CHAPTER 29

Capital Budgeting

Meaning

The term Capital Budgeting refers to the long-term planning for proposed capital outlays or expenditure for the purpose of maximizing return on investments. The capital expenditure may be :

(1) Cost of mechanization, automation and replacement.

(2) Cost of acquisition of fixed assets, e.g., land, building and machinery etc.

(3) Investment on research and development.

(4) Cost of development and expansion of existing and new projects.

DEFINITION OF CAPITAL BUDGETING

Capital Budget is also known as "Investment Decision Making or Capital Expenditure Decisions" or "Planning Capital Expenditure" etc. Normally such decisions where investment of money and expected benefits arising therefrom are spread over more than one year, it includes both raising of long-term funds as well as their utilization. Charles T. Horngnen has defined capital budgeting as "Capital Budgeting is long-term planning for making and financing proposed capital outlays."

In other words, capital budgeting is the decision making process by which a firm evaluates the purchase of major fixed assets including building, machinery and equipment. According to Hamption, John. J., "Capital budgeting is concerned with the firm's formal process for the acquisition and investment of capital."

From the above definitions, it may be concluded that capital budgeting relates to the evaluation of several alternative capital projects for the purpose of assessing those which have the highest rate of return on investment.

Importance of Capital Budgeting

Capital budgeting is important because of the following reasons :

(1) Capital budgeting decisions involve long-term implication for the firm, and influence its risk complexion.

(2) Capital budgeting involves commitment of large amount of funds.

(3) Capital decisions are required to assessment of future events which are uncertain.

(4) Wrong sale forcast ; may lead to over or under investment of resources.

(5) In most cases, capital budgeting decisions are irreversible. This is because it is very difficult to find a market for the capital goods. The only alternative available is to scrap the asset, and incur heavy loss.

(6) Capital budgeting ensures the selection of right source of finance at the right time.

(7) Many firms fail, because they have too much or too little capital equipment.

(8) Investment decision taken by individual concern is of national importance because it determines employment, economic activities and economic growth.

Objectives of Capital Budgeting

The following are the important objectives of capital budgeting :

(1) To ensure the selection of the possible profitable capital projects.

(2) To ensure the effective control of capital expenditure in order to achieve by forecasting the long-term financial requirements.

(3) To make estimation of capital expenditure during the budget period and to see that the benefits and costs may be measured in terms of cash flow.

(4) Determining the required quantum takes place as per authorization and sanctions.

(5) To facilitate co-ordination of inter-departmental project funds among the competing capital projects.

(6) To ensure maximization of profit by allocating the available investible.

Principles or Factors of Capital Budgeting Decisions

A decision regarding investment or a capital budgeting decision involves the following principles or factors :

(1) A careful estimate of the amount to be invested.

(2) Creative search for profitable opportunities.

(3) A careful estimates of revenues to be earned and costs to be incurred in future in respect of the project under consideration.

(4) A listing and consideration of non-monetary factors influencing the decisions.

(5) Evaluation of various proposals in order of priority having regard to the amount available for investment.

(6) Proposals should be controlled in order to avoid costly delays and cost over-runs.

(7) Evaluation of actual results achieved against those budget.

(8) Care should be taken to think all the implication of long range capital investment and working capital requirements.

(9) It should recognize the fact that bigger benefits are preferable to smaller ones and early benefits are preferable to latter benefits.

Capital Budgeting Process

The following procedure may be considered in the process of capital budgeting decisions :

(1) Identification of profitable investment proposals.

(2) Screening and selection of right proposals.

(3) Evaluation of measures of investment worth on the basis of profitability and uncertainty or risk.

(4) Establishing priorities, i.e., uneconomical or unprofitable proposals may be rejected.

(5) Final approval and preparation of capital expenditure budget.

(6) Implementing proposal, i.e., project execution.

(7) Review the performance of projects.

Types of Capital Expenditure

Capital Expenditure can be of two types :

(1) Capital expenditure increases revenue.

(2) Capital expenditure reduces costs.

(1) Capital Expenditure Increases Revenue : It is the expenditure which brings more revenue to the firm either by expanding the existing production facilities or development of new production line.

(2) Capital Expenditure Reduces Costs : Such a capital expenditure reduces the cost of present product and thereby increases the profitability of existing operations. It can be done by replacement of old machine by a new one.

Types of Capital Budgeting Proposals

A firm may have several investment proposals for its consideration. It may adopt after considering the merits and demerits of each one of them. For this purpose capital expenditure proposals may be classified into :

(1) Independent Proposals

(2) Dependent Proposals or Contingent Proposals

(3) Mutually Excusive Proposals

(1) Independent Proposals : These proposals are said be to economically independent which are accepted or rejected on the basis of minimum return on investment required. Independent proposals do not depend upon each other.

(2) Dependent Proposals or Contingent Proposals : In this case, when the acceptance of one proposal is contingent upon the acceptance of other proposals, it is called as "Dependent or Contingent Proposals." For example, construction of new building on account of installation of new plant and machinery.

(3) Mutually Exclusive Proposals : Mutually Exclusive Proposals refer to the acceptance of one proposal results in the automatic rejection of the other proposal. Then the two investments are mutually exclusive. In other words, one can be rejected and the other can be accepted. It is easier for a firm to take capital budgeting decisions on such projects.

Methods of Evaluating Capital Investment Proposals

There are number of appraisal methods which may be recommended for evaluating the capital investment proposals. We shall discuss the most widely accepted methods. These methods can be grouped into the following categories :

I. Traditional Methods :

Traditional methods are grouped in to the following :

(1) Pay-back period method or Payout method.

(2) Improvement of Traditional Approach to Pay-back Period Method.

(a) Post Pay-back profitability Method.

(b) Discounted Pay-back Period Method.

(c) Reciprocal Pay-back Period Method.

(3) Rate of Return Method or Accounting Rate of Return Method.

II. Time Adjusted Method or Discounted Cash Flow Method

Time Adjusted Method further classified into :

(1) Net Present Value Method.

(2) Internal Rate of Return Method.

(3) Profitability Index Method.

I. Traditional Methods

(1) Pay-back Period Method : Pay-back period is also termed as "Pay-out period" or Pay-off period. Pay out Period Method is one of the most popular and widely recognized traditional method of evaluating investment proposals. It is defined as the number of years required to recover the initial investment in full with the help of the stream of annual cash flows generated by the project.

Calculation of Pay-back Period : Pay-back period can be calculated into the following two different situations :

(a) In the case of constant annual cash inflows.

(b) In the case of uneven or unequal cash inflows.

(a) In the case of constant annual cash inflows : If the project generates constant cash flow the Pay-back period can be computed by dividing cash outlays (original investment) by annual cash inflows. The following formula can be used to ascertain pay-back period :

$$\text{Pay-back Period} = \frac{\text{Cash Outlays (Initial Investment)}}{\text{Annual Cash Inflows}}$$

Illustration: 1

A project requires initial investment of Rs. 40,000 and it will generate an annual cash inflows of Rs. 10,000 for 6 years. You are required to find out pay-back period.

Solution:

Calculation of Pay-back period :

$$\text{Pay-back Period} = \frac{\text{Cash Outlays (Initial Investment)}}{\text{Annual Cash Inflows}}$$

$$= \frac{\text{Rs. } 40{,}000}{\text{Rs. } 10{,}000} = 4 \text{ Years}$$

Pay-back period is 4 years, i.e., the investment is fully recovered in 4 years.

(b) In the case of Uneven or Unequal Cash Inflows : In the case of uneven or unequal cash inflows, the Pay-back period is determined with the help of cumulative cash inflow. It can be calculated by adding up the cash inflows until the total is equal to the initial investment.

Illustration: 2

From the following information you are required to calculate pay-back period :

A project requires initial investment of Rs. 40,000 and generate cash inflows of Rs. 16,000, Rs. 14,000, Rs. 8,000 and Rs. 6,000 in the first, second, third, and fourth year respectively.

Solution:

Calculation Pay-back Period with the help of "Cumulative Cash Inflows"

Year	*Annual Cash Inflows* *Rs.*	*Cumulative Cash Inflows* *Rs.*
1	16,000	16,000
2	14,000	30,000
3	8,000	38,000
4	6,000	44,000

The above table shows that at the end of 4th years the cumulative cash inflows exceeds the investment of Rs. 40,000. Thus the pay-back period is as follows :

$$\text{Pay-back Period} = 3 \text{ Years} + \frac{40{,}000 - 38{,}000}{6{,}000}$$

$$= 3 \text{ Years} + \frac{\text{Rs. } 2{,}000}{\text{Rs. } 6{,}000}$$

$$= 3.33 \text{ Years}$$

Illustration : 3

Rahave Ltd. is producing articles mostly by manual labour and is considering to replace it by a new machine. There are two alternative models X and Y of the new machine. Prepare a statement of profitability showing the pay-back period from the following information :

	Machine X	*Machine Y*
Estimate life of the Machine	4 Years	5 Years
Cost of machine	Rs. 1,80,000	Rs. 3,60,000
Estimated savings in scrap	Rs. 10,000	Rs. 16,000

Estimated savings in direct wages	Rs. 1,20,000	Rs. 1,60,000
Additional cost of maintenance	Rs. 16,000	Rs. 20,000
Additional cost of supervision	Rs. 24,000	Rs. 36,000

Solution:

Calculation of Annual Cash Inflows

Particulars	*Machine X Rs.*	*Machine Y Rs.*
Estimated saving in scrap	10,000	16,000
Add : Estimated saving in direct wages	1,20,000	1,60,000
Total saving (A)	1,30,000	1,76,000
Additional cost of maintenance	16,000	20,000
Additional cost of supervision	24,000	36,000
Total additional cost (B)	40,000	56,000
Net Cash Inflows (A) – (B)	90,000	1.20,000

$$\text{Pay-back Period} = \frac{\text{Original Investment}}{\text{Annual Average Cash Inflows}}$$

$$\text{Machine X} = \frac{\text{Rs.1,80,000}}{\text{Rs.90,000}} = 2 \text{ Years}$$

$$\text{Machine Y} = \frac{\text{Rs.3,60,000}}{\text{Rs.1,20,000}} = 3 \text{ Years}$$

Machine X should be preferred because it has a shorter pay-back period.

Illustration: 4

From the following information advise the management as to which project is preferable based on pay-back period. Two projects X and Y, each project requires an investment of Rs. 30,000. The standard cut off period for the company is 5 years.

(Net profit before depreciation and after tax)

Years	*Project X Rs.*	*Project Y Rs.*
I st	10,000	8,000
II nd	10,000	8,000
III rd	4,000	12,000
IV th	6,000	6,000
V th	8,000	7,000

Solution:

Calculation of Pay-back Period

Project X = Rs. 10,000 + Rs. 10,000 + Rs. 4,000 + Rs. 6,000
= Rs. 30,000 is recovered in 4th year
Project Y = Rs. 8,000 + Rs. 8,000 + Rs. 12,000
= Rs. 30,000 is recovered in 3rd year

The Pay-back period of project X and Y are 4 years and 3 years respectively and thus project Y should be preferred because it has a shorter pay-back period.

Accept or Reject Criterion

Investment decisions based on pay-back period used by many firms to accept or reject an investment proposal. Among the mutually exclusive or alternative projects whose pay-back periods are lower than the cut off period, the project would be accepted, if not it would be rejected.

Advantages of Pay-back Period Method

(1) It is an important guide to investment policy

(2) It is simple to understand and easy to calculate

(3) It facilitates to determine the liquidity and solvency of a firm

(4) It helps to measure the profitable internal investment opportunities

(5) It enables the firm to select an investment which yields a quick return on cash funds

(6) It used as a method of ranking competitive projects

(7) It ensures reduction of cost of capital expenditure.

Disadvantages of Pay-back Period Method

(1) It does not measure the profitability of a project

(2) It does not value projects of different economic lives

(3) This method does not consider income beyond the pay-back period

(4) It does not give proper weight to timing of cash flows

(5) It does not indicate how to maximize value and ignores the relative profitability of the project

(6) It does not consider cost of capital and interest factor which are very important factors in taking sound investment decisions.

2. Improvement of Traditional Approach to Pay-back Period

The demerits of the pay-back period method may be eliminated in the following ways:

(a) Post Pay-back Profitability Method : One of the limitations of the pay-back period method is that it ignores the post pay-back returns of project. To rectify the defect, post pay-back period method considers the amount of profits earned after the pay-back period. This method is also known as Surplus Life Over Pay-back Method. According to this method, pay-back profitability is calculated by annual cash inflows in each of the year, after the pay-back period. This can be expressed in percentage of investment.

Post Pay-back Profitability = Annual Cash Inflow x (Estimated Life – Pay-back Period)

The post pay-back profitability index can be determined by the following equation :

$$\text{Post Pay-back Profitability Index} = \frac{\text{Post Pay-back Profits}}{\text{Initial Investments}} \times 100$$

(b) Discounted Pay-back Method : This method is designed to overcome the limitation of the pay-back period method. When savings are not levelled, it is better to calculate the pay-back period by taking into consideration the present value of cash inflows. Discounted pay-back method helps to measure the present value of all cash inflows and outflows at an appropriate discount rate. The time period at which the cumulated present value of cash inflows equals the present value of cash outflows is known as discounted pay-back period.

(c) Reciprocal Pay-back Period Method : This methods helps to measure the expected rate of return of income generated by a project. Reciprocal pay-back period method is a close approximation of the Time

Adjusted Rate of Return, if the earnings are levelled and the estimated life of the project is somewhat more than twice the pay-back period. This can be calculated by the following formula :

$$\text{Reciprocal Pay-back Period} = \frac{\text{Annual Cash Inflows}}{\text{Total Investment}} \times 100$$

Illustration: 5

The company is considering investment of Rs. 1,00,000 in a project. The following are the income forecasts, after depreciation and tax, Ist year Rs. 10,000, 2nd year Rs. 40,000, 3rd year Rs. 60,000, 4th year Rs. 20,000 and 5th year Rs. Nil.

From the above information you are required to calculate : (1) Pay-back Period (2) Discounted Pay-back Period at 10% interest factor.

Solution:

(1) Calculation of Pay-back Period

Year	*Annual Cash Inflows* Rs.	*Cumulative Cash Inflows* Rs.
1	10,000	10,000
2	40,000	50,000
3	60,000	1,10,000
4	20,000	1,30,000
5	—	1,30,000

The above table shows that at the end of 3rd year the Cumulative Cash Inflows exceeds the investment of Rs. 1,00,000. Thus the Pay-back Period is as follows :

$$\text{Pay-back Period} = 2 \text{ Years} + \frac{1,00,000 - 50,000}{60,000}$$

$$= 2 \text{ Years} + \frac{\text{Rs. } 50,000}{\text{Rs. } 60,000}$$

$$= 2 \text{ Years} + 0.833 = 2.833 \text{ Years}$$

(2) Calculation of Discounted Pay-back Period 10% Interest Rate:

Year	*Cash Inflows*	*Discounting Present Value Factor at 10%*	*Present Value of Cash Inflows (2 x3)*	*Cumulative Value of Cash Inflows*
1	*2*	*3*	*4*	
	Rs.	*Rs.*	*Rs.*	*Rs.*
1	10,000	0.9091	9,091	9,091
2	40,000	0.8265	33,060	42,151
3	60,000	0.7513	45,078	87,229
4	20,000	0.6830	13,660	1,00,889
5	—	0.6209	—	1,00,889

From the above table, it is observed that upto the 4th year Rs. 1,00,000 is recovered. Because the Discounting Cumulative Cash Inflows exceeds the original cash outlays of Rs. 1,00,000. Thus the Discounted Pay-back Period is calculated as follows :

$$\text{Pay-back Period} = 3 \text{ Years} + \frac{1,00,000 - 87,229}{13,660}$$

$$= 3 \text{ Years} + \frac{12,771}{13,660}$$

$$= 3 \text{ Years} + 0.935 = 3.935 \text{ Years}$$

(3) Average Rate of Return Method (ARR) or Accounting Rate of Return Method : Average Rate of Return Method is also termed as Accounting Rate of Return Method. This method focuses on the average net income generated in a project in relation to the project's average investment outlay. This method involves accounting profits not cash flows and is similar to the performance measure of return on capital employed. The average rate of return can be determined by the following equation :

$$\text{Average Rate of Return (ARR)} = \frac{\text{Average Income}}{\text{Average Investments}} \times 100$$

(or)

$$= \frac{\text{Cash Flow} - \text{(After Depreciation and Tax)}}{\text{Original Investments}}$$

$$= \frac{\text{No. of Projects}}{\text{No. of Years}} \times 100$$

Where,

Average investment would be equal to the Original investment plus salvage value divided by Two

$$\text{Average Investment} = \frac{\text{Original Investment}}{2}$$

(or)

$$= \frac{\text{Original Investment} - \text{Scrap Value of the Project}}{2}$$

Advantages

(1) It considers all the years involved in the life of a project rather than only pay-back years.

(2) It applies accounting profit as a criterion of measurement and not cash flow.

Disadvantages

(1) It applies profit as a measure of yardstick not cash flow.

(2) The time value of money is ignored in this method.

(3) Yearly profit determination may be a difficult task.

Illustration: 6

From the following information you are required to find out Average Rate of Return :

An investment with expenditure of Rs.10,00,000 is expected to produce the following profits (after deducting depreciation)

1st Year	Rs. 80,000
2nd Year	Rs. 1,60,000
3rd Year	Rs. 1,80,000
4th Year	Rs. 60,000

Solution:

Calculation of Accounting Rate of Return

$$\text{Average Rate of Return} = \frac{\text{Average Annual Profits – Depreciation and Taxes}}{\text{Average Investments}} \times 100$$

$$\text{Average Annual Profits} = \frac{80{,}000 + 1{,}60{,}000 + 1{,}80{,}000 + 60{,}000}{4}$$

$$= \frac{4{,}80{,}000}{4} = \text{Rs. } 1{,}20{,}000$$

$$\text{Average Investments (Assuming Nil Scrap Value)} = \frac{\text{Investment at beginning} + \text{Investment at the end}}{2}$$

$$= \frac{10{,}00{,}000 + 0}{2} = \text{Rs. } 5{,}00{,}000$$

$$\text{Average Rate of Return} = \frac{1{,}20{,}000 + 0}{5{,}00{,}000} \times 100 = 24\%$$

The percentage is compared with those of other projects in order that the investment yielding the highest rate of return can be selected.

Illustration: 7

Calculate the Average Rate of Return for project 'A' and 'B' from the following information :

	Project A	*Project B*
Investments (Rs.)	25,000	37,000
Expected Life (in years)	4	5
Net earnings		
(After Depreciation & Taxes) :		
	Rs.	*Rs.*
1st Year	2,500	3,750
2nd Year	1,875	3,750
3rd Year	1,875	2,500
4th Year	1,250	1,250
5th Year	–	1,250
	7,500	12,500

If the desired rate of return is 12%, which project should be selected?

Solution:

Calculation of Accounting Rate of Return

$$\text{Average Rate of Return} = \frac{\text{Average Annual Profit – Depreciation and Taxes}}{\text{Average Investments}} \times 100$$

Annual Average Profits :

$$\text{Project A} = \frac{7,500}{4} = \text{Rs. } 1,875$$

$$\text{Project B} = \frac{12,500}{5} = \text{Rs. } 2,500$$

Average Investments :

$$= \frac{\text{Investment at beginning} + \text{Investment at the end}}{2}$$

$$\text{Project A} = \frac{25,000 + 0}{2} = \text{Rs.}12,500$$

$$\text{Project B} = \frac{37,500 + 0}{2} = \text{Rs.}18,750$$

$$\text{Average Rate of Return} = \frac{\text{Average Annual Profit – Depreciation and Taxes}}{\text{Average Investments}} \times 100$$

$$\text{Project A} = \frac{1,875}{12,500} \times 100 = 15\%$$

$$\text{Project B} = \frac{2,500}{18,750} \times 100 = 13.33\ \%$$

Both the project satisfy the minimum required rate of return. The percentage is compared with those of other project in order that the investment yielding the highest rate of return can be selected. Project A will be selected as its ARR is higher than Project B.

Illustration: 8

A project costs Rs. 5,00,000 and has a scrap value of 1,00,000 after 5 years. The net profit before depreciation and taxes for the five years period are expected to be Rs. 1,00,000, Rs. 1,20,000, Rs. 1,40,000, Rs. 1,60,000 and Rs. 2,00,000. You are required to calculate the Accounting Rate of Return, assuming 50% rate of tax and depreciation on straight line method.

Solution:

Calculation of Accounting Rate of Return

Particulars	*Years*					
	1 Rs.	*2* Rs.	*3* Rs.	*4* Rs.	*5* Rs.	*Average* Rs.
Net Income before Depreciation and Taxes	1,00,000	1,20,000	1,40,000	1,60,000	2,00,000	1,44,000
Less : Depreciation $\left[\frac{5,00,000 - 1,00,000}{5}\right]$	80,000	80,000	80,000	80,000	80,000	80,000
Net Profit before Taxes	20,000	40,000	60,000	80,000	1,20,000	64,000
Less : Taxes @ 50%	10,000	20,000	30,000	40,000	60,000	32,000
Net Profit After Tax	10,000	20,000	30,000	40,000	60,000	32,000

$$\text{Accounting Rate of Return} = \frac{\text{Average Annual Profits – Depreciation and Taxes}}{\text{Average Investment}} \times 100$$

Average Annual Profits After Depreciation and Taxes = Rs. 32,000

$$\text{Average Investments} = \frac{\text{Original Investments – Scrap Value}}{2}$$

$$= \frac{5,00,000 - 1,00,000}{2} = \frac{4,00,000}{2}$$

$$= \text{Rs. } 2,00,000$$

$$\text{Accounting Rate of Return} = \frac{32,000}{2,00,000} \times 100 = 16\%$$

The percentage is compared with those of other projects in order that the investment yielding the highest rate of return can be selected.

Discounted Cash Flow Method (or) Time Adjusted Method : Discount cash flow is a method of capital investment appraisal which takes into account both the overall profitability of projects and also the timing of return. Discounted cash flow method helps to measure the cash inflow and outflow of a project as if they occurred at a single point in time so that they can be compared in an appropriate way. This method recognizes that the use of money has a cost, i.e., interest foregone. In this method risk can be incorporated into Discounted Cash Flow computations by adjusting the discount rate or cut off rate.

Disadvantages

The following are some of the limitations of Discounted Pay-back Period Method :

(1) There may be difficulty in accurately establishing rates of interest over the cash flow period.

(2) Lack of adequate expertise in order to properly apply the techniques and interpret results.

(3) These techniques are based on cash flows, whereas reported earnings are based on profits. The inclusion of Discounted Cash Flow Analysis may cause projected earnings to fluctuate considerably and thus have an adverse on share prices.

Net Present Value Method (NPV) : This is one of the Discounted Cash Flow technique which explicitly recognizes the time value of money. In this method all cash inflows and outflows are converted into present value (i.e., value at the present time) applying an appropriate rate of interest (usually cost of capital).

In other words, Net Present Value Method discount inflows and outflows to their present value at the appropriate cost of capital and set the present value of cash inflow against the present value of outflow to calculate Net Present Value. Thus, the Net Present Value is obtained by subtracting the present value of cash outflows from the present value of cash inflows.

Equation for Calculating Net Present Value:

(1) In the case of conventional cash flows, i.e., all cash outflows are entirely initial and all cash inflows are in future years, NPV may be represented as follows :

$$NPV = \left[\frac{R_1}{(1+K)^1} + \frac{R_2}{(1+K)^2} + \frac{R_3}{(1+K)^3} + \frac{R_n}{(1+K)^n} \right] - 1$$

(2) In the case of non-conventional cash inflows, i.e., where there are a series of cash inflows as well as cash outflows the equation for calculating NPV is as :

$$NPV = \left[\frac{R_1}{(1+K)^1} + \frac{R_2}{(1+K)^2} + \frac{R_3}{(1+K)^3} + \frac{R_n}{(1+K)^n} \right] - \left[1o + \frac{1_1}{(1+K)^1} + \frac{1_2}{(1+K)^2} + \frac{1_3}{(1+K)^3} + \frac{1_n}{(1+K)^n} \right]$$

Where :

NPV	=	Net Present Value
R	=	Future Cash Inflows at different times
K	=	Cost of Capital or Cut-off rate or Discounting Rate
1	=	Cash outflows at different times

Rules of Acceptance : If the rate of return from a project is greater than the return from an equivalent risk investment in securities traded in the financial market, the Net Present Value will be positive. Alternatively, if the rate of return is lower, the Net Present Value will be negative.

In other words, if a project has a positive Net Present Value it is considered to be viable because the present value of the inflows exceeds the present value of the outflows. If the projects are to be ranked or the decision is to select one or another, the project with the greatest Net Present Value should be chosen

Symbolically the accept or reject criterion can be expressed as follows :

Where

NPV > Zero Accept the proposal
NPV < Zero Reject the Proposal

Advantages of Net Present Value Method

(1) It recognizes the time value of money and is thus scientific in its approach.

(2) All the cash flows spreadover the entire life of the project are used for calculations.

(3) It is consistent with the objectives of maximizing the welfare of the owners as it depicts the positive or otherwise present value of the proposals.

Disadvantages

(1) This method is comparatively difficult to understand or use.

(2) When the projects in consideration involve different amounts of investment, the Net Present Value Method may not give satisfactory results.

Illustration: 9

Calculate the Net Present Value of the following project requiring an initial cash outlays of Rs. 20,000 and has a no scrap value after 6 years. The net profits after depreciation and taxes for each year of Rs. 6,000 for six years. Assume the present value of an annuity of Re.1 for 6 years at 8% p.a. interest is Rs. 4.623.

Solution:

Calculation of Net Present Value

Initial Cash Outlays	=	Rs. 20,000
Present Value of Cash Inflows	=	Rs. 6,000 x Rs. 4,263
	=	Rs. 27,738
Net Present Value (NPV)	=	Present Value of Cash Inflows – Value of Cash Outflows
	=	Rs. 27,738 – Rs. 20,000
	=	Rs. 7,738
Net Present Value (NPV)	=	Rs. 7,738

Illustration: 10

A project cost Rs. 25,000 and it generates cash inflows through a period of five years Rs. 9,000, Rs. 8,000, Rs. 7,000, Rs. 6,000 and Rs. 5,000. the required rate of return is assumed to be 10%. Find out the Net Present Value of the project.

Solution:

The following table gives us the Net Present Value of the Project :

Calculation of Net Present Value

Year 1	*Cash inflows* 2 Rs.	*Discounted Factor* 3 Rs.	*Present Value of Cash Inflows* (2 x 3) = 4 Rs.
1	9,000	0.9091	8,181
2	8,000	0.8264	6,608
3	7,000	0.7513	5,257
4	6,000	0.6830	4,098
5	5,000	0.6209	3,100
		Net Present Value of Cash Inflows	27,244

Net Present Value	=	Present Value of Cash Inflows – Value of Cash Outflow
	=	Rs. 27,244 – 25,000 = Rs. 2,244

Now the NPV of the project is positive and it can be accepted for investment.

Illustration: 11

A project costing Rs. 5,00,000 has a life of 10 years at the end of which its scrap value is likely to be Rs. 50,000. The firm cut-off rate is 12%. The project is expected to yield an annual profit after tax of Rs. 1,00,000 depreciation being charged on straight line basis. At 12% P.A. the present value of the rupee received annually for 10 years is Rs. 5.65 and the value of one rupee received at the end of 10th year is Re. 0.322. Ascertain the Net Present Value of the project.

Solution:

Calculation of Net Present Value :	*Rs.*
Annual Profit after Tax	1,00,000
Add : Depreciation [Rs. 5,00,000 / 5]	50,000
Cash flows after tax (for year 1 to 10)	1,50,000
Present value factor for 10 years at 12 % - 5.65	
Total Present Value (1,50,000 x 5.65)	8,47,500
Cash flow in 10th year (scrap value) 50,000	
Present value factor in 10th years 0.322	
(50,000 x 0.322)	16,100
Present value of cash inflow in 10th year	8,63,600
Less : Present value of cash outflows	5,00,000
Net Present Value (NPV) =	3,63,600

Now the Net Present Value of the project is positive and it can be accepted for investment.

Illustration: 12

M/s. Pandey Ltd. is contemplating to purchase a machine A and B each costing of Rs.5,00,000. Profits before depreciation are expected as follows :

Year	*Cash Inflows*		*Discounted Factor*
1	*Machine A* *Rs.*	*Machine B* *Rs.*	*10%*
1	1,50,000	50,000	0.9092
2	2,00,000	1,50,000	0.8264
3	2,50,000	2,00,000	0.7513
4	1,50,000	3,00,000	0.6830
5	1,00,000	2,00,000	0.6209

Using a 10% discounted rate indicate which of the machine would be profitable using the Net Present Value (NPV) method.

Solution:

Year	*Discounted*	*Machine A*		*Machine B*	
1	*Factor 10%*	*Cash Flow* *Rs.*	*Present Value* *Rs.*	*Cash Flow* *Rs.*	*Present Value* *Rs.*
0	1.0000	(-)5,00,000	(-)5,00,000	(-)5,00,000	(-)5,00,000
1	0.9091	1,50,000	1,36,365	50,000	45,455
2	0.8264	2,00,000	1,65,280	1,50,000	1,23,960
3	0.7513	2,50,000	1,87,825	2,00,000	1,50,260
4	0.6830	1,50,000	1,02,450	3,00,000	2,04,900
5	0.6209	1,00,000	62,090	2,00,000	1,24,180
		8,50,000	6,54,010	9,00,000	6,48,755

Net Present Value =

Machine A = Rs. 6,54,010 – 5,00,000 = Rs. 1,54,010
Machine B = Rs. 6,48,755 – 5,00,000 = Rs. 1,48,755

From the above table, we obsserved that the Net Present Value of Machine A is higher than that of Machine B. Hence Machine A is preferable.

(2) Internal Rate of Return Method (IRR) : Internal Rate of Return Method is also called as "Time Adjusted Rate of Return Method." It is defined as the rate which equates the present value of each cash inflows with the present value of cash outflows of an investment. In other words, it is the rate at which the net present value of the investment is zero.

Horngren and Foster define Internal Rate of Return as the rate of interest at which the present value of expected cash inflows from a project equals the present value of expected cash outflows of the project.

The Internal Rate of Return can be found out by Trial and Error Method. First, compute the present value of the cash flow from an investment, using an arbitrarily selected interest rate, for example 10%. Then compare the present value so obtained with the investment cost.

If the present value is higher than the cost of capital, try a higher interest rate and go through the procedure again. On the other hand if the calculated present value of the expected cash inflows is lower than the present value of cash outflows, a lower rate should be tried. This process will be repeated until and unless the Net Present Value becomes zero. The interest rate that brings about this equality is defined as the Internal Rate of Return.

Alternatively, the internal rate can be obtained by Interpolation Method when we come across 2 rates. One with positive Net Present Value and other with negative Net Present Value. The IRR is considered as the highest rate of interest which a business is able to pay on the funds borrowed to finance the project out of cash inflows generated by the project.

The Interpolation formula can be used to measure the Internal Rate of Return as follows :

$$\text{Lower Interest Rate} + \frac{\text{NPV of Lower Rate}}{\text{NPV Lower Rate (–) NPV Higher Rate}} \times (\text{Higher Rate} - \text{Lower Rate})$$

Evaluation

A popular discounted cash flow method, the internal rate of return criterion has several virtues :

(1) It takes into account the time value of money.

(2) It considers the cash flows over the entire life of the project.

(3) It makes more meaningful and acceptable to users because it satisfies them in terms of the rate of return on capital.

Limitations

(1) The internal rate of return may not be uniquely defined.

(2) The IRR is difficult to understand and involves complicated computational problems.

(3) The internal rate of return figure cannot distinguish between lending and borrowings and hence high internal rate of return need not necessarily be a desirable feature.

Illustration: 13

The cost of a project is Rs. 32,400. It is expected to generate cash inflows of Rs. 16,000, Rs. 14,000 and Rs. 12,000 through it three year life period. Calculate the Internal Rate of Return of the Project.

Solution:

Calculation of Internal Rate of Return (IRR)

To begin with let us try a rate of 20% and calculate the present value of cash inflows on this rate. The following table will give the calculations :

Year 1	*Cash inflows* 2 Rs.	*Discounted Factor at 20%* 3	*Present Value of Cash Inflows (2 x 3) = 4* Rs.
1	16,000	0.833	13,328
2	14,000	0.694	9,716
3	12,000	0.579	6,948
		Total Present Value of Cash Inflows =	Rs. 29,992

Net Present Value = Present Value of Cash Inflows – Value of Cash Outlays

= Rs. 29,992 – Rs. 32,400 = (–) Rs. 2408

Net Present Value (NPV) = – Rs. 2408

The Net Present Value in this case is negative indicating that 20% is the higher rate and so a lower rate should be tried. Let us try 18%, 16% and 14% respectively. On these rates we will get the following results :

Year 1	*Cash Inflows* 2 Rs.	*Discounted Factor 18%* 3	*Present Value (2 x 3)* 4 Rs.	*Discount Factor 16%* 5	*Present Value (2 x 5)* 6 Rs.	*Discount Factor 14%* 7	*Present Value (2 x 7)* 8 Rs.
1	16,000	0.847	13,552	0.862	13,792	0.877	14,032
2	14,000	0.718	10,052	0.743	10,402	0.769	10,766
3	12,000	0.609	7,308	0.641	7,692	0.675	8,100
Present Value of Cash Inflows			30,912		31,886		31,898
Less: Value of Cash Outflows			32,400		32,400		32,400
Net Present Value (NPV) = (–)			1,488		(–) 514		(–) 498

From the above table of Calculation is can be observed that the real rate lies in between 14% and 16%. Therefore let us select 15% as the internal rate to ascrtain its applicability.

Year 1	*Cash inflows* 2 Rs.	*Discounted Factor 15%* 3	*Present Value of Cash Inflows (2 x 3) 4* Rs.
1	16,000	0.870	13,920
2	14,000	0.756	10,584
3	12,000	0.658	7,896

Present Value of Cash Inflows	=	32,400
Less : Value of Cash Outflow	=	32,400
Net Present Value		0

Thus, the Net Present Value at 15% rate is zero. It indicates that the present value of cash inflows is equal to the present value of cash outflows. Thus internal rate of return 15% for the project under review.

Illustration: 14

The cash flows of projects C and D are reproduced below :

Project	*Cash Flows*					
	C_o	C_1	C_2	C_3	*NVP at 10%*	*IRR*
C —	Rs. 10,000	+ 2,000	+ 4,000	+ 12,000	+ Rs. 4,139	26.5%
D —	Rs. 10,000	+ 10,000	+ 3,000	+ 30,000	+ Rs. 3,823	37.6%

(i) Why there is a conflict of ranking?

(ii) Why should you recommend Project C in spite of lower internal rate of return?

Time	*1*	*2*	*3*	
	Period			
PVIF 0.10 t	0.909	0.8264	0.7513	
PVIF 0.14 t	0.8772	0.7695	0.6750	
PVIF 0.15 t	0.8696	0.7561	0.6575	
PVIF 0.30 t	0.7692	0.5917	0.4552	
PVIF 0.40 t	0.7143	0.5102	0.3644	*[CA, May, 2002]*

Solution:

(i) Suppose the discount rates are 0%, 10%, 15%, 30%, and 40%. The Net Present Value for each of the project is given below :

Discount Rate (%)	*Net Present Value (NVP)*	
	C	*D*
0	8,000	6,000
10	4,139	3,823
15	2,660	2,942
30	- 634	831
40	- 2164	- 238

The conflict in ranking arises because of skewness in cash flows. In case of project C, cash flows occur later in the life and in case of project D, cash flows are skewed towards the beginning.

At lower discount rate, project C's NPV will be higher than that of project D.

As the discount rate increases, project C's NPV will fall at a faster rate, due to compounding effect. After break-even discount rate (14%) project D has higher NPV as well as higher IRR.

(ii) If the opportunity cost of funds is 10%, project C should be accepted because the firm's wealth will be more by Rs.316 (Rs.4139 – Rs.3823)

The incremental analysis will substantiate this point :

Project	*Cash Flows (Rs.)*					
	C_o	C_1	C_2	C_3	*NVP at 10%*	*IRR*
C – D	0	– 8,000	+ 1,000	+ 9,000	Rs. 316	12.5%

Thus Project C should be accepted, when opportunity cost of fund is 10%.

(3) Profitability Index Method

Profitability Index is also known as Benefit Cost Ratio. It gives the present value of future benefits, computed at the required rate of return on the initial investment. Profitability Index may either be Gross Profitability Index or Net Profitability Index. Net Profitability Index is the Gross Profitability Index minus one. The Profitability Index can be calculated by the following equation :

$$\text{Profitability Index} = \frac{\text{Present Value of Cash Inflows}}{\text{Initial Cash Outlays}}$$

Rule of Acceptance : As per the Benefit Cost Ratio or Profitability Index a project with Profitability Index greater than one should be accepted as it will have Positive Net Present Value. Likewise if Profitability Index is less than one the project is not beneficial and should not be accepted.

Advantages of Profitability Index:

(1) It duly recognizes the time value of money.

(2) For calculations when compared with internal rate of return method it requires less time.

(3) It helps in ranking the project for investment decisions.

(4) As this method is capable of calculating incremental benefit cost ratio, it can be used to choose between mutually exclusive projects.

Illustration: 15

A project is in the consideration of a firm. The initial outlay of the project is Rs. 10,000 and it is expected to generate cash inflows of Rs. 4,000, Rs. 3,000, Rs. 5,000 and Rs. 2,000 in four years to follow. Assuming 10% rate of discount, calculate the Net Present Value and Benefit Cost Ratio of the project.

Solution:

Profitability Index

Year *1*	*Cash inflows* *2* *Rs.*	*Discounted Factor* *10%* *3*	*Present Value of Cash Inflows* *(2 x 3) 4* *Rs.*
1	4,000	0.909	3,636
2	3,000	0.826	2,478
3	5,000	0.751	3,755
4	2,000	0.683	1,366
		Net Present Value of Cash Inflows =	11,235

Net Present Value (NPV) = Present Value of Cash Inflows – Value of Cash Outflows
= Rs.11,235 – 10,000 = Rs.1,235

Net Present Value = Rs.1235

$$\text{Gross Profitability Index} = \frac{\text{Present Value of Cash Inflows}}{\text{Initial Cash Outlays}}$$

$$= \frac{\text{Rs. } 11{,}235}{\text{Rs. } 10{,}000} = 1.1235$$

Net Profitability Index = Gross Profitability Index – 1.0
= 1.1235 – 1.0
= 0.1235

The Profitability Index indicates less than one, the project is not beneficial and should not be accepted.

Illustration: 16

There are two mutually exclusive projects under active consideration of a company. Both the projects have a life of 5 years and have initial cash outlays of Rs. 1,00,000 each. The company pays tax at 50% rate and the maximum required rate of the company has been given as 10%. The straight line method of depreciation will be charged on the projects. The projects are expected to generate a net cash inflow before taxes as follows :

Year	*Project X* Rs.	*Project Y* Rs.
1	40,000	60,000
2	40,000	30,000
3	40,000	20,000
4	40,000	50,000
5	40,000	50,000

With the help of the above given information you are required to calculate :

(a) The Pay-back Period of each project
(b) The Average Rate of Return for each project
(c) The Net Present Value and Profitability Index for each project
(d) The Internal Rate of Return for each project

On the basis of your calculations advise the company which project it should accept giving reasons.

Solution:

Calculation of Net Income and Net Cash Flows after Taxes

Project	*Cash Flows before Taxes* Rs.	*Depreciation* Rs.	*Income before Taxes* Rs.	*Taxes 50%* Rs.	*Net Income* Rs.	*Net Cash Inflow after Taxes* Rs.
X	40,000	20,000	20,000	10,000	10,000	30,000
	40,000	20,000	20,000	10,000	10,000	30,000
	40,000	20,000	20,000	10,000	10,000	30,000
	40,000	20,000	20,000	10,000	10,000	30,000
	40,000	20,000	20,000	10,000	10,000	30,000
Y	60,000	20,000	40,000	20,000	20,000	40,000
	30,000	20,000	10,000	5,000	5,000	25,000
	20,000	20,000	0	0	0	20,000
	50,000	20,000	30,000	15,000	15,000	35,000
	50,000	20,000	30,000	15,000	15,000	35,000

(a) Calculation of Pay-back Period:

$$\text{Pay-back Period} = \frac{\text{Cash Outlays}}{\text{Annual Cash Inflows}}$$

$$\text{Project X} = \frac{\text{Rs.1,00,000}}{\text{Rs.30,000}} = 3 \text{ years } 4 \text{ months}$$

Project Y = Rs. 40,000 + 25,000 + 20,000 = Rs. 85,000 for 3 years and the remaining amount of Rs. 15,000 (i.e., Rs. 1,00,000 – Rs. 85,000) will be recovered during the fourth year. The total amount realized during the 4th year is Rs. 35,000. Therefore the amount of Rs. 15,000 can be recovered in 5 months and 4 days

Thus, the pay-back period of project Y will be 3 years 5 months and 4 days.

(b) Calculation of Average Rate of Return (ARR):

In this method we need an average income of the two projects and their average investment outlays:

$$\text{Average Income of Project X} = \frac{\text{Total Income of 5 years}}{5}$$

$$= \frac{\text{Rs. } 10{,}000 + 10{,}000 + 10{,}000 + 10{,}000 + 10{,}000}{5}$$

$$= \frac{\text{Rs. } 50{,}000}{5} = \text{Rs. } 10{,}000$$

$$\text{Average Income of Project Y} = \frac{\text{Rs. } 20{,}000 + 5{,}000 + 0 + 15{,}000 + 15{,}000}{5}$$

$$= \frac{\text{Rs.}55{,}000}{5} = \text{Rs.}11{,}000$$

Average Investment for both Project X and Project Y

$$= \frac{\text{Rs. } 1{,}00{,}000}{2} = \text{Rs.}50{,}000$$

The Average Rate of Return for

$$\text{Project X} = \frac{\text{Rs. } 10{,}000}{\text{Rs. } 50{,}000} = 20\%$$

$$\text{Project Y} = \frac{\text{Rs. } 11{,}000}{\text{Rs. } 50{,}000} = 22\%$$

From the above analysis it follows that project Y is superior to project X as it gives 22% average rate of return as against only 20% average rate of return from project X.

(c) Calculation of Net Present Value (NPV) :

Project X

The Present value of one rupee of an annuity for 5 years at 10% rate of interest is 3.791.

Thus, present value of an annuity of Rs.30,000 for 5 years at 10% rate is Rs.30,000 x 3,791 =

		Rs. 1,13,730
Less : Cash Out lays	=	Rs. 1,00,000
Net Present Value	=	Rs. 13,730

$$\text{Profitability Index} = \frac{\text{Rs. } 1{,}13{,}730}{\text{Rs. } 1{,}00{,}000} = 1.137$$

Project Y

Net Cash Flow *1* *Rs.*	*Present Value Factor at 10%* *2*	*Present Value (1 x 2)* *3*
40,000	0.909	36,630
25,000	0.826	20,650
20,000	0.751	15,020
35,000	0.683	23,905
35,000	0.621	21,735

Total Present Value		1,17,670
Less : Cash Outlays		1,00,000
Net Present Value (NPV)	=	17,670

$$\text{Profitability Index} = \frac{\text{Rs.1,17,670}}{\text{Rs.1,00,000}} = 1.177$$

(d) Calculation of Internal Rate of Return (IRR):

IRR is the rate which when applied to discount the cash flow makes the Net Present Value equal to zero. So IRR of the project X will be :

Project X : There is constant cash inflow of Rs. 30,000 for 5 years. The nearest discount factor for this flow can be obtained by dividing the cash outlays of Rs. 1,00,000 by Rs. 30,000 which comes to 3.33 (i.e., Rs. 1,00,000 + Rs. 30,000).

Referring to the present value of annuity table in the annexure (Table A – 4). We find that the nearest discount factor on the 5 year row is 3.352 which corresponds to a discount rate of 15%. But since 3.333 is lower than 3.352, the actual rate should be between 15% and 16%. To obtain the actual rate of discount, the interpretation will be done as follows :

		Differences	
Present value required	Rs. 1,00,000		
Present value at 15% for Rs.30,000 (i.e., 3.352 x 30,000)	1,00,560	Rs. 560	1%
Present value @ 16 % for Rs.30,000 (i.e., 3274 x 30,000)	98,220	Rs. 2,340	

The actual rate of discount in this way will be :

$$= 15\% = \left[1\% \times \frac{560}{2,340}\right]$$

$$= 15\% + 0.24 = 15.24\%$$

Project Y : In the case of project Y the cash inflow stream is uneven and so the trial and error method will be used to find out the actual rate of discount.

Let us begin with 16% rate of discount. The present value will be

Cash Flow *1* *Rs.*	Present Value *Factor at 16%* *2*	Present Value *(1 x 2) = 3* *Rs.*
40,000	0.862	34,480
25,000	0.743	18,580
20,000	0.641	12,820
35,000	0.552	19,320
35,000	0.476	16,660
	Total Present Value =	Rs. 1,01,860

So the total present value is higher than the cash outlay, therefore to make it equal to Rs. 1,00,000, higher rate of discount should be used. Therefore let us calculate the present value at 18% discount rate which read as follows :

Cash Flow *1* Rs.	Present Value *Factor at 18%* *2*	Present Value *(1 x 2) = 3* Rs.
40,000	0.847	33,880
25,000	0.718	17,950
20,000	0.609	12,180
35,000	0.516	18,060
35,000	0.437	15,090
	Total Present Value =	Rs. 97,160

The amount of total value at 18% discount rate is, thus, lower than the cash outlay and therefore a rate lower than 18% is needed to make the NPV equal to Zero. This actual rate can be now, determined with the help of the process of interpolation as follows :

	Rs.	*Difference*	
Present value required	1,00,000		
		1,860 ⎤	
Present value at 16%	1,01,860		2%
		4,700 ⎦	
Present Value at 18%	97,160		

In this way the actual rate of discount will be :

$$= \quad 16\% = + \left[2\% \times \frac{1,860}{4,700} \right]$$

$$= \quad 16\% + 0.79 = 16.79\%$$

The Internal Rate of Return Project X has been found out to be 15.24% whereas the IRR of Project Y is 16.79%. Thus, Project Y should be accepted and project X rejected.

Precisely Project Y is recommended by the IRR method, NPV method, PI method and IRR method. Project X is recommended by Pay-back Period Method. However, it should be noted that Pay-back Period Method is not theoretically sound method.

QUESTIONS

I.

1. What do you understand by Capital Budgeting?
2. Discuss briefly the principles and characteristics of capital budgeting.
3. State the different techniques of selecting capital budgeting proposals.
4. What do you mean by Average Rate of Return?
5. What is Pay-back Method? State its advantages and limitations.
   Write Short Notes on :
   (a) Net Present Value Method
   (b) Profitability Index
   (c) Internal Rate of Return
   (d) Discounted Pay-back Period Method
   (e) Average Rate of Return
   (f) Reciprocal Pay-back Period Method
6. What is the importance of Capital Budgeting?
7. State the objectives of Capital Budgeting.
8. Explain the process of Capital Budgeting.
9. Explain the different types of Capital Budgeting Proposals.
10. What do you understand by Net Present Value Method? State its advantages and disadvantages.

II. Chose the Correct Answer :

1. Fixed Assets are those which are of a ———— nature
   (a) Fixed (b) Current (c) Acid (d) Liquid

2. The simplest capital budgeting technique is ————
   (a) Net Present Value Method
   (b) Pay-back Period Method
   (c) Internal Rate of Return Method
   (d) Average Rate of Return Method
3. ———— is the rate which equates the present value of expected future cash flows with the cost of the investment.
   (a) Average Rate of Return
   (b) Discounted Rate of Return
   (c) Internal Rate of Return
   (d) Time Adjusted Rate of Return
4. ———— is the relationship that exists between the present value of net cash inflows and the present values of cash outflows.
   (a) Profitability Index
   (b) Distribution of Capital
   (c) Discounted Benefit-Cost Ratio
   (d) Cut-off Point
5. While evaluating capital investment proposals, the time value of money is considered in the case of
   (a) Pay-back method (b) Discount Cash Flow Method
   (c) Accounting Rate of Return Method (d) Net Present Value Method
6. The return after the pay-off period is not considered in case of
   (a) Internal rate of Return Method (b) Net Present Value Method
   (c) Pay-back Period Method (d) Accounting Rate of Return Method
7. Depreciation is included in cost in case of
   (a) Average Rate of Return Method (b) Accounting Rate of Return Method
   (c) Pay-back Period Method (d) Present Value Index Method
8. The Cash flows on account of operations are presumed to have been reinvested at the cut-off rate in case of ————
   (a) Net Present Value Method (b) Pay-back Period Method
   (c) Internal Rate of Return Method (d) Discounted Cash Flow Method
9. The technique of long-term planning for proposed capital outlays, and their financing is termed as ————
   (a) Capital Budgeting (b) Cash Budgeting
   (c) Sales Budgeting (d) Revenue Budgeting
10. The Minimum Rate of Return expected of a capital investment project is termed as ————
    (a) Single Point Rate (b) Cut-off Rate
    (c) Normal Rate (d) Both a and b
11. ———— is the annual average yield on a project
    (a) Internal Rate of Return (b) Cut-off Rate
    (c) Accounting Rate of Return (d) None of the above
12. Capital budgeting is also known as ————
    (a) Investment Decision Making (b) Planning Capital Expenditure
    (c) Capital Expenditure Decisions (d) All the above
13. Capital Investment Decisions are generally ———— .
    (a) Irreversible (b) Reversible (c) Recurring (d) Constant
14. Profitability index is also termed as ————
    (a) Benefit Cost Ratio (b) Liquidity Ratio
    (c) Turnover Ratio (d) Solvency Ratio
15. Internal Rate of Return and ——— are the same
    (a) Time Adjusted Rate of Return (b) Average Rate of Return
    (c) Accounting Rate of Return (d) Profitability Index

[Ans : (1) Fixed (2) Pay-back Period Method (3) Internal Rate of Return (4) Profitability Index (5) Discounted Cash flow Method (6) Pay-back Period Method (7) Accounting Rate of Return Method (8) Discounted Cash Flow Method (9) Capital Budgeting (10) Both a and b (11) Accounting Rate of Return (12) All the above (13) Irreversible (14) Benefit Cost Ratio (15) Time Adjusted Rate of Return]

PRACTICAL PROBLEMS

(1) Calculate the pay-back periods of the following projects each requiring a cash outlays of Rs.1,00,000. Suggest which projects are acceptable if the standard pay-back period is 5 years:

	Cash Inflows	
Year	*Project A*	*Project B*
1	30,000	30,000
2	30,000	40,000
3	30,000	20,000
4	30,000	10,000
5	30,000	5,000

[**Ans :** Pay-back period : Project A – 3.33 years, Project B – 4 years. Both Project A and Project B are acceptable]

(2) From the following data calculate : (1) Net Present Value (2) Internal Rate of Return and (3) Pay-back Period for the following projects. Assume a required rate of return of 10% and a 50% tax rate. Firm has a policy of charging depreciation on diminishing balance method. No capital gain taxes are assumed:

	M	*N*
Initial Cash outlay	Rs. 1,00,000	Rs. 1,40,000
Salvage Value	Nil	20,000
Earning before Depreciation and Taxes :		
Year		
1	25,000	40,000
2	25,000	40,000
3	25,000	40,000
4	25,000	40,000
5	25,000	40,000
Expected Life	5 years	5 years

(3) A company has to choose one of the following mutually exclusive projects. Both the projects will be depreciated on a straight line basis. The firm's cost of capital is 10% and the tax rate is 50%. The before tax cash flows are :

	0	*1*	*2*	*3*	*4*	5
X – Rs. 20,0004,200	4,800	7,000	8,000	2,000		
Y – Rs. 15,0004,200	4,500	4,000	5,000	1,000		

Which project should the firm accept, if the following criteria are used?

(a) Pay-back Period (b) Internal Rate of Return

(c) Net Present Value (d) Profitability Index

(4) The cash flow streams for four alternative investment A, B, C, and D are :

Year	*A*	*B*	*C*	*D*
0	2,00,000	3,00,000	2,10,000	3,20,000
1	40,000	40,000	80,000	2,00,000
2	40,000	40,000	60,000	20,000
3	40,000	40,000	80,000	—
4	40,000	40,000	60,000	—
5	40,000	40,000	80,000	—
6	40,000	30,000	60,000	—
7	40,000	30,000	40,000	—
8	40,000	20,000	40,000	—
9	40,000	20,000	40,000	2,00,000
10	40,000	20,000	40,000	50,000

Calculate the (a) Pay-back Period (b) Net Present Value (c) Internal Rate of Return and (d) Profitability Index.

(5) Atlanda Footwear is considering the purchase of a new leather stitching machine to replace an existing machine. The existing machine has a book value of Rs. 20,000 and a salvage value of Rs. 30,000. It can be used for 5 more years at the end of which its salvage value would be nil. The new machine cost Rs. 80,000. It is expected to bring an annual saving of Rs. 30,000 in operating costs. The depreciation rate on both the machines will be $33^1/_3$ % on the written down value method. The new machine will fetch a salvage value of Rs.50,000 after 5 years. The tax rate for the firm is 60%.

What is the Internal Rate of Return of the replacement proposal?

(6) AVS Ltd is considering the purchase of a new machine for Rs. 1,20,000. It has a life of 4 years and an estimated scrap value of Rs. 20,000. The machine will generate an extra revenue of Rs. 4,00,000 P.A. and have additional operating cost of Rs. 3,20,000 P.A. The company cost of capital is 20% and tax rate 50%. Should the machine be purchased?

[**Ans :** Yes, NPV Rs. 23,486]

(7) William & Co. has to choose one of the two alternative machines. Calculate the Pay-back Period and suggest the profitable machine :

	Machine X	*Machine Y*
Cost of Machine	Rs. 2,00,000	2,50,000
Working Life years	5	5
Profit before tax :		
1st Year	60,000	80,000
2nd Year	70,000	1,00,000
3rd Year	80,000	80,000
4th Year	60,000	70,000
5th Year	40,000	60,000
Rate of Income Tax	50%	50%

[**Ans :** Pay-back period, Machine x – 2.69 years, Y – 2.67 years, Machine y is better]

(8) Following data relate to five independent investment projects :

Projects	*Initial Outlay*	*Annual Cash Inflows*	*Life in Years*
P	10,00,000	2,50,000	8
Q	2,40,000	24,000	15
R	1,84,000	30,000	20
S	11,500	4,000	5
T	80,000	12,000	10

Assume a 10% required rate of return and a 50% tax rate. Rank these five investment projects according to each of the following criteria :

(1) Pay-back Period
(2) Accounting Rate of Return
(3) Net Present Value Index
(4) Internal Rate of Return

(9) X Y Z Ltd. Company is considering the purchase of a machine. Two machines P and Q, each costing Rs.50,000, are available. Earning after taxes are expected to be as under :

Year	*Machine P*	*Machine Q*	*Discount Factor at 10%*
	Rs.	*Rs.*	*Rs.*
1	15,000	5,000	0.9091
2	20,000	15,000	0.8264
3	25,000	20,000	0.7513
4	15,000	30,000	0.6830
5	10,000	20,000	0.6209

Evaluate the two alternatives according to NPV method (a discount of 10% is to be used). Which machine should be selected? Why?

[**Ans :** Pay-back period P - 2·6 years; Q - 3.33 years; NPV - P - Rs. 15,385; Q 14,865; profitability Index - P - 1,308; Q - 1,297; P is better.)

(10) (a) A project of Rs. 40,00,000 yielded annually a profit of Rs. 6,00,000 after depreciation) 12½% and is subject to income tax @ 50%, you are required to calculate pay-back period. (b) No-Project is acceptable unless the yield is 10% cash inflows of a certain project along with cash outflows are given below :

Year	*Outflows* Rs.	*Inflows* Rs.
0	3,00,000	-
1	60,000	40,000
2		60,000
3		1,20,000
4		1,60,000
5		60,000
		80,000 (being salvage value at the end of 5 years)

You are required to calculate Net-Present value

[**Ans :** (a) Pay-back period 5 years. (b) Net present value 17,772.]

(11) SS & Co. Ltd. is considering investing in a project requiring a capital outlay of Rs. 2,00,000. Forecast for annual income after depreciation but before tax is as follows :

Year	*Rs.*
1	1,00,000
2	1,00,000
3	8,0000
4	80,000
5	40,000

Depreciation may be taken as 20% on original cost and taxation at 50% of net income. You are required to evaluate the project according to each of the following methods :

a) Pay-back method
b) Rate of Return on Original Investment method
c) Discounted Cash Flow Method taking cost of capital as 10%
d) Net Present Value Index Method and
e) Internal Rate of Return Method

[**Ans :** (a) Pay-back period is 2.25 years
(b) Rate of return on original investment Method 20%
(c) Rate of return on average investment method 40%
(d) Discounted cash flow method Rs. 1,08,130
(e) Net present value index 154%
(f) Internal rate of return method 2.5]

(12) AVS & Co. Ltd. is contemplating the purchase of machine. Two machines P and Q are available; each machine costing Rs. 5,00,000. In comparing the profitability of the machines, a discount rate of 10% is to be used. Earnings after taxation are expected to be as under :

Year	*Cash flow*	
	Machine P Rs.	*Machine Q* Rs.
1	1,50,000	50,000
2	2,00,000	1,50,000
3	2,50,000	2,00,000
4	1,50,000	3,00,000
5	1,00,000	2,00,000

Indicate which machine would be more profitable investment using the various methods of ranking investment proposals.

[**Ans :** (1) Pay-back period P - 2 $^{3}/_{5}$ years, Q - 3 $^{1}/_{2}$ years; machine P is better.
(2) Return on Investment method
Machine P - 28% : Q - 32%; Machine Q is better
(3) Net Present Value method
Machine P - Rs 1,53,850; Q - Rs. 1,48,650; Machine P is better.)

(13) The life of a machine which costs Rs. 1,20,000 is estimated 5 years. Its salvage value is estimated at Rs. 20,000 at the end of the fifth year. The earnings after taxes (before depreciation) are estimated as given below :

Year	*Rs.*
1	10,000
2	60,000
3	90,000
4	80,000
5	70,000

Calculate : (a) Rate of Return on Original Investments
(b) Earnings per (Rupee) unit of investment
(c) Average Rate of Return on Original Investments
(d) Average Rate of Return on Average Investments

[**Ans :** (a) 158% (b) Rs. 158% (c) 31% (d) 76%]

(14) A company has an investment opportunity cashing Rs. 40,000 with the following expected net cash flow (i.e., after tax and before deprecation) :

Year	*Net - cash flow Rs.*
1	7,000
2	7,000
3	7,000
4	7,000
5	7,000
6	8,000
7	10,000
8	15,000
9	10,000
10	4,000

Using 10% as the cost of capital (rate of discount) determine the following :

(a) Pay-back period
(b) Net present value at 10% discounting factor
(c) Profitability Index at 10% discounting factor
(d) Internal rate of return with the help of 10% discounting factor and 15% discounting factor

[**Ans :** (a) 5.62 years (b) Rs. 8,961 (c) 1.22 (d) 14.70%]

(15) Calculate the Pay-back period, Average Rate of Return and Net Present Value for a Project which requires an initial outlays of Rs. 10,000 and generates year ending cash flows of Rs. 6,000; Rs. 3,000; Rs. 2,000 and Rs. 5,000; and Rs. 5,000 from the end of the first year to the end of fifth year. The required rate of return is 10% and pays tax at 50% rate. The project has a life of five years and depredated on straight line basis :

Year	*Discounting factor at 10%*
1	0.909
2	0.826
3	0.751
4	0.683
5	0.621

[**Ans :** Pay-back period - 3.43 years; ARR - 22%; NPV - 1,768].

❑❑❑