CHAPTER 1

INTRODUCTION
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Too frequently the management expresses grave concern over the urgent need for maintaining capital intact which otherwise tends to be dissipated by various economic forces. In order to fulfill the more urgent needs, the management generally muddles over the depreciation policy of the firm and not being successful for obvious reasons shifts the blame on the government for its alleged unfavourable income tax law; as if the income tax law can maintain the firm's capital intact by allowing liberal measurement of depreciation allowance for income tax purpose. This is true not only for the management whose complaints are frequently found in the reports read at the annual general meetings of the companies but also for the academicians in large number who very often complain about the gross apathy of the income tax authorities towards the needs of the firms to maintain their capital intact.

The failure to maintain capital intact does not merely lie in the income tax law but in various other factors which unfortunately have not received the attention they deserve. Thus even to-day there exist misunderstandings amongst the executives of the firms over the nature of the problem of maintenance of capital intact and consequently over its solution. The basic factor which necessitates the maintenance of capital is the degradation sustained to the capital. Like human beings,
capital goods are mortal. They have a limited span of useful life after which they are worth the scrap value. The demise of human being is inevitable but it may be checked by proper medical care, so also proper handling and repair and maintenance of capital goods result in extending their life although at the loss of disproportionate complementary cost. But occasion inevitably arises when its 'virtue' in making finished goods ceases to exist. As there may arise some unforeseen contingencies in the life of man like accidents, epidemic, natural calamities which take a toll of life much earlier than anticipated, there are various technological and economic forces which shorten the useful life of the capital goods. The technological and economic warfare that displaces the capital goods has been described by George Gerberth as "capital goods live out their mortal span in an atmosphere of combat, a struggle for life as bitter, as intolerant of weakness, as the tooth and claw of biological competition. In principle this mechanical warfare surpasses in depravity the carnage of the jungle; the beasts respect their own kind, but machines destroy their own species and others indiscriminately ... Machines ... must defend themselves in a world where new species spring up overnight, where the landscape is never twice the same, where the fitful winds of change are never stilled". Capital goods are kicked downstairs in the scale of service not simply because new facilities

are developed that can perform better or cheaper the same
service rendered by existing units; but the service itself may
be outsourced by the progress of the art or by changes in demand.

There are various types of degradation of capital
goods which require to be analysed so as to develop a sound
scheme for its maintenance intact. They are physical, economic
and statutory in nature. Physical degradation is the most
common type as it happens in the life of any category of capital
goods. The typical phenomenon for this nature of degradation
is identified with the rise in the rate of failures or in other
words, with aging and use, the number of products produced
diminishes though the quality may remain the same. The quantity
produced by the capital good may also remain constant but the
quality may deteriorate. Another alternative is feasible in
which both quantity and quality may undergo deterioration. The
degradation may be due to three reasons, viz. normal wear and
tear sustained to the capital good for working at normal capacity
secondly, the exceptionally heavy usage on additional shift and,
lastly, the capital good undergoes degradation outside the
utilization due to voluntary unemployment.

Whether quantitative or qualitative, the capital goods
are susceptible to failures which may be defined as the lack of
reliance on the capital goods as measured by the owner when it
is used for production. Failure which is due to aging and wear
and tear is a common characteristic of all capital goods. The
difference, of course, exists in the rate of failures in between:
various goods. Some of them undergo rapid failure in the early years when it is extensively utilized; while others may tend to maintain a constant rate of failures except towards the end of the physical life. But the behaviour of almost all of them is to undergo exponential rise in the rate of failures for sometimes towards the end of life, with the result that from the moment of the exponential rise, the complementary cost tends to rise sharply but the benefits produced out of them tend to diminish. This phenomenon is highly important to the owner as both the yield curve and the complementary costs curve meet at a point after which the physical degradation alone would make the use of the capital good unprofitable. The situation is explained in Figure 1.

![Figure 1: The effect of failure from physical degradation on the life of capital.](image)

The rate of failure during the period from $t_0$ to $t_m$ may be considered as normal and the operation of the capital good before $t_m$ stands to be profitable to the owner, since the
value of $S$ is greater than that of $0$ and at $t_0$, the owner neither suffers loss nor earns a profit; but if he decides not to put the good out of use after $t_0$ he enters into a loss period and more alarming is the fact that suddenly the rate of loss suffered by the owner tends to increase sharply as can be seen from the sharp rise of $S$ and the corresponding fall of $0$. (In practice the capital good is subject to high rate of failures during the period shortly after the installation due to initial teething and other difficulties. Since that period is insignificant in relation to the total physical life it is ignored in our present analysis. In fact, we are more concerned with the productive life of the capital good which excludes the time taken in installing and setting for production). In order to maintain capital intact the measurement of the physical degradation as indicated in Fig.1 acts as a warning to the owner for replacement action.

In the above analysis the stationary condition is assumed for which the market is taken as perfect and thus any failure to produce quantitatively and/or qualitatively would directly affect the revenue of the value produced by it. But if the market is less than perfect, the situation has to be a little different. For example, in India for almost all industrial goods a sellers' market exists at present. So the owner may not appreciate the need for discarding the capital good at this stage; but, rather, he plans to renovate and thoroughly repair it with additional cost for arresting, to some extent, the exponential
rise in the rate of failure and, say, he brings it from \( P \) to \( P_1 \). Immediately the complementary cost curve would be unfavourably shifted upwards from \( C \) to \( C_1 \) and also the benefit curve would move upwards from \( B \) to \( B_1 \). This would result in extending the useful life from \( t_m \) to \( t_{m1} \) and both \( B_1 \) and \( C_1 \) would meet at a new point \( H_1 \).

There is another form of degradation of capital good which poses a bigger problem to the owner. It can be called economic degradation. The capital good undergoes degradation in its functions under dynamic situations like changes in technology and in consumers' demand for the product it makes. The peculiar characteristic of such degradation which makes it different from physical degradation is that a capital good may be physically capable of performing its functions both quantitatively and qualitatively but such performance may be functionally uneconomical. A machine hitherto may be considered fit for the present line of production but tomorrow due to change in manufacturing process it may be found to be in surplus and then it may be transferred to some inferior job. The work study and other techniques of modern management have been able to displace many of the capital goods to-day which were indispensable yesterday. This displacement is foreseen and in the end product of the economic warfare of the existing capital goods.

Similarly, a capital hitherto engaged to produce a product may be faced with the problem of being obsolete as a new product or a substitute of the existing one has taken away the
the consumers' liking for the old product. Severe competition from both within and outside the country may take away the virtue of the existing capital. This leads to the economic degradation of capital as well as involuntary unemployment of the capital. Sometimes the owner may voluntarily keep his entire or a part of his capital out of use with the hope of bagging a larger amount of profit from the future opportunity to use than than he would have earned if the capital were currently put to use. Such action by the owner may lead to temporary functional degradation of his capital; but for our purpose such degradations are not to be accounted for. Instead the expenses for maintaining those idle capitals are to be taken as not investment.

Another form of degradation that sometimes baffles the owner is one that results from the statute of the country in which he operates. This is particularly true in India where the owner has to discard some of his existing arrangement and to install in their place some new arrangements in order to comply with the provisions of the Act. For example, the workers in tea gardens are to be provided with pucca houses instead of thatched quarters under the provisions of law. But such displacement of arrangement does not amount to degradation in the sense we are interested in.

Again, the functional degradation of the type resulting from obsolescence has its own variations. Obsolescence may be due to foreseen or foreseeable causes or due to factors which
are entirely unpredictable.

Other factors which affect the maintenance of capital are the useful life of the capital, depreciation representing the change in the value of capital in between two periods of time within its useful life and, finally, the replacement of the exhausted capital. The measurement of depreciation ensures the determination of income which may be consumed without jeopardising the existing stock of capital. But mere determination of consumable income does not guarantee the maintenance of capital unless appropriate steps are taken for the replacement of the exhausted capital. Thus the maintenance of capital intact involves the measurement of the economic worth of alternatives within the economic factors as stated above. The purpose of the present study is to explore the traditional approaches of maintaining capital intact and to examine the feasibility of these approaches for practical purposes. If for some reason or other the traditional approaches are found inadequate, a new approach is to be developed so as to meet the urgent need of maintaining capital of the firms.

JOHN SCOTTISH OF CAPITAL

In order to maintain capital intact, we must be very clear in our mind as to what we mean by capital. The term 'capital' was in use in some form or other even in the primitive society when the economic system was not complicated as it is at present. To trace the beginning of the concept of
capital is no easy task as economists, accountants and lawyers used to speak of the principal of a loan, advances, the gift of nature, stocks, food and clothings, buildings, factories, etc., on different occasions to denote things utilized as an agent of production and such things were denoted by capital.

However, a considerable volume of research has been done in the past on the evolution of the theory of capital. One of them is by Schumpeter who observed, "With Roman jurists and their successors, it (capital) denoted the principal of a loan as distinguished from interest and other necessary claims of the lender. ... It later came to denote the sum of money or their equivalents brought by partners into a partnership or a company, the sum total of a firm's assets, and the like." 2

This concept which is essentially monetary, i.e., actual money or some goods expressed in terms of money, was popular amongst lawyers and businessmen at a time when economists found no employment for it.

Chronologically stating, in the seventeenth and eighteenth centuries wealth, riches, stocks etc. were taken to mean what we now call capital. Even in the beginning of the nineteenth century when economists found a theory of the nature and functions of capital, stock of goods was taken to mean capital, amongst the economists who are credited with developing

early theories of capital the pioneer was Quesnay whose theory primarily emphasized the role of natural agents, and was later taken up by Adam Smith. Turgot also emphasized that wealth other than natural agents is a producible indispensable for all production (Reflexions, III, published in "Phaenomena, 1766-70").

Adam Smith's concept of a person's capital is "that part of his stock from which he expects to derive an income". In his concept of capital he took the suggestion of Quesnay and he was also indirectly influenced by Turgot. Quesnay's 'advance' idea is there in his definition of a person's capital and so also is a hint of productivity of capital; but instead of a theory of interest as in the case of Turgot, only a taxonomy of capital comes from it.

Alfred Marshall referred to the concept of capital as "the language of the market-place commonly regards a man's capital as the part of his wealth which is devoted to acquiring an income in the form of money; or, more generally, to acquisition by means of trade. It may be convenient sometimes to speak of this as his Trade Capital which may be defined to consist of those things which a person uses in his trade such as factory and the business plant of a manufacturer; that is his machinery, his raw material, any food, clothing and the house, room that he may hold for the use of his employees and the goodwill of his

3. Adam Smith - "Wealth of Nations". Chapter I, Book II.
business'. We also made a distinction between capital and wealth by saying that we should speak of capital when considering things as agents of production; and wealth when considering those as results of production, as subjects of consumption, and as yielding pleasures of possession.

There are very few terms in the English language that have a wider variety of meanings and connotations than the word 'capital'. It is thought in physical terms, in value terms, and in money terms. About the wide varieties of the concept of capital, Bowding rightly remarked, "capital, like many other words in our subject, has almost as many meanings as there are economists". Although the different meanings arise out of articulating the concept of capital in some connection or other, there is no ambiguity about the meaning of the term capital as an agent of production used for earning an income. But as the list of goods and services illustrating the concept of capital ranges from food and clothing to factory, docks and machineries, such jumbled up concept fails to serve a fruitful purpose for our study unless they are grouped into suitable classification.

**CLASSIFICATION OF CAPITAL**

An early classification of capital was made by Cuseney in his Theory of Advances. According to him, there are two

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classes of advances (capital), i.e. primitive advances and annual advances. Adam Smith's classification also consists of fixed and circulating capital and he proceeds further to enumerate the various categories of goods that form one or the other and to discuss what should and what should not be included in each category.

A clear distinction between two types of capital is found in Mill's classification. He says that the circulating capital is that which fulfils the whole of its office in the production in which it is engaged, by a single use, but fixed capital exists in a durable shape and the return which it obtains is spread over a period of corresponding duration.

Another type of classification is made to identify three things, i.e. present funds, future funds and the capital goods. Present fund is what is immediately available for use and consumption to the owner of the business in the form of ready money like cash and bank balance. Future funds are things like inventory of finished goods, accounts receivable etc., which will be available in terms of cash only in the near future. Both these classes are nothing but Smith's circulating capital. The capital goods are durable in nature and yield benefit to the owner such that it is not exhausted by single use. They are land, building, factory, plant and

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7. Economists like Chalmers believe that Smith's classification has been drawn from the 'advance idea' of Quesnay. Marshall's classification consists of consumption capital and investment capital, i.e., machinery etc.

machinery etc. This type is what Smith calls fixed capital.

A very useful classification in the context of the present study on the maintenance of capital was made by A.C. Pigou. While defining capital as a lake into which a great variety of things are continually being projected, he observed, "Among these are things of long life like elaborately built factories, things of moderate life, like machinery, and things of very short life, like material designed to be worked up to finished good for consumption or coal destined to be burned". Pigou recognized this classification as necessary for maintaining capital intact in relation to the computation of national dividend.

DEFINITION OF CAPITAL FOR THE PRESENT STUDY

Although there is no doubt about the necessity of maintaining the entire capital of a going concern, the present study is concerned only with the maintenance of what Pigou defines as things of moderate life. In other words, an attempt would be made to study the life span, depreciation and replacement of movable capital goods, like plant and equipment of an economic institution.

The reason for assuming a limited definition of capital is obvious from the fact that the behaviour of three types of capital is widely different and considering the limitation of the scope of a work of this nature, the temptation of covering

all of them under the ambit of this study is checked.

The problem of maintaining things of very short life involves only volume of work but not so complicated even under inflation as that of other things. Things of very short life have frequent turnover within a short period and also it does not encounter any problem of dwelling on futurity and hence uncertainty. Things of long life have their own peculiarity, quite distinct from others. Their lives are long and, more the length of life, the less would they be affected by the economic variables like obsolescence. Then the horizon is difficult of estimation, or more precisely uncertain, the decision criterion is usually the payback period. Another objective of the study is to explore the possibility of making use of the mathematics of present value. The problem of maintaining plant and equipment is universal ordeal faced by the owners of enterprises in India and elsewhere. In almost all annual general meetings of the shareholders of the companies, the chairman invariably draws the attention of the shareholders to the appalling case of dissipation of capital due to inadequate depreciation and continuous deterioration of the virtue of their plant and equipments resulting from inadequate replacement policy. In U.S.A. which is the most industrially advanced country of the world, an estimate was made to find out the capital deficiency of all corporations and other institutions and the finding was that in U.S.A. the capital is being dissipated at the rate of 36 billion annually and the estimated deficit upto 1959 is more than
... billion. In India a figure of this nature is not available. However, our deficit on this account is proportionately more than that of U.S.A. It is also because of the magnitude of the problem for sustaining a healthy economic growth, dependent on the efficient replacement of plant and equipment, that the present study is a selective one.

LEARNING PARADIGM

Prior to examining the suitability of any approach for maintaining capital intact, one has to be very explicit as to what is meant by the term, 'maintain capital intact'. In case there are wide varieties of meaning of the term, the solution of the problem becomes meaningless if later on it is found that the objective goal tends to differ from what is achieved under the approach. For example, if one is concerned with maintaining the real value of the stock of capital, one finds no interest in an approach which ensures the maintenance of the money value of capital.

Thus the basic problem before us is: what do we mean by maintaining capital intact? Is it compatible with the maintenance of the money value or the real value of the stock of capital or the maintenance of its physical stock? Similarly, we may ask ourselves: Do we want the maintenance of the book value or the present value as obtained by discounting the future flow of income by a constant rate of return?

The concept of maintaining the money value has wide application in practice. The popularity of the concept in
largely attributed to the institutional attitude. The Professional Accounting Bodies, whose members are vested with the task of maintaining capital of the firms have repeatedly altered to this concept; although on many occasions they have held contrary views of the meaning.

Economists like Pigou and Engineers in general are of the view that the maintenance of the physical stock of capital should be the appropriate concept even if the maintenance of physical stock is disturbed by technological obsolescence etc.

On the other hand, the maintenance of the real value of capital has traditionally dominated the academic work in this respect. In the term 'real value' may be interpreted in alternative ways, the academicians again held different approach for the term 'real value'. In view of the controversy that exists in understanding the term and also because the meaning of the term has direct bearing on the approach towards solving the problem, the basic question forms an indispensable part of the present study.

REASONS FOR THE PROBLEM STUDY

Although the necessity of maintaining capital intact has for long been a subject of academic interest, the traditional approaches in this regard have somehow or other failed to ensure

the maintenance of capital in the true sense of the term. That means that the traditional approaches have emphasized only on some aspects of the problem, with the result that they cannot be applied in practice to maintain the healthy state of affairs of a going concern. Most of the academic works have confined themselves either in determining the useful life of the stock of capital or in measuring the amount of depreciation or with both. While it is true that the determination of the useful life and the measurement of depreciation are essential requirements for maintaining capital intact, without questioning at this stage the efficacy or otherwise of those approaches, it may be said that such piecemeal approaches fail to ensure the total aspects of the problem. Reasons for being doubtful about the adequacy of the traditional approaches are:—

1. The maintenance of capital not only requires the determination of income which may be consumed without being worse off in future but also implies the solution of the problem of replacement of the exhausted capital; and
2. Both problems, i.e. to account for the changes in the value of capital and to compensate for the loss in the value of capital, have to be solved simultaneously.

Although some of the traditional approaches have derived expressions for the determination of the moment of replacement, that is not enough for the problem of replacement and maintenance of capital. Only in a stationary economy, the moment of replacement tends to coincide with the moment of scrapping a capital good. But in a realistic situation influenced by the dynamic
forces like economic changes and technological advancement, the moment of scrapping hardly coincides with the optimum moment of replacement. Moreover, in recent days a capital good may be replaced out of many alternatives available in the market. Thus the dimension of the replacement portfolio within the basic framework of maintaining capital intact is considerably enlarged. In view of the inability of the traditional approaches to fulfil the urgent need of the firms in maintaining capital intact, the present study is undertaken.

ORGANISATION PLAN FOR THE STUDY

If the new approach is designed to include all aspects of maintaining capital intact, the content of the study should be organised in three distinct phases. This in turn requires a defensible basis for answering three questions:

a) What is meant by maintaining capital intact?
b) How do we account for the outflow of capital?
and c) How are we to plan for the inflow of capital so as to make good the outflow?

These questions are interrelated. Thus the total solution of the problem will depend upon the logical solution of a number of closely related problems within each broad question. In other words, these three questions outlined above are really three facets of a single underlying question and therefore they must be solved simultaneously.
In the first phase, an explicit goal towards which the problem must be directed is to be established. This in turn requires a clear understanding of the question of what is meant by maintaining capital intact.

The second phase is the establishment of a systematic approach towards the determination of the useful life of the capital goods and the determination of the amount of depreciation. In order to have a logical basis for the measurement of outflow of capital we must have an estimation of the life span at the end of which the capital would become useless. Similarly, there must exist some way of determining the income of the firm which may be consumed without allowing the capital to be dissipated. This naturally calls for the solution of the problem of depreciation. Since these two problems have been widely discussed in the literature, a critical review of the most important theories for the solution of the above problems forms an indispensable part of the second phase.

For a going concern the concept of maintaining capital intact is meaningless unless an approach is devised to maintain capital both for the current year and also for the future years. Thus the third phase is concerned with the decision making process involved in replacing the exhausted capital. Broadly speaking, the study of replacement includes the estimation of the quantum of capital to be replaced, the optimum means of replacement and finally the optimum moment of replacement. Thus if some logical approach can be developed for solving the above mentioned three basic questions, the problem of maintaining capital intact can be satisfactorily solved.