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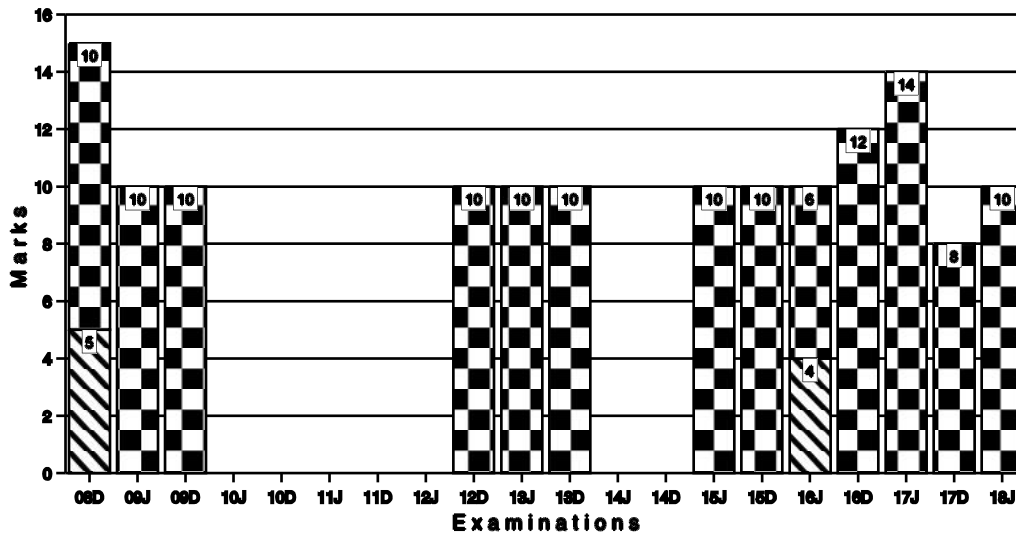
INVESTMENT DECISIONS, PROJECT PLANNING AND CONTROL

THIS CHAPTER INCLUDES

- Estimation of Project Cash Flow
- Relevant Cost Analysis for Projects
- Project Appraisal Methods – DCF and Non-DCF Techniques
- Capital Rationing
- Social Cost Benefit Analysis

Marks of Objective, Short Notes, Distinguish Between, Descriptive & Practical Questions

Legend



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DESCRIPTIVE QUESTIONS

2008 - Dec [4] (a) What are the main stages in the Capital Budgeting process? **(5 marks)**

Answer :

The main stages in capital budgeting process are:

1. Identify and select the project.
2. Compute the funds required for the project and stages of fund requirement.
3. Compute the various cash inflows under various conditions due to the project.
4. Finalise the project for implementation.
5. Decide control parameters for successful implementation of the project.
6. Monitor regularly the progress of the project.

2016 - June [8] Answer the following:

(d) What are the situations in which Net Present Value (NPV) and Internal Rate of Return (ITR) give conflicting results? **(4 marks)**

Answer:

NPV and IRR may give conflicting results in the evaluation of different projects, in the following situations:

- (i) **Initial Investment Disparity:** i.e. Different project sizes,
- (ii) **Project Life Disparity:** i.e. Difference in project lives,
- (iii) **Outflow Patterns:** i.e. when cash outflows arise at different points of time during the Project Life, rather than as Initial Investment (Time 0) only.
- (iv) **Cash Flow Disparity:** when there is a huge difference between initial CFAT and later years' CFAT. A project with heavy initial CFAT than compared to later years will have higher IRR and vice-versa.

PRACTICAL QUESTIONS

2008 - Dec [5] (b) XYZ Ltd. is considering two mutually-exclusive projects. Both require an initial cash outlay of ₹10,000 each for machinery and have a life of 5 years. The company's required rate of return is 10% and it pays tax at 50%. The projects will be depreciated on a straight-line basis. The net cash flows (before taxes) expected to be generated by the projects and the present value (PV) factor (at 10%) are as follows :

| | Year | | | | |
|--------------------|-------|-------|-------|-------|-------|
| | 1 | 2 | 3 | 4 | 5 |
| | ₹ | ₹ | ₹ | ₹ | ₹ |
| Project 1 | 4,000 | 4,000 | 4,000 | 4,000 | 4,000 |
| Project 1 | 6,000 | 3,000 | 2,000 | 5,000 | 5,000 |
| PV factor (at 10%) | 0.909 | 0.826 | 0.751 | 0.683 | 0.621 |

You are required to calculate

- (i) the Pay Back Period of each project;
- (ii) the NPV and the Profitability Index of each project. **(10 marks)**

Answer :

| Year | 1 | 2 | 3 | 4 | 5 |
|-----------------------|-------|-------|-------|--------|--------|
| Cash flows | 4,000 | 4,000 | 4,000 | 4,000 | 4,000 |
| Less : Depreciation | 2,000 | 2,000 | 2,000 | 2,000 | 2,000 |
| EBT | 2,000 | 2,000 | 2,000 | 2,000 | 2,000 |
| Less : tax at 50% | 1,000 | 1,000 | 1,000 | 1,000 | 1,000 |
| Net income | 1,000 | 1,000 | 1,000 | 1,000 | 1,000 |
| CASH flows after tax | 3,000 | 3,000 | 3,000 | 3,000 | 3,000 |
| Cumulative cash flows | 3,000 | 6,000 | 9,000 | 12,000 | 15,000 |

Payback period would be the time when initial investment is recovered in cash. The investment is ₹ 10,000. Payback period would be between 3 and

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4 years. By interpolation it would be 3.33 years.

| Year | 1 | 2 | 3 | 4 | 5 |
|-----------------------|-------|-------|-------|--------|--------|
| Cash flows | 6,000 | 3,000 | 2,000 | 5,000 | 5,000 |
| Less : Depreciation | 2,000 | 2,000 | 2,000 | 2,000 | 2,000 |
| EBT | 4,000 | 1,000 | 0 | 3,000 | 3,000 |
| Less : tax at 50% | 2,000 | 500 | 0 | 1,500 | 1,500 |
| Net income | 2,000 | 500 | 0 | 1,500 | 1,500 |
| CASH flows after tax | 4,000 | 2,500 | 2,000 | 3,500 | 3,500 |
| Cumulative cash flows | 4,000 | 6,500 | 8,500 | 12,000 | 15,500 |

Payback period would be between 3 and 4 years. By interpolation it would be 3.43 years.

2009 - June [5] (b) VEDIKA LTD. with a limited investment funds of ₹ 6,00,000 is evaluating the desirability of 5 (five) investment proposals.

The profiles are summarised below :

Project Investment Annual cash flow (after tax) Life (in years)

| | (₹) | (₹) | |
|---|----------|----------|----|
| M | 1,00,000 | 36,000 | 10 |
| N | 2,00,000 | 1,00,000 | 4 |
| O | 2,40,000 | 60,000 | 8 |
| P | 3,00,000 | 80,000 | 16 |
| Q | 4,00,000 | 60,000 | 25 |

Project N and Q are mutually exclusive. The cost of funds is 10 percent.

Required :

Find out the feasible combination of projects and rank them on the basis of Net Present Value (NPV).

Note : Extracted from the table:

| Year | 10 | 4 | 8 | 16 | 25 | |
|--------------|-------|-------|-------|-------|-------|---------------------------|
| PVIFA at 10% | 6.145 | 3.170 | 5.335 | 7.824 | 9.077 | (8 + 2 = 10 marks) |

Answer :

| Project | Investment | Cash flow | Annuity | PV (cash flow × annuity) | NPV (PV - invest.) |
|---------|------------|-----------|---------|--------------------------|--------------------|
| M | 1,00,000 | 36,000 | 6.145 | 2,21,220 | 1,21,220 |
| N | 2,00,000 | 1,00,000 | 3.170 | 3,17,000 | 1,17,000 |
| O | 2,40,000 | 60,000 | 5.335 | 3,20,100 | 80,100 |

| | | | | | |
|---|----------|--------|-------|----------|----------|
| P | 3,00,000 | 80,000 | 7.824 | 6,25,920 | 3,25,920 |
| Q | 4,00,000 | 60,000 | 9.077 | 5,44,620 | 1,44,620 |

Life of project is not relevant in determination of NPV.

Statement of feasible combination :

| Combination | Investment | NPV | Rank |
|-------------|------------|----------|------|
| M, N and P | 6,00,000 | 5,64,140 | 1 |
| M, N and O | 5,40,000 | 3,18,320 | 4 |
| O and P | 5,40,000 | 4,06,020 | 3 |
| M and Q | 5,00,000 | 2,65,840 | 5 |
| N and P | 5,00,000 | 4,42,920 | 2 |
| N and Q | 6,00,000 | 2,61,620 | 6 |

2009 - Dec [3] (b) ANKIT LTD. a manufacturing company produces 25,000 litres of special lubricants in its plant. The existing plant is not fully depreciated for tax purposes and has a book value of ₹ 3 lakh (it was bought for ₹ 6 lakh six years ago). The cost of the product is as under :

| | |
|-----------------|----------------|
| | Cost/litre (₹) |
| Variable Costs | 60.00 |
| Fixed Overheads | <u>15.00</u> |
| | <u>75.00</u> |

It is expected that the old machine can be used for further period of 10 years by carrying out suitable repairs at a cost of ₹ 2 lakh annually.

A manufacturer of machinery is offering a new machine with the latest technology at ₹ 10 lakh after trading off the old plant (machine) for ₹ 1 lakh. The projected cost of the product will then be :

| | |
|-----------------|----------------|
| | Cost/litre (₹) |
| Variable Costs | 45.00 |
| Fixed Overheads | <u>20.00</u> |
| | <u>65.00</u> |

The fixed overheads are allocations from other department plus the depreciation of plant and machinery.

The old machine can be sold for ₹ 2 lakh in the open market. The new machine is expected to last for 10 years at the end of which, its salvage value will be ₹ 1 lakh. Rate of corporate taxation is 50%. For tax purposes,

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the cost of the new machine and that of the old one may be depreciated in 10 years. The minimum rate of return expected is 10%.

It is also anticipated that in future the demand for the product will remain at 25,000 litres.

Advise whether the new machine can be purchased. Ignore capital gain taxes.

[Given : PVIFA (10%, 10 years) = 6.145, PVIF (10%, 10 years) = 0.386.]

(5 + 3 + 2 = 10 marks)

Answer :

ANKIT LTD.

Comparative Analysis:

| | Old Machine | New Machine | Differential Cash Flow on new machine (₹) Saving/(Extra Cost) ₹ |
|--|-------------|-------------|--|
| Production Ltrs. | 25,000 | 25,000 | |
| Variable Cost per Ltr. (₹) | 60 | 45 | |
| Total Variable Cost (₹) | 15,00,000 | 11,25,000 | 3,75,000 |
| Annual Cost of Repair (₹) | 2,00,000 | — | 2,00,000 |
| Depreciation (₹) | 30,000 | 1,00,000 | (70,000) |
| (10.00+1.00-1.00)/10 | | | |
| Total Saving | | | 5,05,000 |
| Less: Tax Saving (50%) | | | (2,52,500) |
| Add: Depreciation (not being cast outflow) | | | 70,000 |
| | | | 3,22,500 |

Present Value of Cash flow if new machine is taken:

| Year | | Cash Flow (₹) | PV Factor (at 10%) | Present Value (₹) |
|------|--|---------------|--------------------|-------------------|
| 0 | Outflow on new Machine (₹ 10 lakhs) | 10,00,000 | 1 | (10,00,000) |
| 1-10 | Annual Saving (as above) | 3,22,500 | 6.145 (Cum) | 19,81,762 |
| 10 | Salvage value of new machine | 1,00,000 | 0.386 | 38,600 |

10,20,362

Recommendation: Since NPV is positive, the new plant is to be acquired.
2012 - Dec [3] (a) A Company has developed a new toy which has been estimated to have a life cycle of 3 years. To manufacture the toy, the company will have to purchase a semi-automatic injection moulding machine at a cost of ₹ 8,60,000. The machine will have to be scrapped after 3 years at a salvage value of ₹ 1,10,000. Variable cost of producing the toy would be 40% of the sales price.

Fixed expenses, apart from depreciation will be ₹ 50,000 per year. Besides, advertising and selling expenses will have to be incurred at the rate of ₹ 1,00,000 in the first year, ₹ 1,50,000 in the second year and ₹ 50,000 in the third year. The following projection of sales have been made after evaluating the consumer demand:

| Probability | Estimated Sales in year (₹ lakhs) | | |
|-------------|-----------------------------------|--------|--------|
| | Year 1 | Year 2 | Year 3 |
| 0.3 | 12 | 25 | 10 |
| 0.6 | 7 | 17 | 15 |
| 0.1 | 2 | 9 | 4 |

The Company is subject to corporate tax rate of 30% and its cost of capital is 15%.

Prepare a schedule computing the probable sales of the new toy and estimated cash flows in each of the three years. Also determine net present value (NPV) of the proposal. Ignore tax on salvage value.

The present value of ₹ 1 earned at the year end discounted at 15%—

| Year 1 | Year 2 | Year 3 |
|--------|--------|--------|
| 0.87 | 0.756 | 0.658 |

(10 marks)

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Answer:
Schedule showing Sales:
(Amount in ₹ lakh)

| Probability | Year 1 | | Year 2 | | Year 3 | |
|-------------|--------|-----|--------|------|--------|------|
| 0.3 | x 12 | 3.6 | x 25 | 7.5 | x 10 | 3 |
| 0.6 | x 7 | 4.2 | x 17 | 10.2 | x 15 | 9 |
| 0.1 | x 2 | 0.2 | x 9 | 0.9 | x 4 | 0.4 |
| | | 8 | | 18.6 | | 12.4 |

Determination of estimated cash flow:
₹ (lakh)

| | Year 1 | Year 2 | Year 3 |
|--|--------|--------|--------|
| Probable Sales revenue | 8.00 | 18.60 | 12.40 |
| Less : Variable cost @ 40% | 3.20 | 7.44 | 4.96 |
| | 4.80 | 11.16 | 7.44 |
| Less : Depreciation ₹ (8,60,000 – 1,10,000) / 3 | 2.50 | 2.50 | 2.50 |
| Fixed cost | 0.50 | 0.50 | 0.50 |
| | 1.80 | 8.16 | 4.44 |
| Less : Advt. & Sales Exp. | 1.00 | 1.50 | 0.50 |
| Earning before Tax | 0.80 | 6.66 | 3.94 |
| Tax @ 30% | 0.24 | 2.00 | 1.18 |
| Earning after Tax | 0.56 | 4.66 | 2.76 |
| Total Cash flow after tax (add back Depreciation) | 3.06 | 7.16 | 5.26 |
| Add : salvage value | — | — | 1.10 |
| | 3.14 | 7.16 | 6.36 |

| Determination of NPV | CFAT | PV factor | Total PV |
|----------------------------------|------|-----------|----------|
| Year 1 | 3.06 | 0.870 | 2.662 |
| 2 | 7.16 | 0.756 | 5.413 |
| 3 | 6.36 | 0.658 | 4.185 |
| | | | 12.26 |
| Less : Cash outflow (Investment) | | | 8.60 |
| NPV | | | 3.66 |

2013 - June [3] (a) VEDAVYAS Ltd. is considering two mutually exclusive projects M and project N. The Finance Director thinks that the project with the higher NPV should be chosen, whereas the Managing Director thinks that the one with the higher IRR should be undertaken, especially as both projects have the same initial outlay and length of life. The company anticipates a cost of capital of 10% and the net after-tax cash flow of the projects are as follows:

| Year | 0 | 1 | 2 | 3 | 4 | 5 |
|----------------|------------|--------|----------|----------|----------|--------|
| Cash flows (₹) | | | | | | |
| Project M | (4,00,000) | 70,000 | 1,60,000 | 1,80,000 | 1,50,000 | 40,000 |
| Project N | (4,00,000) | | | | 8,000 | 8,000 |

You are required to:

- Calculate the NPV and IRR of each project.
- State with reasons, which project you would recommend.
- Explain the inconsistency in the ranking of the two projects.

Present value Table is given:

| Year | 0 | 1 | 2 | 3 | 4 | 5 |
|-------------|-------|-------|-------|-------|-------|-------|
| PVIF at 10% | 1.000 | 0.909 | 0.826 | 0.751 | 0.683 | 0.621 |
| PVIF at 20% | 1.000 | 0.833 | 0.694 | 0.579 | 0.482 | 0.402 |

((3 + 4) + 2 + 1 = 10 marks)

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Answer :

(i) Calculation of NPV and IRR

NPV of project M:

| Year | Cash Flows | Discount factor (10%) | Discounted values (₹) | Discount factor(20%) | Discounted values (₹) |
|------|------------|-----------------------|-----------------------|----------------------|-----------------------|
| 0 | (4,00,000) | 1.000 | (4,00,000) | 1.000 | (4,00,000) |
| 1 | 70,000 | 0.9.9 | 63,630 | 0.833 | 58,310 |
| 2 | 1,60,000 | 0.826 | 1,32,160 | 0.694 | 1,11,040 |
| 3 | 1,80,000 | 0.751 | 1,35,180 | 0.579 | 1,04,220 |
| 4 | 1,50,000 | 0.683 | 1,02,450 | 0.482 | 72,300 |
| 5 | 40,000 | 0.621 | 24,840 | 0.402 | 16,080 |
| NPV | | | 58,260 | | (38,050) |

IRR of Project M:

At 20% NPV is (-) 38,050 and at 10% NPV id 58,260

$$\therefore \text{IRR} = 10 + \frac{58260}{58260 + 38050} \times 10 = 10 + \frac{58260}{96310} \times 10 = 10 + 6.05 = 16.05\%$$

NPV of Project N:

| Year | Cash Flows (₹) | Discount factor (10%) | Discounted Values (₹) | Discount factor (20%) | Discounted values (₹) |
|------|----------------|-----------------------|-----------------------|-----------------------|-----------------------|
| 0 | (4,00,000) | 1.000 | (4,00,000) | 1.000 | (4,00,000) |
| 1 | 4,36,000 | 0.909 | 3,96,324 | 0.833 | 3,63,188 |
| 2 | 20,000 | 0.826 | 16,520 | 0.694 | 13,880 |
| 3 | 20,000 | 0.751 | 15,020 | 0.579 | 11,580 |
| 4 | 8,000 | 0.683 | 5,464 | 0.482 | 3,856 |
| 5 | 6,000 | 0.621 | 3,726 | 0.402 | 2,412 |
| NPV | | | 37,054 | | (5,084) |

IRR of Project M: 18.79%

- (ii) Both the projects are acceptable because they generate the positive NPV at the company's cost of capital at 10%. However, the company will have to select PROJECT M because it has higher NPV. If the company follows IRR method, then PROJECT N should be selected because of higher internal rate of return (IRR). But when NPV and IRR give contradictory results, a project with higher NPV is generally preferred because of high return in absolute terms. Hence, Project M should be selected.
- (iii) The inconsistency in the ranking of the projects arises because of the difference in the pattern of the cash flows. Project N generated the major cash flow in the first year itself.

2013 - Dec [10] (c) Nava Ratna Ltd. has just installed MACHINE R at a cost of ₹ 2,00,000. This machine has 5 years life with no residual value. The annual volume of production is estimated at 1,50,000 units, which can be sold at ₹ 6 per unit. Annual operating costs are estimated at ₹ 2,00,000 (excluding depreciation) at this output level. Fixed costs are estimated at ₹ 3 per unit for the same level of production.

The company has just come across another model called MACHINE S, capable of giving the same output at an annual operating costs of ₹ 1,80,000 (excluding depreciation). There will be no change in fixed costs. Capital cost of this machine is ₹ 2,50,000 and the estimated life is 5 years with no residual value.

The company has an offer for sale of MACHINE R at ₹ 1,00,000. But the cost of dismantling and removal will amount to ₹ 30,000. As the company has not yet commenced operation, it wants to sell MACHINE R and purchase MACHINE S.

Nava Ratna Ltd. will be a zero-tax company for 7 years in view of several incentives and allowances available. The cost of capital may be assumed as 14%.

Required:

- (i) Advise the company whether it should opt for replacement.

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- (ii) What would be your advice, if MACHINE R has not been installed but the company is in the process of selecting one or the other machine?

[Given: PVIF for 1-5 years = 0.877, 0.769, 0.675, 0.592, 0.519]

(10 marks)**Answer:**

Replacement of Machine R: Incremental cash outflow:

Cash outflow of Machine S ₹ 2,50,000

Less: Sale value of Machine R (₹ 1,00,000 - 30,000) ₹ 70,000

Net outflow ₹ 1,80,000

Incremental cash flow from Machine S:

Annual cash flow from Machine S:

[(1,50,000 × 6) - 1,80,000 - (1,50,000 × 3)] Annual ₹ 2,70,000

Cash flow from Machine R:

[(1,50,000 × 6) - 2,00,000 - (1,50,000 × 3)] ₹ 2,50,000

Net inflow ₹ 20,000

Present value of Incremental cash inflow:

= 20,000 × (0.877 + 0.769 + 0.675 + 0.592 + 0.519) = ₹ 68,640 NPV of

Machine S = 68,640 - 1,80,000 = ₹ (-) 1,11,360.

[₹ 2,00,000 Spent on Machine R is a sunk cost and hence it is not relevant for deciding the replacement]

Decision: NPV of Machine S is negative. Replacement is not advised. If it selects one of the two, independent NPV is to be calculated for this decision.

Independent evaluation of Machine R & Machine S:

(All in ₹)

| Particulars | Machine R | Machine S |
|--|-----------|-----------|
| Units produced | 1,50,000 | 1,50,000 |
| Selling Price @ ₹ 6 | 9,00,000 | 9,00,000 |
| Less: Operating cost (Exclusive of depreciation) | 2,00,000 | 1,80,000 |
| | 7,00,000 | 7,20,000 |

| | | |
|---|----------|----------|
| Contribution | 4,50,000 | 4,50,000 |
| Less: Fixed cost | 2,50,000 | 2,70,000 |
| Annual cash flow | | |
| PV of cash flows for 5 years, i.e., [Sum of PVIF for 14%,5] | | |
| 3.432 × 2,50,000 | 8,58,000 | |
| 3.432 × 2,70,000 | | 9,26,640 |
| Cash out flow | 2,00,000 | 2,50,000 |
| NPV | 6,58,000 | 6,76,640 |

Decision: Choose Machine S as NPV of S is higher than that of R.

2015 - June [5] (a) A Ltd. company has undertaken market research at a cost of ₹ 4 Lakhs in order to forecast the future Cash Flows of an Investment Project with an expected life of four years as follows:

| Year | 1 | 2 | 3 | 4 |
|---------------|-------------|-------------|---------------|-------------|
| Sales revenue | ₹ 25,00,000 | ₹ 51,40,000 | ₹ 1,37,80,000 | ₹ 9,06,000 |
| Costs | ₹ 10,00,000 | ₹ 20,00,000 | ₹ 50,00,000 | ₹ 35,00,000 |

These forecast Cash Flows are before considering inflation of 4.7% p.a. The Capital Cost of the project, payable at the start of first year will be ₹ 40 Lakhs. The Investment Project will have zero scrap value at the end of the fourth year. The level of working capital investment at the start of each year is expected to be 10% of the sales revenue in that year.

Capital allowances would be available on the Capital Cost of the Investment Project on a 25% reducing balances basis. A Ltd. pays tax on Profit at an annual rate of 30% per year with tax being paid one year in arrears.

A Ltd. has a nominal (money terms) after tax Cost of Capital of 12% per year.

Discount Factor at 12% is as under:

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| Year | 1 | 2 | 3 | 4 | 5 |
|-----------------|-------|-------|-------|-------|-------|
| Discount Factor | 0.893 | 0.797 | 0.712 | 0.636 | 0.567 |

Calculate the net Present Value of the Investment Project in nominal terms and comment on its financial acceptability. **(10 marks)**

Answer:

Calculation of Net Present value of the investment project using a nominal terms approach. (₹ In '000')

| Year | 1 | 2 | 3 | 4 | 5 |
|----------------------------|---------|-----------|-----------|-----------|-------|
| Sales Revenue | 2617.50 | 5634.52 | 15815.74 | 1088.72 | - |
| Less: Costs | 1047.00 | 2192.42 | 5738.66 | 4205.86 | - |
| Net Revenue | 1570.5 | 3442.10 | 10077.08 | -3117.14 | - |
| Less: Tax Payable | - | (471.16) | (1032.64) | -3023.12 | - |
| Capital Allowance | - | 300.00 | 225.00 | 168.76 | 506.3 |
| After Tax Cash Flow | 1570.50 | 3270.94 | 9269.44 | -5971.5 | 506.3 |
| Less: Working Capital | -301.72 | (1018.12) | 1472.70 | 108.87 | - |
| Project Cash Flow | 1268.78 | 2252.82 | 10742.14 | (5862.63) | 506.3 |
| Discount Factor 12% | 0.893 | 0.797 | 0.712 | 0.636 | 0.567 |
| Present Value of Cash Flow | 1133.02 | 1795.5 | 7648.4 | (3728.63) | 287.1 |

(₹ In '000')

| | |
|---------------------------|-----------|
| P. V. of Future Cash Flow | 7135.34 |
| Less: Initial Investment | (4000.00) |
| Less: Working Capital | (261.76) |
| NPV | 2873.58 |

The net present value is ₹ 2873.58. So the investment is financially acceptable.

Working Notes:

1. (₹ In '000')

| Year | 1 | 2 | 3 | 4 |
|--------------------------|--------|---------|----------|--------|
| Sales Revenue | 2500 | 5140 | 13780 | 906 |
| Inflated sales (by 4.7%) | 2617.5 | 5634.52 | 15815.74 | 1088.7 |

Inflated costs have been calculated accordingly although the normal discount rate is 12% and general rate of inflation is 4.7%.

2. Capital Allowance

Cost of project = ₹ 40,00,000

Tax @ 30% = ₹ 12,00,000

12,00,000 × 25% = 3,00,000

(12,00,000 - 3,00,000) × 25% = 2,25,000

(9,00,000 - 2,25,000) × 25% = 1,68,750

12,00,000 - 3,00,000 - 2,25,000 - 1,68,750 = 5,06,250

3. Working Capital

10% of Incremental Sales.

(2617.50 - 5634.52) × 10% = (301.72)

(5634.52 - 15815.74) × 10% = (1018.12)

(15815.74 - 1088.72) × 10% = 1472.70

(1088.72 - 0) × 10% = 108.87

261.76

2015 - Dec [5] (a) A company is considering which of two mutually exclusive projects it should undertake. The Finance Director thinks that the project with the higher Net Present Value (NPV) should be chosen whereas the Managing Director thinks that the one with the higher Internal Rate of Return (IRR) should be undertaken especially as both projects have the same initial outlay and length of life. The company anticipates cost of capital of 10% and the net after tax cash flows of the projects are as follows:

| Year end | 0 | 1 | 2 | 3 | 4 | 5 |
|------------------|-------|-----|----|----|----|----|
| Cash flows (000) | (200) | 35 | 80 | 90 | 75 | 20 |
| Project X | | | | | | |
| Project Y | (200) | 218 | 10 | 10 | 4 | 3 |

(i) Calculate the NPV of each project

(4 marks)

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- (ii) Which project do you think will have a higher internal rate of return (IRR)? Why? **(2 marks)**
- (iii) Under what circumstances will NPV and IRR give different ranking of projects? Why? **(2 marks)**
- (iv) Which project would you recommend? Why? **(2 marks)**

Answer:**(a) (i) Calculation of the NPV****Project X**

| Years | Cash Flows | Discount Factor @10% | Discounted values |
|------------|------------|-------------------------|-------------------|
| 0 | (200) | 1.00 | (200) |
| 1 | 35 | 0.91 | 31.85 |
| 2 | 80 | 0.83 | 66.4 |
| 3 | 90 | 0.75 | 67.5 |
| 4 | 75 | 0.68 | 51 |
| 5 | 20 | 0.62 | 12.4 |
| NPV | | | 29.15 |

Project Y

| Years | Cash Flows | Discount Factor @10% | Discounted values |
|------------|------------|-------------------------|-------------------|
| 0 | (200) | 1 | (200) |
| 1 | 218 | 0.91 | 198.38 |
| 2 | 10 | 0.83 | 8.30 |
| 3 | 10 | 0.75 | 7.50 |
| 4 | 4 | 0.68 | 2.72 |
| 5 | 3 | 0.62 | 1.86 |
| NPV | | | 18.76 |

- (ii) Project Y will have a higher IRR since Y has very high initial cash inflow.

Project Y has a payback of less than 2 years. Whereas project X has smaller cash flows which are never in bulk. Hence Y will have a much higher IRR.

IRR assumes that cash flows are reinvested at IRR rates. Whereas NPV assumes investment only at the discount rate.

- (iii) IRR and NPV can give different ranking if, projects compared have uneven cash inflows – the one with higher initial inflows has a higher IRR. When there are initial as well as intervening cash outlays (for e.g. heavy repairs, etc.), so that in the intervening period within the life of the project net cash flows are negative and positives we have a multiple IRR situation. Whereas the NPV is unique.
- (iv) Project X can be recommended if the project has to run through completion and must exist for 5 years, since the net wealth added is higher.

Project Y can be recommended if there is any other investment opportunity for the cash flows generated in the 1st year such that total NPV during the full 5 years is higher than project X.

2016 - June [3] (b) A company is considering a proposal of installing a drying equipment. The equipment would involve a cash outlay of ₹ 6,00,000 and net working capital of ₹ 80,000. The expected life of the project is 5 years without any salvage value. Assume that the company is allowed to charge depreciation on straight line basis for income tax purpose. The estimated before-tax cash inflows (₹'000) are given below:

| | | | | | |
|-------------------------|-----|-----|-----|-----|-----|
| Year-end | 1 | 2 | 3 | 4 | 5 |
| Before-tax cash inflows | 240 | 275 | 210 | 180 | 160 |

The applicable income-tax rate of the company is 35%. If the company's cost of capital is 12%, calculate the equipment's discounted payback period, and net present value. **(6 marks)**

Answer:

Statement showing the calculation of present value of CFAT: [₹ 000]

| Particulars | Year 1 | Year 2 | Year 3 | Year 4 | Year 5 |
|---------------------------------|--------|---------|--------|--------|--------|
| Cash flows before tax | 240 | 275 | 210 | 180 | 160 |
| Less: Tax @ 35% | (84) | (96.25) | (73.5) | (63) | (56) |
| After tax cash flows | 156 | 178.75 | 136.5 | 117 | 104 |
| Add: tax saving on depreciation | 42 | 42 | 42 | 42 | 42 |

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| | | | | | |
|--|--------|--------|--------|--------|--------|
| Net cash flow after tax | 198 | 220.75 | 178.5 | 159 | 146 |
| Release of working capital | – | – | – | – | 80 |
| CFAT for last year | – | – | – | – | 226 |
| PVF at 12% | 0.8929 | 0.7972 | 0.7118 | 0.6355 | 0.5674 |
| PV | 176.79 | 175.98 | 127.06 | 101.04 | 128.23 |
| Cumulative discounted cash flows | 176.79 | 352.77 | 479.83 | 580.87 | 709.10 |
| NPV = ₹ 709.10 – ₹ 680 = ₹ 29.10 thousand | | | | | |

Discounted payback period = 4 Years + (₹ 6,80,000 – 5,80,870) / ₹ 1,28,230
= 4.773 years

2016 - Dec [5] (a) An eatery is located in its own premises at Street A in a city. The Management is planning a relocation to a nearby new location, College Road, also owned by it so that it can attract new clients. Two years ago, the College Road location was considered and ₹ 2,00,000 was paid to a consultant for site study. Due to metro rail construction, the idea had to be abandoned. Now the road is fit for easy access. Until now, the College Road premises could not be let out and was idle. But now, it can be let out on an annual year end lease rental of ₹ 1,20,000. On similar terms, Street A premises would fetch ₹ 2,50,000. The eatery would have to spend ₹ 10,00,000 on initial refurbishment if it relocates. This will entail a bank loan at 12% interest. 25% of its new sales would be from the old customers at the Street A premises who represented 25% of the Street A sales value. Other information is given below:

| Figures (₹/annum) (valid for the next 5 years) | Street A (same as per existing values) | College Road |
|--|--|--------------|
| Sales | 15,00,000 | 21,00,000 |
| Variable Cost | 10,00,000 | 11,00,000 |
| Contribution | 5,00,000 | 10,00,000 |
| Fixed Cost (excluding depreciation) | 1,50,000 | 2,40,000 |
| Depreciation | 30,000 | |

- (i) Depreciation is on straight line basis over 5 years. Assume that the life of the project is 5 years from now in both the premises.
- (ii) Income Tax rate applicable is 35% and taxes are payable at the end of the year.
- (iii) Cash flows from operations arise at the end of the year.
- (iv) There is no salvage value in both the cases at the end of the project life.
- (v) Both the sites are meant for long term usage. There is no sale of the premises envisaged.
- (vi) Weighted average cost of capital until this project begins is 10%.
- (vii) The Bank loan has to be repaid in equal instalments of principal at the end of each year together with the applicable interest on the outstanding principal.
- (viii) Assume no time lag between the capital expenditure and the commencement of operation.
- (ix) Use P.V. factors as given in the table.
- (x) Show calculations to the nearest rupee.
- (xi) The cost - revenue structure is different in both the locations and the above table is applicable for all customers in a location.
- (xii) No significant changes in the working capital requirement.

You are required to present a statement showing the evaluation on an incremental basis, of relocating to the new premises, showing the rationale behind the cash flows you consider and those that you do not, for the evaluation. Recommend from a financial perspective using the NPV method, whether the eatery should relocate to the College Road premises.

(12 marks)

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Answer:

₹

| | College Road | | | Street A | | |
|---|--------------|-----------|--------------------------------|----------|-----------|--------------------------------|
| | 25% | 75% | Total (Amount in Rupees) | 25% | 75% | Total (Amount in Rupees) |
| Sales Value | 5,25,000 | 15,75,000 | 21,00,000 | 3,75,000 | 11,25,000 | 15,00,000 |
| Variable Cost | 2,75,000 | 8,25,000 | 11,00,000 | 2,50,000 | 7,50,000 | 10,00,000 |
| Contribution | 2,50,000 | 7,50,000 | 10,00,000 | 1,25,000 | 3,75,000 | 5,00,000 |
| Fixed Cost (excluding depreciation) | - | 2,40,000 | 2,40,000 | - | 1,50,000 | 1,50,000 |
| Profit (before depreciation) | 2,50,000 | 5,10,000 | 7,60,000 | 1,25,000 | 2,25,000 | 3,50,000 |
| Depreciation | | | 2,00,000 | | | 30,000 |
| Profit | | | 5,60,000 | | | 3,20,000 |

Statement showing relevant cash flows for NPV method

| Items of Cash Flow | Amount (in Rupees) | Working Note |
|---|-----------------------|--|
| Cash profits from operations (year end 1 to 5) | + 2,66,500 | (From existing customers + 1,25,000; from new customers + 2,85,000) Alternatively, difference in the total profit columns since cost revenue structures are different. Hence, ₹ 4,10,000 before tax, i.e., ₹ 2,66,500 after 35% tax. |

| | | |
|---|-------------|--|
| Lease Rental of Street A premises | + 84,500 | Opportunity cost of Street A premises = ₹ 2,50,000 less amount that would have been gained by rent of College Road ₹ 1,20,000 = Opportunity loss, i.e., ₹ 1,30,000 is the opportunity gain, less 35% taxes. |
| Tax shield on Depreciation | + 59,500 | Depreciation (new) = ₹ 2,00,000 less: Old = ₹ 30,000; Net = ₹ 1,70,000; Tax Shield 35% = 35% × ₹ 1,70,000 |
| Total inflows from the project | + 4,10,500 | |
| P.V. factor at 12% × .65 = 7.8% years 1 to 5 | 4.014 | 12% is the project's cost of capital. Average thus far should not be taken, since this project involves this cost. Cost after tax = 65% of 12%. This is the minimum return that the project should fetch for acceptance. |
| Present value of inflows | + 16,47,747 | |
| Initial Outlay = Present value of outflows | - 10,00,000 | Occurs at end of year zero or beginning of year 1. Hence discount rate = 1 |
| Net Present Value | + 6,47,747 | |
| Decision: It is recommended to relocate to the new premises. | | |
| Cash flows not considered in the evaluation : | | |
| Consultant's fee | 2,00,000 | Sunk cost. It has been incurred irrespective of the project and hence not considered. |

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| | | |
|------------------------------|----------|---|
| Bank Interest | | Not considered since it does not arise from the project. It is a financing decision. The specific cost of financing is considered in the cut off rate used for the NPV. |
| Bank Loan – Repayment | 2,00,000 | Not a project outflow. |

2017 - June [2] (a) A Ltd. is considering replacement of an existing machine or to spend money on overhauling it. A Ltd. currently pays no taxes. The replacement machine costs ₹ 50,000 now and requires maintenance of ₹ 5,000 at the end of every year for 5 years. At the end of 5 years, it would have a salvage value of ₹ 10,000 and would be sold. The existing machine requires increasing amounts of maintenance each year and its salvage value falls each year as follows:

| Year | Maintenance (₹) | Salvage (₹) |
|---------|-----------------|-------------|
| Present | 0 | 20,000 |
| 1 | 5,000 | 12,500 |
| 2 | 10,000 | 7,500 |
| 3 | 15,000 | 0 |

The cost of capital of A Ltd. is 15%.

| End of year | 1 | 2 | 3 | 4 | 5 | 6 |
|----------------------------|--------|--------|--------|--------|--------|--------|
| Present value factor @ 15% | 0.8696 | 0.7561 | 0.6575 | 0.5718 | 0.4972 | 0.4323 |

When should the company replace the machine?

(8 marks)

Answer:

A & Co. Equivalent cost of (EAC) of new machine

| | Particulars | Amount (₹) |
|-----|--|------------|
| (i) | Cost of new machine now | 50,000 |
| | Add: P.V. of annual repairs @ ₹ 5,000 per annum for 5 years (₹ 5,000 × 3.3522) | 16,761 |
| | | 66,761 |
| | Less: P.V. of salvage value at the end of 5 years (₹ 10,000 × 0.4972) | 4,972 |
| | | 61,789 |
| | Equivalent annual cost (EAC) (₹ 61,789 / 3.3522) | 18,432 |

Equivalent Cost (EAC) of keeping the old machine

| Present value | I Year | II Year | III Year |
|--|--------|---------|----------|
| (P.V.) | (₹) | (₹) | (₹) |
| Value Present | 20,000 | 12,500 | 7,500 |
| Add: P.V. of annual maintenance (Annual Maintenance/1.15) | 4,348 | 8,696 | 13,043 |
| Total | 24,348 | 21,196 | 20,543 |
| Less: P.V. of salvage value at the end of the year (P.V./1.15) | 10,870 | 6,522 | Nil |
| | 13,478 | 14,674 | 20,543 |
| | 1.15 | 1.15 | 1.15 |
| Equivalent Annual Cost (EAC) | 15,500 | 16,875 | 23,625 |

Advice: The company should replace the old machine after 2 years because the Equivalent Annual Cost (EAC) of the new machine at ₹ 18,432 is lower than the cost of using the existing machine in third year.

2017 - June [5] (b) ABC Ltd. has a capital budget of ₹ 2 crore for the year. From the following information relating to six independent proposals, select

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the projects if (i) the projects are divisible and (ii) projects are indivisible in order to maximise the NPV.

| Proposal | Investment (₹) | NPV (₹) |
|----------|----------------|----------------|
| I | 8,500,000.00 | 5,000,000.00 |
| II | 3,500,000.00 | 2,600,000.00 |
| III | 6,000,000.00 | 2,000,000.00 |
| IV | 4,000,000.00 | 2,500,000.00 |
| V | 6,000,000.00 | 5,000,000.00 |
| VI | 8,000,000.00 | (2,500,000.00) |

(6 marks)

Answer:

- (i) If the projects are divisible
Projects are ranked according to PI and arranged in descending order.

| Proposal | Investment | NPV | PV of Inflows | PI | Rank |
|----------|------------|-----------|---------------|------|------|
| I | 85,00,000 | 50,00,000 | 1,35,00,000 | 1.59 | 4 |
| II | 35,00,000 | 26,00,000 | 61,00,000 | 1.74 | 2 |
| III | 60,00,000 | 20,00,000 | 80,00,000 | 1.33 | 5 |
| IV | 40,00,000 | 25,00,000 | 65,00,000 | 1.63 | 3 |
| V | 60,00,000 | 50,00,000 | 1,10,00,000 | 1.83 | 1 |

| Proposal | Investment | Cum Investment |
|----------|------------|----------------|
| V | 60,00,000 | 60,00,000 |
| II | 35,00,000 | 95,00,000 |
| IV | 40,00,000 | 1,35,00,000 |
| I | 85,00,000 | 2,20,00,000 |
| III | 60,00,000 | 2,80,00,000 |

Only 65,00,000 can be invested in project I. NPV of the project

$$= 65/85 \times 50,00,000 = 38,23,529$$

So the selected projects are V, II, IV and part of I.

(ii) If the projects are indivisible (by trial and error method)

| Feasible Sets | Investments | NPV |
|----------------|-------------|-------------|
| V, II, I | 1,80,00,000 | 1,26,00,000 |
| V, IV, I | 1,85,00,000 | 1,25,00,000 |
| V, II, IV, III | 1,95,00,000 | 1,21,00,000 |
| I, II, IV | 1,60,00,000 | 1,01,00,000 |
| V, IV, III | 1,60,00,000 | 95,00,000 |

Project V, II and I provides the maximum NPV may be undertaken.

2017 - Dec [5] (a) A manufacturing company has an old machine having no book value which can be sold now for ₹ 1,00,000. It can be used for another five years after which it will have to be condemned without any sale value. The company is examining the following options:

Option I: To upgrade the existing machine at a cost of ₹ 20 lacs and continue operations for a further 5 years at the end of which the ₹ 20 lacs would have also fully been depreciated equally over the next 5 years and will fetch a sale value of ₹ 50,000 at the end of the 5th year.

Option II: To replace the old machine with a new one costing ₹ 40 lacs which will have a useful life of 5 years, during which it will be fully depreciated equally. At the end of the 5th year, this machine will have a resale value of ₹ 10 lacs.

The following figures are the after-tax cash profits in rupees without the depreciation shield and the salvage values for the existing situation and the fresh options:

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| End of year | Existing Machine | Upgraded Machine | New Machine |
|-------------|------------------|------------------|-------------|
| 1 | 10,00,000 | 11,00,000 | 12,00,000 |
| 2 | 10,80,000 | 11,80,000 | 12,80,000 |
| 3 | 11,20,000 | 12,20,000 | 13,80,000 |
| 4 | 12,00,000 | 13,00,000 | 14,80,000 |
| 5 | 13,00,000 | 14,00,000 | 16,00,000 |

The hurdle rate used for evaluation is 15%.

Consider that the salvage values and profits will be subjected to tax at the normal tax rate of 40%.

Present an incremental analysis of options I and II and state which is better. Evaluate the better option above over continuing with the old machine without upgrading. **(8 marks)**

Answer:

Option I vs Option II - Incremental Analysis

| End of Year | Operating Profits | PV factor | PV of cash profits (₹) |
|--------------|-------------------|--------------|------------------------|
| 0 | | 1 | |
| 1 | 1,00,000 | 0.870 | 87,000 |
| 2 | 1,00,000 | 0.756 | 75,600 |
| 3 | 1,60,000 | 0.658 | 1,05,280 |
| 4 | 1,80,000 | 0.572 | 1,02,960 |
| 5 | 2,00,000 | 0.497 | 99,400 |
| Total | | 3.353 | 4,70,240 |

New Machine Vs Upgraded Machine

| | | |
|---|---|---------------|
| Operating Profits | | ₹ 4,70,240 |
| Depreciation shield | $(8,00,000 - 4,00,000) \times 40\%$ $= 160,000$ with annuity factor $3.353 = 3.353 \times 1,60,000$ | ₹ 5,36,480 |
| Salvage value | $(10,00,000 - 50,000) \times 60\%$ $= 5,70,000 @ PVF 0.497$ | ₹ 2,83,290 |
| Incremental cost of new machine | 20,00,000 with PV factor 1 | ₹ (20,00,000) |
| Sale value of old machine | 60% × 1 lac, PV 1 | ₹ 60,000 |
| Decrease in NPV with new machine | | ₹ 6,49,990 |
| Decision: Continue with the upgraded machine, Option 1 | | |

Analysis: Continue without upgrade Vs Upgrade old machine

| | | |
|--|---|-------------|
| | | ₹ |
| Increase in operating profits | $1,00,000 \times$ annuity factor 5 years $= 1,00,000 \times 3.353$ | 3,35,300 |
| Depreciation shield | $4,00,000 \times 40\% \times 3.353$ | 5,36,480 |
| Salvage value at yr 5 end | $50,000 \times 60\% \times 0.497$ | 14,910 |
| Sub Total - Incremental benefits over upgrade | | 8,86,690 |
| Incremental cost of upgrade | $20,00,000 \times 1$ | (20,00,000) |
| Net disadvantage of upgrade | | 11,13,310 |
| Conclusion: Do not upgrade. Continue with the old machine as it is. | | |

2018 - June [2] (a) Electronics Pvt. Ltd. is considering a proposal to replace one of its machines. In this connection, the following information is available : The existing machine was purchased 3 years ago for ₹ 20 Lakh. It was

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depreciated 20 per cent per annum on reducing balance basis. It has remaining useful life of 5 years, but its maintenance cost is expected to increase by ₹ 1 Lakh per year from the end of sixth year of its installation. Its present realizable value is ₹ 12 Lakh. The company has several machines having 20% depreciation.

The new machine costs ₹ 30 Lakh and is subject to the same rate and basis of depreciation. On sales after 5 years, it is expected to realize ₹ 18 Lakh. With the new machine, the annual pre-tax operating costs (excluding depreciation) are expected to decrease by ₹ 2 Lakh. In addition, the machine would increase productivity on account of which net pre-tax revenues would increase by ₹ 3 Lakh annually (reckoned at year end). The tax rate applicable to the company is 40% and the cost of capital is 10 per cent.

Advise the company on the choice of the machine from a financial perspective on the basis of NPV.

PV Factors (10%)

| Year | 1 | 2 | 3 | 4 | 5 |
|-----------|-------|-------|-------|-------|-------|
| PV Factor | 0.909 | 0.826 | 0.751 | 0.683 | 0.621 |

Present an incremental analysis of using the existing machine versus replacing the machine with a new one. Present annual discounted cash flows in your answers with separate calculation showing annual discounted cash flows on account of incremental depreciation without netting off capital asset outflows or inflows. Calculations are to be presented to the nearest rupee. P.V. factors with above decimal places should be used. **(10 marks)**