

## ***Capital Budgeting***

**(INCLUDING RISK & DECISION TERM ANALYSIS)**

### **Meaning**

Capital budgeting is the process of making investment decisions in capital expenditures. A capital expenditure may be defined as an expenditure the benefits of which are expected to be received over a period of time exceeding one year. The main characteristic of a capital expenditure is that the expenditure is incurred at one point of time whereas benefits of the expenditure are realised at different points of time in future. In simple language we may say that a capital expenditure is an expenditure incurred for acquiring or improving the fixed assets, the benefits of which are expected to be received over a number of years in future. The following are some of the examples of capital expenditure :

- (1) Cost of acquisition of permanent assets such as land and building, plant and machinery, goodwill, etc.
- (2) Cost of addition, expansion, improvement or alteration in the fixed assets.
- (3) Cost of replacement of permanent assets.
- (4) Research and development project costs, etc.

Capital expenditure involves non-flexible long-term commitment of funds. Thus, capital expenditure decisions are also called as long-term investment decisions. Capital budgeting involves the planning and control of capital expenditure. It is the process of deciding whether or not to commit resources to a particular long term project whose benefits are to be realised over a period of time, longer than one year. Capital budgeting is also known as *Investment Decision Making, Capital Expenditure Decisions, Planning Capital Expenditure and Analysis of Capital Expenditure*.

Charles T. Horngreen has defined capital budgeting as, "Capital budgeting is long term planning for making and financing proposed capital outlays."

According to G.C. Philippatos, "Capital budgeting is concerned with the allocation of the firm's scarce financing resources among the available market 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 expenditures for it."

Richard and Greenlaw have referred to capital budgeting as acquiring inputs with long-run return." In the words of Lynch, "Capital-budgeting consists in planning development of available capital for the purpose of maximising the long term profitability of the concern"

From the above description, it may be concluded that the important features which distinguish capital budgeting decision from the ordinary day to day business decisions are :

- (1) Capital budgeting decisions involve the exchange of current funds for the benefits to be achieved in future ;
- (2) the future benefits are expected to be realised over a series of years ;
- (3) the funds are invested in non-flexible and long-term activities ;
- (4) they have a long term and significant effect on the profitability of the concern :
- (5) they involve, generally, huge funds ;
- (6) they are irreversible decisions.

### **Need and Importance of Capital Budgeting**

Capital budgeting means planning for capital assets. Capital budgeting decisions are vital to any organisation as they include the decisions as to :

- (a) Whether or not funds should be invested in long-term projects such as setting of an industry, purchase of plant and machinery, etc.
- (b) Analyse the proposal for expansion or creating additional capacities.
- (c) To decide the replacement of permanent asset such as building and equipments.
- (d) To make financial analysis of various proposals regarding capital investments so as to choose the best out of many alternative proposals,

The importance of capital budgeting can be well understood from the fact that an unsound investment decision may prove to

be fatal to the very existence of the concern. The need, significance or importance of capital budgeting arises mainly due to the following :

(1) *Large Investments.* Capital budgeting decisions, generally, involve large investment of funds. But the funds available with a firm are always limited and the demand for funds far exceeds the resources. Hence, it is very important for a firm to plan and control its capital expenditure.

(2) *Long-term Commitment of Funds.* Capital expenditure involves not only large amount of funds but also funds for long-term or more or less on permanent basis. The long-term commitment of funds increases the financial risk involved in the investment decision. Greater the risk involved, greater is the need for careful planning of capital expenditure, i.e., Capital Budgeting.

(3) *Irreversible Nature.* The capital expenditure decisions are of irreversible nature. Once the decision for acquiring a permanent asset is taken, it becomes very difficult to reverse that decision for the reason that it is very difficult to dispose of these assets without incurring heavy losses.

(4) *Long-term Effect on Profitability.* Capital budgeting decisions have a long-term and significant effect on the profitability of a concern. Not only the present earnings of the firm are affected by the investments in capital assets but also the future growth and profitability of the firm depends upon the investment decision taken today. An unwise decision may prove disastrous and fatal to the very existence of the concern. Capital budgeting is of utmost importance to avoid over-investment or under-investment in fixed assets.

(5) *Difficulties of Investment Decision.* The long-term investment decisions are more difficult to take because (i) decision extends to a series of years beyond the current accounting period, (ii) uncertainties of future and (iii) higher degree of risk.

(6) *National Importance.* Investment decision though taken by individual concerns is of national importance because it determines employment, economic activities and economic growth.

Thus, we may say that without using capital budgeting techniques a firm may involve itself in a losing project. Proper timing of purchase, replacement, expansion and alteration of assets.

#### **Methods of Capital Budgeting or Evaluation of Investment Proposals**

At each point of time a business firm has a number of proposals regarding various projects in which it can invest funds. But the funds available with the firm are always limited and it is not possible to invest funds in all the proposals at a time. Hence,

it is very essential to select from amongst the various competing proposals, those which give the highest benefits. The crux of the capital budgeting is the allocation of available resources to various proposals. There are many considerations, economic as well as non-economic, which influence the capital budgeting decisions. The crucial factor that influences the capital budgeting decision is the profitability of the prospective investment. Yet the risk involved in the proposal cannot be ignored because profitability and risk are directly related, i.e., higher the profitability, the greater the risk and vice-versa.

There are many methods of evaluating profitability of capital investment proposals. The various commonly used methods are as follows :

**(A) Traditional Methods**

- (1) Pay-back Period Method or Pay-out or Pay-off Method.
- (2) Improvements in Traditional Approach to Pay Back Period Method.
- (3) Rate of Return Method or Accounting Method.

**(B) Time-adjusted Methods or Discounted Methods.**

- (4) Net Present Value Method.
- (5) Internal Rate of Return Method.
- (6) Profitability Index Method.

## TRADITIONAL METHODS

**(1) Pay-back Period Method**

The 'Pay back' sometimes called as pay out or pay off period method represents the period in which the total investment in permanent assets pays back itself. This method is based on the principle that every capital expenditure pays itself back within a certain period out of the additional earnings generated from the capital assets. Thus, it measures the period of time for the original cost of a project to be recovered from the additional earnings of the project itself. Under this method, various investments are ranked according to the length of their pay back periods in such a manner that the investment with a shorter pay-back period is preferred to the one which has a longer pay-back period.

In case of evaluation of a single project, it is adopted if it pays back for itself within a period specified by the management and if the project does not pay back itself within the period specified by the management then it is rejected.

The pay-back period can be ascertained in the following manner :

- (1) Calculate annual net earnings (profits) before depreciation and after taxes ; these are called annual cash inflows.
- (2) Divide the initial outlay (cost) of the project by the annual cash inflow, where the project generates constant annual cash inflows.

Thus, where the project generates constant cash inflows,  
Pay-back period =

$$\frac{\text{Cash outlay of the project or Original Cost of the Asset}}{\text{Annual Cash Inflows}}$$

- (3). Where the annual cash inflows (Profit before depreciation and after taxes) are unequal, the pay-back period can be found by adding up the cash inflows until the total is equal to the initial cash outlay of the project or original cost of the asset.

**Illustration 1.** A project costs Rs. 1,00,000 and yields an annual cash inflow of Rs. 20,000 for 8 years. Calculate its pay-back period.

#### Solution

The Pay-back period for the projects is as follows :

$$\begin{aligned}\text{Pay-back Period} &= \frac{\text{Initial Outlay of the Project}}{\text{Annual Cash Inflow}} \\ &= \frac{1,00,000}{20,000} = 5 \text{ years.}\end{aligned}$$

**Illustration 2.** Determine the pay-back period for a project which requires a cash outlay of Rs. 10,000 and generates cash inflows of Rs. 2,000, Rs. 4,000, Rs. 3,000 and Rs. 2,000 in the first, second, third and fourth year respectively.

#### Solution

$$\text{Total Cash Outlay} = \text{Rs. } 10,000$$

$$\text{Total Cash Inflow for the first 3 years}$$

$$= \text{Rs. } 2,000 + 4,000 + 3,000 = \text{Rs. } 9,000$$

Upto the third year the total cost is not recovered but the total cash inflows for the four years are  $\text{Rs. } 9,000 + 2,000 = \text{Rs. } 11,000$  i.e., Rs. 1,000 more than the cost of the project. So the pay back period is somewhere between 3 and 4 years. Assuming that the cash inflows occur evenly throughout the year, the time required to recover Rs. 1,000 will be  $(1,000/2,000) \times 12 = 6$  months.

Hence, pay back period is 3 years and 6 months.

**Illustration 3.** A project costs Rs. 5,00,000 and yields annually a profit of Rs. 80,000 after depreciation @ 12% p.a. but before tax of 50%. Calculate the pay back period.

**Solution :**

	Rs.
Profit before tax	80,000 ✓
Less tax @ 50%	40,000
Profit after tax	40,000
Add back depreciation @ 12% on Rs. 5,00,000	60,000
Profit before depreciation but after tax or Annual Cash Inflow	1,00,000
 $\text{Pay-back period} = \frac{\text{Cost of the Project}}{\text{Annual Cash Inflow}}$ $= \frac{5,00,000}{1,00,000} = 5 \text{ years.}$	

**Illustration 4.** There are two projects X and Y. Each project requires an investment of Rs. 20,000. You are required to rank these projects according to the pay-back period method from the following information :

(Net Profit before depreciation and after tax)

Years	Project X	Project Y
1st	1,000	2,000
2nd	2,000	4,000
3rd	4,000	6,000
4th	5,000	8,000
5th	8,000	—

**Solution :**

The pay-back period for Project X is 5 years, as

$$(Rs. 1,000 + 2,000 + 4,000 + 5,000 + 8,000)$$

$$= Rs. 20,000$$

While the pay-back period for project Y is 4 years, as

$$(Rs. 2,000 + 4,000 + 6,000 + 8,000 = 20,000)$$

Hence Project Y should be preferred or ranked first.

### Advantages of Pay-back Period Method

- (1) The main advantage of this method is that it is simple to understand and easy to calculate.
- (2) It saves in cost, it requires lesser time and labour as compared to other methods of capital budgeting.
- (3) In this method, as a project with a shorter pay-back period is preferred to the one having a longer pay-back period, it reduces the loss through obsolescence and is

more suited to the developing countries like India which are in the process of development and have quick obsolescence.

- (4) Due to its short-term approach, this method is particularly suited to a firm which has shortage of cash or whose liquidity position is not particularly good.

### Disadvantages

Though pay-back period method is the simplest, oldest and most frequently used method, it suffers from the following limitations :

- (1) It does not take into account the cash inflows earned after the pay-back period and hence the true profitability of the projects cannot be correctly assessed. For example, there are two projects X and Y. Each project requires an investment of Rs. 25,000. The profits before depreciation and after taxes from the two projects are as follows :

Year	Project X		Project Y	
	Rs.		Rs.	
1st	5,000		4,000	
2nd	8,000		6,000	
3rd	12,000		8,000	
4th	3,000		7,000	
5th	—		6,000	
6th	—		4,000	

According to the pay-back method, Project X is better because of earlier pay-back period of 3 years as compared to 4 years pay-back period in case of project Y. But it ignores the earnings after the pay-back period. Project X gives only Rs. 3,000 of earnings after the pay-back period while project Y gives more earnings, i.e., Rs. 10,000 after the pay-back period. It may not be appropriate to ignore earnings after the pay-back period especially when these are substantial.

- (2) This method ignores the time value of money and does not consider the magnitude and timing of cash inflows. It treats all cash flows as equal though they occur in different periods. It ignores the fact that cash received today is more important than the same amount of cash received after, say, 3 years. For Example :

**Years**                                  **Annual Cash Inflows**

	<b>Project No. 1</b>		<b>Project No. 2</b>
	<b>Rs.</b>		<b>Rs.</b>
1	10,000		4,000
2	8,000		6,000
3	7,000		7,000
4	6,000		8,000
5	4,000		10,000
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	35,000		35,000
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According to the pay-back method, both the projects may be treated equal as both have the same cash inflow in 5 years. But in reality Project No. 1 gives more rapid returns in the initial years and is better than Project No. 2.

(3) It does not take into consideration the cost of capital which is a very important factor in making sound investment decisions.

(4) It may be difficult to determine the minimum acceptable pay-back period, it is usually, a subjective decision.

(5) It treats each asset individually in isolation with other assets which is not feasible in real practice.

(6) Pay-back period method does not measure the true profitability of the project as the period considered under this method is limited to a short period only and not the full life of the asset.

In spite of the above mentioned limitations, this method can be used in evaluating the profitability of short-term and medium-term capital investment proposals.

## **(2) Improvements in Traditional Approach to Pay Back Period Methods**

(a) **Post Pay-back Profitability Method.** One of the serious limitations of Pay-back period method is that it does not take into account the cash inflows earned after the pay-back period and hence the true profitability of the project cannot be assessed. Hence, an improvement over this method can be made by taking into account the returns receivable beyond the pay-back period. These returns are called post pay-back profits. Further, post-back profitability index can also be calculated as under :

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

**Capital Budgeting**

**Illustration 5.** For each of the following projects compute (i) pay-back period (ii) post-back profitability and (iii) post-back profitability index :

(a) Initial Outlay	Rs. 50,000
Annual Cash Inflow (After tax but before depreciation)	Rs. 10,000
Estimated Life	8 years
(b) Initial Outlay	Rs. 50,000
Annual Cash Inflow (After tax but before depreciation) :	
First Three years	Rs. 15,000
Next Five years	Rs. 5,000
Estimated Life	8 years
Salvage	Rs. 8,000

**Solution :**

$$(a) (i) \text{ Pay-back period} = \frac{\text{Investment}}{\text{Annual Cash Inflow}}$$

$$= \frac{50,000}{10,000}$$

$$= 5 \text{ years}$$

(ii) Post Pay-back Profitability—Annual Cash Inflow (Estimated Life—Pay back Period)

$$= 10,000 (8 - 5)$$

$$= \text{Rs. } 30,000$$

$$(iii) \text{ Post back Profitability Index} = \frac{30,000}{50,000} \times 100$$

$$= 60\%$$

(b) (i) As the Cash Inflows are not equal during the life of the investment, the Pay-back period can be calculated as :

1st year's Cash Inflow	=	Rs. 15,000
2nd year's Cash Inflow	=	Rs. 15,000
3rd year's Cash Inflow	=	Rs. 15,000
4th years Cash Inflow	=	Rs. 5,000
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		Rs. 50,000

Hence, the pay-back period is 4 years.

(ii) Post pay-back Profitability =

Annual Cash Inflow  $\times$  Remaining Life After Pay-back period.

$$= \text{Rs. } 5,000 \times 4$$

$$= \text{Rs. } 20,000$$

$$(III) \text{ Post Pay-back Profitability Index} = \frac{20,000 \times 100}{50,000}$$

$$= 40\%$$

(b) *Pay-back Reciprocal Method.* Sometimes, Pay-back Reciprocal method is employed to estimate the internal rate of return generated by a project. Pay-back Reciprocals can be calculated as under :

$$\text{Pay-back Reciprocal} = \frac{\text{Annual Cash Inflow}}{\text{Total Investment}}$$

(This can also be calculated in percentage by multiplying the above by 100)

However, this method should be used only when the following two conditions are satisfied :

(i) Equal cash inflows are generated every year.

(ii) The project under consideration has a long life which must be at least twice the pay-back period.

(c) *Post Pay-back Period Method.* One of the limitations of the pay-back period method is that it ignores the life of the project beyond the pay-back period. Post Pay-back Period Method takes into account the period beyond the pay-back. This method is also known as Surplus Life over Pay-back method. According to this method, the project which gives the greater post pay-back period may be accepted. The method can be employed successfully where the various projects under consideration do not differ significantly as to their size and the expected cash inflows are even throughout the life of the project.

(d) *Discounted Pay-back Method.* Another serious limitation of the pay-back period method is that it ignores the time value of money. Hence, an improvement over this method can be made by employing the discounted pay-back period method. Under this method the present values of all cash outflows and inflows are computed at an appropriate discount rate. The present values of all inflows are cumulated in order of time. 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. The project which gives a shorter discounted pay-back period is accepted. The method has been explained in illustration 6.

**Illustration 6.** Calculate discounted pay-back period from the information given below :

Cost of Project	Rs. 6,00,000
Life of the Project	5 years
Annual Cash Inflow	Rs. 2,00,000
Cut off rate 10%	

**Solution :**

### Calculation of Present Values of Cash Inflows

<b>Year</b>	<b>Inflows Rs.</b>	<b>P.V. at 10 discount factor</b>	<b>Present Value Rs.</b>	<b>Cumulative Present Value, Rs.</b>
1	2,00,000	.909	1,81,800	1,81,800
2	2,00,000	.826	1,65,200	3,47,000
3	2,00,000	.751	1,50,200	4,97,200
4	2,00,000	.683	1,36,600	6,33,800
5	2,00,000	.621	1,24,200	7,58,000

Cumulative present value of cash inflows at the end of the third year is Rs. 4,97,200 and it is Rs. 6,33,800 at the end of fourth year. Hence, discounted pay-back period falls in between 3 and 4 years. To be exact

$$\text{discounted pay-back period} = 3 \text{ years} + \frac{1,02,800}{1,36,600}$$

$$= 3\frac{3}{4} \text{ years appx.}$$

### (2) Rate of Return Method

This method takes into account the earnings expected from the investments over their whole life. It is also known as *Accounting Rate of Return method* for the reason that under this method, the Accounting concept of profit (net profits after tax and depreciation) is used rather than cash inflows. According to this method, various projects are ranked in order of the rate of earnings or rate of return. The project with the higher rate of return is selected as compared to the one with lower rate of return. This method can also be used to make decision as to accepting or rejecting a proposal. The expected rate of return is determined and the project which has a higher rate of return than the minimum rate specified by the firm called the *cut off rate*, is accepted and the one which gives a lower expected rate of return than the minimum rate is rejected.

The return on investment method can be used in several ways as follows :

(a) *Average Rate of Return Method* : Under this method average profit after tax and depreciation is calculated and then it is divided by the total capital outlay or total investment in the project. In other words, it establishes the relationship between average annual profits to total investments. Thus,

#### Average Rate of Return

$$= \frac{\text{Total Profits (after dep. & taxes)} \times 100}{\text{Net Investment in the project} \times \text{No. of years of profits}}$$

$$= \frac{\text{Average Annual Profits}}{\text{Net Investment in the project}} \times 100$$

or

**Illustration 7.** A project requires an investment of Rs. 5,00,000 and has a scrap value of Rs. 20,000 after five years. It is expected to yield profits after depreciation and taxes during the five years amounting to Rs. 40,000, Rs. 60,000, Rs. 70,000, Rs. 50,000 and Rs. 20,000. Calculate the average rate of return on the investment.

**Solution :**

$$\begin{aligned}\text{Total Profit} &= \text{Rs. } 40,000 + 60,000 + 70,000 + 50,000 + 20,000 \\ &= \text{Rs. } 2,40,000\end{aligned}$$

$$\text{Average Profit} = \frac{\text{Rs. } 2,40,000}{5} = \text{Rs. } 48,000$$

$$\begin{aligned}\text{Net Investment in the project} &= \text{Rs. } 5,00,000 - 20,000 \text{ (Scrap value)} \\ &= \text{Rs. } 4,80,000.\end{aligned}$$

**Average Rate of Return**

$$\begin{aligned}& \frac{\text{Average Annual Profit}}{\text{Net Investment in the Project}} \times 100 \\ &= \frac{48,000}{4,80,000} \times 100 = 10\%\end{aligned}$$

(b) *Return per unit of Investment Method.* This method is depreciation of the average rate of return method. In this method the total profit after tax and depreciation is divided by the total investment, i.e.,

**Return per unit of Investment**

$$\frac{\text{Total profit (after depreciation & taxes)}}{\text{Net Investment in the Project}} \times 100$$

**Illustration 8.** Continuing illustration 7, the return per unit of investment shall be;

$$\frac{2,40,000}{4,80,000} \times 100 = 50\%$$

(c) *Return on Average Investment Method.* In this method the return on average investment is calculated. Using of average investment for the purpose of return on investment is preferred because the original investment is recovered over the life of the asset on account of depreciation charges. For example:

A machine costs Rs. 1,00,000 and has no scrap value after five years. It is depreciated on straight line method.

The outstanding investment in the project is calculated as follows :

	Rs.
(1) Beginning of the first year	1,00,000
(2) At the end of the first year	80,000
(3) At the end of the second year	60,000
(4) At the end of the third year	40,000
(5) At the end of the fourth year	20,000
(6) At the end of the fifth year	—
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	3,00,000
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$$\text{Average Investment} = \text{Rs. } \frac{3,00,000}{6} = \text{Rs. } 50,000$$

$$\text{Or say, average Investment} = \frac{\text{Total Investment}}{2}$$

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

The return on average investment can be found as follows :

$$\frac{\text{Total Profit after depreciation and taxes}}{\frac{\text{Total Net Investment}}{2}} \times 100$$

**Illustration 9.** Taking the same figures as given in illustration 7, the return on average investment =

$$\frac{2,40,000}{\frac{4,80,000}{2}} \times 100 = 100\%$$

(d) *Average Return on Average Investment Method.* This is the most appropriate method of rate of return on investment. Under this method, average profit after depreciation and taxes is divided by the average amount of investment; thus :

Average Return on Average investment

$$= \frac{\text{Average Annual Profit after dep. and taxes}}{\text{Average Investment}} \times 100$$

$$= \frac{\text{Average Annual Profit}}{\frac{\text{Net Investment}}{2}} \times 100$$

**Illustration 10.** Taking the same figures as given in illustration 7, the average return on average investments

$$= \frac{48,000}{\frac{4,80,000}{2}} \times 100$$

$$= \frac{48,000}{2,40,000} \times 100 \\ = 20\%$$

### **Advantages of Rate of Return Method**

- (1) It is very simple to understand and easy to operate.
- (2) It uses the entire earnings of a project in calculating rate of return and not only the earnings upto the pay-back period and hence gives a better view of profitability as compared to pay-back period method.
- (3) As this method is based upon accounting concept of profit, it can be readily calculated from the financial data.

### **Disadvantages**

- (1) This method also like pay-back period method ignores the time value of money as the profits earned at different points of time are given equal weight by averaging the profits. It ignores the fact that a rupee earned today is of more value than a rupee earned a year after or so.
- (2) It does not take into consideration the cash flows which are more important than the accounting profits.
- (3) It ignores the period in which the profits are earned as a 20% rate of return earned in  $2\frac{1}{2}$  years may be considered to be better than 18% rate of return in 12 years. This is not proper because longer the term of the project, greater is the risk involved.
- (4) This method cannot be applied to a situation where investment in a project is to be made in parts.

### **(B) Time-adjusted or Discounted Cash Flow Methods**

The traditional methods of capital budgeting, i.e., pay-back method as well as accounting rate of return method, suffer from the serious limitations that give equal weight to present and future flow of incomes. These methods do not take into consideration the time value of money, the fact that a rupee earned today has more value than a rupee earned after five years. The time-adjusted or discounted cash flow methods take into account the profitability and also the time value of money. These methods, also called

modern methods of capital budgeting are becoming increasingly popular day by day. Following are the discounted cash flow methods :

### (3) Net Present Value Method

The net present value method is a modern method of evaluating investment proposals. This method takes into consideration the time value of money and attempts to calculate the return on investments by introducing the factor of time element. It recognises the fact that a rupee earned today is worth more than the same rupee earned tomorrow. The net present value method is based on the fact that the cash flow arising at different periods of time differ in value and are not comparable unless their equivalent present values are found. The net present values of all inflows and outflows of cash occurring during the entire life of the project is determined separately for each year by discounting these flows by the firm's cost of capital or a pre-determined rate. The following are the necessary steps to be followed for adopting the net present value method of evaluating investment proposals :

(i) First of all determine an appropriate rate of interest that should be selected as the minimum required rate of return called cut-off rate or discount rate. This rate should be a minimum rate of return below which the investor considers that it does not pay him to invest. The discount rate should be either the actual rate of interest in the market on long-term loans or it should reflect the opportunity cost of capital of the investor.

(ii) Compute the present value of total investment outlay, i.e., cash outflows at the determined discount rate. If the total investment is to be made in the initial year, the present value shall be the same as the cost of investment.

(iii) Compute the present values of total investment proceeds i.e., cash inflows, (profit before depreciation and after tax) at the above determined discount rate.

(iv) Calculate the net present value of each project by subtracting the present value of cash inflows from the present value of cash outflows for each project.

(v) If the net present value is positive or zero, i.e., when present value of cash inflows either exceeds or is equal to the present values of cash outflow, the proposals may be accepted. But in case inflows is less than the present value of cash outflows, the proposals should be rejected

(vi) To select between mutually exclusive projects, the projects should be ranked in order of net present values, i.e., the first preference should be given to the project having the maximum positive net present value.

**PRESENT VALUE TABLE B**  
**Present Value of Rs. 1 payable or receivable Annually for N. Years**

Year	1%	2%	3%	4%	5%	6%	7%	8%	9%	10%
01	0.99010	0.98019	0.97007	0.96154	0.95238	0.94340	0.93458	0.92593	0.91743	0.90909
02	0.98030	0.96117	0.94260	0.92456	0.90703	0.89000	0.87344	0.85734	0.84168	0.82654
03	0.97059	0.94212	0.91514	0.88900	0.86184	0.83969	0.81670	0.79383	0.77218	0.75131
04	0.96908	0.92385	0.85480	0.88849	0.82270	0.79202	0.76290	0.71503	0.70841	0.68301
05	0.95147	0.90573	0.82193	0.86261	0.78153	0.74726	0.71299	0.68058	0.64991	0.62092
06	0.94204	0.91272	0.8797	0.83748	0.79031	0.74622	0.70496	0.66634	0.63017	0.59627
07	0.93348	0.92348	0.90556	0.87056	0.81309	0.74992	0.71468	0.66506	0.62275	0.58447
08	0.91434	0.91434	0.86675	0.85249	0.80941	0.71069	0.67684	0.62741	0.58201	0.54703
09	0.90529	0.90529	0.82031	0.81675	0.76642	0.70259	0.6461	0.59190	0.54391	0.50187
10	0.89632	0.88745	0.84746	0.83748	0.79031	0.74622	0.70496	0.66634	0.63017	0.59627
11	0.88745	0.87846	0.83748	0.82031	0.76642	0.70259	0.6461	0.59190	0.54391	0.50187
12	0.87846	0.86947	0.82031	0.80941	0.76642	0.70259	0.6461	0.59190	0.54391	0.50187
13	0.86947	0.85048	0.80941	0.79031	0.74622	0.69218	0.65112	0.59057	0.54230	0.49825
14	0.86048	0.84143	0.80049	0.78846	0.74726	0.69218	0.65112	0.59057	0.54230	0.49825
15	0.85135	0.83231	0.79031	0.78846	0.74726	0.69218	0.65112	0.59057	0.54230	0.49825
16	0.85282	0.82331	0.78846	0.78846	0.74726	0.69218	0.65112	0.59057	0.54230	0.49825
17	0.84418	0.81418	0.78846	0.78846	0.74726	0.69218	0.65112	0.59057	0.54230	0.49825
18	0.81602	0.80702	0.78846	0.78846	0.74726	0.69218	0.65112	0.59057	0.54230	0.49825
19	0.82774	0.81804	0.80702	0.78846	0.74726	0.69218	0.65112	0.59057	0.54230	0.49825
20	0.81054	0.80143	0.80702	0.78846	0.74726	0.69218	0.65112	0.59057	0.54230	0.49825
21	0.81143	0.80240	0.80702	0.78846	0.74726	0.69218	0.65112	0.59057	0.54230	0.49825
22	0.80143	0.79231	0.79231	0.78846	0.74726	0.69218	0.65112	0.59057	0.54230	0.49825
23	0.79334	0.78534	0.79231	0.78846	0.74726	0.69218	0.65112	0.59057	0.54230	0.49825
24	0.78757	0.77977	0.79231	0.78846	0.74726	0.69218	0.65112	0.59057	0.54230	0.49825
25	0.77977	0.77197	0.79231	0.78846	0.74726	0.69218	0.65112	0.59057	0.54230	0.49825

## Present Value of Re. 1 payable or receivable Annually for N. Years

Year	11%	12%	13%	14%	15%	16%	17%	18%	19%	20%
01	0.90090	0.83286	0.87719	0.86957	0.86207	0.85470	0.84745	0.84034	0.83333	0.82633
02	.81162	.79719	.78315	.76947	.75614	.74316	.73051	.71818	.70616	.69444
03	.73179	.71178	.69305	.67497	.65752	.64066	.62437	.60863	.59342	.57870
04	.65873	.63532	.61332	.59208	.57175	.55229	.53365	.51579	.49867	.48225
05	.59345	.56741	.54276	.51937	.49718	.47611	.45611	.43711	.41905	.40188
06	.53167	.50663	.48032	.45559	.43233	.41044	.38984	.37043	.35214	.33490
07	.48166	.45305	.42506	.39964	.37594	.35383	.33320	.31392	.29592	.27908
08	.43193	.40388	.37616	.35056	.32690	.30503	.28478	.26604	.24867	.23257
09	.39092	.36061	.33288	.30751	.28426	.26205	.24340	.22546	.20897	.19181
10	.35218	.32197	.29459	.26974	.24718	.2268	.20804	.19106	.17560	.16151
11	.31728	.28748	.26070	.23162	.21494	.19542	.17781	.16192	.14576	.13459
12	.28584	.25667	.23071	.20756	.18691	.16846	.15197	.13722	.12400	.11216
13	.25751	.22917	.20416	.1837	.16253	.1423	.12989	.11629	.10420	.09346
14	.21999	.20162	.18068	.15971	.14133	.12520	.11102	.09845	.08757	.07789
15	.20900	.18270	.15988	.14040	.12269	.10793	.09489	.09152	.07359	.06491
16	.18829	.16112	.14150	.12289	.10686	.09304	.08110	.07078	.06184	.05409
17	.16963	.14564	.12522	.10780	.09292	.08021	.06932	.05998	.05196	.04507
18	.15282	.13004	.11081	.09456	.08080	.06914	.05225	.04083	.03667	.03156
19	.13768	.11611	.09806	.08225	.07026	.05461	.05064	.04308	.03669	.03130
20	.12401	.10367	.08678	.07276	.06110	.05139	.04328	.03651	.03084	.02688
21	.11174	.09256	.07680	.06383	.05313	.04430	.03699	.03094	.02591	.02171
22	.10067	.08261	.06796	.05599	.04620	.03819	.03162	.02622	.02178	.01811
23	.0909	.07376	.06014	.04911	.04017	.03292	.02702	.02222	.01830	.01509
24	.08170	.06588	.05322	.04316	.03496	.0288	.02310	.01883	.01518	.01258
25	.07161	.05882	.04710	.03779	.03038	.02447	.01974	.01596	.01292	.01048

## Present Value of Re. 1 payable or Receivable Annually for N. Years

Year	21%	22%	23%	24%	25%	26%	27%	28%	29%	30%
01	0.82645	0.81969	0.81301	0.80645	0.80000	0.78740	0.78125	0.78519	0.7893	0.79172
02	.68101	.67186	.66198	.66036	.64000	.62000	.61035	.61035	.60093	.59172
03	.56437	.55071	.53738	.52449	.51200	.48810	.47684	.47684	.46583	.45557
04	.46651	.45140	.43690	.42297	.40960	.38440	.39253	.39253	.36111	.35013
05	.38454	.37000	.34520	.34111	.32768	.30268	.29104	.29104	.27993	.26933
06	.31863	.30128	.28978	.27509	.26214	.24991	.23833	.22737	.21700	.20718
07	.26333	.24859	.23478	.22184	.20972	.19834	.18766	.17764	.16822	.15877
08	.21763	.20376	.19088	.17891	.16777	.15741	.14776	.13878	.13040	.12259
09	.17986	.16702	.15519	.14428	.13422	.12493	.11635	.10842	.10109	.09403
10	.14864	.13690	.12617	.11635	.10717	.09915	.08470	.07826	.07254	
11	.12265	.11221	.10258	.09383	.08590	.07869	.07214	.06617	.06075	.05580
12	.10153	.09198	.08339	.07567	.06872	.06245	.05680	.05170	.04709	.04292
13	.09391	.07539	.06780	.06103	.05498	.04597	.04470	.04039	.03650	.03302
14	.06934	.05180	.05112	.04921	.04398	.03934	.03522	.03255	.02830	.02540
15	.05731	.04805	.04481	.03969	.03518	.03122	.02773	.02465	.02194	.01954
16	.04756	.04152	.03644	.03201	.02815	.02478	.02183	.01928	.01700	.01503
17	.03914	.03403	.02962	.02581	.02252	.01967	.01719	.01505	.01318	.01156
18	.03435	.02789	.02408	.02082	.01801	.01561	.01354	.01175	.01022	.00889
19	.02673	.02286	.01958	.01679	.01411	.01339	.01066	.00918	.00792	.00684
20	.02209	.01874	.01592	.01153	.00983	.00839	.00717	.00614	.00526	
21	.01826	.01536	.01294	.01092	.00922	.00780	.00661	.00591	.00476	.00405
22	.01509	.01249	.01052	.00880	.00738	.00619	.00520	.00438	.00369	.00311
23	.01247	.01012	.00855	.00710	.00590	.00491	.00410	.00342	.00286	.00249
24	.01031	.00846	.00695	.00573	.00472	.00390	.00323	.00267	.00222	.00184
25	.00852	.00655	.00565	.00462	.00378	.00310	.00254	.00219	.00172	.00142

The present value of Re. 1 due in any number of years can be found with the use of the following mathematical formula :

$$PV = \frac{1}{(1+r)^n}$$

where

PV=present value

r=rate of interest/discount rate

n=number of years.

The present value for all the cash inflows for a number of years is thus found as follows :

$$PV = \frac{A_1}{(1+r)} + \frac{A_2}{(1+r)^2} + \frac{A_3}{(1+r)^3} + \dots + \frac{A_n}{(1+r)^n}$$

$A_1, A_2, A_3, \dots, A_n$ =Future net cash flows (profit after tax but before depreciation)

r=rate of interest

2, 3...and

n=number of years.

Present value can also be found by the use of present value tables.

**Illustration 11.** From the following information calculate the net present value of the two projects and suggest which of the two projects should be accepted assuming a discount rate of 10%—

Initial Investment

Project X	Project Y
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 taxes (cash flows) are as follows :

	Year 1 Rs.	Year 2 Rs.	Year 3 Rs.	Year 4 Rs.	Year 5 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

**Solution :**

### CALCULATIONS FOR NET PRESENT VALUE

#### PROJECT X

Year	Cash flows Rs.	Present Value of Re. 1@ 10% (discount factor) Using present value tables	Present Value of Net Cash flows Rs.
1	5,000	.909	4,545
2	10,000	.826	8,260
3	10,000	.751	7,510
4	3,000	.683	2,049
5	2,000	.621	1,242
5 (Scrap value)	1,000	.621	621
			24,227

	Rs.
<u>Present Value of all cash inflows</u>	— 24,227
<u>Less Present Value of initial investment</u>	— 20,000
(because all the investment is to be made in the first year only, the present value is the same as the cost of the initial investment)	
<u>Net Present Values</u>	<u>— 4,227</u>

**PROJECT Y**

Year	Cash flows Rs.	Present Value of Rs. 1 (@ 10% (discount rate) Using P.V. tables	Present Value of Net Cash Flows Rs.
1	20,000	.909	18,180
2	10,000	.826	8,260
3	5,000	.751	3,755
4	3,000	.683	2,049
5	2,000	.621	1,242
<b>(Scrap Value)</b>	<b>2,000</b>	<b>.621</b>	<b>1,242</b>
			<b>34,728</b>

	Rs.
<b>Total Present Value</b>	<b>— 34,728</b>
<b>Less Present Value of initial investment</b>	<b>— 30,000</b>
<b>Net Present Value</b>	<b>— 4,728</b>

We find that net present value of Project Y is higher than the net present value of project X and hence it is suggested that project Y should be selected.

**Advantages of the Net Present Value Method**

The advantages of the net present value method of evaluating investment proposals are as follows :

- (1) It recognises the time value of money and is suitable to be applied in a situation with uniform cash outflows and uneven cash inflows or cash flows at different periods of time.

- (2) It takes into account the earnings over the entire life of the project and the true profitability of the investment proposal can be evaluated.
- (3) It takes into consideration the objective of maximum profitability.

### **Disadvantages**

The net present value method suffers from the following limitations :

- (1) As compared to the traditional methods, the net present value method is more difficult to understand and operate.
- (2) It may not give good results while comparing projects with unequal lives as the project having higher net present value but realised in a longer life span may not be as desirable as a project having something lesser net present value achieved in a much shorter span of life of the asset.
- (3) In the same way as above, it may not give good results while comparing projects with unequal investment of funds.
- (4) It is not easy to determine an appropriate discount rate.

### **4. Internal Rate of Return Method**

The internal rate of return method is also a modern technique of capital budgeting that takes into account the time value of money. It is also known as 'time adjusted rate of return', 'discounted cash flow', 'discounted rate of return' 'yield method', and 'trial and error yield method'. In the net present value method the net present value is determined by discounting the future cash flows of a project at a predetermined or specified rate called the cut-off rate. But under the internal rate of return method, the cash flows of a project are discounted at a suitable rate by hit and trial method, which equates the net present value so calculated to the amount of the investment. Under this method, since the discount rate is determined internally, this method is called as the internal rate of return method. The internal rate of return can be defined as that rate of discount at which the present value of cash inflows is equal to the present value of cash outflows. It can be determined with the help of the following mathematical formula.

$$C = \frac{A_1}{(1+r)} + \frac{A_2}{(1+r)^2} + \frac{A_3}{(1+r)^3} + \dots \dots \dots \frac{A_n}{(1+r)^n}$$

where  $C$  = Initial Outlay at time Zero.

$A_1, A_2, \dots, A_n$  = Future net cash flows at different periods.

$2, 3, \dots, n$  = number of years

$r$  = rate of discount of internal rate of return,

The internal rate of return can also be determined with the help of present value tables. The following steps are required to practice the internal rate of return method :

(1) Determine the future net cash flows during the entire economic life of the project. The net cash inflows are estimated future profits before depreciation but after taxes.

(2) Determine the rate of discount at which the present value of cash inflows is equal to the present value of cash outflows. This may be determined as follows :

(a) When the annual net cash flows are equal over the life of the asset :

Firstly, find out *Present Value Factor* by dividing initial outlay (cost of the investment) by annual cash flow, i.e.,

$$\text{Net Present Value Factor} = \frac{\text{Initial Outlay}}{\text{Annual Cash Flow}}$$

Then, consult present value annuity tables with the number of years equal to the life of the asset and find out the rate at which the calculated present value factor is equal to the present value given in the table.

Illustration 12. Initial Outlay	=	Rs. 50,000
Life of the asset	=	5 years
Estimated Annual Cash-flow	=	Rs. 12,500

Calculate Internal rate of return.

Solution :

$$\text{Present value Factor} = \frac{\text{Initial Outlay}}{\text{Annual Cash Flow}}$$

$$= \frac{50,000}{12,500} = 4.$$

Consulting Present Value Annuity tables for 5 years period at Present Value Factor of 4,

Internal Rate of Return = 8% Apnx.

(as we see from the table that at 8% for 5 years period, the present value is 3.9927 which is nearly equal to 4).

(b) When the annual cash flows are unequal over the life of the asset :

In case annual cash flows are unequal over the life of the asset, the internal rate of return cannot be determined according to the technique suggested above. In such cases, the internal rate of return is calculated by hit and trial and that is why this method is also known as hit and trial yield method. We may start with any assumed discount rate and find out the total present value of all the cash flows by consulting present value tables. The so calculated total present value of cash inflows as compared with the present value of cash outflows, which is equal to the cost of the initial investment where total investment is to be made in the beginning. The rate at which the total present value of all cash inflows equals the initial outlay, is the internal rate of return. Several discount rates may have to be tried until the appropriate rate is found. The calculation process may be summed up as follows (p. 637) :

## Present Value of an Annuity of Re. 1

Year	1%	2%	3%	4%	5%	6%	7%	8%	9%	10%
1	0.9001	0.9709	0.9915	0.9524	0.9434	0.9346	0.9229	0.9174	0.9091	0.9011
2	1.9704	1.9195	1.8661	1.8594	1.8334	1.8010	1.7833	1.7591	1.7355	1.7135
3	2.9410	2.8839	2.8286	2.7751	2.7232	2.6730	2.6243	2.5771	2.5313	2.4664
4	3.9020	3.8067	3.7171	3.6299	3.5450	3.4651	3.3872	3.3121	3.2397	3.1659
5	4.8535	4.7134	3.5797	4.4518	4.3295	4.2123	4.1002	3.9927	3.8896	3.7569
6	5.7955	5.6014	5.4172	5.2421	5.0757	4.9173	4.7655	4.6229	4.4859	4.3553
7	6.7282	6.4720	6.202	6.7020	5.7863	5.5824	5.3893	5.2064	5.0329	4.8664
8	7.6571	7.3254	7.0196	6.9327	6.4632	6.2048	5.9713	5.7466	5.5348	5.3349
9	8.5561	8.1622	7.7861	7.4353	7.1078	6.8117	6.5152	6.2469	5.9852	5.7590
10	9.4714	8.9325	8.5302	8.1109	7.7217	7.3601	7.0236	6.7101	6.4176	6.1446
11	10.3677	9.7868	9.2526	8.7604	8.3064	7.8868	7.4987	7.1389	6.8050	6.4151
12	11.2552	10.5773	9.9339	9.3850	8.8632	8.3838	7.9427	7.5361	7.107	6.8137
13	12.1338	11.3483	10.6349	10.9856	9.9355	8.8517	8.3576	7.9038	7.4869	7.1034
14	13.0038	12.1062	11.2960	10.3631	9.8936	9.2950	8.7454	8.2442	7.7861	7.3667
15	13.8651	12.8492	11.9379	11.1183	10.3796	9.7125	9.1079	8.5525	8.0607	7.061
16	14.7180	13.5777	12.5610	11.6522	10.8377	10.1059	9.4469	8.8514	8.3125	7.8237
17	15.5624	14.2918	13.1660	12.1656	11.2740	10.4772	9.7632	9.1215	8.546	8.0215
18	16.3984	14.9220	13.7534	12.6592	11.6895	10.8276	10.0591	9.1719	8.7555	8.2014
19	17.2261	15.6784	14.3237	13.1339	12.0853	11.1581	10.3156	9.6016	8.9501	8.3649
20	18.0457	16.3514	14.8774	13.3903	12.4652	11.4699	10.5940	9.8181	9.1255	8.5136
21	18.8571	17.0111	15.4149	14.0291	12.8211	11.7640	10.8155	10.0168	9.222	8.6781
22	19.6605	18.6580	15.9168	14.4511	13.1631	12.0416	11.0612	10.2007	9.424	8.7715
23	20.4552	18.2921	16.4435	14.8368	13.4885	12.3033	11.722	10.3110	9.5802	8.6832
24	21.2435	18.9139	16.9355	15.2469	13.7986	12.5503	11.4693	10.5267	9.7167	9.5647
25	22.0233	19.5224	17.4133	15.6220	14.0939	12.833	11.6536	10.6748	9.6226	9.6770

## Present value of annuity of Rs. 1:

Year	1%	2%	3%	4%	5%	6%	7%	8%	9%
1	0.9009	0.8850	0.8772	0.8666	0.8521	0.8387	0.8247	0.8103	0.8003
2	1.6681	1.6467	1.6257	1.6052	1.5852	1.5665	1.5465	1.5278	1.5125
3	2.3612	2.3216	2.2832	2.2459	2.2096	2.1743	2.1399	2.1065	2.0737
4	2.9745	2.9137	2.8550	2.7982	2.7462	2.6901	2.6386	2.5887	2.5387
5	3.5172	3.4331	3.3522	3.2743	3.1993	3.1272	3.0576	2.9906	2.9206
6	4.2305	4.1114	3.9976	3.8887	3.7845	3.6845	3.5892	3.4973	3.3253
7	4.7122	4.5638	4.4226	4.2883	4.1604	4.0386	3.9224	3.8115	3.7057
8	5.1461	4.9676	4.7988	4.6389	4.4879	4.3436	4.2072	4.0776	3.9357
9	5.5170	5.3282	5.1317	4.6494	4.7716	4.6065	4.4506	4.3050	4.0310
10	5.8992	5.6502	5.4262	5.2161	5.0185	4.8162	4.6586	4.4911	4.1925
11	6.2055	5.9377	5.6869	5.4277	5.2317	5.0286	4.7354	4.4966	4.1998
12	6.4924	6.1944	5.9176	5.6603	5.4206	5.1971	4.9884	4.7932	4.4973
13	6.7469	6.4235	6.1218	5.8424	5.5831	5.3423	5.183	4.9094	4.7147
14	6.9819	6.9282	6.5304	6.0021	5.7245	5.4675	5.2293	5.0081	4.8023
15	7.1909	9.8109	6.4624	6.1422	5.8474	5.5755	5.3242	5.0616	4.8759
16	7.3792	6.6739	6.2651	5.9442	5.6072	5.3721	5.1624	4.9177	4.7256
17	7.5488	7.1196	6.7291	6.4572	6.1280	5.8775	5.5339	5.2732	4.8122
18	7.7016	7.2497	6.8399	6.4674	6.1928	5.9288	5.6278	5.3133	4.8435
19	7.8641	7.7843	7.4694	7.0248	6.6232	6.2993	5.9293	5.6099	4.9094
20	8.0217	7.8421	7.4694	7.0248	6.6232	6.2993	5.9293	5.6099	4.9476

## Present value of an Annuity of Re. 1

Year	21%	22%	23%	24%	25%	26%	27%	28%	29%	30%
1	0.8261	0.8197	0.8130	0.8065	0.8000	0.7937	0.7874	0.7813	0.7752	0.7692
2	1.5095	1.4915	1.4740	1.4568	1.4400	1.4235	1.4074	1.3916	1.3761	1.3609
3	2.0739	2.0422	2.0114	1.9813	1.9520	1.9234	1.8956	1.8684	1.8420	1.8116
4	2.5401	2.4936	2.4483	2.4183	2.3835	2.3516	2.3202	2.2800	2.2410	2.1662
5	2.9260	2.2626	2.8035	2.7455	2.9393	2.6351	2.5827	2.5120	2.4830	2.4236
6	3.2446	3.9169	3.2923	3.0205	2.9614	2.8850	2.8210	2.7594	2.7000	2.6427
7	3.5179	3.4155	3.3270	3.2423	3.1611	3.0233	2.9087	2.9370	2.8662	2.8021
8	3.7256	3.6193	3.5179	3.4212	4.3289	3.2407	3.1564	3.0758	2.9986	2.9247
9	3.9054	3.7863	4.6731	3.5655	4.4631	3.3657	3.2728	3.1842	3.0997	3.0190
10	4.0541	3.9232	3.7993	3.6819	3.5705	3.4648	3.3644	3.2689	3.1781	3.0915
11	4.1769	4.0354	3.9018	3.7757	3.6564	3.5435	3.4365	3.3351	3.2388	3.1473
12	4.2785	4.1274	3.9852	3.8514	3.7251	3.6040	3.4433	3.3868	3.2859	3.1903
13	4.3624	4.2028	4.0530	3.9124	3.7801	3.6555	3.6381	3.4272	3.3224	3.2233
14	4.4317	4.2646	4.1082	3.9616	3.8241	3.6959	3.5733	3.4587	3.3507	3.2487
15	4.4890	4.3152	4.1530	4.0013	4.8593	3.7461	3.6010	3.4134	3.3726	3.2682
16	4.5364	4.3567	4.1894	4.0303	4.8874	3.7509	3.6228	3.5026	3.3890	3.2832
17	4.5755	4.3908	4.2190	4.0521	3.9000	3.7703	3.6600	3.5177	3.4028	3.2449
18	4.6079	4.4147	4.2431	4.0799	3.9279	3.7261	3.6536	3.5292	3.4130	3.3097
19	4.6346	4.4415	4.2627	4.0967	3.9424	3.7985	3.6642	3.5386	3.4210	3.3193
20	4.6567	4.4603	4.2786	4.1103	3.9519	3.8083	3.6726	3.5458	3.4271	3.3158
21	4.6752	4.4756	4.2916	4.1212	3.9621	3.1116	3.6792	4.5514	3.4319	3.3198
22	4.6900	4.4882	4.3021	4.1300	3.9705	3.8323	3.6844	3.5558	3.4356	3.3230
23	4.7025	4.4985	4.3106	4.1771	3.9764	3.8273	3.6885	3.5592	3.4384	3.3254
24	4.7128	4.5070	4.3176	4.1428	3.9811	3.8312	3.6918	3.5619	3.4406	3.3272
25	4.7213	4.5119	4.3212	4.1474	3.9849	3.8342	3.6943	3.5640	3.4423	3.3286

- (i) Prepare the cash flow table using an arbitrary assumed discount rate to discount the net cash flow to the present value.
- (ii) Find out the Net Present Value by deducting from the present value of total cash flows calculated in (i) above the initial cost of the investment.
- (iii) If the Net Present Value (NPV) is positive, apply higher rate of discount.
- (iv) If the higher discount rate still gives a positive net present value, increase the discount rate further until the NPV becomes negative.
- (v) If the NPV is negative at this higher rate, the internal rate of return must be between these two rates :

### Illustration 13

Initial Investment	=	Rs. 60,000
Life of the Asset	=	4 years
<b>Estimated Net Annual Cash Flows :</b>		
1st Year	=	Rs. 15,000
2nd Year	=	Rs. 20,000
3rd Year	=	Rs. 30,000
4th Year	=	Rs. 20,000

Calculate Internal Rate of Return.

(See solution on page no. 638)

(3) Accept the proposal if the internal rate of return is higher than or equal to the minimum required rate of return, i.e. the cost of capital or cut off rate and reject the proposal if the internal rate of return is lower than the cost of cut-off rate.

(4) In case of alternative proposals select the proposal with the highest rate of return as long as the rates are higher than the cost of capital or cut-off rate.

### Advantages of Internal Rate of Return Method

The internal rate of return method has the following advantages :

- (i) Like the net present value method, it takes into account the time value of money and can be usefully applied in situations with even as well as uneven cash flow at different periods of time.
- (ii) It considers the profitability of the project for its entire economic life and hence enables evaluation of true profitability.
- (iii) The determination of cost of capital is not a prerequisite for the use of this method and hence it is better than net present value method where the cost of capital cannot be determined easily.

Solution (Illustration) 13 :

CASH FLOW TABLE AT VARIOUS ASSUMED DISCOUNT RATES OF 10%, 12%, 14%, & 15%.

Year	Annual Cash Flow	Discount rate 10%		12%		14%		15%	
		P.V.F.	P.V.	P.V.F.	P.V.	P.V.F.	P.V.	P.V.F.	P.V.
1	15,000	.909	13,635	.892	13,580	.877	13,555	.869	13,525
2	20,000	.826	16,520	.797	15,940	.769	15,310	.736	15,120
3	30,000	.751	22,530	.711	21,510	.674	20,220	.637	19,710
4	20,000	.693	13,660	.653	12,700	.592	11,840	.571	11,420
									<u>60,595</u>
									<u>59,285</u>

The present value of net cash flows at 14% rate of discount is Rs. 60,595 and at 15% rate of discount is Rs. 59,285. So the initial cost of investment which is Rs. 60,000 falls in between these two discount rates. At 14% the NPV is +₹95 but at 15% the NPV is -₹15, we may say that IRR = 14.5% (approx.).

- (iv) It provides for uniform ranking of various proposals due to the percentage rate of return.
- (v) This method is also compatible with the objective of maximum profitability and is considered to be a more reliable technique of capital budgeting.

#### **Disadvantages :**

In spite of so many advantages, it suffers from the following drawbacks :

- (i) It is difficult to understand and is the most difficult method of evaluation of investment proposals.
- (ii) This method is based upon the assumption that the earnings are reinvested at the internal rate of return for the remaining life of the project, which is not a justified assumption particularly when the average rate of return earned by the firm is not close to the internal rate of return. In this sense, Net Present Value method seems to be better as it assumes that the earnings are reinvested at the rate of firm's cost of capital.
- (iii) The results of NPV method and IRR method may differ when the projects under evaluation differ in their size, life and timings of cash flows.

#### **(5) Profitability Index Method**

It is also a time-adjusted method of evaluating the investment proposals. Profitability index also called as *Benefit-Cost ratio (B/C)* is the relationship between present value of cash inflows and the present value of cash outflows. Thus,

$$\text{Profitability Index} = \frac{\text{Present Value of Cash inflows}}{\text{Present Value of Cash outflows}}$$

or P.I. =  $\frac{\text{PV of Cash inflows}}{\text{Initial Cash outlay}}$

The profitability index may be found for net present values of inflows.

$$\text{P.I. (Net)} = \frac{\text{NPV (Net Present Value)}}{\text{Initial Cash Outlay}}$$

The net profitability index can also be found as Profitability Index (gross) minus one.

The proposal is accepted if the profitability index is more than one and is rejected in case the profitability index is less than one. The various projects are ranked under this method in order of their profitability index, in such a manner that one with higher profitability index is ranked higher than the other with lower profitability index.