

# Chapter 3.3

## TECHNIQUES OF CAPITAL BUDGETING

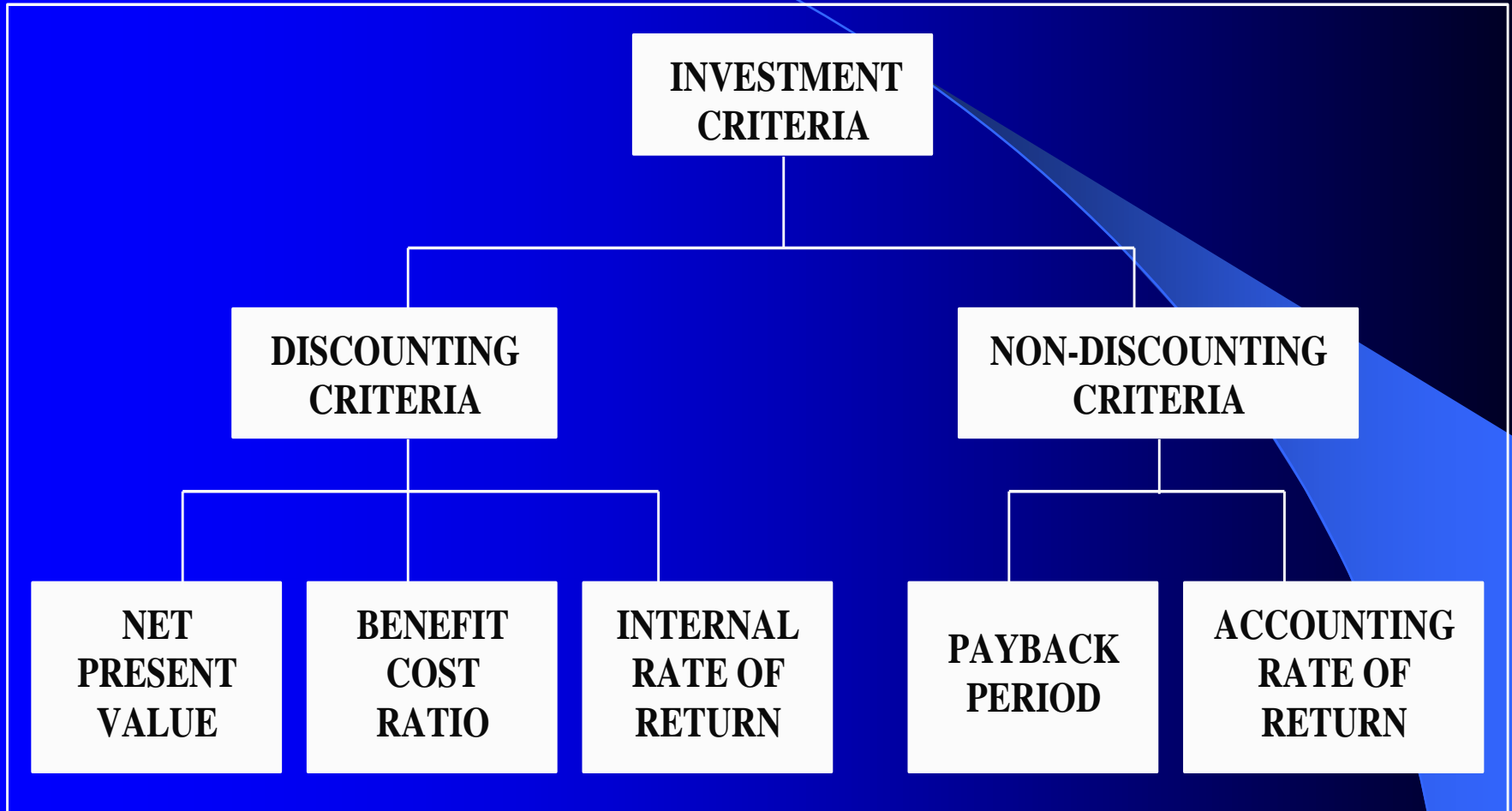
# CAPITAL EXPENDITURES AND THEIR IMPORTANCE

- The basic characteristics of a capital expenditure (also referred to as a capital investment or just project) is that it involves a current outlay (or current and future outlays) of funds in the expectation of receiving a stream of benefits in future
- Importance stems from
  - Long-term consequences
  - Substantial outlays
  - Difficulty in reversing

# CAPITAL BUDGETING PROCESS

- Identification of Potential Investment Opportunities
- Assembling of Investment Proposals
- Decision Making
- Preparation of Capital Budget and Appropriations
- Implementation
- Performance Review

# INVESTMENT CRITERIA



# NET PRESENT VALUE

$$\text{NPV} = \sum_{t=1}^n \frac{C_t}{(1 + r_t)^t} - \text{Initial investment}$$

# NET PRESENT VALUE

The net present value of a project is the sum of the present value of all the cash flows associated with it. The cash flows are discounted at an appropriate discount rate (cost of capital)

## Naveen Enterprise's Capital Project ( Cost of Capital=15%)

<i>Year</i>	<i>Cash flow</i>	<i>Discount factor</i>	<i>Present value</i>
0	-100.00	1.000	-100.00
1	34.00	0.870	29.58
2	32.50	0.756	24.57
3	31.37	0.658	20.64
4	30.53	0.572	17.46
5	79.90	0.497	39.71
			Sum = 31.96

### Pros

- Reflects the time value of money
- Considers the cash flow in its entirety
- Squares with the objective of wealth maximisation

### Cons

- Is an absolute measure and not a relative measure

# BENEFIT COST RATIO

$PVB$

$$\text{Benefit-cost Ratio : } BCR = \frac{PVB}{I}$$

$PVB$  = present value of benefits

$I$  = initial investment

To illustrate the calculation of these measures, let us consider a project which is being evaluated by a firm that has a cost of capital of 12 percent.

Initial investment :		Rs 100,000
Benefits:	Year 1	25,000
	Year 2	40,000
	Year 3	40,000
	Year 4	50,000

The benefit cost ratio measures for this project are:

$$BCR = \frac{\frac{25,000}{(1.12)} + \frac{40,000}{(1.12)^2} + \frac{40,000}{(1.12)^3} + \frac{50,000}{(1.12)^4}}{100,000} = 1.145 \quad NBCR = BCR - 1 = 0.145$$

# INTERNAL RATE OF RETURN

The internal rate of return (IRR) of a project is the discount rate that makes its NPV equal to zero.

## *Net Present Value*

- Assumes that the discount rate (cost of capital) is known.
- Calculates the net present value, given the discount rate.

## *Internal Rate of Return*

- Assumes that the net present value is zero
- Figures out the discount rate that makes net present value zero



# CALCULATION OF IRR

You have to try a few discount rates till you find the one that makes the NPV zero

Year	Cash flow	Discounting rate : 20%		Discounting rate : 24%		Discounting rate : 28%	
		<u>Discount</u>	<u>Present</u>	<u>Discount</u>	<u>Present</u>	<u>Discount</u>	<u>Present</u>
		factor	Value	factor	Value	factor	Value
0	-100	1.000	-100.00	1.000	-100.00	1.000	-100.00
1	34.00	0.833	28.32	0.806	27.40	0.781	26.55
2	32.50	0.694	22.56	0.650	21.13	0.610	19.83
3	31.37	0.579	18.16	0.524	16.44	0.477	14.96
4	30.53	0.482	14.72	0.423	12.91	0.373	11.39
5	79.90	0.402	32.12	0.341	27.25	0.291	23.25
		NPV = 15.88		NPV = 5.13		NPV = - 4.02	

# CALCULATION OF IRR

$$\text{Smaller discount rate} + \frac{\text{NPV at the smaller rate}}{\text{Sum of the absolute values of the NPV at the smaller and the bigger discount rates}} \times \text{Bigger discount rate} - \text{Smaller discount rate}$$

$$24\% + \frac{5.13}{5.13 + 4.02} [28\% - 24\%] = 26.24\%$$

# PROBLEMS WITH IRR

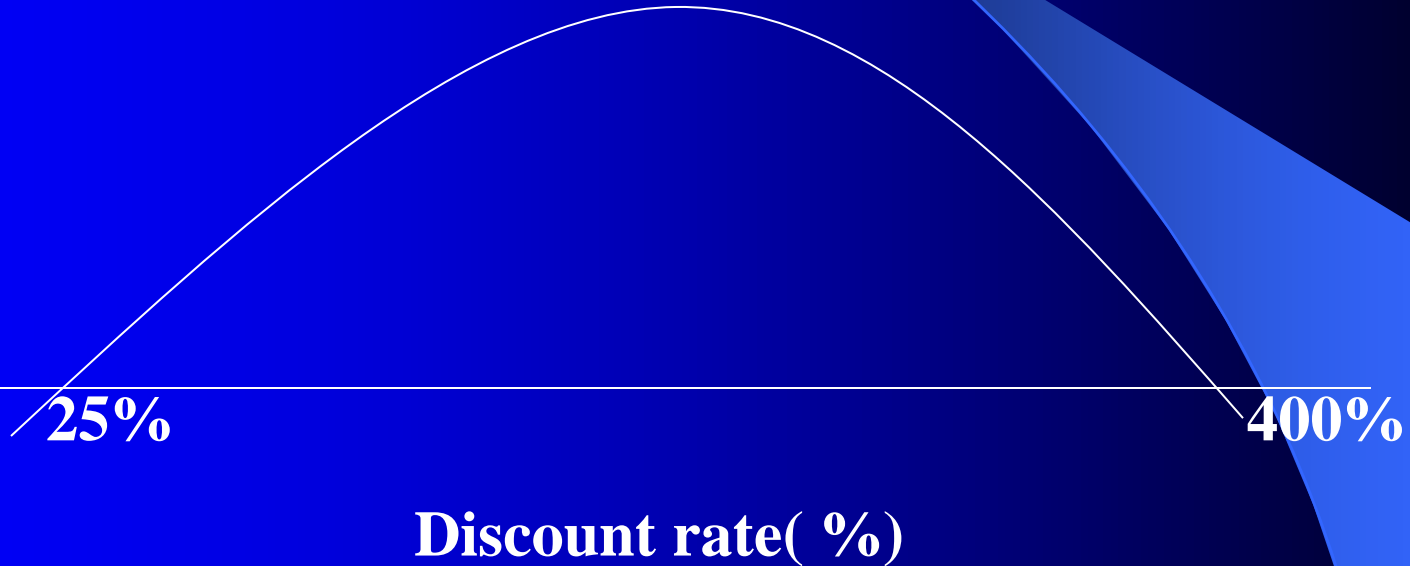
- Non-conventional cash flows
- Mutually exclusive projects
- Lending vs. Borrowing
- Differences between short-term and long-term interest rates

# NON-CONVENTIONAL CASH FLOWS

$C_0$                        $C_1$                        $C_2$   
**-160                      +1000                      -1000**

**TWO IRRs : 25% & 400%**

**NPV**



**NO IRR :**

$C_0$                        $C_1$                        $C_2$   
**150                      -450                      375**

# MUTUALLY EXCLUSIVE PROJECTS

	$C_0$	$C_1$	IRR	NPV (12%)
P	-10,000	20,000	100%	7,857
Q	-50,000	75,000	50%	16,964

# LENDING VS BORROWING

	$C_0$	$C_1$	IRR	NPV (10%)
A	-4000	6000	50%	145
B	4000	-7000	75%	-236

# PAYBACK PERIOD

Payback period is the length of time required to recover the initial outlay on the project

## Naveen Enterprise's Capital Project

Year	Cash flow	Cumulative cash flow
0	-100	-100
1	34	- 66
2	32.5	-33.5
3	31.37	- 2.13
4	30.53	28.40

### Pros

- Simple
- Rough and ready method for dealing with risk
- Emphasises earlier cash inflows

### Cons

- Fails to consider the time value of money
- Ignores cash flows beyond the payback period

# AVERAGE RATE OF RETURN

Average PAT

Average Book Value of Investment (Beginning)

## Naveen Enterprise's Capital Project

Year	Book Value of Investment(Beg)	PAT
1	100	14
2	80	17.5
3	65	20.12
4	53.75	22.09
5	45.31	23.57

$$ARR = \frac{1/5 (14+17.5 +20.12+22.09+23.57)}{1/5(100+80+65+53.75+45.31)} = 28.31\%$$

### Pros

- Simple
- Based on accounting information  
businessmen are familiar with
- Considers benefits over the entire project life

### Cons

- Based on accounting profit,  
not cash flow
- Does not take into account the  
time value of money



# INVESTMENT APPRAISAL

## IN PRACTICE

- Over time, discounted cash flow methods have gained in importance and internal rate of return is the most popular evaluation method.
- Firms typically use multiple evaluation methods.
- Accounting rate of return and payback period are widely employed as supplementary evaluation methods.

# SUMMING UP

- $$\text{NPV} = \sum_{t=1}^n \frac{C_t}{(1+r)^t} - I$$

- $$\text{BCR} = \frac{PVB}{I}$$

- IRR is the value of  $r$  in the following equation

$$I = \sum_{t=1}^n \frac{C_t}{(1+r)^t}$$

- The payback period is the length of time required to recover the initial cash outlay on the project
- The accounting rate is defined as:

$$\frac{\text{Average profit after tax}}{\text{Average book value of investment}}$$

# Example

- 1) The expected cash flows of a project are as follows:

Year	Cash Flow
0	-100000
1	20000
2	30000
3	40000
4	50000
5	30000

- The cost of capital is 12%. Calculate the following: a) net present value b) benefit cost ratio c) internal rate of return d) modified internal rate of return e) payback period f) discounted payback period

# Solution

- A)  $NPV = -100000 + (20000/1.12) + (30000/1.12^2) + (40000/1.12^3) + (50000/1.12^4) + (30000/1.12^5) = 19060$
- B) Benefit cost ratio is  $= 119060/100000 = 1.19$

- C) Try discount rate of 18%. The NPV is 1750. Try a discount rate of 19%. The NPV at 19% discount rate is -780
- Hence IRR is
- $(1750/2530) = 0.69 = 18\% + 0.69 = 18.69\%$

- D) MIRR = The future value of benefits when compounded at 12% is
- $= 20000 * (1.12^4) + 30000 * (1.12^3) + 40000 * (1.12^2) + 50000 * (1.12) + 30000$   
 $= 209790$
- $= 100000 * (1+r)^5 = 209790$
- MIRR = 15.97%

- E) The payback period is slightly more than 3 years
- F) The discounted payback period is slightly less than 4 years



# Exercise

- Q.1 Sulabh International is evaluating a project whose expected cash flows are as follows:

Year	Cash flow (Rs.)
0	-1000000
1	100000
2	200000
3	300000
4	600000
5	300000

# Exercise

- a) What is the NPV of the project, if the discount rate is 14% for the entire period?
- b) What is the NPV of the project if the discount rate is 12% for year 1 and rises every year by 1%?

# Exercise

- Q.2 What is the internal rate of return of an investment which involves a current outlay of Rs. 300000 and results in a annual cash inflow of Rs. 60000 for 7 years?

# Exercise

- Q.3) What is the internal rate of return of the following cash flow stream?

Year	Cash Flow (Rs.)
0	(3000)
1	9000
2	(3000)

# Exercise

- Q.4 If an equipment costs Rs. 500000 and lasts 8 years, what should be the minimum annual cash inflow before it is worthwhile to purchase the equipment? Assume that the cost of capital is 10%.

# Exercise

- Q.5 How much can be paid for a machine brings an annual cash inflow of Rs. 25000 for 10 years? Assume that the discount rate is 12%.

# Exercise

- Q.6 The cash flows associated with three projects P, Q and R are given below:

	Net	Cash	Flows
Year	P	Q	R
0	(2000)	(2000)	(2000)
1	1400	500	500
2	600	1100	500
3	400	900	1600

- Calculate the net present value of each project at discount rate of 5%, 10%, 15%, 25% and 30%

# Exercise

- Q.7) Phoenix Company is considering two mutually exclusive investments, Project P and Project Q. the expected cash flows of these projects are as follows:

Year	Project P (Rs.)	Project (Q) Rs.
0	(1000)	(1600)
1	(1200)	200
2	(600)	400
3	(250)	600
4	2000	800
5	4000	100