CHAPTER - 5

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Ordinarily, depreciation measures the changes in the value of capital in between the beginning and the end of a period. But there is a serious controversy as to (1) what are the purposes of depreciation; (2) how do we measure it; and finally (3) how should we distribute the value of the capital over its lifetime. It appears that the various concepts of depreciation that have been discussed in the existing literature and used in practice, result from the varying purposes for which depreciation has been studied. Such is the extent of controversy that as a managerial problem, it has no counterpart which has drawn together the various disciplines of business administration. Engineers, Economists, Accountants, Lawyers and the General Executives — all have engaged themselves in finding a logical and practicable solution of the problem, with the obvious outcome of a heap of literature which invariably produced a hodge-podge of confused concepts of depreciation.

Only a mention of some of such concepts of depreciation would show how confused they are. For example, Economists think that depreciation is the difference between the present value of future rental originating from two points of time. It is said

to be based on the fundamental principle of the economic theory of value. The concept is subjective in nature. They also say that once the capital has been installed it has to earn what it can. Its remuneration is then a quasi-rent and not included in the prime cost which must alone be recovered in the short run except in the sense of 'user cost'. The objective of the subjective measurement of depreciation is then to determine the real income of the firm, albeit maintenance of capital.

Contrary to the above, accountants are practical-minded. They recognize depreciation as an element of cost and are basically guided by the postulates of their professional bodies. For example, Recommendation No. 9 of the Institute of Chartered Accountants in England and Wales defines depreciation as, "the part of the fixed asset to its owner which is not recoverable when the asset is finally put out of use by him. Provision against this loss of capital is an integral cost of conducting the business during the effective commercial life of the asset and is not dependent upon the amount of profit earned". This concept is objective in nature and does not bother about what the value of capital is to-day in terms of what it would produce in future.

The opinion of the judiciary is again controversial. Although many court decisions corroborate the accountants' concept, a remarkable exception is found in the verdict of

Justice Sutherland who, speaking for the court, said, "Manifestly this allowance (depreciation) can not be limited by the original cost because if value have advanced, the allowance is not sufficient to maintain the level of efficiency. The utility is entitled to see that from earnings the value of property invested is kept unimpaired, so that at the end of any given term of years the original investment remains as it was at the beginning. This naturally calls for expenditures equal to the cost of worn-out equipment at the time of replacement and this, for all practical purposes, means the present value. It is the settled view of this court that the rate base is present value and it would be wholly illogical to adopt a different rate for depreciation."

Likewise, others have attempted in vain to suggest a logical and workable concept of depreciation. None was probably so frank in expressing his inability to define depreciation as Charles Smith who said, "I have long struggled with a definition of depreciation. In fact, I have been a member of the National Committee which have been studying the subject of depreciation for many years. That Committee of the National Association of Railroad and Utilities Commission, 1933 finally gave up the attempt and substituted instead a description of depreciation."


The failure of Charles Smith and others to conceptualise depreciation does not lie in depreciation itself; but in the fact that the concepts were developed to be used for various purposes. In order to avoid further failure, let us examine the various purposes of depreciation and see how far such purposes are relevant to and compatible with each other.

**PURPOSE OF DEPRECIATION**

The purposes of depreciation may be stated as:

(i) to determine the funds available to the business;
(ii) to determine the cost of products and their selling price;
(iii) to determine the value of capital when it is discarded; and finally
(iv) to measure the business income which may be consumed after maintaining capital intact.

(i) Ever since the introduction of accounting for fixed assets, depreciation was considered as a source of fund required to be raised for the replacement of the exhausted one. Apart from considering depreciation as an internal source of fund, it is also claimed as an external source in the form of providing tax shield to the business firms. Accountants' contribution is primarily directed to its ability to produce the tax shield.

After World War II, the controversy between Accountants and the Income Tax Authorities gained a further momentum as the fund obtained through tax shield became considerable due to the high rate of income tax. From the available accounting literature, it appears that the sole purpose of depreciation is to compute the tax liability. Since the Income Tax law provides for depreciation as an allowable expense, the larger the allowable amount
of depreciation the greater would be the fund so available through tax shield.

Right or wrong, there also exists a strong view that if depreciation is viewed as a source of fund, its measurement should be so made that the net income obtained after deduction of depreciation may be consumed and at the same time the firm remains as well off at the end as it was at the beginning; even after paying the income tax at the prevailing rate. It means that income tax has to be levied in such a way that its payment should not be made partly out of current income and partly out of capital.

But the claim of depreciation as an internal source of fund is questionable on many grounds. Firstly, it is a wrong notion that depreciation creates fund. A fund may be created in two ways, i.e. by sacrifice of some of the existing assets or by assuming a fresh liability. If the inflow of fund results from the sacrifice of existing asset, it does not create any fresh fund to the business but is merely a paper entry in the books of accounts of the firm through transfer of the amount of fund from one account to another. The creation of new liability amounts to inflow of fund; but, unfortunately, it has no relevance to the claim of depreciation as an internal source of fund. Since depreciation is obtained by appropriation of the gross income of the business, it is the revenue of the firm that really creates fund. In this connection Robert Elymore rightly observed, "Depreciation allowances are, aside from tax considerations, merely a paper entry; they do not in themselves actually
give the firm any funds".

Secondly, it is implicit in the assumption that the inflow of funds resulting from revenue must be greater than the total outflow of funds representing all current expenses. This is not always true in the history of a firm. As it normally earns profit, it also sometimes suffers loss. Sticking to the assumption, it then amounts to saying that during loss period, the value of firm's assets does not depreciate, as during the period the firm can not produce any positive fund. No argument is necessary to show how absurd is the assumption.

Thirdly, in order to ascertain the amount of internal fund produced by each equipment through depreciation, profit has to be identified with each equipment. But for multiple-equipment firm, it becomes a formidable task, if not absolutely impossible.

Many objections may also be raised against its claim as an external source of fund. It is misleading to conceive that it is the depreciation which produces fund externally. Truly speaking, it is the tax law which provides fund. However, without bothering about the fine-spun arguments as to who produces funds, let us examine the circumstances under which depreciation creates fund. The circumstances are: (a) the capital goods must be owned by a firm which is established for profit only; (b) the firm has to earn profit; (c) its profits are to be liable for

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of payment/income tax; and finally (d) the tax law of the country in which it operates must provide for depreciation as an allowable expense.

The first condition restricts the purpose of depreciation to the selective concerns and thus ignores a large number of concerns which are established not for earning profit but for rendering social service. For example, the Railways Organisations and many departmental undertakings of the Government of India extensively use capital goods for rendering social services. The exhaustion of their capital goods is measured but such measurement does not produce any fund for them. The single largest consumer of capital goods, i.e. the Defence Organisation of the Government of U.S.A., where the private capital plays a very important role, is concerned with the depreciation of the capital goods but their concern is not for seeing how much fund has been generated through depreciation.

The second condition is unrealistic. In the private sector where profit is the primary motive, there are periods of economic ebb and flow. During the economic ebb, the firm uses the capital goods and may exhaust them completely without making any profit. Even within an expanding firm, one unit may be run at a loss with the objective of maximising the aggregate profit of the firm. If the purpose of depreciation is to create fund, the situation becomes anomalous within the same firm as each unit will have its own notion of depreciation.
Looking at the third condition, it seems that if profit is earned by the firm, it is liable to income tax and thus the tax shield provided by the depreciation allowance creates fund for the firm. Now, if we define profit as the excess of current income over the current expenses, there are many such firms in India and elsewhere which earn profit but are exempted from the payment of income tax by the operation of the law of the respective country.

The final condition is at present true for India and elsewhere. But for generalising the purpose of depreciation as a source of external fund, it has to be seen as to what was the provision of income tax law in the past so that in the light of the past we may predict such probability in future. In this connection, we find that some concept of depreciation is as old as the use of capital goods but it is not until the present century that depreciation has been recognised as an allowable expense in the Income Tax law. In U.S.A., for example, depreciation was recognised as a deductible expense only from 1925.

On the whole, it has now been made sufficiently clear that if one is asked to mention the primary purpose of depreciation, one would definitely decline to consider the creation of fund as the primary purpose. However, so long as depreciation remains to be an allowable expense in the Income Tax law, depreciation shall continue to remain an interesting and controversial topic for the Tax Accountants and the lawyers.

(ii) The claim that depreciation is to be treated as an element of cost, like materials, labour etc. is also found to be a favourite of the Accountants. Accountants, who advocate full costing, say that depreciation enters into the cost of production and thus, in line with the principle of matching the cost with revenues, it is included in the elements of costs that determine the selling price. In their opinion, each product is to be allocated a share of capital cost represented by depreciation. The quantum of such cost to be absorbed in each product depends upon the application of the accounting principle of benefit test.

But the concept is somewhat misleading and at the same time contradictory to another equally important accounting concept of realisation. If depreciation is added to the cost of finished goods inventory at the end of the financial period, it would inevitably lead to recognising profit which is not yet realised. Such procedure is so damaging to the economic prudence of a firm that the profit is augmented by double the amount of depreciation absorbed in unsold stock of inventory. Such augmentation of profit may have a serious financial consequence by enhanced payment of income tax and possibly by a liberal payment of dividend.

Let us now consider how far depreciation is linked up with the selling price of the product. Since depreciation is taken as an element of cost, those, advocating full costing, claim that depreciation affects the selling price and also the volume of the product. According to them, the selling price includes
total cost of production and sale plus the planned rate of profit. But in practice we find that cost is not the dictator. In general, the producer keeps in mind the cost while offering his product for sale and at the same time the consumer estimates the utility to be derived. If the utility to be derived is less than the sacrifice of his purchasing power, he refrains from buying. Then the selling price is determined by the market conditions of demand and supply.

In a competitive market, the price of a product is set at a point where the marginal cost equals the marginal revenue. Under the situation the producer increases the volume of production for maximizing his profit so long as the differential cost of the additional volume equals the increment in revenue.

In order to understand the implication of depreciation on the selling price in a competitive market, reference has to be made to the economic scale. If the firm produces below capacity, depreciation does not enter into the marginal cost except in the sense of user cost which for this situation is zero. But while producing at full capacity, additional capital good would be necessary for producing additional unit and thus depreciation as user cost enters into the marginal cost and its implication is usually higher marginal cost.

Under imperfect competition, the firm is, to some extent, capable of dictating the selling price and may utilise the opportunity to include depreciation in the selling price. But that does not mean automatically that there are no external forces
to curve his freedom. The inclusion of depreciation in the selling price may result in a falling demand and/or attracting substitutes. Thus selling price is affected by depreciation rather in a restricted sense.

The position of utility is somewhat peculiar as the utility rate is determined, after taking into consideration a 'fair rate of return' to the investors. In utilities not only depreciation but also income tax are included in the cost of services for fixing the utility rate. But the depreciation concept which is used for fixing the utility rate is certainly not the 'user cost', but the maintenance intact of capital.

(iii) The third purpose for which the measurement of depreciation is required, is to determine the value of the capital 'ed in the event of its resale. Here the depreciation is represented by the difference between the initial value of the capital good and the value at the moment of resale.

(iv) The fourth purpose is to measure the change in the value of capital good in between the beginning and the end of a period so that the income that would be available for consumption after deduction of depreciation does not impair the maintenance intact of capital. If the fall in the value of capital is not measured.

7. See: Opening Brief of Pacific Gas and Electric Company before the Public Utilities Commission of the State of California, September, 1933.

and made good by setting apart the equivalent amount of depreciation, the firm fails to maintain its economic prudence by consuming such unadjusted income. Consumption of income without maintaining capital intact leads to the dissipation of capital. The law also imposes upon the Joint Stock Companies in India and elsewhere that dividends must not be paid out of capital. It is needless to emphasise here that the primary purpose of depreciation is to maintain capital intact which is at present disturbed by price-level changes and other dynamic factors and if the primary purpose is achieved, the subsidiary purposes are automatically taken care of.

**Basis for Valuation**

Once we have finalised our goal of measuring depreciation, the subsequent tasks become, to a great extent, streamlined. But before we can decide on the pattern of the distribution of depreciation over the economic life of capital, the basis for the valuation of depreciation is to be determined. But here also we find that the basis for valuing depreciation is muddled with a great variety of controversy. The primary controversy is whether the valuation should be based on historical cost or on the present value. To trace the origin of the controversy, we find that it is as old as the provision made in the Income Tax law for admitting depreciation as an allowable expense. The Accountant’s contribution in this regard is primarily concerned with the determination of taxable income. Although the maintenance of capital is somehow implicit in it, very little was done
about maintenance of capital and thus the determination of real income.

Of course, there would not have been so much controversy over the basis of valuation, had there not been price level changes, and the depreciation allowance in tax law. Joel Bean described the outcome of the controversy, "one of the significant by-products of inflation was a bitter controversy even among accountants, lawyers, economists, and politicians on the truth of fiction of accounting practice in such a period. The argument was a cross-patch of speculations on legal and moral obligations to investors, tax liabilities, established accounting traditions, future price levels and political convenience. Out of the controversy came income statements with a rush of special reserves and footnoted explanations and some extraordinary depreciation treatment".

**HISTORICAL COST IS PRESENT VALUE**

Historical cost basis is the oldest method and even now is the basis for valuing depreciation in many countries like India.


U.S.A., U.K. etc. The reason for its prolonged use and popularity is that the depreciation is handled by the Accountants of the firm who are guided by the postulates of the Professional Accounting Bodies. Although Accountants are not less intelligent in realizing the truth of fiction of the controversy, there is great hesitancy on the part of the profession to officially depart from the cost basis of accounting. Trace back the early history of accounting, we find that "only original cost was used since Accountants were in reality book-keepers concerned only with the recording of the history of a particular venture. One need not go back very far, however to find many examples of accounting doctrine advocating cost basis". Now-a-days accountants are not simply record-keepers but management accountants; still the prejudice of adhering to cost basis exists. The American Accounting Association in its 1940 Revision of Accounting Concepts and Standards, underlyig corporate financial statements adhered to cost basis, because they said, "there seems to have no sound reason for repeated adjustment of capital values for the ordinary changes in price levels commonly experienced from generation to generation". It is also said that occasional uncoordinated appraisals produce a hotch-potch of unrelated years.

The Committee on Accounting Procedure of the American Institute of C.P.A.s. in Bulletin No.53, December 1937, also held to the cost basis. The professional bodies argue that if we depart from historical cost in order to determine current charge

of depreciation, we would be confronted with so much distortion that income statement would be of little use.

There are many Economists also who hold the cost basis of valuation of depreciation. Their view is that a change for depreciation in excess of cost is faulty and rather difficult to compute and justify and also does violate the accounting assumption of cost and stable money. Robert Fisser is more critical and observed, "to the extent that replacement requirement may offer a criterion for the size of depreciation allowances perhaps depreciation allowances are too high and not profits, as well as not income and not investment, are understated by conventional accounting practices". While expressing this view, Fisser was referring to the accelerated depreciation for the growth firm.

Both A.I.P.A. and I.C.A. of England and also advocate the assumption of stable money value. These Institutes recommend to their members to prepare the accounting statements on this assumption. The Internal Revenue Board and Securities Exchange Commission of U.S.A., as well as the Tucker Committee on the Taxation of Trading Profits, London (April 1951), held the same view for measuring depreciation. In India, the accounting basis

for depreciation is also historical cost. This prolonged use of cost basis can be attributed mainly to the Institutional behaviour towards the problem of depreciation.

It is, however, interesting to investigate into the logic of the assumption of stable money, albeit the historical cost basis. The assumption of stable money is presumably based on the idea that in the long run, the money values tend to correct themselves towards stability. But how unrealistic is the assumption is evident from the fiscal history which demonstrates that monetary purchasing power is not stable and at the present time there is a strong built-in bias for inflation. The inflation of the past 25 years has resulted in unrecorded economic cost of the depreciable capital goods. In 1958 the annual unrecorded depreciation on capital goods owned by business corporations is estimated at $6 billion. The estimated cost of replacing obsolete capital goods in that country has reached an alarming high of $95 billion. The magnitude of inflation has heightened so much in recent days that it would be worth to assume inflation as ordinary changes in price-levels. Price fluctuations are not just cyclical ripples but are major disturbances. As Keynes stated, "There is a secular trend of prices upward which tends to nullify the notions that price fluctuations correct themselves".

It is also contended that any deviation from historical

cost would be an abandonment of a "cost" basis of accounting.

But what do we mean by cost? Many economists take the position that cost is not the number of monetary units but rather the measure of economic sacrifice involved. Thus U.S. Paton in his statement before the Hills Committee (Days and Means Committee on Depreciation Reform U.S.A. 1959), said, "On this basis (as mentioned above) there is no more sense in treating alike the dollars of different vintages than there would be in combining dollars, pounds and francs without counting them to a common basis. and, in the same connection, current revenues and current expenses are simply not compatible with depreciation accruals which are in dollars of early vintages".

To overcome the difficulties of maintaining capital intact during the continued period of inflation, many countries including Austria, West Germany, Belgium, Sweden, Switzerland, France, Japan and Latin American Countries have changed the basis of valuation to some sort of present value.

In U.S.A. repeated representations were made before the Ways and Means Committee on Tax Reform for changing the basis of valuation to price level adjustment. A very good case was made by U.S. Steel Corporation for adopting the present value basis for

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depreciation, but the representation was turned down both by Internal Revenue Board and E.C. R.C. Jones also reiterated the necessity of discarding the cost basis.

The situation in England is in no way different. The Institute of Chartered Accountants of England and Wales and other Professional Accounting Bodies held conventions for reconsidering the impact of inflation on accounting principle.

They came out with recommendations to the members for expanding supplementaries and footnotes for reflecting the price-level effect and for sticking to the cost basis of valuation. One of its most purgant critics writing in "Financial Times," just after the recommendation appeared, after referring to report expressed himself thus, "you see! True Profits - my foot. The life blood of British industry can be drained away so soon as the conventions of the Institute of Chartered Accountants remain inviolate. You start off trading with a dozen coconuts and finish up with twelve peanuts, but you get your auditor's certificate all right."

Since the assumption of stable money value is the only logic for adhering to historical cost basis, it seems reasonable


22. Other arguments in favour of historical cost are easiness in calculation, approved method by Tax authorities, unambiguous presentation of state of affairs to the investors etc.
to call for its change so that the capital of the firm can be maintained intact in the midst of continuous price-level changes. Alternative to the historical cost is the present value basis. If we can get a logical and workable approach to what we mean by present value, it may be examined whether the capital can be maintained by adhering to such present value. Unfortunately, the possibility of a clear concept of present value is again shrouded by the existence of dubious concepts. Had it been unique in meaning much of the controversy would have been eliminated. However, in respect of the objective of the concepts, there is complete agreement that the present value approach is to be designed to maintain capital in terms of its real value.

The present value concept can be identified with three schools of thought. They are current market value, subjective value and objective value as corrected by suitable index number for price level changes. Let us now consider the basic approaches to the present value concept in measuring the change in the value of capital.

(a) Current Market Value

The fundamental principle underlying the current market value theory is that if depreciation is viewed as a source of maintaining capital intact, the only logical base for the valuation of depreciation is the current market value of the individual capital goods. As the replacements are to be effected in current market price, the historical cost or the present value of the
future flow of funds is irrelevant. Under the theory, it is also claimed that as revenues and expenses represent the current market price, the determination of real income which would be available for consumption, requires the measurement of depreciation also of the same vintage. It assumes that the present value of a capital good which is pertinent to the maintenance of capital intact is the market value. Thus it is said that the depreciation of a capital good during a period is the difference between the market value of that capital good at the beginning of the period as well as at the end. This concept would not be vitiated either by the price level changes or the dynamic forces like technological obsolescence and the change in consumers' demand as the market value of the capital good has already taken care of them. It is thus claimed by the advocates of the theory that if the principle of market value is accepted by the Income Tax authorities and the professional Institute like Accounting Bodies, the operation of the theory is not only simple but also economical, as it does not involve estimating the salvage value, rate of deduction etc., which are essentially involved in historical cost depreciation. Furthermore, the firm can determine net income in real terms after payment of income tax and can appraise whether the rate of income hitherto available for consumption is maintained or not.

But the efficacy of the market value theory can be challenged both in principle and in its practicability. The assumption of the theory that the market value represents the true value of a capital good now in use by its owner is itself
fallacious. The theory fails to recognize the distinction between the inside value and the market value of a capital good. The inside value indicates the present value of the benefits yet to be derived by its owner by keeping it in operation under an existing combination of co-operating goods. If the firm decides to-day a different combination of capital goods under which the scale of service of the capital good in question may be changed, obviously its inside value will also change, although the alternative uses of capital may be considered for the same period of time. But at that moment of taking a decision, the market value of the capital remains unaltered by any decision of a single owner. The reason for this remoteness of reflecting true value by the market value is that the market value does not represent the inside value of the capital good. Since the market value oscillates around a balancing point, determined marginally by the least efficient pair of all sellers and buyers of such capital good, the inside value of capital tends to be greater than its market value, although fluctuations may temporarily lead to the reverse. Unless by rare accident, the equality happens to be true, the principle underlying the market value will always distort the problem of maintaining capital intact.

The validity of the theory is also questionable if viewed from the standpoint of its use by the owners of capital goods. There are many capital goods whose market value can not be determined as the capital good may have been superseded. In these days of technological advancement, the untimely burial of
the existing capital good is not an exception; but in many cases, it has become the general law. Thus for those capital goods the market value theory has no application. For the rest which are not totally obsolete, the theory may be applied if the market value can be determined. In order, then, to determine the market value, there must exist an organised second-hand market for those capital goods, where the capital goods of varying ages are bought and sold. But the implicit assumption of the existence of a single organised second-hand market is unrealistic. Thus the market value theory is untenable in logic and also fails to serve its purpose in practice.

(b) Subjective Value

The fundamental principle underlying the present value theory is that the value of a capital good depends on what it would produce for its owner in future. Thus the value of a capital good may be defined as the present value of the discounted flow of funds obtainable during its remaining life. It is logical in the sense that if one is interested in knowing the value of a thing in his possession, one does not bother about what its value is in terms of what it was in the past or in terms of what it sells for the market; but obviously, his interest lies in its value in the light of the benefit it would offer to the owner in future. Since the present value under the theory depends on futurity, the subjective value theory is forward-looking.
According to the theory, the depreciation of a capital good is the difference between its discounted present values of future flows originating from two points of time. Conceptually, the subjective theory is a sound method of determining depreciation aimed at maintaining capital intact after consuming the real income. All controversies over a logical concept of present value would have been totally thrown away and a complete agreement would have been attained in favour of subjective value, had it been without blench. Thus, although theoretically the subjective value is a fool-proof method, it could not achieve its objective by easing out the problem of applying the theory in practice.

The theory assumes that there is perfect foresight of the owner in projecting the future flow of funds, net of projected expenses, so that the present value of net flows can be determined by application of a discount factor. In reality, the projection is not possible with certainty. That is possible is the projection of a probable flow of funds. Thus the present value of the capital and also the amount of its depreciation are subjected to uncertainty. However capable the projector might be in his estimation, the end product always produces some probable values. Thus what we determine under the subjective value theory is probable depreciation, execute the probable real income.

When we are concerned with the maintenance of capital, there should not exist any dubiety, like probable depreciation etc.
At this stage, a distinction has to be recognised between how much should a businessman consume in order to remain as well off at the end of the period as he was at the beginning and how should he invest so that he can expect to remain well off in future. The subjective value approach is used in deciding on investment proposals, not because it is fool-proof but because the businessman does not possess any better tool for doing it. Thus, instead of abstaining from investment so long an unblemished tool is found out, he invests on the basis of probable gains obtained by the subjective approach. But the amount of income has to be certain so that a certain amount of money may be paid to the government by way of income tax. Likewise a dividend warrant ceases to be a warranty of payment by the firm unless a definite sum of money is mentioned therein.

Some are also of the view that the flow produced by a capital good can not be determined in many cases wherein the articles sold are the product of a number of capital goods. But this is not a serious limitation. The flow of benefit may be identified with each capital good by prorating the total revenue on some suitable basis.

On the whole, it may be said that the subjective value approach is based on a sound theoretical concept with its utter failure to serve the practical purpose.

(c) Objective Value

The objective value theory is also aimed at achieving a particular goal i.e. the maintenance of capital intact. The
objective value may be defined as an approach which is designed to maintain the present value of capital by deducting an appropriate amount of depreciation from annual income. The principle underlying the approach is that since the businessman is concerned with the measurement of the loss of the real value of capital and the loss of real value is indicated by the sacrifice of the opportunity to utilise the capital otherwise, the businessman is interested in the value at the beginning of the period and also that at the end of the period. In practice, it is a formidable task to obtain the value at the end of each period within the life of capital unless the factors contributing to the loss of capital are accountable. Thus instead of first determining the value at the end, the factors responsible for the change in value are analysed and expressed in monetary terms, and then the end value is obtained by deduction of the depreciation from the beginning value.

The factors contributing towards the sacrifice of the opportunity to utilise elsewhere depend upon the normal wear and tear, abnormal usage of capital that is sustained during its life time. The normal wear and tear and also the abnormal wear and tear are accounted for in terms of time served by the capital good. For depreciation under dynamic economy, the impact of price level changes is also estimated by reference to the trends of price indices of the capital good. The correction of the amount of depreciation resulting from price level changes is done by the use of a suitable index factor, so that the end result is reflected in real terms. The measurement of the
Present value in this way leads to the determination of real income and also to the proper maintenance of capital. As mentioned earlier, some sort of objective value base has been adopted in many countries of the world to reflect the state of financial affairs of the firms in real terms, so as to rectify the anomalies resulting from inflation.

Although the objective value has been widely adopted, the approach may be criticised on the ground that it fails to recognise the economic theory of the value of capital. Instead of being absolutely forward-looking, it is partially forward-looking but primarily backward-looking. The focal point under the theory is not what it may produce in future but what it did in the past, and towards the end of the process, the changes in the price level of the capital good are considered for expressing the value in real terms. This is a compromise between a sound concept with practical difficulty and a wrong concept with operational easiness. It is not considered a serious drawback of the theory. Once the owner of the capital good is in a dilemma, he has to make a choice. But he is not inclined to yield either to the historical cost basis as the theory fails to guarantee the maintenance of capital in any economic sense or to the present value theories like subjective value or market value because such concepts are not usable in practice. Then he must be provided with some means of maintaining his capital intact. Under the circumstances, the objective value theory provides the owner with a compromising approach; although it is true that compromises have the defects of compromises.
Although not so basic as above, another criticism is that the depreciation collected by price level adjustments may create confusion as to what index number we should use. Should we take the General Index number or the Index number of a specific group of capital goods? Obviously choice is for the specific Index number. Since our objective is to maintain each class of capital which are differently affected by their demand and supply affected by inflation and technological obsolescence, the only sensible choice lies in favour of their particular Index number. Thus the general Index number is irrelevant for our present purpose. For example, E. J. Philips Gloeilampenfabrieken, a large International Industrial Company with Head Quarters in the Netherlands, determines the present value of its fixed assets on the basis of the trend of specific price levels and not of the general price level.

A further criticism is the administrative difficulty of the Income Tax authorities to work with the vexed price index problem. It is apprehended that the price level adjustment for the taxable income would lead to increased administrative cost and also to increased number of litigation over the validity of the index number to be applied. The problem of litigation and the enhanced cost of tax administration can be resolved very easily if the responsibility of publishing the specific index number to be used for tax administration is left to the government only. Of course, the strongest opponent of price level adjustment of...

the taxable income is the Tax Authorities who apprehend a fall in its revenue. But it is believed that the loss of revenue accruing from increased depreciation allowance will be more than regained from the additional revenue to be collected on the additional income which would be generated from maintaining capital intact.

The change in tax law is also objected on the ground that it would favor only those tax payers who use depreciable assets and thus it is against the principle of equity. The objection, however, is not sound because the change would rather do away with that now amounts to a capital tax on top of income tax and would establish equity to the tax payers in general.

A change in favor of realistic depreciation in the tax law is always desirable. If it does not materialize at this stage, the owners should even then apply the objective value approach in their internal accounting for the purpose of maintaining their capital intact. In that case, the owner can select any published specific index number of his choice, as his accounting is then intended for internal purpose.

It is clear from the foregoing discussion that the basis for valuation of capital should be the objective value. But the conspicuous drawbacks of the objective value approach are its failure (i) to account for the value of the service rendered by capital in proportion to the total service obtainable during its economic life; and (ii) to estimate the impact of the foreseeable obsolescence and the expansion of the economy on the remaining value of capital. Thus what we obtain under the
objective value approach is almost similar to that obtainable under the historical cost basis excepting that the amount of depreciation as obtained by historical cost basis is adjusted by an index number for price-level changes. Such approach, therefore, fails to reveal the true value of the remaining stock of capital. Moreover, as discussed in Chapter 3, any attempt to account for the depreciation of capital should also provide for the foreseable obsolescence of capital and/or of its products and the impact of expansion of the economy. It is, therefore, suggested that in order to maintain capital intact the businessman should adopt the objective value approach which fully recognizes the impact of the obsolescence and the expansion in the valuation of capital and also the necessity of distributing depreciation in terms of service rendered.

PATTERN OF DISTRIBUTING DEPRECIATION

From the existing practices in Industry, it is evident that the impact of continuous inflation particularly after the world war II on the maintenance of capital intact through depreciation was not seriously considered. In a large number of countries, the firms are conscious of the gradual dissipation of their capital through retarded depreciation. Still they are not making realistic depreciation charges even for internal accounting. Although various methods of depreciation have been discussed in the literature, the widely used methods are
straight-line and the accelerated depreciation like Declining balance and sum-of-the-years digits. A survey report of the depreciation methods followed by the capital goods industries in U.S.A. in 1954 indicates that of the firms responding to the questionnaire, 33% follow straight line method, 62% accelerated methods and 2% other methods. In India, similar reports are not available. However, after considering the influence of Income Tax law on the policy and practices of the firms, it may be assumed that straight-line and declining balance are the popular methods in India.

But if depreciation is viewed as a criterion for maintaining capital intact, we find that both straight-line and accelerated methods are vulnerable. The methods are directed towards recovering what is called the historical cost of the capital. And that too is also spread over the physical life of the capital. Under a dynamic economy characterised by inflation, the recovery of original cost does not ensure the maintenance of capital in any economic sense. Furthermore, in view of the technological advancement and also the change in consumers' demand, the physical life tends to be greater than the economic life during which the recovery period should be confined. As the distribution of depreciation is deliberately extended beyond the economic life, the methods can not make full recovery of the investment in capital, even for that purpose, if we assume no change in the money value. Thus, conceptually speaking, the

Basic principles under the methods are untenable for our purpose.

Although the basic principles are the same, the accelerated methods differ widely from the straight-line method both in respect of the objective and the methodology. When the objective of straight-line method is simple and concerned with the recovery of original cost by arbitrarily distributing the original cost equally over the physical life, the accelerated methods attempt to boost up the investment of the firm by accelerating the recovery of the investment in the early years of the physical life. The arbitrary distribution under the straight-line method is objected to on the ground that its assumption that the service rendered by capital is uniform throughout its life, is contrary to the normal behaviour of the capital goods. Since the serviceability is ignored on the plea of simplicity in accounting under the method, it contradicts the accounting principle of benefit test. Moreover, if we even ignore the influence of economic forces on the utilization of capital good, the physical deterioration alone would make the capital less serviceable as it ages. Thus the method, as a whole, is logically unsound.

The accelerated methods have some advantages over the straight-line method. Dumar has made a case to show that if a firm has a growth rate of investment in capital goods identical with the rate of its retained profits, the whole investment programme of the firm after the expiry of the life of the first batch of capital goods can be financed internally year after year.
by adopting accelerated depreciation for income tax purposes. This conclusion holds good in case of an old, moderately growing firm or a newly growing firm, whose investment is affected by inflation and technological advancement. But the firm can not achieve it by adopting straight-line method in such a dynamic economy.

Prior to the Internal Revenue Code of 1934, strong views were expressed that if the Revenue Code is altered in favour of allowing accelerated methods of depreciation for income tax purposes, the problem of inadequacy of internal funds in effecting replacement during inflation can be permanently solved in the growing economy of U.S.A. Similarly, it was also held that without any discrimination, the foreign investment in developing countries would get encouragement as the accelerated depreciation would permit the foreign investors to amortize their investment in a short period. After amending the Revenue Code of 1934, a definite trend developed in the industries of U.S.A. for shifting the depreciation method from the straight-line to the accelerated methods. It has been claimed in favour of the accelerated methods that they have the ability to provide the firms with (a) sufficient internal funds to finance replacements in an inflationary economy; and


(b) interest-free loan from the government by deferring the payment of income tax temporarily and, in case of ever growing firms, permanently.

It is also claimed under the methods that it is the only plausible way of indirectly providing the firms with depreciable assets with the needed incentive to augment their investments; otherwise a direct measure of reducing the tax rate in the way of helping those firms, would unduly favour others who do not possess any depreciable asset.

Thus they appear to be the most appropriate methods of protecting the interest of the firms. But a careful rethinking might prove as well that a lot of frustration might be in store for those firms who do not satisfy the basic conditions under the methods. In order, therefore, to reap the advantages of the accelerated methods, the conditions are: that (i) the growth of the firm must be in terms of annual investment in capital goods; (ii) the income tax rate should not rise in future years so as not to nullify the advantage of delaying the payment of income tax; and (iii) there must be sufficient profit to take advantage of accelerated depreciation.

Because of the first condition, its application is limited to the growing firms only. Even within the growing economy of U.S.A. there are industries like textiles, steel mills etc. which are not growing in the above sense. A composite plant having a large amount of initial investment with longer life does not need replacement so frequently that along with the
growth of the economy, its annual replacement would grow. Rather its replacement programme is discontinuous. Hence with discontinuous replacement, the firms' liquidity tends to be adversely affected in the lean year of replacement.

The second condition is also doubtful. If the government desires in future to compensate for the loss of revenue from the accelerated depreciation by augmenting the income tax rate, or if the government is forced by its commitments to increase the rate of income tax as an important source of deficit financing, which is very true in the developing countries like India, the so-called claim of the accelerated depreciation fails to substantiate.

The third condition is simple but fails to be always true.

The accelerated methods can also be objected to on other grounds:

(1) There exists an erroneous belief that accelerated depreciation by any of its methods would produce funds for the firm. It has been shown earlier that depreciation does not create any fund. The fund of this nature is always produced by the revenue of the firm. What may be possible is that with the existing rate of income, the accelerated depreciation would divert more funds for investment only by depriving the stockholders and the workers of their legitimate remuneration.

(2) The entire case of the accelerated depreciation is motivated by the anxiety that even if a firm has high promise for
profitable investment, the external funds would either not be available or be available only against uneconomic rates. Strictly speaking, there is no logic in such anxiety. If the opportunity of investing internal funds inside the firm is greater than investing elsewhere, the theory of investment demands that the investing public would be more inclined to invest in this firm than elsewhere - thus there need not be any difficulty in obtaining external funds for the firm at a reasonable cost of capital.

(3) If the sole purpose of depreciation is the early amortization of investment in capital goods, Dean's cash-flow depreciation, which proposes to write off the entire amount of investment in the initial year, is still better than accelerated methods. No argument is necessary to find out the fallacy in such an approach.

(4) The methods do not recognize the service rendered by capital in the computation of depreciation. The most serious objection is the one-eyed objective of the methods. It appears as if the sole purpose of any method of depreciation is to create incentives for the investment of the firm. In those days of technological advancement the dimension of investment portfolio has been considerably enlarged. Thus it is hardly realistic to think that the gross investment of a firm would consist only of retained profits and depreciation. What is more alarming is the gross neglect of the methods to ignore the necessity of

30. See: Joel Dean's Statement before the Hills Committee on (Depreciation Reform) Days and Means House of Representative (Washington), 1959.
maintaining capital intact. By disregarding any attempt to measure changes in the value of capital, the accelerated methods have forcefully by-passed the primary purpose of depreciation i.e. to maintain capital intact.

**SERVICE VALUE METHOD**

The inadequacy of both the straight line method and the accelerated methods to meet the requirement of maintaining the real value of capital has been made clear by the foregoing discussion. In their place, a new approach is proposed under the name of service value method which is primarily aimed at maintaining capital intact by distributing the value of capital in proportion to the service rendered during the economic life. For this purpose, it is assumed that while the owner has to estimate the economic life (as shown in Chapter 4) during which the investment in capital has to be amortised, an estimate is also made of the service expected from the capital during its economic life. Then the depreciation for a year depends partly on the measurement of wear and tear in terms of the service rendered in a year as a percentage of total service and partly on the estimation of the change in the value of capital in between the end of the consecutive years resulting from price-level. The effects of obsolescence and expansion are discussed later on.

For the purpose of reflecting the change in the value of capital, the price index of a particular group of capital
good would be taken, when the depreciation is measured separately for each group. Alternatively, if the depreciation of the entire stock of capital is jointly measured, the correction factor would be the price index of the capital goods as a whole. If the enterprise has a limited variety of capital goods, the desirable result would be obtained by the application of the group index numbers.

DEPRECIATION UNDER STATIONARY ECONOMY

Although it is unusual in these days to have stationary economy in the strictest sense of the term, the measurement of depreciation is proposed firstly under the assumption of stationary economy simply for theoretical purposes. Thus, given the percentage of services expected from the utilization of the capital for any year within its economic life, the annual depreciation for the nth year may be written as

\[ d_n = s_n \sigma, \]

for which \( s_n \) is the percentage of the total service rendered in the nth year and \( \sigma \) is the initial investment in capital goods.

INFLATION OF PRICE LEVEL CHANGES ON DEPRECIATION

But in a dynamic economy, characterized by the price level changes, the capital of a firm can not be maintained by the application of the above formula. Since in a changing economy, the value of capital is continuously changing, the factors contributing towards the change in value are included
into the measurement of depreciation. As the impact of inflation or deflation is reflected in the rise or fall in the price index of the capital goods, such impact has to be incorporated into the formula of a stationary economy so as to make it useful under a dynamic economy. Thus, if \( a_{-C} \) is given and the price indices of the capital goods are known, the depreciation \( D \) for the \( n \)th year may be written as:

\[
P_n = a_{-C} \cdot P_1 + \sum_{n=1}^{P-1} D \cdot \left( \frac{P_n}{P_{n-1}} - 1 \right)
\]

where \( P_n \) and \( P_1 \) indicate the price indices of the capital goods in the \( n \)th and the initial year respectively.

Let us take an example to show the computation of depreciation under the service value method. Suppose, a capital good whose initial cost is Rs. 10,000, has an estimated economic life of 5 years with no salvage value. The percentage of total service expected from it and also the price indices during its life are given as follows:

31. The formula for depreciation in \( n \)th year is derived as follows:

Since there is no change in the price index in the first year, the depreciation for the 1st year \( D_1 = a_{-C} \cdot C \).

In the Second Year:

\[
D_2 = a_{-C} \cdot \frac{P_2}{P_1} + D_1 \left( \frac{P_2}{P_1} - 1 \right).
\]

Thus for 3rd year and onwards

\[
D_3 = a_{-C} \cdot \frac{P_3}{P_1} + D_2 \left( \frac{P_3}{P_2} - 1 \right) + D_1 \left( \frac{P_2}{P_1} - 1 \right).
\]
<table>
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<tr>
<th>Year</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
</tr>
</thead>
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<tr>
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<td>25</td>
<td>20</td>
<td>15</td>
<td>10</td>
</tr>
<tr>
<td>Price Index of the Capital good</td>
<td>120</td>
<td>110</td>
<td>120</td>
<td>130</td>
<td>140</td>
</tr>
</tbody>
</table>

Applying the formula as given above, we obtain the following depreciation pattern

1st year = Rs. 3,000
2nd year = Rs. 3,050
3rd year = Rs. 2,950
4th year = Rs. 2,700
5th year = Rs. 2,500

Total sum amortized = Rs. 14,000

The same formula can be used for the determination of depreciation of the multiple stock of capital for which $a_n$ is

\[ D_n = a_n c \frac{P_n}{P_1} + D_2 \left( \frac{P_4}{P_3} - 1 \right) + D_3 \left( \frac{P_4}{P_4} - 1 \right) + D_4 \left( \frac{P_4}{P_4} - 1 \right) + D_5 \left( \frac{P_4}{P_4} - 1 \right) \]

Simplifying the expression, we get

\[ D_5 = a_n c \frac{P_2}{P_1} + \left( \frac{P_5}{P_5} - 1 \right)(D_2 + D_3 + D_4 + D_5) \]

Thus the depreciation for the nth year is given by

\[ D_n = a_n c \frac{P_n}{P_1} + \sum_{n=1}^{n-1} D \left( \frac{P_n}{P_{n-1}} - 1 \right). \]
taken as the percentage of the total service in the nth year to be obtained from the stock of capital during their average economic life, C the calculated initial value of the multiple stock of capital and P the price index of the capital goods in general.

The interest on the value of the capital has been ignored in the above formula as its omission would not make a great conceptual difference, but would result in some saving in computation. However, with interest on the opening balance of the book value obtained after deducting the depreciation under stationary condition, the formula can be rewritten as

\[ P_n = B_n \left( \frac{P}{P_1} \right) + \sum_{n=1}^{n-1} \left( \frac{P}{P_{n-1}} - 1 \right) + \hat{B}_n \cdot i \]

where \( i \) = rate of interest and

\[ P_n = \] the opening book value in the nth year which may be derived as

\[ B_n = C \left( 1 - \frac{n-1}{S} \right), \] taking \( S = \text{Total Service} \) to be obtained from the capital during its economic life.

**INFLUENCE OF THE OBSERVANCE AND THE EXPANDER OF ECONOMY ON DEPRECIATION**

So far we have considered the applicability of the service value method of depreciation in a stationary economy and also in a dynamic economy characterized by price level changes. But in a realistic situation, the measurement of
Depreciation is also affected by the obsolescence and the expansion of the economy. In Chapter 4, it has been shown that the obsolescence in general tends to shorten the economic life of capital goods while the expansion of the economy as a whole or in the industry in which the capital good is employed tends to extend its economic life. Moreover, while affecting the economic life, the value of the capital is also affected by capital loss at the moment it experiences obsolescence which is now foreseen and thus could not be provided for earlier. Thus it is assumed that in order to show the influence of the above dynamic forces on the amount of depreciation, fresh estimates are to be made of the remaining economic life, the service to be rendered by the capital good during the new economic life and also the new initial value of the capital good at the moment at which the dynamic forces are reckoned. The depreciation also is to be calculated from the moment of reckoning dynamic forces on the basis of the new values obtained for the parameters used in the Service Value Method.

Thus, if \( t \) indicates the moment at which the obsolescence and/or the expansion occurs, \( n \) the percentage of the total new service in the \( n \)th year, \( d \) the value of the capital good at the moment, \( t \) and \( p \) the price index of the year in which the dynamic forces occur, we can determine depreciation \( D \) for the \( n \)th year after effecting the influence of the price level changes, the obsolescence and the expansion of the economy from
the following formula:

\[ D_n = ot_n C_t - V_t + \sum_{n=1}^{n-1} 3 \left( \frac{P_n}{P_{n-1}} - 1 \right) \]

If interest is included, the value of \( D_{n-1} \) is to be added to the above formula.

The need, on the whole, recurs twice that no long the conclusion of capital is not desired by the owner for his book of accounts even though he is anxious to maintain his capital intact, and until the Income Tax Law is amended to the above dynamic effects, the accounting treatment of depreciation would be to deduct the depreciation obtained under assumption of stationary economy from the opening book value of the capital and the additional depreciation for dynamic factors may be accumulated under a Reserve for maintenance of capital. Whether such reserve should be invested in gilt-edged securities or be merged with the regular investment of the firm is a matter to be decided by the owner. However, if the opportunity of investing such reserve inside the business tends to be greater than investing elsewhere (which is also true in most cases), outside investment is not encouraged. Interest being a remuneration for holding the investment in the capital, it is taken as a current pay out for dividend etc.

32. It would be better to apply the cost of capital and not that of interest. Since we are not concerned here with the fine analysis of opportunity cost of investment, the point is not pursued further.
Although the method would ensure the proper maintenance of capital, doubts might be expressed about its applicability as the core factor underlying the method is the estimation of the total service expected during the economic life. Since such an exact estimation is not possible, one may be disinclined to use the method which is uncertain. Strictly speaking, it is not a serious objection. No solution of the problem of depreciation is possible unless we agree to compromise with some degree of uncertainty. Even in the traditional methods like straight-line which is conceptually unsound, we can not get rid of uncertainty. Who can predict with certainty the physical life of the capital so that the distribution of depreciation over that life can be accomplished with absolute conviction?

The initial problem is then the estimation of the economic life which expires at the moment when the gross benefit to be derived from its products is equal to its complementary costs. Once we determine the economic life, the task of estimating the service during its life is automatically achieved as the use are intermingled. But another obstacle to the use of the service value method in the difficulty of securing a satisfactory unit of measuring the service of a capital good which is carried in diversified production. Without being involved into further complication in obtaining the basic data, the plausible way is to express each year's service in terms of a percentage of total net benefits obtainable during the entire economic life.
Alternatively, the diversified products can be expressed into homogeneous unit by machine hour taken by each product.

In conclusion it may be said that if the depreciation is viewed as one of the means of maintaining capital intact, the changes in the value of capital are to be measured in present value by applying the service value method of depreciation. Of course the maintenance of capital is a complex problem which cannot be solved by depreciation alone. The service value method only uncovers a step further in achieving the objective by determining the income which may be consumed without jeopardizing the existing stock of capital, while the ultimate maintenance of capital depends truly on the programme of replacement of the exhausted capital.