**Answer on Question #51641, Management, Other**

a). A company is considering the following investment projects.

Cash flows in Kes

Project Initial Outlay C1 C2

A (10,000) 10,000

B (10,000) 7,500 7,500 12,000

C (10,000) 2,000 4,000 3000

D (10,000) 10,000 3,000 3,000

Required:

Rank the projects according to:

i. Payback period (1 Marks)

ii. Accounting rate of return (1 Marks)

iii. Internal Rate of Return (2 Marks)

iv. Profitability Index (1 Marks)

v .Net present value (2 Marks)

Use 10% where cost of capital is not given especially in cases of NPV and IRR.

**Solution:**

**i. Payback period.**

In given problem we note the data of the task. The information is provided in the Table

Table Projects Cash flows.

| Project | Year 0 | Year 1 | Year 2 | Year 3 | Year 4 |
|---|---|---|---|---|---|
| A | (10,000) | 10,000 | | | |
| B | (10,000) | 7,500 | 7,500 | 12,000 | |
| C | (10,000) | 2,000 | 4,000 | 3000 | |
| D | (10,000) | 10,000 | 3,000 | 3,000 | |

The payback period is the time period required for the amount invested in an asset to be repaid by the net cash outflow generated by the asset.

In order to determine the payback period we apply the following method of calculation, we divide the cash outlay (which is assumed to occur entirely at the beginning of the project) by the amount of net cash flow generated by the project per year.

Thus, for the Project A the Payback period will be equal.

$$\text{Payback period of the Project A} = \frac{\text{Original investment}}{\text{Average cash flow}} = \frac{10{,}000}{10{,}000} = 1 \text{ year}$$

For the Project B the Payback period will be equal.

$$\text{Payback period of the Project B} = \frac{\text{Original investment}}{\text{Average cash flow}} = \frac{10{,}000}{9{,}000} = 1.11 \text{ year}$$

The table indicates that the real payback period is located somewhere between Year 1 and Year 2.

For the Project C the Payback period will be equal.

$$\text{Payback period of the Project C} = \frac{\text{Original investment}}{\text{Average cash flow}} = \frac{10{,}000}{3{,}000} = 3.33 \text{ year}$$

The table indicates that the real payback period is located somewhere after Year 3.

For the Project D the Payback period will be equal.

$$\text{Payback period of the Project D} = \frac{\text{Original investment}}{\text{Average cash flow}} = \frac{10{,}000}{5333.33} = 1.875 \text{ year}$$

The table indicates that the real payback period corresponds to 1 year.

**ii. Accounting rate of return.**

Accounting rate of return (ARR) method uses expected net operating income to be generated by the investment proposal rather than focusing on cash flows to evaluate an investment proposal. Under this method, the asset's expected accounting rate of return (ARR) is computed by dividing the expected incremental net operating income by the initial investment and then compared to the management's desired rate of return to accept or reject a proposal. For the calculation we apply the following formula.

$$\text{Accounting rate of return } = \frac{\text{Incremental Accounting income}}{\text{Initial Investment}}$$

Now we apply this formula to our problem.

Incremental net operating income: Incremental revenues – Incremental expenses including depreciation.

In first case for ARR depreciation will be deducted to cash flow. For the Project A cash in flow 10,000 and depreciation is equal to 10,000, hence, the Profit = 0%.

For the Project B the accounting rate of return will be equal.

$$\text{Accounting rate of return of the Project B} = \frac{(7{,}500 + 7{,}500 + 12{,}000 - 10{,}000)/3}{5{,}000}$$

$$= \frac{5{,}666.67}{5{,}000} \cdot 100 = 113.3\%$$

$$\text{Accounting rate of return of the Project C} = \frac{(2{,}000 + 4{,}000 + 3{,}000 - 10{,}000)/3}{5{,}000}$$

$$= -6.67\%$$

$$\text{Accounting rate of return of the Project D} = \frac{(10{,}000 + 3{,}000 + 3{,}000 - 10{,}000)/3}{5{,}000} = 40\%$$

If for the calculation we apply the following formula:

$$\text{ARR} = \frac{\text{Average profit}}{\text{Average investment}}$$

Then for the Project A this value will be equal

$$\text{ARR} = \frac{10{,}000}{10{,}000} = 100\%$$

Then for the Project B this value will be equal

$$\text{ARR} = \frac{(7{,}500 + 7{,}500 + 12{,}000)/3}{10{,}000} = 90\%$$

Then for the Project C this value will be equal

$$\text{ARR} = \frac{(2000 + 4000 + 3000)/3}{10{,}000} = 30\%$$

Then for the Project D this value will be equal

$$\text{ARR} = \frac{(10000 + 3000 + 3000)/3}{10{,}000} = 53.33\%$$

**iii. Internal Rate of Return.**

Internal rate of return (IRR) method also takes into account the time value of money. It analyzes an investment project by comparing the internal rate of return to the minimum required rate of return of the company.

The internal rate of return is the rate at which an investment project promises to generate a return during its useful life. The formula for IRR is:

$$\left[\frac{\text{CF}_1}{(1+\text{r})^1} + \frac{\text{CF}_2}{(1+\text{r})^2} + \frac{\text{CF}_3}{(1+\text{r})^3} + \cdots + \frac{\text{CF}_\text{n}}{(1+\text{r})^\text{n}}\right] - \text{Initial Investment} = 0$$

Based on the above formula we can calculate the internal rate of return for each Project.

IRR for Project A

$$\left[\frac{10{,}000}{(1+0.01)^1}\right] = 9900.99$$

Since NPV is fairly close to zero at 1% value of r, therefore IRR ≈ 1%

IRR for Project B

$$\frac{7500}{(1+0.647)^1} + \frac{7500}{(1+0.647)^2} + \frac{12000}{(1+0.647)^3} = 10{,}004.57$$

Since NPV is fairly close to zero at 64.7% value of r, therefore IRR ≈ 64.7%

IRR for Project C

The investment's IRR is must be less than 1%, which is the rate that makes the present value of the investment's cash flows equal to zero. If we have the value of rate equal to 1%, then we obtain the following result.

$$\frac{2000}{(1+0.01)^1} + \frac{4000}{(1+0.01)^2} + \frac{3000}{(1+0.01)^3} = 8813.15$$

Thus, the IRR must be less 1%.

IRR for Project D

$$\frac{10000}{(1+0.3755)^1} + \frac{3000}{(1+0.3755)^2} + \frac{3000}{(1+0.3755)^3} = 10{,}008.47$$

The investment's IRR is 37.55%, which is the rate that makes the present value of the investment's cash flows approximately equal to zero.

**iv. Profitability Index**

Profitability index is an investment appraisal technique calculated by dividing the present value of future cash flows of a project by the initial investment required for the project.

We create the Table for the first project A.

| Year | Cash Flow | Discounted Cash Flows |
|---|---|---|
| 0 | -10000 | |
| 1 | 10000 | 9090.909 |

The total PV of future cash flows = 9090.909

Initial Investment = 10,000

$$\text{PI} = \frac{9090.909}{10{,}000} = 0.91$$

Since we have PI < 1, we make a decision to reject the project.

Next we make the same table for the Project B.

| Year | Cash Flow | Discounted Cash Flows |
|---|---|---|
| 0 | -10000 | |
| 1 | 7500 | 6818.182 |
| 2 | 7500 | 6198.347 |
| 3 | 12000 | 9015.778 |

The total PV of future cash flows = 22,032.307

Initial Investment = 10,000

$$\text{PI} = \frac{22{,}032.307}{10{,}000} = 2.203$$

Since PI > 1, the project can be accepted.

Now we make calculation for the Project C. As in previous part we create the Table.

| Year | Cash Flow | Discounted Cash Flows |
|---|---|---|
| 0 | -10000 | |
| 1 | 2000 | 1818.182 |
| 2 | 4000 | 3305.785 |
| 3 | 3000 | 2253.944 |

The total PV of future cash flows = 7,377.911

Initial Investment = 10,000

$$\text{PI} = \frac{7{,}377.911}{10{,}000} = 0.74$$

Since we have PI < 1, we make a decision to reject the project.

Now we make calculation for the Project D. As in previous part we create the Table.

| Year | Cash Flow | Discounted Cash Flows |
|---|---|---|
| 0 | -10000 | |
| 1 | 10000 | 9090.909 |
| 2 | 3000 | 2479.339 |
| 3 | 3000 | 2253.944 |

The total PV of future cash flows = 13 824.192

Initial Investment = 10,000

$$\text{PI} = \frac{13{,}824.192}{10{,}000} = 1.38$$

Since PI > 1, the project can be accepted.

**v .Net present value.**

The formula for calculating NPV is as follows.

$$\text{NPV} = \sum_{t=1}^{n} \frac{\text{CF}_t}{(1+\text{R})^t} - \text{CF}_0$$

Where:
NPV – Net Present Value of the project;
$\text{CF}_t$ – cash flow in period t;
$\text{CF}_0$ – cash flow at the initial moment. The initial cash flow is equal to investment capital ($\text{CF}_0$ = IC);
r – the discount rate.

Thus, we apply this formula for calculation the NPV for the first Project A. We obtain the following result.

$$\text{NPV} = -10{,}000 + \frac{10{,}000}{(1+0.10)^1} = -909.09$$

$$\text{NPV for the Project A equal to} -909.09$$

We apply formula the same for calculation the NPV for the Project B. We obtain the following result.

$$\text{NPV} = -10{,}000 + \frac{7{,}500}{(1+0.10)^1} + \frac{7{,}500}{(1+0.10)^2} + \frac{12{,}000}{(1+0.10)^3} = -10{,}000 + 22032.31$$
$$= 12{,}032.31$$

$$\text{NPV for the Project B equal to } 12{,}032.31$$

We apply the same formula for calculation the NPV for the Project C. We obtain the following result.

$$\text{NPV} = -10{,}000 + \frac{2{,}000}{(1+0.10)^1} + \frac{4{,}000}{(1+0.10)^2} + \frac{3{,}000}{(1+0.10)^3} = -10{,}000 + 7377.91$$
$$= -2{,}622.087$$

$$\text{NPV for the Project C equal to } -2{,}622.087$$

We apply the same formula for calculation the NPV for the Project D. We obtain the following result.

$$\text{NPV} = -10{,}000 + \frac{10{,}000}{(1+0.10)^1} + \frac{3{,}000}{(1+0.10)^2} + \frac{3{,}000}{(1+0.10)^3} = -10{,}000 + 13824.19$$
$$= 3{,}824.19$$

NPV for the Project D equal to 3,824.19