Chapter 9 Capital Budgeting

INTRODUCTION

The word Capital refers to be the total investment of a company of firm in money, tangible and intangible assets. Whereas budgeting defined by the "**Rowland** and **William**" it may be said to be the art of building budgets. Budgets are a blue print of a plan and action expressed in quantities and manners.

The examples of capital expenditure:

1. Purchase of fixed assets such as land and building, plant and machinery, good will, etc.
2. The expenditure relating to addition, expansion, improvement and alteration to the fixed assets.
3. The replacement of fixed assets.
4. Research and development project.

Definitions

According to the definition of **Charles T. Hrongreen,** "capital budgeting is a long-term planning for making and financing proposed capital out lays.

According to the definition of **G.C. Philippatos,** "capital budgeting is concerned with the allocation of the firms source financial resources among the available opportunities. The consideration of investment opportunities involves the comparison of the expected future streams of earnings from a project with the immediate and subsequent streams of earning from a project, with the immediate and subsequent streams of expenditure".

According to the definition of **Richard and Green law,** "capital budgeting is acquiring inputs with long-term return".

According to the definition of **Lyrich,** "capital budgeting consists in planning development of available capital for the purpose of maximizing the long-term profitability of the concern".

It is clearly explained in the above definitions that a firm's scarce financial resources are utilizing the available opportunities. The overall objectives of the company from is to maximize the profits and minimize the expenditure of cost.

Need and Importance of Capital Budgeting

1. **Huge investments:** Capital budgeting requires huge investments of funds, but the available funds are limited, therefore the firm before investing projects, plan are control its capital expenditure.
2. **Long-term:** Capital expenditure is long-term in nature or permanent in nature. Therefore financial risks involved in the investment decision are more. If higher risks are involved, it needs careful planning of capital budgeting.
3. **Irreversible:** The capital investment decisions are irreversible, are not changed back. Once the decision is taken for purchasing a permanent asset, it is very difficult to dispose off those assets without involving huge losses.
4. **Long-term effect:** Capital budgeting not only reduces the cost but also increases the revenue in long-term and will bring significant changes in the profit of the company by avoiding over or more investment or under investment. Over investments leads to be unable to utilize assets or over utilization of fixed assets. Therefore before making the investment, it is required carefully planning and analysis of the project thoroughly.

CAPITAL BUDGETING PROCESS

Capital budgeting is a difficult process to the investment of available funds. The benefit will attained only in the near future but, the future is uncertain. However, the following steps followed for capital budgeting, then the process may be easier are.

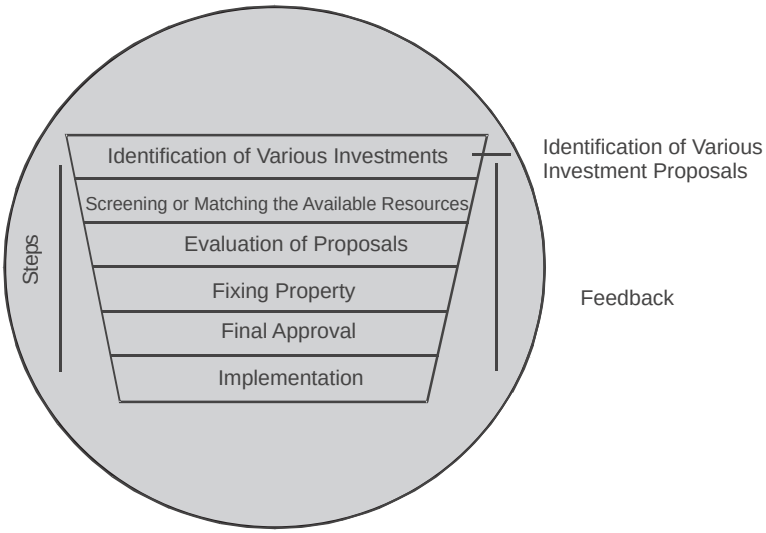

Fig. 9.1 *Capital Budgeting Process*

1. **Identification of various investments proposals:** The capital budgeting may have various investment proposals. The proposal for the investment opportunities may be defined from the top management or may be even from the lower rank. The heads of various department analyse the various investment decisions, and will select proposals submitted to the planning committee of competent authority.
2. **Screening or matching the proposals:** The planning committee will analyse the various proposals and screenings. The selected proposals are considered with the available resources of the concern. Here resources referred as the financial part of the proposal. This reduces the gap between the resources and the investment cost.
3. **Evaluation:** After screening, the proposals are evaluated with the help of various methods, such as pay back period proposal, net discovered present value method, accounting rate of return and risk analysis. Each method of evaluation used in detail in the later part of this chapter. The proposals are evaluated by.
   (a) Independent proposals
   (b) Contingent of dependent proposals
   (c) Partially exclusive proposals.

   Independent proposals are not compared with another proposals and the same may be accepted or rejected. Whereas higher proposals acceptance depends upon the other one or more proposals. For example, the expansion of plant machinery leads to constructing of new building, additional manpower etc. Mutually exclusive projects are those which competed with other proposals and to implement the proposals after considering the risk and return, market demand etc.
4. **Fixing property:** After the evolution, the planning committee will predict which proposals will give more profit or economic consideration. If the projects or proposals are not suitable for the concern's financial condition, the projects are rejected without considering other nature of the proposals.
5. **Final approval:** The planning committee approves the final proposals, with the help of the following:
   (a) Profitability
   (b) Economic constituents
   (c) Financial violability
   (d) Market conditions.

   The planning committee prepares the cost estimation and submits to the management.
6. **Implementing:** The competent autherity spends the money and implements the proposals. While implementing the proposals, assign responsibilities to the proposals, assign responsibilities for completing it, within the time allotted and reduce the cost for this purpose. The network techniques used such as PERT and CPM. It helps the management for monitoring and containing the implementation of the proposals.

7. **Performance review of feedback:** The final stage of capital budgeting is actual results compared with the standard results. The adverse or unfavourable results identified and removing the various difficulties of the project. This is helpful for the future of the proposals.

KINDS OF CAPITAL BUDGETING DECISIONS

The overall objective of capital budgeting is to maximize the profitability. If a firm concentrates return on investment, this objective can be achieved either by increasing the revenues or reducing the costs. The increasing revenues can be achieved by expansion or the size of operations by adding a new product line. Reducing costs mean representing obsolete return on assets.

METHODS OF CAPITAL BUDGETING OF EVALUATION

By matching the available resources and projects it can be invested. The funds available are always living funds. There are many considerations taken for investment decision process such as environment and economic conditions.

The methods of evaluations are classified as follows:

(A) Traditional methods (or Non-discount methods)

(i) Pay-back Period Methods
(ii) Post Pay-back Methods
(iii) Accounts Rate of Return

(B) Modern methods (or Discount methods)

(i) Net Present Value Method
(ii) Internal Rate of Return Method
(iii) Profitability Index Method

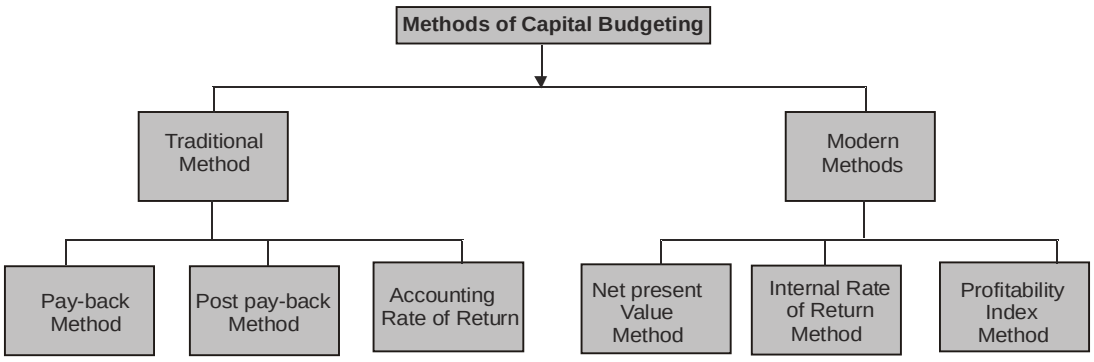

Fig. 9.2 *Capital Budgeting Methods*

Pay-back Period

Pay-back period is the time required to recover the initial investment in a project.

(It is one of the non-discounted cash flow methods of capital budgeting).

$$\text{Pay-back period} = \frac{\text{Initial investment}}{\text{Annual cash inflows}}$$

Merits of Pay-back method

The following are the important merits of the pay-back method:

1. It is easy to calculate and simple to understand.
2. Pay-back method provides further improvement over the accounting rate return.
3. Pay-back method reduces the possibility of loss on account of obsolescence.

Demerits

1. It ignores the time value of money.
2. It ignores all cash inflows after the pay-back period.
3. It is one of the misleading evaluations of capital budgeting.

Accept/Reject criteria

If the actual pay-back period is less than the predetermined pay-back period, the project would be accepted. If not, it would be rejected.

Exercise 1

Project cost is Rs. 30,000 and the cash inflows are Rs. 10,000, the life of the project is 5 years. Calculate the pay-back period.

Solution

$$= \frac{\text{Rs. } 30{,}000}{\text{Rs. } 10{,}000} = 3 \text{ Years}$$

The annual cash inflow is calculated by considering the amount of net income on the amount of depreciation project (Asset) before taxation but after taxation. The income precision earned is expressed as a percentage of initial investment, is called unadjusted rate of return. The above problem will be calculated as below:

$$\text{Unadjusted rate of return} = \frac{\text{Annual Return}}{\text{Investment}} \times 100$$

$$= \frac{\text{Rs. } 10{,}000}{\text{Rs. } 30{,}000} \times 100$$

$$= 33.33\,\%$$

Exercise 2

A project costs Rs. 20,00,000 and yields annually a profit of Rs. 3,00,000 after depreciation @ 12½ % but before tax at 50 %. Calculate the pay-back period.

Profit after depreciation	3,00,000
Tax 50%	1,50,000
	1,50,000
Add depreciation	
20,00,000 $12\frac{1}{2}$%	2,50,000
Cash in flow	4,00,000

Solution

$$\text{Pay-back period} = \frac{\text{Investment}}{\text{Cash flow}}$$

$$= \frac{20,00,000}{4,00,000} = 5 \text{ years.}$$

Uneven Cash Inflows

Normally the projects are not having uniform cash inflows. In those cases the pay-back period is calculated, cumulative cash inflows will be calculated and then interpreted.

Exercise 3

Certain projects require an initial cash outflow of Rs. 25,000. The cash inflows for 6 years are Rs. 5,000, Rs. 8,000, Rs. 10,000, Rs. 12,000, Rs. 7,000 and Rs. 3,000.

Solution

Year	Cash Inflows (Rs.)	Cumulative Cash Inflows (Rs.)
1	5,000	5,000
2	8,000	13,000
3	10,000	23,000
4	12,000	35,000
5	7,000	42,000
6	3,000	45,000

The above calculation shows that in 3 years Rs. 23,000 has been recovered Rs. 2,000, is balance out of cash outflow. In the 4th year the cash inflow is Rs. 12,000. It means the pay-back period is three to four years, calculated as follows

$$\text{Pay-back period} = 3 \text{ years} + 2000/12000 \times 12 \text{ months}$$

$$= 3 \text{ years } 2 \text{ months.}$$

Post Pay-back Profitability Method

One of the major limitations of pay-back period method is that it does not consider the cash inflows earned after pay-back period and if the real profitability of the project cannot be assessed. To improve over this method, it can be made by considering the receivable after the pay-back period. These returns are called post pay-back profits.

Exercise 4

From the following particulars, compute:

1. Payback period.
2. Post pay-back profitability and post pay-back profitability index.

(a)	Cash outflow	Rs. 1,00,000
	Annual cash inflow (After tax before depreciation)	Rs. 25,000
	Estimate Life	6 years
(b)	Cash outflow	Rs. 1,00,000
	Annual cash inflow (After tax depreciation)	
	First five years	Rs. 20,000
	Next five years	Rs. 8,000
	Estimated life	10 Years
	Salvage value	Rs. 16,000

Solution

(a) (i) Pay-back period

$$= \frac{\text{Initial investment}}{\text{Annual cash inflows}}$$

$$= \frac{1,00,000}{25,000} = 4 \text{ Years}$$

(ii) Post pay-back profitability

= Cash inflow (Estimated life – Pay-back period)

= 25,000 (6 – 4)

= Rs. 50,000

(iii) Post pay-back profitability index

$$= \frac{50,000}{1,00,000} \times 100 = 50\,\%$$

(b) Cash inflows are equal, therefore pay back period is calculated as follows:

(i)

Year	Cash Inflows (Rs.)	Cumulative Cash Inflows (Rs.)
1	20,000	20,000
2	20,000	40,000
3	20,000	60,000
4	20,000	80,000

Contd....

5	20,000	1,00,000
6	8,000	1,08,000
7	8,000	1,16,000
8	8,000	1,24,000
9	8,000	1,32,000
10	8,000	1,40,000

(ii) Post pay-back profitability.

= Cash inflow (estimated life – pay-back period)

= 8,000 (10–5)

= $8000 \times 5 = 40,000$

(iii) Post pay-back profitability index

$$= \frac{40,000}{1,00,000} \times 100 = 40\,\%$$

Accounting Rate of Return or Average Rate of Return

Average rate of return means the average rate of return or profit taken for considering the project evaluation. This method is one of the traditional methods for evaluating the project proposals:

Merits

1. It is easy to calculate and simple to understand.
2. It is based on the accounting information rather than cash inflow.
3. It is not based on the time value of money.
4. It considers the total benefits associated with the project.

Demerits

1. It ignores the time value of money.
2. It ignores the reinvestment potential of a project.
3. Different methods are used for accounting profit. So, it leads to some difficulties in the calculation of the project.

Accept/Reject criteria

If the actual accounting rate of return is more than the predetermined required rate of return, the project would be accepted. If not it would be rejected.

Exercise 5

A company has two alternative proposals. The details are as follows:

	Proposal I	**Proposal II**
	Automatic Machine	Ordinary Machine
Cost of the machine	Rs. 2,20,000	Rs. 60,000
Estimated life	5½ years	8 years
Estimated sales p.a.	Rs. 1,50,000	Rs. 1,50,000
Costs : Material	50,000	50,000
Labour	12,000	60,000
Variable Overheads	24,000	20,000

Compute the profitability of the proposals under the return on investment method.

(M.Com., Madras and Bharathidasan)

Solution

Profitability Statement

	Automatic Machine	**Ordinary Machine**
Cost of the machine	Rs. 2,20,000	Rs. 60,000
Life of the machine	5½ years	8 years
	Rs.	**Rs.**
Estimated Sales	(A) 1,50,000	1,50,000
Less : Cost : Material	50,000	50,000
Labour	12,000	60,000
Variable overheads	24,000	20,000
Depreciation (1)	40,000	7,000
Total Cost	(B) 1,26,000	1,37,000
Profit (A) – (B)	24,000	12,500

Working:

(1) Depreciation = Cost ÷ Life

Automatic machine = 2,20,000 ÷ 5½ = 40,000

Ordinary machine = 60,000 ÷ 8 = 7,500

$$\text{Return on investment} = \frac{\text{Average profit}}{\text{Original investment}} \times 100$$

$$= \frac{24,000}{2,20,000} \times 100 \qquad \frac{12,500}{60,000} \times 100$$

10.9% 20.8%

Automatic machine is more profitable than the ordinary machine.

Net Present Value

Net present value method is one of the modern methods for evaluating the project proposals. In this method cash inflows are considered with the time value of the money. Net present value describes as the summation of the present value of cash inflow and present value of cash outflow. Net present value is the difference between the total present value of future cash inflows and the total present value of future cash outflows.

Merits

1. It recognizes the time value of money.
2. It considers the total benefits arising out of the proposal.
3. It is the best method for the selection of mutually exclusive projects.
4. It helps to achieve the maximization of shareholders' wealth.

Demerits

1. It is difficult to understand and calculate.
2. It needs the discount factors for calculation of present values.
3. It is not suitable for the projects having different effective lives.

Accept/Reject criteria

If the present value of cash inflows is more than the present value of cash outflows, it would be accepted. If not, it would be rejected.

Exercise 6

From the following information, calculate the net present value of the two project and suggest which of the two projects should be accepted a discount rate of the two.

	Project X	Project Y
Initial Investment	Rs. 20,000	Rs. 30,000
Estimated Life	5 years	5 years
Scrap Value	Rs. 1,000	Rs. 2,000

The profits before depreciation and after taxation (cash flows) are as follows:

	Year 1	Year 2	Year 3	Year 4	Year 5
	Rs.	Rs.	Rs.	Rs.	Rs.
Project x	5,000	10,000	10,000	3,000	2,000
Project y	20,000	10,000	5,000	3,000	2,000

Note : The following are the present value factors @ 10% p.a.

Year	1	2	3	4	5	6
Factor	0.909	0.826	0.751	0.683	0.621	0.564

(MBA, Madurai-Kamaraj University, May 2005)

Solution

Year	Cash Inflows		Present Value of Rs. 1 @ 10%	Present Value of Net Cash Inflow	
	Project X Rs.	Project Y Rs.		Project X Rs.	Project Y Rs.
1	5,000	20,000	0.909	4,545	18,180
2	10,000	10,000	0.826	8,260	8,260
3	10,000	5,000	0.751	7,510	3,755
4	3,000	3,000	0.683	2,049	2,049
5	2,000	2,000	0.621	1,242	1,242
Scrap Value	1,000	2,000	0.621	621	1,245
Total present value				24,227	34,728
Initial investments				20,000	30,000
Net present value				4,227	4,728

Project Y should be selected as net present value of project Y is higher.

Exercise 7

The following are the cash inflows and outflows of a certain project.

Year	Outflows	Inflows
0	1,75,000	-
1	5,50,000	35,000
2		45,000
3		65,000
4		85,000
5		50,000

The salvage value at the end of 5 years is Rs. 50,000. Taking the cutoff rate as 10%, calculate net present value.

Year	1	2	3	4	5
P.V.	0.909	0.826	0.751	0.683	0.621

Solution

Year	Cash Inflows Rs.	Present Value Factor @ 10%	Present Value of Cash Inflows
1	35,000	0.909	31,815
2	45,000	0.826	37,170

Contd....

3	65000	0.751	48815
4	85000	0.683	58055
5	50000	0.621	31050
5(Salvage)	50000	0.621	31050
		Total present value of cash inflows	237955

Less : Total present value of outflows

Cash outflow at the beginning	1,75,000
Cash outflow at the end of first Year 50000×0.909	45,450
Total value of outflows	2,20,450
Net Present Value	17,505

If the cash inflows are not given in that cases the calculation of cash inflows are Net profit after tax + Depreciation. In this type of situation first find out the Net profit after depreciation and deducting the tax and then add the deprecation. It gives the cash inflow.

Exercise 8 From the following information you can learn after tex and depreciation concept.

Initial Outlay	**Rs. 1,00,000**
Estimated life	5 Years
Scrap Value	Rs. 10,000
Profit after tax :	
End of year 1	Rs. 6,000
2	Rs. 14,000
3	Rs. 24,000
4	16,000
5	Nil

Solution Depreciation has been calculated under straight line method. The cost of capital may be taken at 10 %. P.a. is given below.

Year	1	2	3	4	5
PV factor @ 10%	0.909	0.826	0.751	0.683	0.621

$$\text{Depreciation} = \frac{\text{Initial cash outflow} - \text{scrap value}}{\text{Estimated Life of the project}}$$

$$= \frac{1,00,000 - 10,000}{5}$$

$$= \frac{90,000}{5} = \text{Rs.}18,000$$

Year	Profit after Tax	Depreciation	Cash Inflow
1	6,000	18,000	24,000
2	14,000	18,000	32,000
3	24,000	18,000	42,000
4	16,000	18,000	34,000
5	Nil	18,000	18,000

Net Present Value

Year	Cash Inflow	Discount factor @ 10%	Present value (Rs.)
1	24,000	0.909	21,816
2	32,000	0.826	26,432
3	42,000	0.751	31,542
4	34,000	0.683	23,222
5	18,000	0.621	11,178

Total present value of cash inflows	1,14,190
Less : Initial cash investment	1,00,000
Net present value	1,41,90

Internal Rate of Return

Internal rate of return is time adjusted technique and covers the disadvantages of the traditional techniques. In other words it is a rate at which discount cash flows to zero. It is expected by the following ratio:

$$\frac{\text{Cash inflow}}{\text{Investment initial}}$$

Steps to be followed:

Step1. find out factor

Factor is calculated as follows:

$$F = \frac{\text{Cash outlay (or) initial investment}}{\text{Cash inflow}}$$

Step 2. Find out positive net present value

Step 3. Find out negative net present value

Step 4. Find out formula net present value

Formula

$$\text{IRR} = \text{Base factor} + \frac{\text{Positive net present value}}{\text{Difference in positive and Negative net present value}} \times \text{DP}$$

Base factor = Positive discount rate

DP = Difference in percentage

Merits

1. It consider the time value of money.
2. It takes into account the total cash inflow and outflow.
3. It does not use the concept of the required rate of return.
4. It gives the approximate/nearest rate of return.

Demerits

1. It involves complicated computational method.
2. It produces multiple rates which may be confusing for taking decisions.
3. It is assume that all intermediate cash flows are reinvested at the internal rate of return.

Accept/Reject criteria

If the present value of the sum total of the compounded reinvested cash flows is greater than the present value of the outflows, the proposed project is accepted. If not it would be rejected.

Exercise 9

A company has to select one of the following two projects:

	Project A	Project B
Cost	Rs.22,000	20,000
Cash inflows:		
Year 1	12,000	2,000
Year 2	4,000	2,000
Year 3	2,000	4,000
Year 4	10,000	20,000

Using the Internal Rate of Return method suggest which is Preferable.

Solution

$$F = \frac{\text{Cash outlay}}{\text{Cash inflow}}$$

Project A

$$\text{Cash Inflow} = \frac{\text{Total cash inflow}}{\text{No. of years}}$$

$$= \frac{28{,}000}{4} = 7000$$

$$= \frac{22000}{7000} = 3.14$$

The factor thus calculated will be located in table II below. This would give the estimated rate of return to be applied discounting the cash for the internal rate of returns. In this of project A the rate comes to 10% while in case of project B it comes to15%.

Project A

Year	Cash Inflows Rs.	Discounting Factor at 10%	Present Value Rs.
1	12000	0.909	10908
2	4000	0.826	3304
3	2000	0.751	1502
4	10000	0.683	6830
			22544
Less: Initial Investment.			22000
Net Present Value			544

The present value at 10% comes to Rs. 22,544. The initial investment is Rs. 22,000. Interest rate of return may be taken approximately at 10%.

In the case more exactness is required another trial which is slightly higher than 10% (since at this rate the present value is more than initial investment) may be taken. Taking a rate of 12% the following results would emerge.

Year	Cash Inflows Rs.	Discounting Factor at 12.6%	Present Value Rs.
1	12,000	0.893	10,716
2	4,000	0.794	3,188
3	2,000	0.712	1,424
4	10,000	0.636	6,380
			21,688
Less:	Initial Investment Value		22,000
	Net Present Value		(–)312

$$\text{IRR} = \text{Base factor} + \frac{\text{Positive net present value}}{\text{Difference in positive and Negative net present value}} \times \text{DP}$$

Base factor = 10%

DP = 2%

$$= 10\% + \frac{544}{544 - (-312)} \times 2\%$$

$$= 10\% + \frac{544}{856} \times 2$$

$$= 10 + 1.27$$

$$= 11.27\%$$

Project B

Year	Cash Inflows Rs.	Discount Factor at 15%	Present value Rs.
1	2,000	0.909#	1,818
2	2,000	0.826	1,652
3	4,000	0.751	3,004
4	20,000	0.683	13,660
		Total present value	20,134
Less:		Initial investment	20,000
		Net present value	134

$$\text{IRR} = 10\% \frac{134}{134-(2676)} \times 5\%$$

$= 10\% + 0.24\%$ IRR $= 10.24\%$

Thus, internal rate of return in project 'A' is higher as compared to project 'B'. Therefore project 'A' is preferable.

Exercise 10

A project costs Rs. 16,000 and is expected to generate cash inflows of Rs. 4,000 each 5 years. Calculate the Interest Rate of Return.

Solution

$$F = \frac{16,000}{4,000} = 4$$

Facts may lays between 6% to 8%

4.221 for 6%

3.993 for 8%

4000 × 4.21	=	16,840
4000 × 3.99	=	15,960
6% present value		16,840
Less: Investment		16,000
Net present value		840

8% present value	15,960
Less: Investment	16,000
	−40

$$\text{IRR} = 6\% + \frac{840}{840 - (-40)} \times 2\%$$

$$= 6\% + 1.91\%$$

$$= 7.91\%.$$

Excess Present Value Index

Excess present value is calculated on basis of net present value. It gives the results in percentage.

Exercise 11

The initial of an equipment is Rs. 10,000. Cash inflow for 5 years are estimated to be Rs. 3,500 per year. The management is desired minimum rate of excess present value index.

Solution

Present value of Rs. 1 received annually for 5 years can be had form the annuity table.

Present value of 3,500 received annually for 5 years.

$$\text{Excess present value index} = \frac{\text{Total present value of cash inflows}}{\text{Total present value of cash outflows}}$$

$$= \frac{11,732}{10,000} \times 100$$

$$= 117,32\%$$

Capital Rationing

In the rationing the company has only limited investment the project are selected according to the profitability. The project has selected the combination of proposal that will yield the greatest portability.

Exercise 12 Let us assume that a firm has only Rs. 20 lakhs to invest and funds cannot be provided. The various proposals along with the cost and profitability index are as follows.

Proposal	Pool of the project	Profitability Index
1	6,00,000	1.46
2	2,00,000	.098
3	10,00,000	2.31
4	4,00,000	1.32
5	3,00,000	1.25

Solution

In this example all proposals expect number 2 give profitability exceeding one and are profitable investments. The total outlay required to be invested in all other (profitable) project is Rs. 25,00,000(1 + 2 + 3 + 4 + 5) but total funds available with the firm are Rs. 20 lakhs and hence the firm has to do capital combination of project within a total which has the lowest profitability index along with the profitable proposals cannot be taken.

RISK AND UNCERTAINLY IN CAPITAL BUDGETING

Capital budgeting requires the projection of cash inflow and outflow of the future. The future in always uncertain, estimate of demand, production, selling price, cost etc., cannot be exact.

For example: The product at any time it become obsolete therefore, the future in unexpected. The following methods for considering the accounting of risk in capital budgeting. Various evaluation methods are used for risk and uncertainty in capital budgeting are as follows:

(i) Risk-adjusted cut off rate (or method of varying discount rate)
(ii) Certainly equivalent method.
(iii) Sensitivity technique.
(iv) Probability technique
(v) Standard deviation method.
(vi) Co-efficient of variation method.
(vii) Decision tree analysis.

(i) Risk-adjusted cutoff rate (or Method of varying)

This is one of the simplest method while calculating the risk in capital budgeting increase cut of rate or discount factor by certain percentage an account of risk.

Exercise 13 The Ramakrishna Ltd., in considering the purchase of a new investment. Two alternative investments are available (X and Y) each costing Rs. 150000. Cash inflows are expected to be as follows:

Cash Inflows

Year	Investment X Rs.	Investment Y Rs.
1	60,000	65,000
2	45,000	55,000
3	35,000	40,000
4	30,000	40,000

The company has a target return on capital of 10%. Risk premium rate are 2% and 8% respectively for investment X and Y. Which investment should be preferred?

Solution

The profitability of the two investments can be compared on the basis of net present values cash inflows adjusted for risk premium rates as follows:

	Investment X			Investment Y		
Year	Discount Factor10% + 2% = 12%	Cash Inflow Rs.	Present Value Rs.	Discount Factor 10% + 8%=18%	Cash Inflow Rs.	Present Values
1	0.893	60,000	53,580	0.847	85,000	71,995
2	0.797	45,000	35,865	0.718	55,000	39,490
3	0.712	35,000	24,920	0.609	40,000	24,360
4	0.635	30,000	19,050	0.516	40,000	20,640
			1,33,415			1,56,485

Investment X

Net present value = 133415 – 150000

= – Rs. 16585

Investment Y

Net present value = 156485 – 150000

= Rs. 6485

As even at a higher discount rate investment Y gives a higher net present value, investment Y should be preferred.

(ii) Certainly equivalent method

It is also another simplest method for calculating risk in capital budgeting info reduceds expected cash inflows by certain amounts it can be employed by multiplying the expected cash inflows by certainly equivalent co-efficient in order the uncertain cash inflow to certain cash inflows.

Exercise 14

There are two projects A and B. Each involves an investment of Rs. 50,000. The expected cash inflows and the certainly co-efficient are as under:

Year	Project A		Project B	
	Cash inflows	Certainly co-efficient	Cash inflows	Certainly Co-efficient
1	35,000	.8	25,000	.9
2	30,000	.7	35,000	.8
3	20,000	.9	20,000	.7

Risk-free cutoff rate is 10%. Suggest which of the two projects. Should be preferred.

Solution

Calculations of cash Inflows with certainly:

Year	Project A			Project B		
	Cash Inflow	Certainly Co-efficient	Certain Cash Inflow	Cash Inflow	Certainly Co-efficient	Certain Cash Inflow
1	35,000	.8	28,000	25,000	.9	22,500
2	30,000	.7	21,000	35,000	.8	28,000
3	20,000	.9	18,000	20,000	.7	14,000

Calculation of present values of cash inflows:

Year	Project A		Project B		
	Discount Factor @ 10%	Cash Inflows	Present Values	Cash Inflows	Present Value
1	0.909	28,000	25,452	22,500	20,453
2	0.826	21,000	17,346	28,000	23,128
3	0.751	18,000	13,518	14,000	10,514
Total			56,316		54,095

	Project A	Project B
Net present value	= Rs. 56,316 – 50,000	54,095 – 50,000
	= Rs. 6,316	Rs. 4,095

As the net present value of project A in more than that of project B. Project A should be preferred:

(iii) Sensitivity technique

When cash inflows are sensitive under different circumstances more than one forecast of the future cash inflows may be made. These inflows may be regarded on 'Optimistic', 'most likely' and 'pessimistic'. Further cash inflows may be discounted to find out the net present values under these three different situations. If the net present values under the three situations differ widely it implies that there is a great risk in the project and the investor's is decision to accept or reject a project will depend upon his risk bearing activities.

Exercise 15

Mr. Selva is considering two mutually exclusive project 'X' and 'Y'. You are required to advise him about the acceptability of the projects from the following information.

	Project X Rs.	Projects Y Rs.
Cost of the investment	1,0,0000	1,00,000
Forecast cash inflows per annum for 5 years		
Optimistic	60,000	55,000
Most likely	35,000	30,000
Pessimistic	20,000	20,000

(The cut-off rate may be assumed to be 15%).

Solution

Calculation of net present value of cash inflows at a discount rate of 15%.

(Annuity of Re. 1 for 5 years).

For Project X

Event	Annual cash Inflow Rs.	Discount factor @ 15 %	Present value Rs.	Net Present value Rs.
Optimistic	60,000	3.3522	2,01,132	1,01,132
Most likely	35,000	3.3522	1,17,327	17,327
Pessimistic	20,000	3.3522	67,105	(32,895)

For Project Y

Event	Annual cash Inflow Rs.	Discount factor @ 15 %	Present value Rs.	Net Present value Rs.
Optimistic	55,000	3.3522	1,84,371	84,371
Most likely	30,000	3.3522	1,00,566	566
Pessimistic	20,000	3.3522	67,105	(32,895)

The net present values on calculated above indicate that project Y is more risky as compared to project X. But at the same time during favourable condition, it is more profitable also. The acceptability of the project will depend upon Mr. Selva's attitude towards risk. If he could afford to take higher risk, project Y may be more profitable.

(iv) Probability technique

Probability technique refers to the each event of future happenings are assigned with relative frequency probability. Probability means the likelihood of future event. The cash inflows of the future years further discounted with the probability. The higher present value may be accepted.

Exercise 16

Two mutually exclusive investment proposals are being considered. The following information in available.

	Project A (Rs.)	Project B (Rs.)
Cost	10,000	10,000

Cash inflows Year	Rs.	Probability	Rs.	Probability
1	10,000	.2	12,000	.2
2	18,000	.6	16,000	.6
3	8,000	.2	14,000	.2

Assuming cost of capital at (or) advise the selection of the project:

Solution

Calculation of net project values of the two projects.

Project A

Year	P.V. Factor @ 10 %	Cash Inflow	Probability	Monetary Value	Present Value Rs.
1	0.909	10,000	.2	2,000	1,818
2	0.826	18,000	.6	10,800	8,921
3	0.751	8,000	.2	1,600	1,202
		Total Present value			11,941
		Cost of Investment			10,000
		Net present value			1,941

Project B

Year	P.V. Factor @ 10 %	Cash Inflow	Probability	Monetary Value	Present Value Rs.
1	0.909	12,000	.2	2,400	2,182
2	0.826	14,000	.6	8,400	6,938
3	0.751	14,000	.2	2,800	2,103
		Total present value			11,223
		Cost of investment			10,000
		Net present value			1,223

As net present value of project A is more than that of project B after taking into consideration the probabilities of cash inflows project A is more profitable one.

(v) Standard deviation method

Two Projects have the same cash outflow and their net values are also the same, standard durations of the expected cash inflows of the two Projects may be calculated to measure the comparative and risk of the Projects. The project having a higher standard deviation in said to be more risky as compared to the other.

Exercise 17

From the following information, ascertain which project should be selected on the basis of standard deviation.

Project X		Project Y	
Cash inflow	**Probability**	**Cash inflow**	**Probability**
Rs.		**Rs.**	
3,200	.2	32,000	.1
5,500	.3	5,500	.4
7,400	.3	7,400	.4
8,900	.2	8,900	.1

Solution

Project X

Cash inflow	Deviation from Mean (d)	Square Deviations d^2	Probability	Weighted Deviations (td^2)
1	2	3	4	5
3,200	(–) 6,250	9,30,25,000	.2	18,60,500
5,500	(–) 750	56,2,500	.3	1,68,750
7,400	(+) 1,150	13,22,500	.3	3,96,750
8,900	(+) 2,650	70,22,500	.2	14,04,500

n= 1 Σfd^2 = 38,30,500

$$\text{Standard Deviation (6)} = \sqrt{\frac{\Sigma fd^2}{n}}$$

$$= \sqrt{\frac{3830500}{1}}$$

$$= 1957.2$$

Project Y

1	2	3	4	5
3,200	(–) 3,050	9,30,25,000	.1	9,30,250
5,500	(–) 750	5,62,500	.4	2,25,000
7,400	(+) 1,150	13,22,500	.4	5,29,000
8,900	(+) 2,650	70,22,500	.1	7,02,250

n= 1 Σfd^2 = 3830500

$$\text{Standard deviation(6)} = \sqrt{\frac{\Sigma fd^2}{n}}$$

$$= \sqrt{\frac{2386500}{1}}$$

$$= 1544.8$$

As the standard deviation of project X is more then that of project Y, A is more risky.

(vi) Co-efficient of variation method

Co-efficient of variation is a relative measure of dispersion. It the projects here the same cost but different net present values, relatives measure, i.e., Co-efficient of variation should be risk induced. It can be calculated as:

$$\text{Co-efficient of variation} = \frac{\text{Standard deviation}}{\text{mean}} \times 100$$

Exercise 18

Using figure of previous example compute co-efficient of variation and suggest which proposal should be accepted:

Solution

$$\textbf{For project X} = \frac{1957.2}{6250} \times 100$$

$$= 31.31\,\%$$

$$\textbf{For project Y} = \frac{1544.8}{6250} \times 100$$

$$= 29.52\,\%$$

As the co-efficient of variation of project 'X' in more then that 'Y' project X in more risk. Hence, project Y should be selected.

(vii) Decision tree analysis

In the modern business world, putting the investments are become more complex and taking decisions in the risky situations. So, the decision tree analysis helpful for taking risky and complex decisions, because it consider all the possible event's and each possible events are assigned with the probability.

Construction of Decision Tree

1. Defined the problem
2. Evaluate the different alternatives
3. Indicating the decision points
4. Assign the probabilities of the monetary values
5. Analysis the alternatives.

Accept/Reject criteria

If the net present values are in positive the project may be accepted otherwise it is rejected.

Exercise 19

Mr. Kumar in considering an investment proposal of Rs.40,000. The expected returns during the left of the investment are as under:

Year I

Event	Cash Inflow	Probability
(i)	16,000	.3
(ii)	24,000	.5
(iii)	20,000	.2

Year II

Cash inflows in **year1** are:

	16,000		24,000		20,000	
	Cash Inflows (Rs.)	Prob	Cash Inflows (Rs.)	Prob	Cash Inflows (Rs.)	Prob
(i)	30,000	.2	40,000	.1	5,000	.2
(ii)	40,000	.6	60,000	.8	8,000	.5
(iii)	50,000	.2	80,000	.1	12,000	.3

using 10% as the cost of capital, advise about the acceptability of the proposal:

Solution

Calculation of net present values of cash inflows

Year	Year I Prob. Cash Inflow		Year II Prob. Cash Inflow	Net Present Value of Inflow	Joint Prob.	Expected Net Present value
Cash outflow Rs.40,000	.3	1,6000	.2 30,000	(–) 676	.06	(–) 40.56
			.6 40,000	7,584	.18	1,365.12
			.2 50,000	15,844	.06	950.64
	.5	24,000	.1 20,000	14,856	.04	742.80
			.8 60,000	31,376	.10	2,550.40
			.1 80,000	47,896	.06	2,394.80
	.2	20,000	.2 50,000	19,480	.04	779.20
			.5 80,000	44,260	.10	4,426.00
			.3 1,20,000	77,300	.06	4,638.00
					1.00	27,806.40

As the proposal yields a net present value of +27806.40 at a discount for of 10% other proposal may be accepted.

MODEL QUESTIONS

1. What is capital budgeting? Explain its needs and importance.
2. What are the stages of capital budgeting process?
3. Explain the various methods of capital budgeting techniques.
4. What is risk and uncertainty?
5. Calculate the payback period from the following information:
   Cash outlay Rs. 50,000 and cash inflow Rs. 12,500. (**Ans.** 4 years)
6. From the following information, calculate the pay-back periods for the 3 projects. Which liquors Rs. 2,00,000 each? Suggest most profitable project.

Year	Project I	Project II	Project III
1	50,000	60,000	35,000
2	50,000	70,000	45,000
3	50,000	75,000	85,000
4	50,000	45,000	50,000
5	50,000	–	35,000

7. The machine cost Rs. 1,00,000 and has scrap value of Rs. 10,000 after 5 years. The net profits before depreciation and taxes for the five years period are to be projected that Rs. 20,000, Rs. 24,000, Rs. 30,000, Rs. 26,000 and Rs. 22,000. Taxes are 50%. Calculate pay-back period and accounting rate of return.
   (**Ans.** 4 years 3 months and 11.2%)
8. A company has to choose one of the following two actually exclusive machine. Both the machines have to be depreciated. Calculate NPV.

Cash inflows

Year	Machine X	Machine Y
0	–20,000	–20,000
1	5,500	6,200
2	6,200	8,800
3	7,800	4,300
4	4,500	3,700
5	3,000	2,000

(**Ans.** Machine X is recommended)

9. A machine cost Rs. 1,25,000. The cost of capital is 15%. The net cash inflows are as under:

Year	Rs.
1	25,000
2	35,000
3	50,000
4	40,000
5	25,000

Calculate internal rate of return and suggest whether the project should be accepted of cost. (**Ans.** Reject the machine)

10. Which project will be selected under NPU and IRR?

	A	B
Cash outflow	2,00,000	3,00,000
Cash inflows at the end of		
1 Year	60,000	40,000
2 Year	50,000	50,000
3 Year	50,000	60,000
4 Year	40,000	90,000
5 Year	30,000	1,00,000
Cost of capital is 10%.		

(Reject the two projects because less then the cost of capital).

11. SP Limited company is having two projects, requiring a capital outflow of Rs. 3,00,000. The expected annual income after depreciation but before tax is as follows:

Year	Rs.
1	9,000
2	80,000
3	70,000
4	60,000
5	50,000

Depreciation may be taken as 20% of original cost and taxation at 50% of net income:

You are required 10 calculated

(a) Pay-back period
(b) Net present value
(c) According rate of return
(d) Net present value index.
(e) Internal rate of return.

(**Ans.** 3.5 years, Rs. 25,745, 43.437%, 108.58%, 13.87%)

12. From the following information, select which project is better.

Cash Inflows (Year)	I	II
0	–20,000	–20,000
1	7,000	8,000
2	7,000	9,000
3	6,000	5,000

Risk less discount rate is 5%. Project I is less risks as compared to project II. The management consider risk premium rates at 5% and 10% respectively appropriate for discounting the cash inflows.

13. There are two mutually exclusive projects I and II. Each projects requires an investment of Rs. 60,000. The following are the cash inflows and certainly co-efficient are as follows.

Year	Project I		Project II	
	Cash inflow	Certainty Co-efficient	Cash Inflow	Certainty Co-efficient
1	30,000	.7	25,000	.9
2	25,000	.8	25,000	.8
3	25,000	.9	30,000	.7

Risk-free cutoff rate is 10%. Evaluate which project will be considered.

(**Ans.** Project II is considered)

14. Mr. X is considering two mutually exclusive investment I and II. From the following details advice Mr. X.

	Project I	Project II
Cost of investment	75,000	75,000
Annual income for 5 years Optimistic	37,500	41,250
Most likely	26,250	22,500
Pesionistic	15,000	15,000

The cutoff rate is 12%.

(**Ans.** Project B is preferred)

15. Two mutually exclusive projects are being considered. The following detail is available.

Year	Project A		Project B	
	Rs.	Profitability	Rs.	Profitability
1	12,000	-	12,000	-
2	10,000	.2	10,000	.2
3	15,000	.6	20,000	.6
4	25,000	.2	20,000	.2

(**Ans.** select Project B)

16. Mr. A is considering two mutually exclusive investment projects, from following information select the Project on the basis of standard deviation and co-efficient of variation method.

Cash	Project I Rs. 15,000.		Project II Rs. 15,000	
Cash inflow Year	Rs.	Probabilities	Rs.	Probabilities
1	3,000	.3	4,000	.1
2	4,000	.2	6,000	.4
3	7,000	.3	7,000	.3
4	6,000	.2	3,000	.2

(**Ans.** I Rs. 1673 and 33.46 %
II Rs. 1581 and 31.62 %
Select Project II)

17. Mr. X is considering the project an investment of Rs. 26,000. The expensed returns during the life if the project of are as follows:

Year I

Event	Cash inflow	Probability
a	12,000	.2
b	14,000	.6
c	9,000	.2

Year II

Cash inflows is year I are.

	Rs. 12,000		Rs. 14,000		Rs. 9,000	
	Cash inflow	Probability	Cash inflow	Probability	Cash inflow	Probability
1	18,000	.3	22,000	.2	28,000	.4
2	20,000	.4	26,000	.7	32,000	.5
3	20,000	.3	30,000	.1	35,000	.1

Using 10 % as the use of capital, advise about the acceptability of the proposal.

(**Ans.** Accept the project because + Rs. 6657 at 10 %)