Capital Budgeting

Investment Decisions of the Firm

Capital Budgeting

Expected Cash flows-Inflow&out flow

Initial Cash outflow

Cost of the TV 117000

+Installation charge 4000

+wiring charges 2000

123000

-Music system 3000

1. Initial Cash outflow 120000

2. Expected Cash inflows

1 20000

2 25000

3 30000

4 15000

15000 30000 3.Terminal cash inflow

105000

120000

-15000

10000 selling

1. Initial Cash outflow

2. Expected Cash inflows/subsequent cash inflows

3. Terminal Cash inflow

Initial Cash Out Flow

Cost of the New Asset

Add: Installation charges

Capital Expenditure

Additional Working Capital

Less: 1.Scrap/Salvage Value of the old Asset

2. Tax benefit on account of Capital loss on sale of old asset

Add: Tax Liability on account of Capital Gain on sale of old asset

2. Expected Cash Inflows/Subsequent Cash inflows /Incremental Cash inflow

EBIT

-Interest

-Depreciation

EBT

-Tax

P/EAT

+Depreciation

Expected Cash inflow

3. Terminal Cash inflow value

Annual Cash inflow for the last year

+Scrap value of the proposal (if any)

+Working capital released

Evaluate the Investment decision in an asset/project /proposal

New Business

Asset ?? Project??

Existing Business

1. Modernisation
2. Replacement
3. Expansion
4. Diversification
5. Situation

Decision making

1. Mutually Exclusive decisions

2. Accept –Reject Decision

3. Contingent Decision

Capital Budgeting Process

Project Generation

Project Evaluation

Project Selection

Project Execution

Methods of Appraisal of Capital Budgeting

Traditional Method

We don’t consider the Time value Money   
Non Discounting Techniques

1. Payback Period (PBP)Method

2. Accounting rate of return (ARR)

Modern Method

We consider Time Value Money Discounting Technique

Net Present Value Method (NPV)

Internal Rate of Return (IRR)

Profitability Index (PI)

Discounted Payback period

**Traditional Techniques**

1. PBP= Original Investment of the Project

Annual Cash inflows of the Project

Prob 1.Mohan & Co is considering the purchase of a machine. Two machine X and Y each costing Rs.50000 are available. Cash flows are expected to be as under .Calculate the Pay back period

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| Year | Machine X-Cash flows in Rs | Cumulative  Cash flow | | Machine Y Cash flows in Rs | CCF |
| 1 | 15000 | 15000 | | 5000 | 5000 |
| 2 | 20000 | 35000 | | 15000 | 20000 |
| 3 | 25000 | 15000/25000  =.6 | | 20000 | 40000 |
| 4 | 15000 |  | | 30000 | 10/30= |
| 5 | 10000 |  | | 20000 |  |
|  | PBP | 2.6years | 3.33 years | |  |

Solution:

PBP for Machine X= 2 years + 15000/25000= 0.6 years

PBP for Machine X= 2.6years

Prob 2.A project requires an initial investment of Rs 60000 and yields an annual cash inflow of Rs.20000 for 8 years. What is the PBP?

Solution:

PBP= Original Investment of the Project

Annual Cash inflows of the Project

PBP= Original Investment of the Project

Annual Cash inflows of the Project

PBP=60000/20000= 3 years

Traditional Method/Non discounting technique

1. Accounting Rate of Return

It considers the earnings of the project for the Economic life.

The rate of return is expressed as the percentage of the earnings of the investment in a particular project.

The profit under this method is calculated as profit after depreciation and tax.

ARR=Average Annual income after tax and depreciation

Initial Investment

ARR= Average Annual Income (after tax and depreciation)

Average Investment

Average Investment = Original Investment/2

Average Investment =

Original Investment –Scrap value + (Additional Working Capital +Scrap Value)

2

**Accept/ Reject Rule:**

Projects having returns higher than the minimum rate established by the management will be accepted or reject

Prob 3.Determine the ARR from the following details of two machines X and Y:

|  |  |  |
| --- | --- | --- |
| Particulars | Machine X | Machine Y |
| Original cost | Rs.56125 | Rs.56125 |
| Additional investment in working capital | Rs 5000 | Rs 6000 |
| Estimated life in years | 5 | 5 |
| Estimated salvage value | Rs.3000 | Rs.3000 |
| Income Tax | 55% | 55% |
| Annual Estimated Income after depreciation and Tax | | |
| Years | X | Y |
| 1 | 3375 | 11375 |
| 2 | 5375 | 9375 |
| 3 | 7375 | 7375 |
| 4 | 9375 | 5375 |
| 5 | 11375 | 3375 |

Depreciation has been charged on straight line method.

Solution:

Machine X

ARR= Average Annual Income (after tax and depreciation)

Average Investment

Average Annual Income

= Total income/Estimated life of the machine

|  |  |
| --- | --- |
| Years | X |
| 1 | 3375 |
| 2 | 5375 |
| 3 | 7375 |
| 4 | 9375 |
| 5 | 11375 |
| Total | 36875 |

Avg Annual Income =36875/5=7375

Average Investment =

Original Investment –Scrap value + (Additional Working Capital +Scrap Value)

2

56125-3000 +(6000+3000) =35563

2

ARR for Machine Y=7375/35563=20.73%

Decision : Machine X can be selected as it has higher ARR

Machine Y

|  |  |
| --- | --- |
| Years | Y |
| 1 | 11375 |
| 2 | 9375 |
| 3 | 7375 |
| 4 | 5375 |
| 5 | 3375 |
| Total | 36875 |

Avg Annual Income =36875/5=7375

Average Investment =

Original Investment –Scrap value + (Additional Working Capital +Scrap Value)

2

56125-3000 +(5000+3000) =34563

2

ARR for Machine Y=7375/35563=20.73%

Prob 4.A company is considering investment in purchasing a Machine. The machine that has been shortlisted by the manager are A and B. The details of the machine are as follows:

Both the Machines cost Rs 50000 each

PAT are expected to be as follows:

|  |  |  |
| --- | --- | --- |
| Year | Machine A | B |
| 1 | 15000 | 5000 |
| 2 | 20000 | 15000 |
| 3 | 25000 | 20000 |
| 4 | 15000 | 30000 |
| 5 | 10000 | 20000 |

Evaluate the two alternatives according to

1. PBP
2. Return on Invesment method

Assume straight line method of depreciation

Solution:

a.PBP

Machine A- 2 years 7 months

Machine B- 3 years 4 months

ARR=Average Annual income after tax and depreciation

Initial Investment

ARR for Machine A- 17000/50000=34% =68%

ARR for Machine B- 18000/50000=36% =72%

Normally projects will have a cut off rate of 25% which is generally considered across various sectors

**Modern Techniques**/**Discounted Cash flow Techniques**

Discounted cash flow method or time adjusted technique is an improvement over the traditional techniques.

In evaluation of the projects, the need to give

significance to the timing of return is effectively considered in all DCF methods.

DCF methods are cash flow based and take the cognisance of both the interest factors and cash flow after the pay-back period.

The most popular techniques of DCF methods are:

* The net present value
* The internal rate of return
* Profitability index

**Net present value**

Net present value (NPV) method recognises the time value of money.

It correctly admits that cash flows occurring at different time periods differ in value. Therefore, there is the need to find out the present values of all cash flows.

NPV method is the most widely used technique among the DCF methods.

**Steps involved in NPV method are:**

1. Forecasting the cash flows, both inflows and outflows of the projects to be taken up for execution.
2. Decisions on discount factor or interest factor. The appropriate discount rate is the firm’s cost of capital or required rate of return expected by the investors.
3. Computation of the present value of cash inflows and outflows using the discount factor selected.
4. Calculation of NPV by subtracting the PV of cash outflows from the present value of cash inflows.

**Accept or reject criteria**

If NPV is positive, the project should be accepted.

If NPV is negative the project should be rejected.

Accept or reject criterion can be summarised as given below:

NPV > Zero = accept

NPV < Zero = reject

NPV= Zero = Indifferent

NPV method can be used to select between mutually exclusive projects by examining whether incremental investment generates a positive net present value.

Prob 5.A project costs Rs.25000 and is expected to generate cash inflows.

The following table shows the cash inflows.

Cash Inflows

|  |  |
| --- | --- |
| **Year** | **Cash inflows** |
| 1 | 10,000 |
| 2 | 8,000 |
| 3 | 9,000 |
| 4 | 6,000 |
| 5 | 7,000 |

The cost of capital is 12%.

The following table shows the present value factors.

|  |  |
| --- | --- |
| **Year** | **PV factor at 12%** |
| 1 | 0.893 |
| 2 | 0.797 |
| 3 | 0.712 |
| 4 | 0.636 |
| 5 | 0.567 |

Compute the NPV and IRR of the project.

Solution:

|  |  |  |  |
| --- | --- | --- | --- |
| **Year**  **(1)** | **Cash inflows** (2) | **PV factor at 12%(3)** | **Discounted Cash Flow(4=2x3)** |
| 1 | 10,000 | 0.893 | 8930 |
| 2 | 8,000 | 0.797 | 6376 |
| 3 | 9,000 | 0.712 | 6408 |
| 4 | 6,000 | 0.636 | 3816 |
| 5 | 7,000 | 0.567 | 3969 |
|  |  | Total DCF | 29499 |
|  |  | Less Initial Investment | 25000 |
|  |  | NPV | +4499 |

As NPV of the Project is more than Zero with Rs 4499, it is advisable to accept the Project

Prob 6.Find out the NPV for a project which requires an initial investment of Rs 20000 and which involves a net cash flows of Rs 6000 each year for 6 years. The cost of funds is 8%. There is no scrap value.

|  |  |
| --- | --- |
| Years | Cash Flows |
| 2021 | -20000 |
| 2022 | 6000 |
| 2023 | 6000 |
| 2024 | 6000 |
| 2025 | 6000 |
| 2026 | 6000 |
| 2027 | 6000 |

Solution :

|  |  |  |  |
| --- | --- | --- | --- |
| Years | Cash Flows | PVIF @8% | DCF |
| 2021 | -20000 | 1 | -20000 |
| 2022 | 6000 | 0.9259 | 5555.4 |
| 2023 | 6000 | 0.8573 | 5143.8 |
| 2024 | 6000 | 0.7938 | 4762.8 |
| 2025 | 6000 | 0.7350 | 4410 |
| 2026 | 6000 | 0.6805 | 4083 |
| 2027 | 6000 | 0.6301 | 3780.6 |
|  |  | Total DCF | 27735.6 |
|  |  | -Initial Investment | -20000 |
|  |  | NPV | 7735.6 |

NPV= (Annual Cash inflow x PVAF r,n)-Initial Cash out lay

Calculation of IRR

NPV @ 8%= (6000x4.6229)-20000=

NPV=27737.4-20000=+7737.4

NPV @ 12%=4428

NPV@16%

NPV @19%=+458

NPV @20%=-47

IRR lies between 19% and 20%

NPV @ 6%= (6000x4.9173)-20000

NPV=29503.8-20000=+9503

NPV@ 19%= (6000x3.410)-20000=+ 460

NPV @ 20%=(6000x3.326)-20000= -44

IRR is approximately 20%

**Internal Rate of Return IRR**

IRR is a rate at which NPV of a project is zero

Accept if IRR>Cost of Capital or Minimum Rate expected

Reject if IRR< CoC or Minimum Rate expected

FV=PV(1+r)n

PV=FV 1 1

(1+r)n  (1+.22)1

**Profitability Index**

PI=Total present value of cash inflows or Total of DCF

Original Investment

PI=27735.6 = 1.38

20000

Accept if PI>1

Reject if PI <1

NPV Method

Prob 7.Machine A Costs Rs.100000 payable immediately .Machine B costs Rs.120000 half payable immediately and half payable in one year’s time .The cash receipts expected are as follows:

|  |  |  |
| --- | --- | --- |
| Year | Machine A | Machine B |
| 1 | 20000 | 60000 |
| 2 | 60000 | 60000 |
| 3 | 40000 | 80000 |
| 4 | 30000 |  |
| 5 | 20000 |  |

At 7% opportunity cost, which machine should be selected on the basis of NPV?

Solution :

Cash outflow

Machine A -0 year Cash outlay Rs.100000

Machine B- 0 Year Cash outlay Rs.60000

1 Year Cash outlay Rs.60000

Calculation of NPV for Machine A

|  |  |  |  |
| --- | --- | --- | --- |
| Year | Machine A | PVIF @7% | DCF |
| 0 | -100000 | 1 | -100000 |
| 1 | 20000 | 0.9345 | 18690 |
| 2 | 60000 | 0.8734 | 52404 |
| 3 | 40000 | 0.8162 | 32648 |
| 4 | 30000 | 0.7628 | 22884 |
| 5 | 20000 | 0.7129 | 14258 |
|  |  | Total DCF | 140884 |
|  |  | NPV | +40884 |
|  |  | Ranked | 2 |

|  |  |  |  |
| --- | --- | --- | --- |
| Year | Machine B | PVIF @7% | DCF |
| 0 | -60000 | 1 | -60000 |
| 1 | -60000 | 0.9345 | -56070 |
| 1 | 60000 | 0.9345 | 56070 |
| 2 | 60000 | 0.8734 | 52404 |
| 3 | 80000 | 0.8162 | 65296 |
|  |  | Total Discounted Cash inflows | 173770 |
|  |  | Total of Cash O/f | -116070 |
|  |  | NPV | +57700 |
|  |  | Ranked | 1 |

Machine B will be selected as it gives higher NPV

Prob 8. XYZ Ltd. has to replace one of its machine for which it has following options:

a. Installation of equipment “Best” having cost of Rs 75000 which is expected to generate a cash inflow of Rs 20000 per annum for next 6years

b. Installation of equipment “Better” having cost of Rs 50000 which is expected to generate a cash inflow of Rs.18000 per annum for next 4 years.

Which equipment should be preferred if the company adopts method.

1. Payback period
2. NPV
3. IRR
4. PI

The cost capital is at 10%.

Solution :

Shortcut method for calculation of IRR process

Step 1 Initial Investment

Avg Annual Cash flow

Best = 75000 = 3.75

20000

Better= 50000/18000= 2.77

Step 2: Refer the PVAF table under for 6years and find at what rate you get

The value 3.75 =15% for BEST

Better at 2.75 in the 4 years is at 16%

Step 3: Cut off rate from which you can start calculating NPV and arrive at the rate at which NPV is zero

BEST

NPV at 15% =20000x3.7845

=75690-75000= +690

NPV at 16%

=20000x3.6847=73694-75000=-1306

IRR lies between 15% and 16%

IRR=Lower Rate +NPV at the lower rate x (HR-LR)

NPV at the Higher rate-NPV at Lower Rate

IRR=15%+ 690 x (16%-15%) = 15.37%

1306-690

Better Machine

NPV@16%=18000x2.7982=50367-50000=+360

NPV@17%=18000x2.743=49374-50000=-626

IRR=16%+ 364 x (17-16) =16.36 %

626-364

NPV at the cost of Capital 10%=

BEST 20000x4.355=87100-75000=+12100

BETTER 18000x3.170=57060-50000=+7060

PI for BEST= 87100/75000= 1.16

PI for BETTER= 57060/50000=1.14

|  |  |  |
| --- | --- | --- |
| CBbased | BEST | BETTER |
| PBP | 3.7years | 2.77years |
| Ranking | 2 | 1 |
| IRR | 15.37% | 16.36% |
| Ranking | 2 | 1 |
| NPV | 12100 | 7060 |
| Ranking | 1 | 2 |
| PI | 1.16 | 1.14 |
| Ranking | 1 | 2 |

Discounted Pay back period

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Year | Machine A | PVIF @7% | DCF | Cumulative DCF |
| 1 | 20000 | 0.9345 | 18690 | 18690 |
| 2 | 60000 | 0.8734 | 52404 | 71094 |
| 3 | 40000 | 0.8162 | 32648 | 28906/32648 |
| 4 | 30000 | 0.7628 | 22884 |  |
| 5 | 20000 | 0.7129 | 14258 |  |

Discounted PBP=2years + 28906/32648

2.8years= 2years 10months

100000-71094=28906 yet to be received

Prob 9.A company is considering a new project for which the investment data are as follows:

Capital Outlay Rs 200000

Depreciation 20%

Forecasted annual income before charging depreciation, but after all other charges are as follows:

|  |  |
| --- | --- |
| Year | Cash inflows |
| 1 | 100000 |
| 2 | 100000 |
| 3 | 80000 |
| 4 | 80000 |
| 5 | 40000 |

On the basis of the available data, set out calculations, illustrating and comparing the following methods of evaluating the return:

1. PBP

2. Rate of return on original investment

3. IRR

Solution :

1. PBP = 2years
2. Calculation of return on original Investment

Capital Outlay Rs 200000

Depreciation 20% per annum

Depreciation per annum =200000x(20/100)=40000

|  |  |  |  |
| --- | --- | --- | --- |
| Year | Cash inflows | Depreciation | Cash inflow less depreciation |
| 1 | 100000 | 40000 | 60000 |
| 2 | 100000 | 40000 | 60000 |
| 3 | 80000 | 40000 | 40000 |
| 4 | 80000 | 40000 | 40000 |
| 5 | 40000 | 40000 | 0 |
|  |  |  |  |

Depreciation = 200000x20% =40000

Return on Investment= Average Income x100

Original Investment

ROI=(60000+60000+40000+40000+0)/5 =40000 x100

200000 200000

ROI=20%

Calculation of IRR

Step 1: Initial Invst

Avg Annual Cash flow

200000

(100000+100000+80000+80000+40000)/5

200000 = 2.5

80000

Step 2: Refer the PVAF table for 5 year and find rate at which we get the value 2.5

28% and 30% 2.4356

Step 3:

Step 3 Cut off rate is considered as 28% and NPV is calculated to arrive at the IRR

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| Year | Cash inflows | 28% | 30% | 33% | 34% |
| 1 | 100000 | PV=100000(1/(1.28)1 |  |  | PV=100000(1/(1.34)1 |
| 2 | 100000 | PV=100000(1/(1.28)2 |  |  | PV=100000(1/(1.34)2 |
| 3 | 80000 | PV=80000(1/(1.28)3 |  |  | PV=80000(1/(1.34)3 |
| 4 | 80000 | PV=80000(1/(1.28)4 |  |  | PV=80000(1/(1.34)4 |
| 5 | 40000 | PV=40000(1/(1.28)5 |  |  | PV=40000(1/(1.34)5 |
|  | NPV | +18751 |  |  | -2361.76 |

IRR=Lower Rate +NPV at the lower rate x (HR-LR)

NPV at the Higher rate-NPV at Lower Rate

IRR=28% +18751 x (34-28)

2361.76-18751

IRR=28% +18751 x (34%-28%)

16389.24

28%+1.1441x6%=33.27% to 34.5%

Debate NPV v/s IRR

Prob 10.A company is considering as to which of the nutually exclusive projects it should undertaken. The finance Director thinks that the project with the Higher NPV should be chosen whereas the MD thinks that 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 cash inflows after tax of the projects are as follows

Rs in thousands

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

Required:

a.Calculate the NPV and IRR of each project

b.State, with reason, which project you would recommend.

Decision Based on NPV

Machine X

Decision based on IRR

Machine Y

The project with higher NPV is generally preferred because of higher return in absolute terms. Hence Project X should be selected .