

3

ADVANCED CAPITAL BUDGETING DECISIONS

Question 1

Invest Corporation Ltd. adjusts risk through discount rates by adding various risk premiums to the risk free rate. Depending on the resultant rate, the proposed project is judged to be a low, medium or high risk project.

Risk level	Risk free rate (%)	Risk Premium (%)
Low	8	4
Medium	8	7
High	8	10

DEMONSTRATE the acceptability of the project on the basis of Risk Adjusted rate.

(MTP 4 Marks April '19)

Answer:

Calculation of Risk Adjusted rate

Risk level	Risk free rate (%)	Risk Premium (%)	Risk adjusted rate (%)
Low	8	4	12
Medium	8	7	15
High	8	10	18

The cash flows of the project considered are as following:

Point in time (yearly intervals)	0	1	2
Cash flow (₹ in crore)	(100)	45	80

If the project is judged to be low risk

Years	0	1	2
PV (₹ in crore)	(100)	$\frac{45}{1+0.12} = 40.18$	$\frac{80}{1+0.12^2} = 63.78$

NPV = 40.18 + 63.78 – 100 = 3.96: Accept

If the project is judged to be medium risk

Years	0	1	2
PV (₹ in crore)	(100)	$\frac{45}{1+0.15} = 39.13$	$\frac{80}{1+0.15^2} = 60.49$

NPV 39.13 + 60.49 – 100 = (0.38); Reject

If the project is judged to be High risk

Years	0	1	2
PV (₹ in crore)	(100)	$\frac{45}{1+0.18} = 38.14$	$\frac{80}{1+0.18^2} = 57.45$

NPV 38.14 + 57.45 – 100 = (4.41); Reject

Question 2

A&R Ltd. has undertaken a project which has an initial investment of ₹ 2,000 lakhs in plant & machinery and ₹ 800 lakhs for working capital. The plant & machinery would have a salvage value of ₹ 474.61 lakhs at the end of the fifth year. The plant & machinery would depreciate at the rate of 25% p.a. on WDV method.

The other details of the project for the five-year period are as follows:

Sales	10,00,000 units p.a.
Selling price per unit	₹ 500
Variable cost	50% of selling price
Fixed overheads (excluding depreciation)	₹ 300 lakh p.a.
Corporate tax rate	35%
Rate of interest on bank loan	12%
After tax required rate of return	15%

Required:

CACULATE net present value (NPV) of the project and DETERMINE the viability of the project.

(i) DETERMINE the sensitivity of project's NPV under each of the following condition:

- Decrease in selling price by 10%;
- Increase in cost of plant & machinery by 10%.

PV factor	Year-1	Year-2	Year-3	Year-4	Year-5
12%	0.892	0.797	0.711	0.635	0.567
15%	0.869	0.756	0.657	0.571	0.497

(MTP 10 Marks, May'20) (Same concept different figures MTP 10 Marks Oct'23)

Answer:

Calculation of Net Present Value (NPV):

	Year-1	Year-2	Year-3	Year-4	Year-5
Sales volume (Qty. in lakh)	10	10	10	10	10
Contribution per unit (₹) (Selling price – variable cost)	250	250	250	250	250
Total contribution (₹ in lakh)	2,500	2,500	2,500	2,500	2,500
Less: Fixed overheads (₹ In lakh)	300	300	300	300	300
PBDT	2,200	2,200	2,200	2,200	2,200
Less: Depreciation (₹ in lakh) (Working note-1)	500	375	281.25	210.94	158.20
PBT	1,700	1,825	1,918.75	1,989.06	2,041.80
Less: Tax @ 35%	595	638.75	671.56	696.17	714.63
PAT	1,105	1,186.25	1,247.19	1,292.89	1,327.17
Add: Depreciation	500	375	281.25	210.94	158.20
Add: Salvage value of plant & machinery	-	-	-	-	474.61
Add: Working capital	-	-	-	-	800
Net Cash inflow	1,605	1,561.25	1,528.44	1,503.83	2,759.98
P. V factor @15%	0.869	0.756	0.657	0.571	0.497
P. V of cash inflows	1,394.74	1,180.31	1,004.18	858.68	1,371.71

Net Present Value = P. V of cash inflows – P. V of cash outflows

= ₹ (1,394.74 + 1,180.31 + 1,004.18 + 858.68 + 1,371.71) – (₹ 2,000 + ₹ 800)

= ₹ 3,009.62 lakh

The NPV of the project is positive, hence, the project is viable.

Working note - 1:

	Year-1	Year-2	Year-3	Year-4	Year-5
Opening balance	2,000	1,500	1,125	843.75	632.81
Depreciation @25%	500	375	281.25	210.94	158.20
Closing WDV	1,500	1,125	843.75	632.81	474.61

(ii) Determination of sensitivity of NPV w.r.t.
a. Decrease in selling price by 10%

	Year-1	Year-2	Year-3	Year-4	Year-5
Sales volume (Qty. in lakh)	10	10	10	10	10
New Selling price	450	450	450	450	450
Variable cost	250	250	250	250	250
Contribution per unit (₹) (Selling price – variable cost)	200	200	200	200	200
Total contribution (₹ in lakh)	2,000	2,000	2,000	2,000	2,000
Less: Fixed overheads (₹ In lakh)	300	300	300	300	300
PBDT	1,700	1,700	1,700	1,700	1,700
Less: Depreciation (₹ in lakh) (Working note- 1)	500	375	281.25	210.94	158.20
PBT	1,200	1,325	1,418.75	1,489.06	1,541.80
Less: Tax @ 35%	420	463.75	496.56	521.17	539.63
PAT	780	861.25	922.19	967.89	1,002.17
Add: Depreciation	500	375	281.25	210.94	158.20
Add: Salvage value of plant & machinery	-	-	-	-	474.61
Add: Working capital	-	-	-	-	800
Net Cash inflow	1,280	1,236.25	1,203.44	1,178.83	2,434.98
P. V factor @15%	0.869	0.756	0.657	0.571	0.497
P. V of cash inflows	1,112.32	934.61	790.66	673.11	1,210.18

$$\text{NPV} = ₹ (1,112.32 + 934.61 + 790.66 + 673.11 + 1,210.18) - (₹ 2,000 + ₹ 800)$$

$$= ₹ 4,720.88 - ₹ 2,800 = 1,920.88 \text{ lakh}$$

10% reduction in selling price reduces the NPV by 36.18% $(3,009.62 - 1,920.88 / 3,009.62)$

b. Increase in project cost by 10%

	Year-1	Year-2	Year-3	Year-4	Year-5
PBDT	2,200	2,200	2,200	2,200	2,200
Less: Depreciation (₹ in lakh) (Working note- 2)	550	412.5	309.37	232.03	174.03
PBT	1,650	1,787.50	1,890.63	1,967.97	2,025.97
Less: Tax @ 35%	577.50	625.63	661.72	688.79	709.09
PAT	1072.50	1,161.87	1,228.91	1,279.18	1,316.88

Add: Depreciation	550	412.5	309.37	232.03	174.03
Add: Salvage value of plant & machinery	-	-	-	-	474.61
Add: Working capital	-	-	-	-	800
Net Cash inflow	1,622.50	1,574.37	1,538.28	1,511.21	2,765.52
P. V factor @15%	0.869	0.756	0.657	0.571	0.497
P. V of cash inflows	1,409.95	1,190.22	1,010.65	862.90	1,374.46

NPV ₹ (1,409.95 + 1,190.22 + 1,010.65 + 862.90 + 1,374.46) - (₹ 2,200 + ₹ 800)

₹ 5,848.18 - ₹ 3,000 = 2,848.18 lakh

10% increase in project cost reduces the NPV only by 5.36% (3,009.62-2,848.18/3,009.62)

Working note-2:

	Year-1	Year-2	Year-3	Year-4	Year-5
Opening balance	2,200	1,650	1,237.50	928.13	696.10
Depreciation @25%	550	412.5	309.37	232.03	174.03
Closing WDV	1,650	1,237.50	928.13	696.10	522.07

Question 3

A firm can make investment in either of the following two projects. The firm anticipates its cost of capital to be 10%. The pre-tax cash flows of the projects for five years are as follows:

Year	0	1	2	3	4	5
Project A (₹)	(2,00,000)	35,000	80,000	90,000	75,000	20,000
Project B (₹)	(2,00,000)	2,18,000	10,000	10,000	4,000	3,000

Ignore Taxation.

An amount of ₹ 35,000 will be spent on account of sales promotion in year 3 in case of Project A. This has not been taken into account in calculation of pre-tax cash flows.

The discount factors are as under:

Year	0	1	2	3	4	5
PVF (10%)	1	0.91	0.83	0.75	0.68	0.62

You are required to calculate for each project:

- The payback period
- The discounted payback period
- Desirability factor
- Net Present Value

(MTP 10 Marks, Oct'20) (Same concept different figures MTP 10 Marks Sep'23)

Answer:

Calculation of Present Value of Cash Flows

Year	PV Factor @ 10%	Project A		Project B	
		Cash Flows (₹)	Discounted Cash Flows	Cash Flows (₹)	Discounted Cash Flows
0	1.00	(2,00,000)	(2,00,000)	(2,00,000)	(2,00,000)
1	0.91	35,000	31,850	2,18,000	1,98,380
2	0.83	80,000	66,400	10,000	8,300
3	0.75	55,000 (90,000-35,000)	41,250	10,000	7,500
4	0.68	75,000	51,000	4,000	2,720
5	0.62	20,000	12,400	3,000	1,860
Net Present Value			2,900		18,760

(1) The Payback period of the projects:

Project-A: The cumulative cash inflows up-to year 3 is ₹1,70,000 and remaining amount required to equate the cash outflow is ₹30,000 i.e. (₹2,00,000 – ₹1,70,000) which will be recovered from year-4 cash inflow. Hence, Payback period will be calculated as below:

$$3 \text{ years} + \frac{\text{₹ } 30,000}{\text{₹ } 75,000} = 3.4 \text{ years or 3 years 4.8 months or 3 years 4 months and 24 days}$$

Project-B: The cash inflow in year-1 is ₹2,18,000 and the amount required to equate the cash outflow is ₹2,00,000, which can be recovered in a period less than a year. Hence, Payback period will be calculated as below:

$$= \frac{\text{₹ } 2,00,000}{\text{₹ } 2,18,00,000} = 0.917 \text{ years or 11 months}$$

(ii) Discounted Payback period for the projects:

Project-A: The cumulative discounted cash inflows up-to year 4 is ₹1,90,500 and remaining amount required to equate the cash outflow is ₹9,500 i.e. (₹2,00,000 – ₹1,90,500) which will be recovered from year-5 cash inflow.

Hence, Payback period will be calculated as below:

$$4 \text{ Years} + \frac{\text{₹ } 9,500}{\text{₹ } 12,400}$$

0.917 years or 11 months

Project-B: The cash inflow in year-1 is ₹1,98,380 and remaining amount required to equate the cash outflow is ₹1,620 i.e. (₹2,00,000 - ₹1,98,380) which will be recovered from year-2 cash inflow. Hence, Payback period will be calculated as below:

$$1 \text{ year} + \frac{\text{₹ } 1620}{\text{₹ } 8300} = 1.195 \text{ years Or } 1 \text{ Year } 2.34 \text{ months Or } 1 \text{ Year } 2 \text{ months and } 10 \text{ days.}$$

(iii) Desirability factor of the projects

Desirability Factor (Profitability Index)

$$\begin{aligned} &= \frac{\text{Discounted value Cashlufows.}}{\text{Discounted value of Cashoutflows}} \\ \text{Project A} &= \frac{\text{₹ } 2,02,900}{2,00,000} = 1.01 \\ \text{Project B} &= \frac{\text{₹ } 2,18,760}{2,00,000} = 1.09 \end{aligned}$$

(iv) Net Present Value (NPV) of the projects:

Please refer the above table. Project A - ₹ 2,900

Project B - ₹ 18,760

Question 4

SG Ltd. is considering a project "Z" with an initial outlay of ₹ 7,50,000 and life of 5 years. The estimates of project are as follows:

	Lower Estimates	Base	Upper Estimates
Sales (units)	4,500	5,000	5,500
	(₹)	(₹)	(₹)
Selling Price put.	175	200	225
Variable cost put.	100	125	150
Fixed Cost	50,000	75,000	1,00,000

Depreciation included in Fixed cost is ₹ 35,000 and corporate tax is 25%.

Assuming the cost of capital as 15%, DETERMINE NPV in three scenarios i.e. worst, base and best case scenario. PV factor for 5 years at 15% are as follows:

Years	1	2	3	4	5
P. V. Factor	0.870	0.756	0.658	0.572	0.497

(MTP 7 Marks April'21, RTP May'22 Old SM)

Answer:

(i) Calculation of Yearly Cash Inflow

In worst case: High costs and Low price (Selling price) and volume (Sales units) are taken. In best case: Low costs and High price (Selling price) and volume (Sales units) are taken.

	Worst Case	Base	Best Case
Sales (units) (A)	4,500	5,000	5,500
	(₹)	(₹)	(₹)
Selling Price p.u.	175	200	225
Less: Variable cost p.u.	150	125	100
Contribution p.u. (B)	25	75	125
Total Contribution (A × B)	1,12,500	3,75,000	6,87,500
Less: Fixed Cost	1,00,000	75,000	50,000
EBT	12,500	3,00,000	6,37,500
Less: Tax @ 25%	3,125	75,000	1,59,375
EAT	9,375	2,25,000	4,78,125
Add: Depreciation	35,000	35,000	35,000
Cash Inflow	44,375	2,60,000	5,13,125

Calculation of NPV in different scenarios

	Worst Case	Base	Best Case
Initial outlay (A) (₹)	7,50,000	7,50,000	7,50,000
Cash Inflow (C) (₹)	44,375	2,60,000	5,13,125
Cumulative PVF @ 15% (d)	3.353	3.353	3.353
PV of Cash Inflow (B = c × d) (₹)	1,48,789.38	8,71,780	17,20,508.13
NPV (B - A) (₹)	(6,01,210.62)	1,21,780	9,70,508.13

Question 5

Sadbhavna Limited is a manufacturer of computers. It wants to introduce artificial intelligence while making computers. It estimates that the annual savings from the artificial intelligence (AI) include a reduction of five employees with annual salaries of ₹ 3,00,000 each, ₹ 3,00,000 from reduction in production delays caused by inventory problem, reduction in lost sales ₹ 2,50,000 and ₹ 2,00,000 from billing issues.

The purchase price of the system for installation of artificial intelligence is ₹ 20,00,000 with installation cost. of ₹ 1,00,000. The life of the system is 5 years and it will be depreciated on a straight -line basis. The salvage value is zero which will be its market value after the end of its life of five years.

However, the operation of the new system for AI requires two computer specialists with annual salaries of ₹ 5,00,000 per person. Also, the estimated maintenance and operating expenses of 1,50,000 is required.

The company's tax rate is 30% and its required rate of return is 12%.

From the above information:

- (i) CALCULATE the initial cash outflow and annual operating cash flow over its life of 5 years.
- (ii) Further, EVALUATE the project by using Payback Period, Net Present Value and Profitability Index.
- (iii) You are also REQUIRED to obtain the cash flows and NPV on the assumption that book salvage value for depreciation purposes is ₹ 2,00,000 even though the machine is having no real worth in terms of its resale value. Also, the book salvage value of ₹2,00,000 is allowed for tax purposes.

Also COMMENT on the acceptability of the project in (ii) and (iii) above.

(MTP 10 Marks, Oct'21)

Answer:

- (i) **Project's Initial Cash Outlay**

Cost 20,00,000

Installation Expenses 1,00,000

Total Cash Outflow 21,00,000 Depreciation per year = $21,00,000 / 5 = 4,20,000$

Project's Operating Cash Flows over its 5-year life	
Savings (A)	
Reduction in salaries (₹3,00,000 × 5)	15,00,000
Reduction in production delays	3,00,000
Reduction in lost sales	2,50,000
Gains due to timely billing	2,00,000
	22,50,000

Costs (B)	
- Depreciation	4,20,000
- Additional Specialist Cost (₹5,00,000 × 2)	10,00,000
- Maintenance Cost	1,50,000
	15,70,000
Increase in Profit before tax (A - B)	6,80,000
Less: Tax @ 30%	2,04,000

Profit after tax	4,76,000
Cash Inflows = Profit after tax + Depreciation	
= 4,76,000 + 4,20,000 = 8,96,000	
(ii) Evaluation of the project by using NPV Method	

Year	Cash Inflows	PVAF (12%, 5y)	Total PV
1.5	8,96,000	3.605	32,30,080
Less: Total Initial Cash Outflow Net Present Value			21,00,000
			11,30,080

Since NPV is positive, therefore, the project is acceptable.

Evaluation of the project by using Profitability Index Method

$$\begin{aligned}\text{Profitability Index} &= \text{Present Value of Cash Inflows} / \text{Present Value of Cash Outflows} \\ &= 32,30,080 / 21,00,000 \\ &= 1.538\end{aligned}$$

Since, the profitability index is more than 1, the project is acceptable.

Calculation of the Project's Payback*

Year	Net Cash Flow	Cumulative Cash Flow
1	8,96,000	8,96,000
2	8,96,000	17,92,000
3	8,96,000	26,88,000
4	8,96,000	35,84,000
5	8,96,000	44,80,000

Here, the payback period is 2 years plus a fraction of the 3rd year So, payback period
 $= 2 \text{ years} + 3,08,000 / 8,96,000$
 $= 2.34 \text{ years}$

* Payback period may also be solved directly as follows: $21,00,000 / 8,96,000 = 2.34 \text{ years}$
 Project's cash flows and NPV assuming that the book salvage for depreciation purpose is

₹ 2,00,000

$$\begin{aligned}\text{Depreciation} &= (\text{₹}21,00,000 - 2,00,000) / 5 \\ &= 3,80,000\end{aligned}$$

Cash Inflows for the years 1 to 5 are:

Savings (calculated as earlier) 22,50,000

Less: Costs		
- Depreciation	3,80,000	
- Additional Specialists cost	10,00,000	
- Maintenance cost	1,50,000	15,30,000
Profit before tax		7,20,000
Less: Tax @ 30%		2,16,000
Profit after tax		5,04,000
Cash Inflow (5,04,000 + 3,80,000)		8,84,000
Calculation of NPV		

It may be noted that at the end of year 5, the book value of the project would be ₹ 2,00,000 but its realizable value is nil. So, the capital loss of ₹ 2,00,000 will result in tax savings of ₹60,000 (i.e., ₹ 2,00,000 × 30%), as the capital loss is available for tax purposes in view of the information given. Therefore, at the end of year 5, there would be an additional inflow of ₹ 60,000. The NPV may now be calculated as follows:

Year	Cash Flow (₹)	PVAF (12%, n)	PV
1-5	8,84,000	3.605	31,86,820
5	60,000	0.567	34,020
PV of inflows			32,20,840
Outflows			21,00,000
NPV			11,20,840

As the NPV of the project is positive, the project is acceptable.

Question 6

X Ltd. is considering two mutually exclusive projects A and B.

Net Cash flow probability distribution of each project has been given below:

Project - A		Project - B	
Net Cash Flow (₹)	Probability	Net Cash Flow (₹)	Probability
1,72,000	0.30	3,38,000	0.20
1,82,000	0.30	3,18,000	0.30
1,92,000	0.40	2,98,000	0.50

(i) COMPUTE the following:

- (I) Expected Net Cash Flow of each project.
- (II) Variance of each project.
- (III) Standard Deviation of each project.
- (IV) Coefficient of Variation of each project.

(ii) IDENTIFY which project do you recommend? Give reason.

(MTP 8 Marks March'22 & March'23, PYP 10 Marks Nov'20)

(Same concept different figures RTP Nov'21)

Answer:

(i) Calculation of Expected Net Cash Flow (ENCF) of Project A and Project B

Project - A			Project - B		
Net Cash Flow (₹)	Probability	Expected Net Cash Flow (₹)	Net Cash Flow (₹)	Probability	Expected Net Cash Flow (₹)
1,72,000	0.30	51,600	3,38,000	0.20	67,600
1,82,000	0.30	54,600	3,18,000	0.30	95,400
1,92,000	0.40	76,800	2,98,000	0.50	1,49,000
ENCF		1,83,000			3,12,000

(II) Variance of Projects

Project A

$$\begin{aligned}\text{Variance } (\sigma^2) &= (1,72,000 - 1,83,000)^2 \times (0.3) + (1,82,000 - 1,83,000)^2 \times (0.3) + \\ &+ (1,92,000 - 1,83,000)^2 \times (0.4) \\ &= 3,63,00,000 + 3,00,000 + 3,24,00,000 \\ &= 6,90,00,000\end{aligned}$$

Project B

$$\begin{aligned}\text{Variance } (\sigma^2) &= (3,38,000 - 3,12,000)^2 \times (0.2) + (3,18,000 - 3,12,000)^2 \times (0.3) + \\ &+ (2,98,000 - 3,12,000)^2 \times (0.5) \\ &= 13,52,00,000 + 1,08,00,000 + 9,80,00,000 \\ &= 24,40,00,000\end{aligned}$$

(III) Standard Deviation of Projects

Project A

$$\text{Standard Deviation } (\sigma) = \sqrt{\text{Variance } (\sigma^2)} = \sqrt{6,90,00,000} = 8,306.624$$

Project B

$$\text{Standard Deviation } (\sigma) = \sqrt{\text{Variance } (\sigma^2)} = \sqrt{24,40,00,000} = 15,620.499$$

(IV) Coefficient of Variation of Project

Projects	Coefficient of variation $\frac{\text{Standard Deviation}}{\text{Expected Net Cash Flow}}$	Risk	Expected Net Cash Flow
A	$\frac{8.306.624}{1,83,000} = 0.045 \text{ or } 4.5\%$	Less	Less
B	$\frac{15.620.499}{3,12,000} = 0.050 \text{ or } 5.0\%$	More	More

- (ii) in project A risk per rupee of cash flow is 0.045 (approx.) while in project B it is 0.050 (approx.). Therefore, Project A is better than Project B.

Question 7

X. Ltd. is considering its new project with the following details:

Sr. No.	Particulars	Figures
1	Initial capital cost	₹ 400 Cr.
2	Annual unit sales	5 Cr.
3	Selling price per unit	₹ 100
4	Variable cost per unit	₹ 50
5	Fixed costs per year	₹ 50 Cr.
6	Discount Rate	6%

Required:

- Tabulate the NPV of the project. Does it represent the actual outcome ? Comment.
- Examine the impact of 2.5 percent adverse variance in each of the variables on the project's NPV. Decide which variable is having maximum effect?
- Critically analyse the Sensitivity analysis as method of incorporating risk in capital budgeting decisions.

Consider Life of the project as 3 years.

(RTP May'24) (MTP 10 Marks Sep'22, Old SM)

Answer:

(i) Calculation of Net Cash Inflow per year

	Particulars	Figures
A	Selling price per unit	100
B	Variable cost per unit	50
C	Contribution per unit (A-B)	50
D	Number of units sold per year	5 Cr
E	Total Contribution (C x D)	₹ 250 Cr
F	Fixed cost per year	₹ 50 Cr
G	Net cash inflow per year (E-F)	₹ 200 Cr

Calculation of Net Present Value (NPV) of the Project

Year	Year Cash Flow (₹ in Cr.)	PV Factor @ 6%	Present Value (PV) (₹ in Cr.)
0	(400.00)	1.000	(400.00)
1	200.00	0.943	188.60
2	200.00	0.890	178.00
3	200.00	0.840	168.00
Net Present Value			134.60

Here, NPV represent the most likely outcomes and not the actual outcomes. The actual outcome can be lower or higher than the expected outcome.

(ii) Sensitivity Analysis considering 2.5 % Adverse Variance in each variable.

	Particulars	Base	Initial capital cost increased to ₹ 410 crore	Selling Price per Unit Reduced to 97.5	Variable Cost Per Unit increased to ₹ 51.25	Fixed Cost Per Unit increased to 51.25	Units sold per year reduced to 4.875 crore
		(₹)	(₹)	(₹)	(₹)	(₹)	(₹)
A	Selling price per unit	100	100	97.50	100	100	100
B	Variable cost per unit	50	50	50	51.25	50	50
C	Contribution per unit (A - B)	50	50	47.50	48.75	50	50

		(₹ in Cr.)	(₹ in Cr.)	(₹ in Cr.)	(₹ in Cr.)	(₹ in Cr.)	(₹ in Cr.)
D	Number of units sold per year (units in Crores)	5	5	5	5	5	4.875
E	Total	250	250	237.50	243.75	250	243.75
	Contribution n (C x D)						
F	Fixed cost per year	50	50	50	50	51.25	50
G	Net Cash Inflow per year (E - F)	200	200	187.50	193.75	198.75	193.75
H	PV of Net cash Inflow per year (G x 2.673)	534.60	534.60	501.19	517.89	531.26	517.89
I	Initial capital cost	400	410	400	400	400	400
J	NPV (H - I)	134.60	124.60	101.19	117.89	131.26	117.89
K	Percentage Change in NPV	-	-7.43%	-24.82%	-12.41%	-2.48%	-12.41%

The above table shows that by changing one variable at a time by 2.5% (adverse) while keeping the others constant, the impact in percentage terms on the NPV of the project can be calculated. Thus, the change in selling price has the maximum effect on the NPV by 24.82%.

Advantages of Sensitivity Analysis:

Following are the main advantages of Sensitivity Analysis:

- (1) **Critical Issues:** This analysis identifies critical factors that impinge on a project's success or failure.
- (2) **Simplicity:** It is a simple technique.

Disadvantage of Sensitivity Analysis

Following are the main disadvantages of Sensitivity Analysis:

- (1) **Assumption of Independence:** This analysis assumes that all variables are independent i.e. they are not related to each other, which is unlikely in real life.
- (2) **Ignore probability:** This analysis does not look to the probability of changes in the variables

Question 8

The initial investment outlay for a capital investment project consists of ₹ 150 lacs for Plant & machinery and ₹ 60 lacs for Working Capital. Other details are summarized below:

Sales–1.5 lakh units of output per year for years 1 to 5 Selling Price–120 per unit of output

Variable cost–60 per unit of output

Fixed overheads (excluding depreciation)–22.5 lakhs per year for years 1 to 5

Salvage value of Plant & machinery Equal to the Written Down Value (WDV) at the end of year 5 Tax rate 40%

Time horizon 5 years

Post tax cut off rate 12%. PVAF (12%,5 Years) is 3. 6048.PV @12% 5th year is 0.5674.

Rate of depreciation 20% on the Straight-Line Method (SLM)

Required:

- a) INDICATE the financial viability of the project by calculating the NPV
- b) DETERMINE the sensitivity of the project's NPV under each of the following conditions:
 - (i) Decrease in selling price by 10%
 - (ii) Increase in variable cost by 10%
 - (iii) Increase in cost of Plant & machinery by 10%

(MTP 10 Marks Oct'22)

Answer:

a) Calculation of Cash Flow After Tax (CFAT) in original scenario

Sr. No.	Particulars	
1	Sales units	1,50,000
		(₹)
2	Sale Price pu	120
3	Sales	1,80,00,000
4	Variable Cost pu.	60
5	Variable Cost	90,00,000
6	Contribution (3-4)	90,00,000
7	Fixed OH (Excluding Depreciation)	22,50,000
8	Depreciation	30,00,000
9	EBIT or PBT (6-7-8)	37,50,000
10	Tax@40%	15,00,000
11	Profit After Tax (PAT)	22,50,000
12	Add: Depreciation	30,00,000
13	CFAT	52,50,000

Calculation of NPV in original Scenario

Years	Particulars	Cash Flows	PVF	PV
0	Initial Investment	(1,50,00,000)	1	(1,50,00,000)
0	Initial WC introduced	(60,00,000)	1	(60,00,000)
1 to 5	CFAT	52,50,000	3.6048	189,25,075
5	WC released	60,00,000	0.5674	34,04,561
	NPV			13,29,636

Since the NPV of the project is Positive the project is viable.

b) Sensitivity Analysis of the project under various conditions

Sr. No	Particulars	(i) Selling Price reduced by 10%	(ii) Variable Cost increased by 10%	(iii) Plant & Machinery cost increased by 10%
1	Sales units	1,50,000	1,50,000	1,50,000
		₹	₹	₹
2	Sale Price p.u.	108	120	120
3	Sales	162,00,000	180,00,000	180,00,000
4	Variable Cost p.u.	60	66	60
5	Variable Cost	90,00,000	99,00,000	90,00,000
6	Contribution (3-4) [or Contribution per unit x 1,50,000 units]	72,00,000	81,00,000	90,00,000
7	Fixed OH (Excluding Depreciation)	22,50,000	22,50,000	22,50,000
8	Depreciation	30,00,000	30,00,000	33,00,000
9	EBIT or PBT (6-7-8)	19,50,000	28,50,000	34,50,000
10	Tax	7,80,000	11,40,000	13,80,000
11	PAT	11,70,000	17,10,000	20,70,000
12	Add: Depreciation	30,00,000	30,00,000	33,00,000
13	CFAT	41,70,000	47,10,000	53,70,000
14	PV of CFAT (CFAT x 3.6048)	150,31,917	169,78,496	193,57,648
15	WC released (60,00,000 x 0.5674)	34,04,561	34,04,561	34,04,561
16	Initial Investment	(1,50,00,000)	(1,50,00,000)	(1,50,00,000)
17	Initial WC introduced	(60,00,000)	(60,00,000)	(60,00,000)
18	NPV (14+15-16-17)	(25,63,522)	(6,16,943)	2,62,209
19	% Change in NPV (Based on original NPV (13,29,636))	-292.80%	-146.40%	-80.28%

From the above calculations it can be seen that change in selling price is most sensitive and has the maximum effect on the NPV.

Question 9

Based on the details given below, you are required to UNDERTAKE NPV sensitivity analysis for the factors Sales Price, Sales units, Variable cost, Fixed Cost and Initial Investment for a 10% adverse variation in each of the mentioned factors Assume straight line depreciation is allowed for tax purpose:

Initial Investment	₹ 15,00,000
Tenure of Project (Years)	4
Sales Units	6000
Sales Price p.u.	₹ 250
Variable Cost p.u.	₹ 80
Fixed Cost	₹ 2,00,000
Tax Rate	30%
Salvage Value	₹ 1,50,000
Cost of Capital	14%

Use the below PV factors for calculation purpose

Year	0	1	2	3	4
PVF @ 14%	1.00	0.8772	0.7695	0.6750	0.5921

(MTP 10 Marks Apr' 23)

Answer:

Computation of CFAT (year 1 to year 4)

Sr. No.	Particulars	Original Case	Sales Units reduced by 10%	SP reduced by 10%	Variable Cost Increased by 10%
A	Sale Price p.u.	₹ 250	₹ 250	₹ 225	₹ 250
B	Sale units	6000	5400	6000	6000
C	Sales (A × B)	₹ 15,00,000	₹ 13,50,000	₹ 13,50,000	₹ 15,00,000
D	Variable Cost p.u.	₹ 80	₹ 80	₹ 80	₹ 88
E	Variable Cost (B × D)	₹ 4,80,000	₹ 4,32,000	₹ 4,80,000	₹ 5,28,000
F	Contribution (C – E)	₹ 10,20,000	₹ 9,18,000	₹ 8,70,000	₹ 9,72,000
G	Less: Fixed Cost	₹ -2,00,000	₹ -2,00,000	₹ -2,00,000	₹ -2,00,000
H	PBDT (F-G)	₹ 8,20,000	₹ 7,18,000	₹ 6,70,000	₹ 7,72,000
I	Less: Depreciation				
	$\frac{(15,00,000 - 1,50,000)}{4}$	₹ -3,37,500	₹ -3,37,500	₹ -3,37,500	₹ -3,37,500

	<u>(16,00,000 - 1,50,000)</u> 4	-	-	-	-
J	PBT	₹ 4,82,500	₹ 3,80,500	₹ 3,32,500	₹ 4,34,500
K	Less: Taxes @ 30%	₹ -1,44,750	₹ -1,14,150	₹ -99,750	₹ -1,30,350
L	PAT	₹ 3,37,750	₹ 2,66,350	₹ 2,32,750	₹ 3,04,150
M	Add: Depreciation	₹ 3,37,500	₹ 3,37,500	₹ 3,37,500	₹ 3,37,500
N	CFAT	₹ 6,75,250	₹ 6,03,850	₹ 5,70,250	₹ 6,41,650

Sr. No.	Particulars	Fixed Cost increased by 10%	Initial Investment increased by 10%
A	Sale Price p.u.	₹ 250	₹ 250
B	Sale units	6000	6000
C	Sales (A x B)	₹ 15,00,000	₹ 15,00,000
D	Variable Cost p.u.	₹ 80	₹ 80
E	Variable Cost (B x D)	₹ 4,80,000	₹ 4,80,000
F	Contribution (C - E)	₹ 10,20,000	₹ 10,20,000
G	Less: Fixed Cost	₹ -2,20,000	₹ -2,00,000
H	PBDT (F - G)	₹ 8,00,000	₹ 8,20,000
I	Less: Depreciation		
	<u>(15,00,000 - 1,50,000)</u> 4	₹ -3,37,500	-
	<u>(16,00,000 - 1,50,000)</u> 4	-	₹ -3,62,500
J	PBT	₹ 4,62,500	₹ 4,57,500
K	Less: Taxes @ 30%	₹ -1,38,750	₹ -1,37,250
L	PAT	₹ 3,23,750	₹ 3,20,250
M	Add: Depreciation	₹ 3,37,500	₹ 3,62,500
N	CFAT	₹ 6,61,250	₹ 6,82,750

Calculation of NPV and sensitivity analysis

Sr. No.	Particulars	Original Case	Sales Units reduced by 10%	SP reduced by 10%	Variable Cost Increased by 10%
I	CFAT	₹ 6,75,250	₹ 6,03,850	₹ 5,70,250	₹ 6,41,650
II	PVAF @14%	2.9138	2.9138	2.9138	2.9138
III	PV of CFATs (I x II)	₹ 19,67,543	₹ 17,59,498	₹ 16,61,594	₹ 18,69,640
IV	Salvage	₹ 1,50,000	₹ 1,50,000	₹ 1,50,000	₹ 1,50,000

V	PVF @ 14%	0.5921	0.5921	0.5921	0.5921
VI	PV of Salvage (IV x V)	₹ 88,815	₹ 88,815	₹ 88,815	₹ 88,815
VII	Initial Investment	₹ 15,00,000	₹ 15,00,000	₹ 15,00,000	₹ 15,00,000
VIII	NPV (III + VI - VII)	₹ 5,56,358	₹ 3,48,313	₹ 2,50,409	₹ 4,58,455
IX	Sensitivity (Case NPV-Original NPV) / Original NPV		-37.39%	-54.99%	-17.60%
				Mast sensitive	

Sr. No.	Particulars	Fixed Cost increased by 10%	Initial Investment increased by 10%
I	CFAT	₹ 6,61,250	₹ 6,82,750
II	PVAF @ 14%	2.9138	2.9138
III	PV of CFATS (I x II).	₹ 19,26,750	₹ 19,89,397
IV	Salvage	₹ 1,50,000	₹ 1,50,000
V	PVF @ 14%	0.5921	0.5921
VI	PV of Salvage (IV x V)	₹ 88,815	₹ 88,815
VII	Initial Investment	₹ 15,00,000	₹ 16,50,000
VIII	NPV (III + VI - VII)	₹ 5,15,565	₹ 4,28,212
IX	Sensitivity(Case NPV - Original NPV)/ Original NPV)	-7.33%	-23.03%
		Least sensitive	

Question 10

Consider the below mentioned table for the risk premium and the coefficient of variation

Co-efficient of Variation	Risk Premium
0	0
0 to 0.25	2%
0.25 to 0.50	3%
0.50 to 0.75	4%
0.75 to 1	6%

A company is evaluating two projects with an initial investment of ₹ 1,50,000 for each project with cash inflow from them occurring at the end of 5th Year which depends on possible scenarios prevailing during the investment period. The details of the same are as follows:

Scenario	Project X		Project Y	
	Cash Flow (₹)	Probability	Cash Flow (₹)	Probability
Superb	5,00,000	0.20	4,00,000	0.30
Better	3,00,000	0.30	3,50,000	0.20
Moderate	1,50,000	0.15	2,50,000	0.20
Bad	50,000	0.20	75,000	0.20
Worse	10,000	0.15	5,000	0.10

If the ongoing government bond yield is 6%, identify WHICH project to be undertaken.

(RTP Nov' 22)

Answer:

A. Calculation of Expected Cash Flow, Standard Deviation & Co-efficient of variation

(a) Project X

Probability (P)	Cash Flows (x)	Px	P.x2
0.20	5,00,000	1,00,000	50,00,00,00,000
0.30	3,00,000	90,000	27,00,00,00,000
0.15	1,50,000	22,500	3,37,50,00,000
0.20	50,000	10,000	50,00,00,000
0.15	10,000	1,500	1,50,00,000
		2,24,000	80,89,00,00,000

$$\text{Expected Cash flow} = \sum P.x = 2,24,000 = \bar{X}$$

$$\begin{aligned} \text{Standard Deviation} &= \sqrt{\sum P.x^2 - (\sum P.x)^2} \\ &= \sqrt{80,89,00,00,000 - (2,24,000)^2} \\ &= \sqrt{30,71,40,00,000} \\ \sigma_x &= 1,75,254 \end{aligned}$$

$$\begin{aligned} \text{Co-efficient of variation} &= \frac{\sigma_x}{\bar{X}} = \frac{1,75,254}{2,24,000} \\ \text{COV}_x &= 0.7824 \end{aligned}$$

(b) Project Y

Probability (P)	Cash Flows (y)	P.y	P.y2
0.3	4,00,000	1,20,000	48,00,00,00,000
0.2	3,50,000	70,000	24,50,00,00,000
0.2	2,50,000	50,000	12,50,00,00,000
0.2	75,000	15,000	1,12,50,00,000
0.1	5,000	500	25,00,000
		2,55,500	86,12,75,00,000

$$\text{Expected Cash flow} = \sum P.x = \bar{y} = 2,55,500$$

$$\begin{aligned}\text{Standard Deviation} &= \sqrt{\sum P.y^2 - (\sum P.y)^2} \\ &= \sqrt{86,12,75,00,000 - (2,55,500)^2}\end{aligned}$$

$$\sigma_y = 1,44,386$$

$$\text{Co-efficient of variation} = \frac{\sigma_y}{\bar{y}} = \frac{1,44,386}{2,55,500}$$

$$\text{COV}_y = 0.5651$$

B. Calculation of Risk Adjusted Discount Rate

Project	COV	Risk Premium	RADR
X	0.7824	6%	6% + 6% = 12%
Y	0.5651	4%	6% + 4% = 10%

C. Calculation of NPV

Year	Project X			Project Y		
	Cash Flows	PVF@ 12%	PV	Cash Flows	PVF@ 10%	PV
0	(1,50,000)	1	(1,50,000)	(1,50,000)	1	(1,50,000)
5	2,24,000	0.5674	1,27,098	2,55,500	0.6209	1,58,640
NPV			(22,902)			8,640

∴ NPV of project Y is higher, Project Y should be selected.

Question 11

Remi limited is a manufacturer of mobile phones in India. Currently the company is dependent on the foreign supplier for import of the battery. It is considering investment of ₹ 55,00,000 in a new machine for manufacturing battery of mobile phones. The expected life of machine is 5 years and has no scrap value. It is expected that 3 lakhs units will be produced and sold each year at a selling price of ₹ 20 per unit. The estimated variable costs and annual fixed costs will be ₹ 12 per unit and ₹ 6,00,000 respectively. Consider 14% to be an appropriate cost of capital. Ignore the taxation and depreciation.

CALCULATE the expected net present value of the project.

You are also REQUIRED to measure the sensitivity of the projects NPV to a 10% decrease in the project variables sale price per unit and sales volume and 10% increase in Fixed Cost.

(RTP May 23)

Answer:

Calculation of NPV and sensitivity for different scenarios

	Original Scenario	Sale Price reduced by 10%	Sales Volume reduced by 10%	Fixed Cost increased by 10%
Units	300000	300000	270000	300000
Sale Price p.u.	₹ 20	₹ 18	₹ 20	₹ 20
VC p.u.	₹ 12	₹ 12	₹ 12	₹ 12
Contribution p.u.	₹ 8	₹ 6	₹ 8	₹ 8
Contribution	₹ 24,00,000	₹ 18,00,000	₹ 21,60,000	₹ 24,00,000
Less: Fixed Cost	₹ 6,00,000	₹ 6,00,000	₹ 6,00,000	₹ 6,60,000
Profit/Cash Flows	₹ 18,00,000	₹ 12,00,000	₹ 15,60,000	₹ 17,40,000
PVAF (14%, 5 years)	3,4331	3.4331	3.4331	3.4331
PV of Cash Inflows	₹ 61,79,546	₹ 41,19,697	₹ 53,55,606	₹ 59,73,561
Less: Initial Investment	₹ (55,00,000)	₹ (55,00,000)	₹ (55,00,000)	₹ (55,00,000)
NPV	₹ 6,79,546	₹ (13,80,303)	₹ (1,44,394)	₹ 4,73,561
%Change in NPV	NA	(303.12%)	(121.25%)	(30.31%)
Sensitivity	NA	30.3121	12.1249	3.0312
		times	times	times

Sales Price is the most sensitive variable of all and needs to be given due attention during the life of the project.

Question 12

K.P. Ltd. is investing ₹ 50 lakhs in a project. The life of the project is 4 years. Risk free rate of return is and risk premium is 6%, other information is as under:

Sales of 1st year	₹ 50 lakhs
Sales of 2nd year	₹ 60 lakhs
Sales of 3rd year	₹ 70 lakhs
Sales of 4th year	₹ 80 lakhs
P/V Ratio (same in all the years)	50%
Fixed Cost (Excluding Depreciation) of 1st year	₹ 10 lakhs
Red Cost (Excluding Depreciation) of 2nd year	₹ 12 lakhs
Fixed Cost (Excluding Depreciation) of 3rd year	₹ 14 lakhs
Fixed Cost (Excluding Depreciation) of 4th year	₹ 16 lakhs

Ignoring interest and taxes,

You are required to calculate NPV of given project on the basis of Risk Adjusted Discount Rate.

Discount factor @ 6% and 12% are as under:

Year	1	2	3	4
Discount Factor @ 6%	0.943	0.890	0.840	0.792
Discount Factor@ 12%	0.893	0.797	0.712	0.636

(PYP 5 Marks, July'21)

Answer:

Calculation of Cash Flow

Year	Sales (₹ in Lakhs) (A)	P/V ratio (B)	Contribution (₹ in Lakhs) (C) = (A x B)	Fixed Cost (₹ in Lakhs) (D)	Cash Flows (₹ in lakhs) (E) = (C-D)
1	50	50%	25	10	15
2	60	50%	30	12	18
3	70	50%	35	14	21
4	80	50%	40	16	24

When risk-free rate is 6% and the risk premium expected is 6%, then risk adjusted discount rate would be $6\% + 6\% = 12\%$,

Calculation of NPV using Risk Adjusted Discount Rate (@12%)

Year	Cash flows (₹ in Lakhs)	Discounting Factor @12%	Present Value of Cash Flows (₹ in lakhs)
1	15	0.893	13.395
2	18	0.797	14.346
3	21	0.712	14.952
4	24	0.636	15.264
Total of present value of Cash flow			57.957
Less: Initial Investment			50.000
Net Present value (NPV)			7.957

Question 13

Kanoria Enterprises wishes to evaluate two mutually exclusive projects X and Y. The particulars are as under:

	Project X (₹)	Project Y (₹)
Initial Investment	1,20,000	1,20,000
Estimated cash inflows (per annum for 8 years)		
Pessimistic	26,000	12,000
Most Likely	28,000	28,000
Optimistic	36,000	52,000

The cut off rate is 14%. The discount factor at 14% are:

Year	1	2	3	4	5	6	7	8	9
Discount factor	0.877	0.769	0.675	0.592	0.519	0.456	0.400	0.351	0.308

Advise management about the acceptability of projects X and Y.

(PYP 5 Marks, May' 19)

Answer:

The possible outcomes of Project x and Project y are as follows:

Estimates	Project X				Project Y			
	Estimated Annual Cash inflows (₹)	PVF @14% for 8 years	PV of Cash flow (₹)	NPV (₹)	Estimated Annual Cash Inflows (₹)	PVF @ 14% for 8 years	PV of Cash flow (₹)	NPV (₹)
Pessimistic	26,000	4.639	1,20,614	614	12,000	4.639	55,668	(-64,332)
Most likely	28,000	4.639	1,29,892	9,892	28,000	4.639	1,29,892	9,892
Optimistic	36,000	4.639	2,41,228	47,004	52,000	4.639	2,41,228	1,21,228

In pessimistic situation project X will be better as it gives low but positive NPV whereas Project Y yield highly negative NPV under this situation. In most likely situation both the project will give same result. However, in optimistic situation Project Y will be better as it will give very high NPV. So, project X is a riskless project as it gives positive NPV in all the situation whereas Y is a risky project as it will result into negative NPV in pessimistic situation and highly positive NPV in optimistic situation. So acceptability of project will largely depend on the risk taking capacity (Risk seeking/ Risk aversion) of the management.

Question 14

P. Ltd. is considering a project with the following details:

Initial Project Cost	₹1,00,000			
Annual Cash Inflow (₹)	1	2	3	4
	30,000	40,000	50,000	60,000
Project Life (Years)	4			
Cost of Capital	10%			

MEASURE the sensitivity of the project to change in initial project cost and Annual cash inflows: (considering each factor at a time) such that NPV become zero.

IDENTIFY which of the two factors; the project is most sensitive to affect the acceptability of the project

Year	1	2	3	4	5
PVIF _{0.10, t}	0.909	0.826	0.751	0.683	0.621

(PYP 5 Marks May'22)

Answer:

Computation of Net Present Value (NPV):

Year	PVF@ 10%	Original Cash Flows (₹)	PV (₹)	PV (₹)
0	1	(1,00,000)		(1,00,000)
1	0.909	30,000	27,270	
2	0.826	40,000	33,040	
3	0.751	50,000	37,550	
4	0.683	60,000	40,980	1,38,840
NPV				38,840

Determination of the most Sensitive factor:

(i) **Sensitivity Analysis w.r.t. Initial Project cost (such that NPV becomes zero):**

NPV of the project would be zero when the initial project cost is increased by ₹ 38,840.

∴ Percentage change in Initial project cost

$$\frac{₹ 38,840}{10,00,000} \times 100 = 38.84\%$$

(ii) **Sensitivity Analysis w.r.t. Annual Cash inflows (such that NPV becomes zero):**

NPV of the project would be zero when the Annual cash inflows is decreased by ₹ 38,840.

$$\therefore \text{Percentage change in the Annual cash inflows} = \frac{₹ 38,840}{1,38,480} \times 100 = 27.97\%$$

Conclusion: Annual cash inflows factor is the most sensitive as only a change beyond 27.97% in savings makes the project unacceptable.

Question 15

A company wants to invest in a project. This requires an initial investment of ₹ 4,50,000. Salvage value after estimated useful life of 5 years is ₹50,000. Other details of project are as follows:

	Worst case	Most likely	Best case
Contribution (₹)	3,30,000	5,40,000	6,31,250
Fixed cost (excluding depreciation) (₹)	75,000	1,50,000	2,00,000

Tax rate is 40%. Expected cost of capital of project is 12%. Ignore tax on capital gain.

(i) Calculate NPV in each scenario:

The company is certain about most likely result in first two years, but uncertain about remaining period. In such a situation, calculate NPV expecting worst case scenario during next two years and best-case scenario in the remaining period.

(PYP 5 Marks May '23)

Years	1	2	3	4	5
PVIF _{0.12,t}	0.893	0.797	0.712	0.636	0.567
PVIFA _{0.12,t}	0.893	1.690	2.402	3.038	3.605

Answer:

- (i) Initial Investment = ₹4,50,000
 Salvage Value = ₹ 50,000
 Useful Life = 5 years

Calculation of cash flow in each scenario

Particulars	Scenario		
	Worst case	Most Likely	Best case
Contribution	3,30,000	5,40,000	6,31,250
Less: Fixed Cost	75,000	1,50,000	2,00,000
Less: Depreciation	80,000	80,000	80,000
Profit before tax	1,75,000	3,10,000	3,51,250
Less: Taxes	70,000	1,24,000	1,40,500
Profit after tax	1,05,000	1,86,000	2,10,750
Add: Depreciation	80,000	80,000	80,000
Cash Flow After Tax	1,85,000	2,66,000	2,90,750

The possible outcomes will be as follows:

Year	PVF@ 12%	Worst Case		Most likely		Best case	
		Cash Flow	PV	Cash Flow	PV	Cash Flow	PV
0	1	(4,50,000)	(4,50,000)	(4,50,000)	(4,50,000)	(4,50,000)	(4,50,000)
1-5	3.605	1,85,000	6,66,925	2,66,000	9,58,930	2,90,750	10,48,153.75
5	0.567	50,000	28,350	50,000	28,350	50,000	28,350
NPV			2,45,275		5,37,280		6,26,503.75

Alternative presentation

(i) Computation of NPV of different scenarios

Year	DF	Worst case		Most-likely case		Best case	
		CF	DCF	CF	DCF	CF	DCF
0	1.000	(450000)	(450000)	(450000)	(450000)	(450000)	(450000)
1	0.893	185000	165205	266000	237538	290750	259640
2	0.797	185000	147445	266000	212002	290750	231728
3	0.712	185000	131720	266000	189392	290750	207014
4	0.636	185000	117660	266000	169176	290750	184917
5	0.567	185000	104895	266000	150822	290750	164855
5	0.567	50000	28350	50000	28350	50000	28350
	NPV		2,45,275		5,37,280		6,26,504

- (i) If the company is certain about the most likely result in first two years but uncertain about the remaining period, then, NPV expecting worst case scenario during next two years and best-case scenario in remaining period will be as follows:

$$\begin{aligned}
 &= -4,50,000 + \frac{2,66,000}{(1 + 0.12)} + \frac{2,66,000}{(1 + 0.12)^2} + \frac{1,85,000}{(1 + 0.12)^3} + \frac{1,85,000}{(1 + 0.12)^4} + \\
 &+ \frac{2,90,750}{(1 + 0.12)^5} + \frac{50,000}{(1 + 0.12)^5} \\
 &= -4,50,000 + (2,66,000 \times 0.893) + (2,66,000 \times 0.797) + (1,85,000 \times 0.712) \\
 &+ (1,85,000 \times 0.636) + (2,90,750 \times 0.567) + (50,000 \times 0.567) \\
 &= -4,50,000 + 2,37,538 + 2,12,002 + 1,31,720 + 1,17,660 + 1,64,855 + 28,350 \\
 &= ₹4,42,125
 \end{aligned}$$

Alternative presentation

(iii) Computation of NPV on the basis of fixed scenarios

Years	Scenarios	DF	CF	DCF (DF*CF)
0	Initial Outflow	1.000	(450000)	(450000)
1	Most-likely case	0.893	266000	237538
2	Most-likely case	0.797	266000	212002
3	Worst case	0.712	185000	131720
4	Worst case	0.636	185000	117660
5	Best case	0.567	290750	164855
5	Salvage	0.567	50000	28350
				4,42,125

(All figures are in ₹)

Question 16

R Ltd. is considering a project with the following Cash flows:

in ₹

Years	Cost of Plant	Recurring Cost	Savings
0	20,000		
1		8,000	24,000
2		10,000	28,000

The cost of capital is 9%

Evaluate the sensitivity of the project in respect of all factors except time such that:

- (i) NPV become zero and
- (ii) adversely varying factors value by 10%

The P. V. factor at 9% are as under:

Year	Factor
0	1
1	0.917
2	0.842

Note: Round off calculation upto 2 decimal points.

(MTP 8 Marks April'24)

Answer:

Working Note:

Year 1	Running Cost	₹ 8,000 × 0.917	=	(₹ 7,336)
	Savings	₹ 24,000 × 0.917	=	₹ 22,008
Year 2	Running Cost	₹ 10,000 × 0.842	=	(₹ 8,420)
	Savings	₹ 28,000 × 0.842	=	₹ 23,576
				₹ 29,828
Year 0	Less: P. V. of Cash Outflow	₹ 20,000 × 1		₹ 20,000
	NPV			₹ 9,828

(i) Sensitivity Analysis (by making NPV Zero)

(1) Increase of Plant Value by ₹ 9,828

$$\therefore \frac{9,829}{20,000} \times 100 = 49.14\%$$

(2) Increase of Running Cost by ₹ 9,828

$$\therefore \frac{9828}{7336 + 8420} = \frac{9828}{15756} \times 100 = 62.38\%$$

(3) Fall in Savings by ₹ 9,828

$$\therefore \frac{9,828}{22,008 + 23,576} = \frac{9,828}{45,584} \times 100 = 21.56\%$$

Hence, savings factor is the most sensitive to affect the acceptability of the project as in comparison of other two factor a slight % change in this fact shall more affect the NPV than others

(i) **Sensitivity Analysis if there is a variation of 10% in the factors.**

(1) If the initial project cost is varied adversely by say 10%

NPV (Revised) (₹ 9,828 - ₹ 2,000) = ₹ 7,828

$$\text{Change in NPV} = \frac{(\text{₹ } 9,828 - \text{₹ } 7,828)}{\text{₹ } 9,828} = 20.35\%$$

(2) If Annual Running Cost is varied by say 10%

NPV (Revised) (₹ 9828 - ₹ 800 × 0.917 = ₹ 1000 × 0.843)

= ₹ 9828 - ₹ 733.6 - ₹ 843

= ₹ 8251.4

$$\text{Change in NPV} = \frac{\text{₹ } 9,828 - \text{₹ } 8251.4}{\text{₹ } 9,828} = 16.14\%$$

(3) If Savings is varied by say 10%

NPV (Revised) (₹ 9,828 - ₹ 2400 × 0.917 - ₹ 2800 × 0.843)

= ₹ 9,828 - ₹ 2,200.80 - ₹ 2,360.40 = ₹ 5,266.80

$$\text{Change in NPV} = \frac{\text{₹ } 9,828 - \text{₹ } 5266.80}{\text{₹ } 9,828} = 46.41\%$$

Hence, savings factor is the most sensitive to affect the acceptability of the project