

$$\therefore \frac{4,914}{10,000} \times 100 = 49.14\%$$

(ii) Increase of Running Cost by ₹ 4,914

$$\frac{4,914}{3,668 + 4,210} = \frac{4,914}{7,878} \times 100 = 62.38\%$$

(iii) Fall in Saving by ₹ 4,914

$$\frac{4,914}{11,004 + 11,788} = \frac{4,914}{22,792} \times 100 = 21.56\%$$

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

Question – 13

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:

Years	Cost of Plant
0	1
1	0.917
2	0.842

Note: Round off calculation upto 2 decimal points.

(MTP April – 2024)**Solution:****Working Note:**

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

(i) Sensitivity Analysis (by making NPV Zero)**(1) Increase of Plant Value by ₹ 9,828**

$$\therefore \frac{9,828}{20,000} \times 100 = 49.14\%$$

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

$$\frac{9,828}{7,336 + 8,420} = \frac{9,828}{15,756} \times 100 = 62.38\%$$

(3) Fall in Saving by ₹ 9,828

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

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

(ii) 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 × 0.842)

$$= \text{₹ 9,828} - \text{₹ 733.60} - \text{₹ 842} = \text{₹ 8,252.40}$$

$$\text{Change in NPV} = \frac{\text{₹ 9,828} - \text{₹ 8,252.40}}{\text{₹ 9,828}} = 16.03\%$$

(3) If Saving is varied by say 10%.

NPV (Revised) (₹ 9,828 – ₹ 2400 × 0.917 – ₹ 2800 × 0.842)

$$= \text{₹ 9,828} - \text{₹ 2,200.80} - \text{₹ 2,357.60} = \text{₹ 5,269.60}$$

$$\text{Change in NPV} = \frac{\text{₹ 9,828} - \text{₹ 5,269.60}}{\text{₹ 9,828}} \times 100 = 46.38\%$$

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

Question – 14

The Easygoing Company Limited is considering a new project with initial investment, for a product “Survival”. It is estimated that IRR of the project is 16% having an estimated life of 5 years.

Financial Manager has studied that project with sensitivity analysis and informed that annual fixed cost sensitivity is 7.8416%, whereas cost of capital (discount rate) sensitivity is 60%.

Other information available are:

Profit Volume Ratio (P/V) is 70%,

Variable cost ₹ 60/- per unit

Annual Cash Flow ₹ 57,500/-

Ignore Depreciation on initial investment and impact of taxation. Calculate

- (i) Initial Investment of the Project
- (ii) Net Present Value of the Project
- (iii) Annual Fixed Cost
- (iv) Estimated annual unit of sales
- (v) Break Even Units

Cumulative Discounting Factor for 5 years

8%	9%	10%	11%	12%	13%	14%	15%	16%	17%	18%
3.339	3.890	3.791	3.696	3.605	3.517	3.433	3.352	3.274	3.199	3.127

(SM TYK – 12)

Solution:

(i) Initial Investment

IRR = 16% (Given)

At IRR, NPV shall be zero, therefore

$$\begin{aligned}
 \text{Initial Cost of Investment} &= \text{PVAF (16\%, 5)} \times \text{Cash Flow (Annual)} \\
 &= 3.274 \times ₹ 57,500 \\
 &= ₹ 1,88,255
 \end{aligned}$$

(ii) Net Present Value (NPV)

Let Cost of Capital be X, then $\frac{16-X}{X} = 60\%$ X = 10%

Thus NPV of the project

$$\begin{aligned}
 &= \text{Annual Cash Flow} \times \text{PVAF (10\%, 5)} - \text{Initial Investment} \\
 &= ₹ 57,500 \times 3.791 - ₹ 1,88,255 \\
 &= ₹ 2,17,982.50 - ₹ 1,88,255 \\
 &= ₹ 29,727.50
 \end{aligned}$$

(iii) Annual Fixed Cost

Alternative I

Let change in the Fixed Cost which makes NPV zero is X. Then,

$$₹ 29,727.50 - 3.791X = 0$$

$$\text{Thus } X = ₹ 7,841.60$$

Let original Fixed Cost be Y then,

$$Y \times 7.8416\% = ₹ 7,841.60$$

$$Y = ₹ 1,00,000$$

Thus Fixed Cost is equal to ₹ 1,00,000

Alternative II

$$\text{Sensitivity in FC} = \frac{\text{NPV}}{\text{PV of FC}}$$

$$7.8416\% = \frac{29,727.50}{\text{PV of FC}}$$

$$\text{PV of FC} = ₹ 3,79,100$$

$$\text{PV of FC} = \text{Annual FC} \times \text{PVAF}$$

$$3,79,100 = X \times 3.791$$

$$X = ₹ 1,00,000$$

(iv) Estimated Annual Units of Sales

$$\text{Selling price per unit} = \frac{₹ 60}{100\% - 70\%} = ₹ 200$$

$$\frac{\text{Annual Cash Flow} + \text{Fixed Cost}}{\text{P/V Ratio}} = \text{Sales Value}$$

$$\frac{₹ 57,500 + ₹ 1,00,000}{0.70} = ₹ 2,25,000$$

$$\text{Sales in Units} = \frac{₹ 2,25,000}{₹ 200} = 1,125 \text{ units}$$

(v) Break Even Units

$$\frac{\text{Fixed Cost}}{\text{Contribution Per Unit}} = \frac{1,00,000}{140} = 714.285 \text{ units}$$

Question – 15

Unnat Ltd. is considering investing ₹ 50,00,000 in a new machine. The expected life of machine is five years and has no scrap value. It is expected that 2,00,000 units will be produced and sold each year at a selling price of ₹ 30.00 per unit. It is expected that the variable costs to be ₹ 16.50 per unit and fixed costs to be ₹ 10,00,000 per year. The cost of capital of Unnat Ltd. is 12% and acceptable level of risk is 20%.

You are required to measure the sensitivity of the project's net present value to a change in the following project variables:

- Sale Price;
- Sales Volume;
- Variable Cost;
- On further investigation it is found that there is a significant chance that the expected sales volume of 2,00,000 units per year will not be achieved. The sales manager of Unnat Ltd. suggests that sales volumes could depend on expected economic states which could be assigned the following probabilities:

State of Economy	Annual Sales (in Units)	Probability
Poor	1,75,000	0.30
Normal	2,00,000	0.60
Good	2,25,000	0.10

Calculate expected net present value of the project and give your decision whether company should accept the project or not.

(SM TYK – 13)**Solution:****NPV Calculation**

$$\begin{aligned} \text{NPV} &= (30 - 16.50) \times 2,00,000 \text{ unit} \times 3.605 - 10,00,000 \times 3.605 - 50,00,000 \\ &= 13.50 \times 7,21,000 - 36,05,000 - 50,00,000 \end{aligned}$$

$$= ₹ 11,28,500$$

(a) Sales Price

Let assume contribution per unit be x

$$x \times 7,21,000 - 86,05,000 - 50,00,000 = 0$$

$$x = \frac{86,05,000}{7,21,000} = 11.93$$

$$\text{CPU} = \text{SP} - \text{VC}$$

$$11.93 = x - 16.50$$

$$x = ₹ 28.43$$

$$\begin{aligned} \text{Sensitivity} &= \frac{30 - 28.43}{30} \times 100 \\ &= 5.23\% \end{aligned}$$

Alternative

Let the sale price/Unit be S so that the project would break even with 0 NPV.

$$\therefore ₹ 50,00,000 = [2,00,000 (S - ₹ 16.50) - ₹ 10,00,000] \text{PVIAF } (12\%, 5)$$

$$₹ 50,00,000 = [2,00,000 S - ₹ 33,00,000 - ₹ 10,00,000] 3.605$$

$$₹ 50,00,000 = [2,00,000S - ₹ 43,00,000] 3.605$$

$$₹ 13,86,963 = 2,00,000S - ₹ 43,00,000$$

$$₹ 56,86,963 = 2,00,000S$$

S = ₹ 28.43 which represents a fall of $(30 - 28.43)/30$ or 0.0523 or 5.23%

(b) Sales Volume

Let assume present value of sales volume be x

$$13.50 x - 36,05,000 - 50,00,000 = 0$$

$$x = \frac{86,05,000}{13.50} = 6,37,407$$

$$\begin{aligned}\text{Sensitivity} &= \frac{7,21,000 - 6,37,407}{7,21,000} \times 100 \\ &= 11.59\%\end{aligned}$$

Alternative

Let V be the sale volume so that the project would break even with 0 NPV.

$$\therefore ₹ 50,00,000 = [V (₹ 30 - ₹ 16.50) - ₹ 10,00,000] \text{PVIAF} (12\%, 5)$$

$$₹ 50,00,000 = [V (₹ 13.50) - ₹ 10,00,000] \text{PVIAF} (12\%, 5)$$

$$₹ 50,00,000 = [₹ 13.50V - ₹ 10,00,000] 3.605$$

$$₹ 13,86,963 = ₹ 13.50V - ₹ 10,00,000$$

$$₹ 23,86,963 = ₹ 13.50V$$

V = 1,76,812 which represents a fall of $(2,00,000 - 1,76,812)/2,00,000$ or 0.1159 or 11.59%

(c) Variable Cost

Let assume variable cost per unit be x

$$\text{CPU} = \text{SP} - \text{VC}$$

$$11.93 = 30 - x$$

$$x = 18.07$$

$$\begin{aligned}\text{Sensitivity} &= \frac{18.07 - 16.50}{16.50} \times 100 \\ &= 9.51\%\end{aligned}$$

Alternative

Let the variable cost be V so that the project would break even with 0 NPV.

$$₹ 50,00,000 = [2,00,000 (₹ 30 - V) - ₹ 10,00,000] \text{PVIAF}(12\%, 5)$$

$$₹ 50,00,000 = [₹ 60,00,000 - 2,00,000 V - ₹10,00,000] 3.605$$

$$₹ 50,00,000 = [₹ 50,00,000 - 2,00,000 V] 3.605$$

$$₹ 13,86,963 = ₹ 50,00,000 - 2,00,000 V$$

$$₹ 36,13,037 = 2,00,000V$$

$V = ₹ 18.07$ which represents a fall of $(18.07 - 16.50)/16.50$ or 0.0951 or 9.51%

(d) Expected Net Present Value

$$(1,75,000 \times 0.30) + (2,00,000 \times 0.60) + (2,25,000 \times 0.10) = 1,95,000$$

$$\begin{aligned} \text{NPV} &= [1,95,000 \times ₹ 13.50 - ₹ 10,00,000] 3.605 - ₹ 50,00,000 \\ &= ₹ 8,85,163 \end{aligned}$$

Further NPV in worst and best cases will be as follows:

Worst Case:

$$[1,75,000 \times ₹ 13.50 - ₹ 10,00,000] 3.605 - ₹ 50,00,000 = - ₹ 88,188$$

Best Case:

$$[2,25,000 \times ₹ 13.50 - ₹ 10,00,000] 3.605 - ₹ 50,00,000 = ₹ 23,45,188$$

Thus, there are 30% chances that the rise will be a negative NPV and 70% chances of positive NPV. Since acceptable level of risk of Unnat Ltd. is 20% and there are 30% chances of negative NPV hence project should not be accepted.

Question – 16

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:

1. Calculate the NPV of the project.
2. Compute the impact on the project's NPV considering a 2.5 per cent adverse variance in each variable. Which variable is having maximum effect?

Consider Life of the project as 3 years.

Solution:

1. Calculation of Net Cash Inflow per Year

	Particulars	Amount (₹)
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 × 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.

2. Sensitivity Analysis considering 2.5% Adverse Variance in each variable

Particulars	Base	Initial capital cost increased to ₹ 410	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
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