method

3. Internal Rate of Return Method

These methods use the incremental cash flows from each potential investment, or *project*. Techniques based on accounting earnings and accounting rules are sometimes used - though economists consider this to be improper - such as the *accounting rate of return*, and "return on investment." Simplified and hybrid methods are used as well, such as *payback period* and *discounted payback period*.

Accounting Rate of Return (ARR)

- Accounting rate of return (ARR) is a formula that reflects the percentage rate of return expected on an investment, or asset, compared to the initial investment cost.
- The ARR formula divides an asset's average revenue by the company's initial investment to derive the ratio or return that one may expect over the lifetime of the asset, or related project. ARR does not consider the time value of money or cash flows, which can be an integral part of maintaining a business.

The formula for $ARR = \text{Average Annual Profit} / \text{Average Investment}$

Where:

Average Annual Profit = Total profit over Investment Period / Number of Years

Average Investment = (Book Value at Year 1 + Book Value at End of Useful Life) / 2

If the ARR is equal to 5%, this means that the project is expected to earn five cents for every dollar invested per year.

Accounting Rate of Return (ARR)

How to Use ARR, example:

A business is considering a project that has an initial investment of Rs. 250,000 and forecasts that it would generate revenue for the next five years. Here's how the company could calculate the ARR:

Initial investment: Rs. 250,000

Expected revenue per year: Rs. 70,000

Time frame: 5 years

ARR calculation: Rs. 70,000 (annual revenue) / Rs. 250,000 (initial cost)

ARR = 0.28 or 28% ($0.28 * 100$)

The average profits after tax are determined by adding up the PAT for each year and dividing the result by the number of years.

The average investment is calculated by dividing the net investment by two. Thus,

$$ARR = \frac{\left[\sum_{t=1}^n EBIT_t (1 - T) \right] \div n}{(I_0 + I_n) \div 2}$$

Where, EBIT is earnings before interest and taxes, T tax rate, I_0 book value of investment in the beginning, I_n book value of investment at the end of n years.

Decision Criteria:

The ARR can be used as a decision criterion to select investment proposal.

1. If the ARR is higher than the minimum rate established by the management, accept the project.
2. If the ARR is less than the minimum rate established by the management, reject the project.

The ranking method can also be used to select or reject the proposal using ARR. It will rank a project number one if it has highest ARR and lowest rank would be given to the project with lowest ARR.

- If the annual profit for a project over the life of the investment averages to Rs. 20,000, and the average investment value in a given year is Rs. 100,000, then ARR would be calculated as below:

$20000 / 100000 = 20\%$ is the ARR

- There are two different projects a company is considering for investment and a decision has to be made based on which project yields better ARR. Following are the details:

Description	Proposal I	Proposal II
Estimated average annual profit from the projects (A)	RS. 40,000	Rs. 30,000
Average Investment Value (B)	Rs. 140,000	Rs. 100,000
Estimated ARR (A/B)	29%	30%

When a decision has to be made only based on the accounting rate of return:

The proposal II has 30% ARR and yields a better result to the company. Hence Proposal II should be selected.

The formula for ARR = Average Annual Profit / Average Investment

Where:

Average Annual Profit = Total profit over Investment Period / Number of Years

Average Investment = (Book Value at Year 1 + Book Value at End of Useful Life) / 2

For example, A project requires an investment of Rs. 10,00,000. The plant & machinery required under the project will have a scrap value of Rs. 80,000 at the end of its useful life of 5 years. The profits after tax and depreciation are estimated to be as follows:

Year	1	2	3	4	5
PAT (Rs)	50000	75000	125000	130000	80000

We shall calculate ARR using above formula.

$$ARR = \frac{(50000 + 75000 + 125000 + 130000 + 80000) \div 5}{(1000000 + 80000) \div 2} = 17.04\%$$

Question: XYZ Company is considering investing in a project that requires an initial investment of Rs. 100,000 for some machinery. There will be net inflows of Rs. 20,000 for the first two years, Rs. 10,000 in years three and four, and Rs. 30,000 in year five. Finally, the machine has a salvage value of Rs. 25,000. Also state whether you recommend the project for investment when the management expects a rate of return of 10%.

Step 1: Calculate Average Annual Profit

Inflows,

Years 1 & 2($20,000 \times 2$) : Rs. 40,000

Inflows, Years 3 & 4($10,000 \times 2$) : Rs. 20,000

Inflow, Year 5: Rs. 30,000

Less: Depreciation($100,000 - 25,000$): -Rs. 75,000

Total Profit: Rs. 15,000

Average Annual Profit($15,000 / 5$): **Rs. 3,000**

Step 2: Calculate Average Investment

Average Investment($\text{Rs. } 100,000 + \text{Rs. } 25,000$) / 2 = **Rs. 62,500**

Step 3: Use ARR Formula

ARR = $\text{Rs. } 3,000 / \text{Rs. } 62,500 = 4.8\%$

Merits of ARR

- Easy to calculate and understand.
- Consider all profits of the project.
- It is based on accounting information which is readily available and familiar to Businessman. Information can easily be drawn from accounts department.

Limitation of ARR

- Consider accounting profits not cash inflows.
- Ignores time value of money.
- Does not differentiate between size of investment required for each project.
- Determination of Minimum Acceptance rate is difficult.

Modern Methods or Discounted Cash Flow Method

1. Net present value method
2. Internal rate of return method
3. Profitability index method

Internal Rate of Return (Trial and Error Method)

- This technique is also known as yield on investment, marginal productivity of capital, marginal efficiency of capital, rate of return, and time-adjusted rate of return.

The internal rate of return (IRR) is a discounting cash flow technique which gives a rate of return earned by a project. The internal rate of return is the discounting rate where the total of initial cash outlay and discounted cash inflows are equal to zero. In other words, it is the discounting rate at which the net present value(NPV) is equal to zero.

- It is the rate of return at which the net present value of a project becomes zero. They call it 'internal' because it does not take any external factor (like inflation) into consideration.

Discounting Criteria: Internal Rate of Return

Internal Rate of Return Method:- IRR is the rate of return that a project earns. The rate of discount calculated by trial and error, where the present value of future cash flows is equal to the present value of outflows, is known as the Internal Rate of Return.

$$\text{IRR} = \text{Higher Rate} - \frac{\text{NPV of Higher Rate}}{\text{Difference in cash flows}} * \text{Difference in Rate}$$

$$\text{IRR} = \text{Lower Rate} + \frac{\text{NPV of Lower Rate}}{\text{Difference in cash flows}} * \text{Difference in Rate}$$

Decision Criteria:

- If the IRR is more than the cost of capital, the project has to be accepted.
- If the IRR is less than the cost of capital, the project has to be rejected.

Example

The expected cash flows of a project are:-

Year	Cash Flows (Rs.)
1	20,000
2	30,000
3	40,000
4	50,000
5	30,000

The cash outflow is Rs. 1,00,000 The cost of capital is 10%

Calculate: NPV and IRR

Computation of NPV and PI

Year	Cash Flows (Rs.)	PV Factors@10%	PV of Cash Flows (Rs.)
1	20,000	.909	18,180
2	30,000	.826	24,780
3	40,000	.751	30,040
4	50,000	.683	34,150
5	30,000	.620	18,600
	Total Cash Inflow		1,25,750
	Less: Cash Outflows		1,00,000
	NPV		25,750

Computation of IRR

Year	Cash Flows (Rs.)	PV Factors @19%	PV of Cash Flows (Rs.)	PV Factors @18%	PV of Cash Flows (Rs.)
1	20,000	.84	16,800	.847	16,940
2	30,000	.706	21,180	.718	21,540
3	40,000	.593	23,720	.609	24,360
4	50,000	.499	24,950	.516	25,800
5	30,000	.42	12,600	.437	13,110
Total Cash Inflow			99,250		1,01,750
Less Cash Outflows			1,00,000		1,00,000
NPV			(-)750		(+)1750

Computation of IRR Contd..

$$\text{IRR} = \text{Higher Rate} - \frac{\text{NPV of Higher Rate}}{\text{Difference in cash flows}} * \text{Difference in Rate}$$

$$\text{IRR} = 19 - \frac{750}{2500} * 1 = 18.7 \%$$

Merits of IRR

- It considers time value of money.
- It considers all cash inflows.
- It does not use the concept of required rate of return or the cost of capital.

Limitations of IRR

- It is most difficult technique for calculation.
- It yields multiple rates.
- It is not suitable for evaluation mutually exclusive projects.
- Assumption of profits are reinvested at IRR not logical.
- May not give fruitful results when project life or cash outflows are unequal.

Difference between NPV & IRR

- Outcome: The NPV method results in a value that a project will produce, while IRR generates in percentage return.
- Purpose: The NPV method focuses on project surpluses, while IRR is focused on the breakeven cash flow level of a project.
- Decision support: The NPV method presents an outcome that forms the foundation for an investment decision, since it presents a value in rupees. The IRR method does not help in making this decision, since its percentage return does not tell the investor how much money will be made.
- Generally, NPV is the more effective method of evaluating projects. IRR is not so effective, it provides only break even rate of return not about the profitability of the project.