CHAPTER I

THE FRAMEWORK
CHAPTER - I
THE FRAMEWORK

I. Background of the Study

Capital investments refer to "commitments of resources made in the hope of realizing benefits that are expected to occur over several time periods". An unanimous agreement exists that capital investment decisions are the most important among the decisions involved in the functions of finance. The process of investment decision making is present in every company whether it is in the public, private or joint sector. More and more awareness is developing on the part of the firms about the need for using scientific and systematic methods for capital investment appraisal in the place of "rules of thumb". As the magnitude and dimensions of the investments undertaken are increasing, a general feeling is growing that 'tongue-in-cheek methods' quite often result into misleading decisions. Especially in India this is the present state of affairs.

The above kinds of situations are giving a boost to the conduct of more and more research studies in this area. These studies can broadly be classified into the following categories:

(1) those which attempt to understand what is happening — i.e., what are the current practices in capital investment decision making, and trying to evaluate them in the light of the existing theory; and

(2) those which attempt to develop a set of operational procedures in capital investment appraisal by extending or modifying the existing procedures or by designing new procedures.

The methods in the former category have an empirical slant whereas those in the latter have a theoretical slant. Both are important in their own way. The former category tells what is the current state of affairs and how they can be improved. The second category on its part provides the relevant, improved theory to the first category for evaluating the current practices.

No theory is perfect and foolproof. It is subjected to a continuous process of improvement by academic contributions of various persons from time to time. These
contributions can be in terms of developing a new approach, extending or modifying the existing ones. These can be in terms of proving the disutility of existing approaches as well. These contributions (to all the relevant areas of theory) are a must if a nation has to grow and be forward-looking. This is true for capital investment appraisal and this is true for any other area as well. Hence there is an evergrowing need for the studies of the second type.

Vast theory exists in the area of capital investment decision making. But there exists a need for clarifications, modifications and making this theory more and more operational, apart from developing a new theory.

The present study is an effort in the direction of formulating, through clarifying and modifying existing methods, theoretically sound methods of capital investment appraisal which are operationally feasible.

II. A Review of Certain Fundamental Aspects of Capital Investment Decision Making

(i) Discounted Cash Flow Approach:

Several authors consider that Discounted Cash Flow (DCF) techniques are superior to the other conventional techniques in appraising capital investments. The concept

of discounted cash flow provides a method of taking into account the timing of the various cash flows of the capital investment project. These methods assume a time value of money from one period to the next, which is termed as rate of discount, cost of capital etc. This rate can be constant or can vary from period to period. These rates may also be not known with certainty beforehand.

However, Adelson argues the other way about the utility of DCF approach. Inspite of this criticism which is quite appealing, the DCF approach is gaining ground. Not only its use is being advocated by various authors but it is being used by many firms. Porwal states that some studies recently conducted in U.S.A. have shown that the use of these DCF techniques for evaluation of capital expenditure proposals is increasing and that now almost all the large corporations are using them or atleast are aware of them. He draws these conclusions on the basis of the study made by Petty, Scott and Bird.

Although as Porwal observes that these techniques have not become much popular in India, which is a developing country (to which the author of this thesis belongs), still a sizeable percentage of firms included in his study relating to India have shown their first preference in using DCF techniques. A similar conclusion has been arrived at by Prasanna Chandra in his survey of twenty firms in India using capital investment evaluation and capital budgeting preparation. Chandra finds that discounted cash flow (DCF) techniques, though not commonly used, are gaining in importance particularly in the evaluation of large investments.

As to the possible causes for the DCF techniques not being much popular in India, Porwal identifies existence of sellers' market in many products, too many government restrictions, unprecedented rise in prices etc. He then goes on to state that "as soon as conditions improve in India these techniques should be applied in a larger measure."  

7. This percentage to be specific is two-fold: 30% for projects regarding the existing product lines and 44% for projects concerning new product lines. Ibid.,p.31.
(ii) The DCF Methods:

In the Capital Budgeting literature the two DCF methods which appear more prominently for capital investment appraisal are: (i) Net Present Value Method and (ii) Yield Method (also called as "Internal Rate of Return" Method).\footnote{Some of the other DCF methods which appear frequently in the literature are Profitability Index Method and Discounted Payback Method. It has been shown that the profitability index method, which is a variant of net present value method, may give incorrect rankings for conflicting investment proposals. The discounted payback method, which is developed by incorporating the discounting into the traditional payback method, even though takes into account the differences in the timing of proceeds earned prior to payback date, still has the same weakness of ignoring the cash proceeds earned after the payback date, which the traditional payback method has. Since both these methods are considered to be inferior methods, most of the discussion in the literature concentrates on the net present value and yield methods.}

A good amount of discussion appears in the finance and management literature about these two methods based primarily on the situations of Certainty of future returns. These methods have also been employed in the situations of Uncertainty (and Risk) after proper moulding. The experts seem to be divided between these two methods. For instance Bienman and Smidt\footnote{op.cit., p.57.} advise the use of the former, whereas Merret and Sykes\footnote{op.cit., p.123.} prefer the latter.

The Net Present Value method needs directly a value of rate of discount in its computations, whereas the yield method does not need a value of rate of discount in its computations. However, a value of this rate is needed for...
comparison when the yield method is used. But the yield method does provide a flexibility with respect to rate of discount, if properly used, since it can indicate the desirability of the project at all rates of discount. A complete discussion of these aspects is being taken up in the next chapter.

III. Contents of the Study

This study attempts to develop theoretically sound and operationally feasible methods for Capital Investment Decision Making. Both the situations, i.e. certainty of returns, and, uncertainty of returns where some kind of risk measurement is possible, are being covered. The methods developed thus are primarily based on the Yield and NPV methods. However, this study emphasises the usefulness of the flexibility resulting in the use of the yield method.

This study consists of five chapters. This chapter which is the first one is aimed at offering the framework of the study. The next two sections of this chapter deal with the assumptions made and notations used in this study respectively.

The methods of capital investment appraisal under certainty situations are discussed in Chapter II, while those under uncertainty situations involving uncertainty in returns have been dealt with in the chapter to follow.
These methods are developed under the conditions of perfect capital markets. These are extensions of ordinary yield methods. A justification of using these procedures is given in the light of methods available in the literature. In other words the methods of this study highlight a proper use of yield method in Capital Investment Appraisal. The use of these methods which involve the computation of roots of polynomials needs the use of computer. The aspect of reinvestment rates is also covered under certainty situations.


Briefly these attributes can be summarized as given below:

(1) All market participants (i.e. individuals and firms) are price takers.
(2) There are no transaction costs such as brokerage fees and transfer taxes in selling, buying or issuing securities.
(3) All traders (individuals and firms) have equal and free access to the information about the ruling prices and all other relevant properties of the securities traded.
(4) There are no income taxes on the earnings from securities or if there are, there are no income tax differentials between income in the form of capital gains and dividends or interest.
(Even though this is not strictly an attribute of the market proper this assumption is also made in developing perfect capital market models).

Another attribute that is usually specified is that all investment assets are infinitely divisible. (Cf. op. cit., p. 216).
The Indian capital investment climate is not a healthy one. The reasons for such a phenomenon are the various imperfections in the Indian capital market and certain non quantifiable factors which are affecting the capital investments to a significant extent. A discussion about the features of Indian capital investment scene - the imperfections in the capital market, and the 'non quantifiable' factors, and their importance to capital investments in India is presented in Chapter IV. Further, in the light of this discussion the suitability of the methods suggested in Chapters II and III is appraised. It has been concluded that, for some time in the future these methods are of much use in India.

In the last chapter i.e. Chapter V, certain concluding observations are presented.

IV. Assumptions

(i) Objective of the Firm:

Near unanimity exists regarding the objective of the firm in finance and capital budgeting literature. Van Horne states: "Because the principle of maximization of shareholder wealth provides a rational guide for running a business and for the efficient allocation of resources in society, we use it as our assumed objective in considering how financial decisions should be made."\(^1\) He also states that this objective

is achieved through maximization of market price of company's common stock. Johnson also expresses the same objective: "The objective of capital investment in a firm, regardless of the legal form of its organization, is to maximize the utility or satisfaction of its owners. This utility is a function of the owner's wealth, which in turn, is directly related to the market price of the owner's equity." This he states in continuation of and in conformity with his earlier formulation: "maximization of the aggregate market price of the firm's common stock." Fama and Miller state the objective of the firm in similar terms. They show that, when there exist perfect capital markets and those markets are organised so as the shares can be freely bought and sold, the criterion of "maximization of market value of current stockholders' holding" should lead precisely to the same investment-operating decisions that each stockholder would make if he were running the firm himself. However, the total market value of a firm i.e., the total of all stockholders' holdings in a firm comprises holdings of different types of security holders, for instance, common stock and bonds. As the total market value of the firm increases, some of the firm's security

17. Fama and Miller, op.cit., p.69.
holders are better off but others are worse off. These authors state that those who are better off receive more than enough to compensate in turn those who are worse off and so induce the latter to go along with the decision. Further, they comment that such problems are somewhat artificial in the context of a perfect certainty model. In the context of uncertainty, these problems may become less artificial.18 However, even in this case, from a practical viewpoint, situations of potential conflict between bondholders and shareholders would probably not arise. This is because "in general investment opportunities that increase a firm's market value by more than their cost both increase the value of the firm's shares and strengthen the firm's future ability to meet its current bond commitments."19 As long as the current shareholders have the obligation of meeting the current bondholders' and related commitments, maximisation of market value of current shareholders in the firm can be considered as equivalent to maximization of market value of the firm, thus, as a suitable criterion, in both the situations — certainty and uncertainty. Fama and Miller, also, at one place in their book, use the criterion of "maximize the market value of the shares outstanding before the investment decision is made" implying

18. Fama and Miller, op. cit., p.72.
that this is same as the market value criterion mentioned by them at other places.\textsuperscript{20} It is quite reasonable to consider that common stockholders as shareholders in applying this criterion as they have the basic responsibility of meeting these commitments. Bierman and Smidt, though do not regard this objective as an exact one, conclude: "maximization of the value of the stock holders' holdings is a reasonable description of what we would like our measure of investment worth to accomplish."\textsuperscript{21}

Porterfield, however, assumes slightly different objective: "maximize market value per share and not the aggregate market value of its (firm's) shares."\textsuperscript{22} This is in contrast to Johnson's formulation which is maximization of the aggregate market price of the firm's common stock. By 'aggregate market price' he means the number of outstanding shares times the market price per share.

In principle, maximization of aggregate market value of all shares is a better criterion than maximization of market value per share, since former gives a correct picture of the wealth of the owners in the case of stock splits and

\begin{enumerate}
\item \textsuperscript{20} Fama and Miller, \textit{op.cit.},p.108.
\item \textsuperscript{21} Harold Bierman (Jr.) and Seymour Smidt, \textit{The Capital Budgeting Decision - Fourth Edition}, p.11. They consider this criterion as an approximate one because it has some limitations for example, it does not help decide between a decision that elevates the value of a stock now but depresses later and a decision that depresses the stock now and elevates it later.
\end{enumerate}
stock dividends. The maximization of market value per share gives a misleading conclusion in the event of stock splits and stock dividends. In the absence of these (stock splits and stock dividends), both criteria are equivalent. Owing to this reason and due to its advocacy by most of the authors, the objective of "maximization of aggregate market value of firm's outstanding common stock" is assumed in this study as the objective of the firm.

(ii) Features of Capital Investment Projects:

It is assumed in this study that all capital investment projects considered in this study have following features. If any change is made it will be mentioned at the appropriate place.

1. All cash transactions are assumed to occur at one time point, and also at the end of a period which happens for all the periods throughout the life of the project.

2. The net cash flow after deduction of taxes is determined for each period of the project.

3. The discounting (or compounding) is done on a discrete basis.

Based on the above, the following can be noted:

(a) In this study a capital investment project is considered as a set of cash flows. The set is unique in the case of certainty while in the case of uncertainty there are several such sets and only one of which can occur.
For instance let a typical project be as given below:

\((-10,000; 20,000; 30,000; 15,000)\)

This implies that the above project needs an outlay of Rs.10,000 in the beginning and gives rise to net cash inflow of Rs.20,000; Rs. 30,000 and Rs.15,000 at the end of periods, one, two and three respectively. This project has a life of three periods and it can be represented by a diagram such as one shown below:

<table>
<thead>
<tr>
<th>Cash Flow (in Rs.)</th>
<th>-10,000</th>
<th>20,000</th>
<th>30,000</th>
<th>15,000</th>
</tr>
</thead>
<tbody>
<tr>
<td>Time Point (Period)</td>
<td>0</td>
<td>1</td>
<td>2</td>
<td>3</td>
</tr>
</tbody>
</table>

(b) Discrete discounting (and compounding) can be viewed in the following manner:

At a rate of discount 'r' per period (expressed in fraction) an amount of 'P' at present is equal to \(P(1 + r)\) after one period, \(P(1 + r)^2\) after two periods so on and so forth.

(4) The rate of discount does not vary with the time during the life of a project. In other words it is assumed to be the same throughout the life of the project. This may not be the case in some real life situations. When varying
rates are considered, however, it becomes extremely difficult to develop methods which are flexible with respect to rate(s) of discount. Moreover, to determine beforehand the rate in each future period may turn out to be a futile exercise in terms of accuracy. It is better to use a single rate with the assumption that this holds good at least to an approximate extent.

(5) The situations are free of capital rationing. This can be justified on two counts: The first one is that it is felt that capital rationing usually results in a less than optimal policy. When two projects have positive net present value and if there is a capital rationing in terms of the amount available for outlays, it may be quite likely that one of them is rejected. Instead of this it is suggested that management should raise the needed funds by cutting dividends, borrowing, or even selling more common stock. Even though this may not be always possible in practice, it can be noted that capital rationing will reduce the returns to the owners in the long run, which otherwise would have resulted.

The second reason is the government restrictions on the companies. Porwal observes: "Funds, generally speaking, are no constraint for most of the companies under study in India. Capital rationing is not much of a problem here. The only limit is government restrictions of varied types." Similarly, Prasanna Chandra in his survey referred to earlier, observes that funds limitation, considered at length in theory, does not appear to be a serious constraint with prosperous firms and that a more serious constraint appears to be the governmental delays.  

V. Notation

(1) Any project of life 'n' periods (say) can be expressed as a set of cash flows in the following manner:

\[ (X_0, X_1, X_2, \ldots, X_n) \]

Where \( X_0 \) is the cash flow at the beginning of the project, 
\( X_t \) is the cash flow at the end of period 't' 
\((t = 1, \ldots, n)\), if the cash flow is negative it is an outflow and if the cash flow is positive it is an inflow.

---

25. Porwal, op.cit., p.65. However, it should be noted that Porwal's study covers the firms in private sector only. In Chapter IV the aspect of capital rationing in the Indian capital investment scene is discussed. The contention of the author of this thesis is that the capital rationing is a forced one rather than natural on account of various government restrictions. Several companies in the private sector as a result do not find a favourable climate to raise funds by any means.

26. op.cit.,p.11.
(2) Rate of discount (in fraction) is usually denoted as \( r' \) and \( k' \) is defined as:

\[ k = (1 + r) \]

(3) Net Present Value of the project at a rate \( r' \) is denoted as \( P(r) \) or \( P(k) \) and is given by:

\[ P(r) = X_0 + \frac{X_1}{k} + \frac{X_2}{k^2} + \ldots + \frac{X_n}{k^n} = \sum_{t=0}^{n} \frac{X_t}{k^t} \]

(4) Net Future Value of the project at a rate \( r' \) is denoted as \( F(r) \) or \( F(k) \) and is given by:

\[ F(r) = X_0k^n + X_1k^{n-1} + X_2k^{n-2} + \ldots + X_n = \sum_{t=0}^{n} X_t k^{n-t}. \]

(4a) It can be seen that

\[ F(r) = k^n P(r) \]

(5) Annual Equivalent value \(^{27}\) of the project at a rate \( r' \) is denoted as \( a(r) \) or \( a(k) \) and is given by:

\[ a(r) = \frac{r}{k^n - 1} F(r) \]

(6) Yields (or internal rates of return) of a project are the values of \( r' \) (non negative) which make \( P(r) \) (expression (3) above) or \( F(r) \) (expression (4) above), equal to zero.

\(^{27}\) When the flows are all costs, this is referred to as annual equivalent cost, equivalent annual cost or equivalent uniform annual cost.
Above are the most frequently used expressions in this study. Further expressions and their notations will be introduced in the following sections, as and when the need arises.

Net Present Value is also known in its abbreviated form NPV. In this study both the terms, viz. net present value and NPV, are used interchangeably. Similarly yield, internal rate of return and its abbreviation IRR are used as synonyms in subsequent pages.