

## Capital Budgeting

→ Equations

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

Benefit-Cost Ratio

$$BCR = \frac{PV_B}{I}$$

$$\text{Net-BCR} = \frac{PV_B - I}{I} = BCR - 1$$

Internal Rate of Return

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

Payback Period. (Period)

• Initial Investment = Cash flow at time Period

Discounted Payback Period

Initial Investment = Discounted Cash flow at time Period.

Accounting Rate of Return

Profit After tax

Book Value of the Investment

Example: NPV and BCR.

As part of its programme of supporting start-up ventures, ABC Bank has provided the full initial investment cost Rs 150 lakhs to Krish at a interest rate of 6% p.a. The estimated net cash flows of the project are as follows: (Rs in lakhs)

Year	1	2	3	4	5
Net Cash flow	40	60	80	50	60

Calculate the net present value and the net benefit cost ratio of the project.

Solution:

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

$$\begin{aligned} \text{Pr of Cash flow} &= \frac{40}{1.06} + \frac{60}{(1.06)^2} + \frac{80}{(1.06)^3} + \frac{50}{(1.06)^4} + \frac{60}{(1.06)^5} \\ &= 37.72 + 53.44 + 64.2 + 39.6 + 44.82 \\ &= 242.44. \end{aligned}$$

$$NPV = 242.44 - 150 = 92.44 \text{ Rs in lakhs}$$

$$\begin{aligned} \rightarrow NBCR &= \frac{PV_B}{I} - 1 \\ &= \frac{242.44}{150} - 1 = 1.618 - 1 = 0.618 \end{aligned}$$

★ IRR.

What is the internal rate of return of an investment which involves a current outlay of Rs. 3,00,000 and results in an annual cash inflow of Rs 55,000 for 7 years?

Solution

$$3,00,000 = \sum_{t=1}^{n=7} \frac{55000}{(1+r)}$$

→ Trial and Error Method.

Assume. 10%.

$$55000 \times PVIFA_{10\%, 7 \text{ years}} = 55000 \times 4.868 \\ = 264740$$

$$\text{Assume } 11\% = 55000 \times 4.412 = 24916 [259160]$$

$$\text{Assume } 9\% = 55000 \times 5.033 = [276815]$$

$$\text{Assume } 6\% = 55000 \times 5.582 = [307010]$$

~~It is between 6% to 9%.~~

~~$$\begin{array}{r}
 307010 \\
 6\% + 30195 \\
 \hline
 6\% + 0.007 \\
 \hline
 6.007\%
 \end{array}$$~~

$$\text{Assume } 8\% = [286330]$$

$$8\% = [296395]$$

~~It is between 6% to 8%.~~

$$6\% + \frac{7010}{10615} \times 1\%$$

### Example:-

Company is considering two projects A and B, each of which requires initial outlay of Rs. 45 Million. Expected Cash flows from these projects are:

Year	Project A	Project B
1	11	36
2	18	20
3	32	18
4	35	10

### Questions:-

- 1) What is the payback period for both projects?
- 2) What is the discounted payback period for both projects if cost of capital is 12%?
- 3) If both the projects are independent and  $r$  is 12%, Which Project should the firm invest in?
- 4) If two projects mutually exclusive and  $r$  is 10%, Which Project should the firm invest in?

### Solution:-

#### 1) Payback period

$$\text{Project A} = \frac{11 + 18}{2+5} \text{ years} = 3.2 \text{ years}$$

$$\text{Project B} = \frac{36}{20} = 1.8 \text{ years}$$

## 2) Discounted Payback Period

Project A =	12% Discount CF	Project B	12% Discounted CF
Cash flow A	9.823	36	32.148
11	14.346	20	15.94
18	22.484	18	12.816
32	23.532	10	6.36
35			
	<u>2.91 years</u>		<u>1.806 years</u>

3) If both the projects are independent.

$$\text{NPV} = -45 + 9.485 = 25.485 \text{ Project A}$$

$$= 67.264 - 45 = 22.264 \text{ Project B}$$

Both the Projects can be accepted

4) If both the Projects are mutually exclusive,  $r=10\%$ .

$$\text{Project A} = -45 + 9.999 + 14.868 + 24.032 + 23.905 \\ = 27.804$$

$$\text{Project B} = -45 + 32.424 + 16.52 + 13.518 + 6.83 \\ = 24.592$$

Project A has higher NPV so we can choose project A.

### Example

Expected Cashflows are as follows:

Year	Cash flow
0	-100,000
1	20000
2	30000
3	30000
4	40000
5	50000

Cost of Capital is 12%. Calculate:

- (i) NPV (ii) BCR (iii) IRR (iv) Payback Period  
 (v) Discounted Payback Period

### Solution:-

$$(i) \text{NPV} = -1,00,000 + 17860 + 23910 + 21360 + 25440 \\ + 28350 \\ = 16920$$

$$(ii) \text{BCR} = \frac{\text{PVB}}{I} = \frac{116920}{100000} = 1.1692$$

$$(iii) \text{IRR} = \text{Assume } 14\%.$$

$$14540 + 23040 + 20250 + 23680 + 25950 = 110490$$

$$\text{Assume } 16\%. \\ 17240 + 22290 + 19230 + 22080 + 23800 = 104640$$

$$\text{Assume } 18\%.$$

$$16940 + 21540 + 18240 + 20640 + 21850 = 99240$$

(iv) Payback Period = 3.5 years

(v) Discounted Payback Period =

17860

23910

21360

25440

28350

4.40 years.

### Examples    Accounting Rate of Return.

Mohan Enterprise financial data as follows:

Year	BV of Investment	PAT
1	100	14
2	80	17.5
3	65	20.12
4	53.75	22.09
5	45.31	23.57

### Solutions:

$$\text{ARR} = \frac{\text{Avg PAT}}{\text{Avg BV of I}} = \frac{\frac{1}{5}(14+17.5+20.12+22.09+23.57)}{\frac{1}{5}(100+80+65+53.75+45.31)} = 28.31\%$$