

Time Value of Money

The concept of time value of money is based on the fact that money has a time value i.e. a rupee today is more important than a rupee tomorrow. It is needless to say that money receivable in future is less valuable than money received today. A rational person has a preference to receive money today than tomorrow as the rupee received today has a higher value than if received in future.

Time preference of money is practically important due to:

1. Inflation: In inflationary situation money received today has more purchasing power than money received in future.
2. Current consumption: A rational person shall defer current consumption only in expectation of increased wealth in the form of investment.
3. Reinvestment purpose: Money can be reinvested to earn interest to beat the inflationary situation and to maintain purchasing power.

Importance of Time Value of Money

The cash inflows and outflows arising at different points of time can be made comparable by using the concept of time value of money:

Investment Decision

Investment decision is concerned with the allocation of capital into long-term investment projects. The cash flow from long-term investment occur at different point in time in the future. They are not comparable to each other and against the cost of the project spent at present. To make them comparable, the future cash flows are discounted back to present value.

Financing Decision

Financing decision is concerned with designing optimum capital structure and raising funds from least cost sources. The concept of time value of money is equally useful in financing decision, especially when we deal with comparing the cost of different sources of financing. The effective rate of interest of each source of financing is calculated based on time value of money concept.

Leasing vs. Buying:

In leasing versus buying decision, we calculate the present value of cost of leasing and cost of buying. The present value of costs of two alternatives are compared against each other to decide on appropriate source of financing.

Valuation of Securities

The concept of time value of money is useful to securities investors. They use valuation models while making investment in securities such as stock and bonds. These security valuation models consider time value of cash flows from securities.

Others: Besides, the concept of time value of money is also used in evaluating proposed credit policies and the firm's efficiency in managing cash collection under current assets management.

Future value of a single flow

Future value of a single cash flow compounded annually

$$FV_n = PV (1+i)^n$$

FV_n = Future value of initial flow after n years

PV = Initial investment

i = Annual rate of investment

n = No. of years of investment

The expression $(1+i)^n$ represents the future value of an initial investment invested today at the end of n years at i rate of interest is referred to as **Future Value Interest Factor [FVIF(i,n)]**.

Future value of a lump sum amount when compounding is done more than once a year

$$FV_n = PV \left(1 + \frac{i}{m}\right)^{m \times n}$$

m = No. of times compounding is done during a year

Effective Rate of Interest

$$i = \left(1 + \frac{i}{m}\right)^m - 1$$

Present Value of Perpetuity = P/i , where P is the amount payable as perpetuity, and i is the interest rate

Compounding process for multiple flows

We have to add the future compounded values of the sums received over the time period. For example if we are investing Rs. 100, Rs. 200 and Rs. 300 at the beginning of year 1, 2 and 3 respectively at 12% interest the amount that will accumulate at the end of 3 years can be calculated as

$$\text{Rs. } 100 \times \text{FVIF}_{(12,3)} + \text{Rs. } 200 \times \text{FVIF}_{(12,2)} + \text{Rs. } 300 \times \text{FVIF}_{(12,1)}$$

FVIF_(12,3) means Future Value Interest Factor at 12% for 3 years and for quick reference can be looked up in the FVIF table

Future Value of an Annuity

A series of periodic cash flows of equal amounts are known as annuity. These cash flows can be receipts or payments. If the equal amounts of cash flow occur at the end of each period over a specified time horizon, then this stream of cash flow is defined as a **regular annuity** or **deferred annuity**. On the other hand if cash flows occur at the beginning of each period then it is known as **annuity due**.

$$\text{FVA}_n = A \left[\frac{(1+i)^n - 1}{i} \right]$$

A = Cash flow at the end of every year for n years

i = rate of interest expressed as decimal e.g. 12% is 0.12

n = time horizon

FVA_n = Accumulated amount at the end of n years

The expression $\left[\frac{(1+i)^n - 1}{i} \right]$ is called **Future Value Interest Factor of an Annuity [FVIFA_(i,n)]** and it expresses the accumulation of Re. 1 invested or received at the end of every year for a period of n years at i rate of interest.

Sinking Fund Factor

From $\text{FVA}_n = A \left[\frac{(1+i)^n - 1}{i} \right]$ we can say

$$A = \text{FVA}_n \left[\frac{i}{(1+i)^n - 1} \right]$$

The expression $\left[\frac{i}{(1+i)^n - 1} \right]$ is known as the Sinking Fund Factor. It is the amount that has to be invested at the end of every year for a period of n years at the rate of interest i to accumulate Re. 1 at the end of the period.

Present value of a single flow

With the help of this approach the present value of a future cash flow or a stream of cash flows can be determined.

$$\text{PV} = \left[\frac{\text{FV}_n}{(1+i)^n} \right]$$

The expression $\frac{1}{(1+i)^n}$ is defined as **Present Value Interest Factor, PVIF_(i,n)** and is the reverse of FVIF_(i,n)

Present value of multiple flows

We have to add the present values of the sums received over the time period. For example if we are to receive Rs. 100, Rs. 200 and Rs. 300 at the end of year 1, 2 and 3 respectively discounted at 12%, the equivalent amount at the present is

$$\text{Rs. } 300 \times \text{PVIF}_{(12,3)} + \text{Rs. } 200 \times \text{PVIF}_{(12,2)} + \text{Rs. } 100 \times \text{PVIF}_{(12,1)}$$

PVIF_(12,3) means Present Value Interest Factor at 12% for 3 years. For quick reference use the PVIF table.

Present Value of an Annuity

The present value of an annuity "A" receivable at the end of every year for a period of "n" years at "i" rate of interest can be expressed as

$$\text{PVA}_n = A \left[\frac{(1+i)^n - 1}{i (1+i)^n} \right]$$

The expression $\left[\frac{(1+i)^n - 1}{i (1+i)^n} \right]$ is called **Present Value Interest Factor of an Annuity, [PVIFA_(i,n)]**

Capital Recovery factor

In order to find out the equated annual instalments to repay a loan taken, we need to find out "A" as PVA_n i.e. the loan amount is known

$$A = \text{PVA}_n \left[\frac{i (1+i)^n}{(1+i)^n - 1} \right]$$

Sources of Capital

Finance is an important input for any type of business and is needed for working capital and for permanent investment. The total funds employed in a business are obtained from various sources. Some of the funds are permanently held in the business, such as share capital and reserves (**equity**), some others are held for a long period such as long-term borrowings or debentures (**debt**).

Capital Structure represents the total long-term investment in a business firm. It includes funds raised through ordinary and preference shares, bonds, debentures, term loans from financial institutions, earned revenue, capital surpluses, etc.

An appropriate capital structure should incorporate the following features:

- 1. Flexibility:** A sound capital structure, must be flexible. The consideration of flexibility gives the financial manager ability to alter the firm's capital structure with a minimum cost and delay warranted by a changed situation. It should also be possible for the company to provide funds whenever needed to finance its profitable activities.
- 2. Profitability:** A sound capital structure is also one that also possesses the feature of profitability, i.e., it must be advantageous to the company. It should permit the maximum use of leverage at a minimum cost with the constraints. Thus a sound capital structure tends to minimize 'cost' of financing and maximize earnings per share (EPS).
- 3. Solvency:** A sound capital structure should also have the feature of solvency, i.e., it should use the debt capital only up to the point where significant risk is not added. As has been already observed the use of excessive debt threatens the solvency of the company.
- 4. Conservation:** The capital structure should be conservative in the sense that the debt capacity of the company should not exceed. The debt capacity of a company depends on its ability to generate future cash flows. It should have enough cash to pay creditors fixed charges and principal amount. It should be remembered that cash insolvency might also lead to legal insolvency.
- 5. Control:** The capital structure should involve minimum risk of loss of control of the company.

A careful consideration of these criteria points to the conflicting nature. For example the use of debt capital is more economical but the same capital adds to the financial risk of the company. As such the emphasis given to each of the elements will differ from one company to another. Also the characteristic features of a company may consider these and additional criteria.

Difference between debt and equity

	Basis	Debt	Equity
1.	Date of maturity	Debt has a fixed date of maturity when it is either repaid or converted into equity shares.	Equity has perpetual life i.e. it is not to be repaid unless the company is wound up.
2.	Claim	Debt has a prior claim both on annual cash flows in terms of interest and on the assets of the company in case of liquidation.	Equity has a residual claim i.e. there are surplus funds after payment of interest and tax, equity shareholders may be paid dividend at the discretion of the Board of Directors. In the same way, the equity shareholders are repaid after all external dues have been paid off in the event of liquidation of the company.
3.	Tax benefit	Interest on debt is a tax deductible expenditure.	Dividend to equity shareholders is paid after payment of tax and the company does not get any tax benefit.
4.	Voting right	They are lenders to the company and do not have voting rights.	They are the owners of the company and enjoy voting rights.

Cost of Capital

The cost of a source of finance is the minimum return expected by its suppliers. The expected return depends on the degree of risk assumed. A high degree of risk is assumed by shareholders than debt-holders. Debt-holders get a fixed rate of interest but shareholder's dividend is not fixed. The loan of debt-holders is returned within a prescribed period, while shareholders can get back their capital only when the company is wound up. This leads one to conclude that debt is a cheaper source of funds than equity. The preference share capital is cheaper than equity capital, but is not as cheap as debt. However, a company should not employ a large amount of debt. Theoretically, a company should have a right mix of debt & equity so that its overall cost of capital is minimum.

Measuring the cost of capital needs a separate treatment. Needless to say, it is desirable to minimize the cost of capital. Hence, cheaper sources should be preferred, other things remaining same.

Weighted average cost of capital (WACC) is defined as the weighted average of the cost of various sources of finance, weight being the book value or market value of each source of finance outstanding. As mentioned earlier, cost of various sources of finance refers to the return expected by the respective investors.

A company may procure long term funds from various sources like equity share capital, preference share capital, debentures, term loan etc. at different costs depending upon the risk perceived by the investors. When all these cost of different forms of long term funds are weighted by their relative proportion in the total long term funds, we get the overall composite cost of capital termed as weighted average cost of capital.

Capital Budgeting

Capital budgeting is applied to evaluate expenditure decisions which involve current outlays in return for an anticipated flow of future benefits.

Importance

Capital budgeting decisions have been given the primary importance to financial decision making since they are the most crucial and critical business decisions as they have significant impact on the profitability aspect of the firm. Capital budgeting decisions have been given special importance because:

1. Capital budgeting has long term implications. Its effects will extend into the future and will have to be endured for a longer period than the consequences of current operating expenditure.
2. Capital budgeting requires large amount of funds. Therefore investment decisions must be thoughtful and correct.
3. Once the capital budgeting decisions are taken, they are not easily reversible.
4. Capital budgeting decisions are most difficult because of the fact that their assessment depends on the future uncertain events and activities of the firm. It is a difficult task to estimate future benefits accurately.

Methods of Appraisal

Capital budgeting decisions involve long term commitment. For this purpose a sound appraisal method should be adopted in order to measure the economic worth of each investment project.

Investment criteria intended to be used must possess the following features:

1. It should be a criterion which may be applicable to any investment project
2. It must provide a way of distinguishing between acceptable and unacceptable projects
3. It must provide a ranking of projects according to desirability
4. It should give more importance to early benefits than later ones

There are a number of investment criteria which are widely used. The methods of appraising capital expenditure decisions can be classified into 2 broad categories:

- a. Non-discounted technique
- b. Discounted technique

a. Non-discounted technique

- 1. Average Rate of return (ARR):** is used in order to measure the profitability of the investment proposals. Under this method, average annual profit (after tax) is expressed as a percentage of investment.

$$ARR = \frac{\text{Average annual profit after tax}}{\text{Average investment}} \times 100$$

Average annual profit after tax is determined by adding the after-tax expected profits for each year over the life of the project and dividing the same by the number of years.

$$\text{Average Investment} = \frac{\text{Total investment}}{2}$$

or

$$\text{Average Investment} = \text{Salvage value} + (\text{Cost price} - \text{Salvage value})/2$$

Advantage:

- i. It is very simple and easy to calculate
- ii. It uses readily available accounting information

Disadvantage:

- i. Based on accounting profit and not on cash flows
- ii. Does not recognize the timings of cash inflows (i.e. time value of money)
- iii. Does not take into consideration the length of lives of the project

- 2. Pay back Period:** It is defined as the number of years required to cover the original cash outlay which are invested in a project. In other words, pay back period is the period required for the savings in cost or net cash flow after tax but before depreciation, to recover the investment. It can be easily understood that the project with the shortest pay back period will be treated as the best.

Advantage:

- i. It is simple to understand and easy to operate
- ii. It looks into the liquidity aspect i.e. how soon the cost of the asset will be recovered
- iii. Short term approach (shortest pay back period is the best) reduces the chance of loss through obsolescence particularly when the industry is subject to rapid industrial development

Disadvantage:

- i. It recognizes recovery of capital cost only and not profits earned while the project continues after pay back period
- ii. It does not recognize the time value of money

b. Discounted technique

1. **Net Present Value (NPV):** is the time value of money approach to evaluate the return from an investment proposal. The project's future cash inflows are discounted at a stipulated rate (usually the cost of capital) to arrive at their present value of the cost of the project (i.e. the cash outflow) is subtracted from the sum of present values of cash inflows. The difference is the net present value. The decision rule under NPV is to accept the project if NPV is positive and reject if NPV is negative.

Advantage:

- i. It recognizes time value of money
- ii. It recognizes all cash flows throughout the life of the project
- iii. It helps to satisfy the wealth maximizing objective of the firm

Disadvantage:

- i. Arriving at the correct discounting factor (i.e. interest rate) is very difficult

2. **Profitability Index (or Benefit Cost Ratio):** It is the relation between the present value of future net cash inflows and the initial cash outlay.

$$PI = \frac{\text{Present value of cash inflow}}{\text{Initial Cash Outlay}}$$

As long as PI is equal to or greater than 1, an investment proposal is acceptable. In the case of mutually exclusive proposals, the higher the index, the more profitable is the proposal and vice versa.

Although PI is an extension of the NPV method, financial managers prefer the NPV method over PI as the former expresses in absolute term, the expected economic contribution of the project. In contrast PI expresses only the relative profitability. Therefore NPV method is the better of the two methods when one has to choose between mutually exclusive projects that involve different initial outlays under conditions when a firm has unlimited funds available for investment. On the other hand, in case of capital rationing, PI method will be more useful since it indicates a return from a project per rupee of initial investment which is the limiting factor.

3. **Net Benefit Cost Ratio:**

$$NBCR = \frac{\text{Net Present value of cash inflow}}{\text{Initial Cash Outlay}}$$

If NBCR is greater than 0 then the project can be accepted.

4. **Internal Rate of Return:** IRR is a discounting rate which equates the present value of cash inflows with the present value of cash outflows. In other words, the rate at which the net present value equals to zero is known as IRR. It is actually the rate of return earned by the project.

According to this method, IRR should be compared with a required rate of return known as the cut-off or the hurdle rate, which is often taken to be the firm's cost of capital. If the IRR is more than the required rate, the project is profitable; otherwise it should be rejected.

Depreciation

Depreciation is the permanent and continuous decrease in the book value of a fixed asset due to use, passage of time, obsolescence, expiration of legal rights or nay other cause.

Fixed assets are used in the business to derive benefit for more than one accounting period. Periodic profit (i.e. profit for an accounting period which is typically 1 year) is measured by charging the cost against the periodic revenue. Since fixed assets enable generation of periodic revenue, an appropriate proportion of the cost of the fixed assets which is believed to be used or expired for generation of periodic revenue, needs to be charged as cost of the fixed assets is termed as depreciation.

Depreciation accounting is a system of accounting which aims to distribute cost of the fixed asset (less salvage value, if any) over the estimated useful life of the asset in a systematic and rational manner.

Causes of Depreciation:

1. Physical wear and tear: The decrease in the value of the fixed asset due to use.
2. Passage of time: when the assets are exposed to forces of nature like wind, rain, sun, etc. their value may decrease even if they are not put to use.
3. Technological obsolescence: with improvement in technology an earlier fixed asset may become obsolete before its expected useful life.
4. Expiration of legal rights: When the use of an asset, say patents, is governed by time bound arrangement, the value of the asset decreases with time.

Need for charging depreciation:

1. To ascertain the true results of operations of an organization it is necessary to charge the depreciation (cost) against the income (revenue) in each accounting period.
2. To present true and fair financial position because if depreciation is not charged, the unexpired cost of the asset would be overstated.
3. To ascertain true cost of production by including depreciation as an item of cost.
4. For company form of organization, it is compulsory to charge depreciation.
5. The amount of depreciation provision can be invested annually to provide funds for replacement of the asset at the end of its useful life.

Methods of calculating depreciation:

1. **Straight Line Method (SLM):** Under SLM, a fixed and equal amount in the form of depreciation, according to a fixed percentage on the original cost, is written off during each accounting period over the expected useful life of the asset.

How to calculate depreciation under SLM?

$$\text{i. Amount of depreciation} = \frac{\text{Original cost} - \text{Residual value}}{\text{Expected useful life of the asset}}$$

$$\text{ii. Rate of depreciation} = \frac{\text{Amount of depreciation}}{\text{Original cost of the asset}} \times 100$$

Illustration:

Original cost of the asset Rs. 1,00,000; residual value (or salvage value) Rs. 20,000; expected life of the asset 5 years.

$$\text{Amount of depreciation} = \frac{\text{Rs. 1,00,000} - \text{Rs. 20,000}}{5 \text{ years}} = \text{Rs. 16,000}$$

$$\text{Rate of depreciation} = \frac{\text{Rs. 16,000}}{\text{Rs. 1,00,000}} \times 100 = 16\% \text{ per year}$$

Calculation of depreciation and book value over the life of the asset under SLM

Original cost	Rs. 1,00,000
Less: Depreciation at the end of Year 1	Rs. 16,000
Book Value at the beginning of Year 2	Rs. 84,000
Less: Depreciation at the end of Year 2	Rs. 16,000
Book Value at the beginning of Year 3	Rs. 68,000
Less: Depreciation at the end of Year 3	Rs. 16,000
Book Value at the beginning of Year 4	Rs. 52,000
Less: Depreciation at the end of Year 4	Rs. 16,000
Book Value at the beginning of Year 5	Rs. 36,000
Less: Depreciation at the end of Year 5	Rs. 16,000
Book Value at the end of Year 5	Rs. 20,000

2. **Written Down Value Method (WDV):** This method involves the application of a pre-determined percentage of the book value of the asset at the beginning of every accounting period so as to calculate the amount of depreciation. The amount of depreciation reduces every year.

Illustration

Original cost Rs. 2,00,000; rate of depreciation 15%. Show depreciation calculation for 4 years.

Calculation of depreciation and book value over the life of the asset under WDV method

Original cost	Rs. 2,00,000
Less: Depreciation (15% of Rs. 2,00,000)	Rs. 30,000
Book Value at the beginning of Year 2	Rs. 1,70,000
Less: Depreciation (15% of Rs. 1,70,000)	Rs. 25,500
Book Value at the beginning of Year 3	Rs. 1,44,500
Less: Depreciation (15% of Rs. 1,44,500)	Rs. 21,675
Book Value at the beginning of Year 4	Rs. 1,22,825
Less: Depreciation (15% of Rs. 1,22,825)	Rs. 18,424
Book Value at the end of Year 4	Rs. 1,04,401

Difference between SLM and WDV method of Depreciation

No.	Basis	SLM	WDV
1.	Meaning	SLM is a method of depreciation in which the cost of the asset is spread uniformly over the life of the asset by writing off a fixed amount every year.	WDV is a method of depreciation in which a fixed rate of depreciation is charged on the book value of the asset over its useful life.
2.	Calculation	Depreciation is calculated on the original cost of the asset.	Depreciation is calculated on the basis of the written down value of the asset.
3.	Amount of depreciation	The annual depreciation charge under SLM remains fixed during the life of the asset.	Amount of depreciation under WDV method reduces every year
4.	Book value written off	Book value of the asset is completely written off i.e. the asset value is reduced to zero or its salvage value.	The asset's book value is never written off completely.
5.	Initial year's depreciation	Amount of depreciation under SLM is initially lower compared to that under WDV.	Under WDV method the amount of depreciation at the beginning years are higher.
6.	Suitability	Best with assets with negligible repairs.	Appropriate for assets whose repairs increase as the get older.

Replacement Analysis

Replacement decision attempts to formulate a policy as to when to replace the existing machines irrespective of whether they still have some utility left or not. If the existing machine has become obsolete, the firm is forced to replace it. In this case it is not a replacement decision but a selection of one from many possible replacement alternatives.

If a firm continues to persist with the policy not to replace till the life of the existing machine is over it may be supporting an uneconomical situation. The replacement of existing machine raises the question of time of replacement that is most economical to the firm.

The existing machine is termed as the "defender" and the machine that might be bought to replace the existing one is called the "challenger". Replacement analysis deals with the evaluation of defender and challenger. Various replacement analysis techniques are applied depending upon different circumstances for existing installed asset (i.e. defender) against the best current available asset (i.e. challenger). If the defender proves to be economical it will be retained else it will be replaced with the challenger.

Sensitivity Analysis

The risk for the capital budgeting projects emanates from the variability of its cash flow. Cash flows are projected on the basis of few critical assumptions. Normally, such assumptions relate to key variables such as the level of output, selling price of the product, cost structure, administrative and other overheads etc. Any change in these key determinants will cause a change in the cash flows and therefore the net present value (NPV) of the project.

Sensitivity analysis measures the change in the NPV of the project with respect to change in one of the independent variables impacting the NPV. For example, one may like to know whether a decline in the selling price by 10% which managers may see as a distinct possibility, can be sustained by the project.

Sensitivity analysis helps managers identify which of the assumptions is the most critical for the project. It not only helps them in making an initial decision of acceptance / rejection of project but also lets them focus their attention on key variables, in order of their criticality to the project's viability in an ever-changing environment.