CONCEPTUAL FRAMEWORK
4.1 AN OVERVIEW

In this chapter we have examined in detail the theoretical framework concerning the project feasibility and we have also analysed the financial and economic appraisal techniques for projects.

4.1.1 According to one definition, a project is an activity on which we spend money in expectation of returns. It has a specific starting point and a specific end point. An alternative definition of a project is that it is any specific scheme or activity on which costs are incurred and benefits are derived. It has a definite beginning and a definite end. The project remains alive so long as costs are being incurred or/and benefits are being derived.

4.1.2 A good feasibility report of a project should have the following characteristics:
   a) Measurability
   b) Reliability
   c) Consistency
   d) Feasibility
   e) Optimality
The essence of project appraisal is to find out whether the project is profitable or not. But this alone is not enough. The outputs of the project have to be viewed in the light of the goals and objectives. Hence the project has to be evaluated on the basis of the goals and objective, besides checking its feasibility from the following viewpoints, before recommending its acceptance, modification or rejection.

Technical Feasibility

4.1.4 The project must first be considered from the point of view of its technical feasibility. The technical feasibility has to be examined in depth by the technically qualified people.

Commercial Feasibility

4.1.5 The project has to be viewed from the point of view of the market. It should be examined whether the product has marketability. The demand has to be assessed with the help of a market survey. This aspect is best done by an Economist and for transport projects by a Transport Economist.

Financial Feasibility

4.1.6 This has to be assessed on the basis of the following points:-
4.1.7 It should be examined as to what type of managerial and workers' skills would be required for the project, and whether persons with requisite skills are available in adequate number and at what cost.

Economic Feasibility

4.1.8 It should be examined whether the project is feasible from the point of view of the national economy. It should be assessed as to what economic resources would be required; whether they are adequately available; if so, at what cost and what is the economic rate of return of the project.

Social Feasibility

4.1.9 It should be examined whether the project is feasible from the viewpoint of the social objectives and goals laid down in the national policy.
Political Feasibility

4.1.10 Although it has not been given in books and literature on project appraisal but it is a very important factor and it needs to be assessed first. If the project is not politically feasible, the other exercises need not be done at all.

4.1.11 Economic, social and political feasibilities should always be done for public sector projects.

4.1.12 The project appraisal techniques are applied for the following purposes:

a) To choose from amongst the alternative projects. Alternative projects for the same objectives may differ in respect of labour, capital and material input and they may achieve the laid down objectives upto varying degrees.

b) To select between alternative locations.

c) To determine the optimum allocation of natural resources.

d) To determine proper timing of the investment, i.e. to determine whether the investment in a particular project should be undertaken now or postponed to a later date.
4.2 APPRAISAL TECHNIQUES

In this conceptual framework an attempt will be made to discuss some of the financial and economic appraisal techniques for projects. Investment worthwhileness of a project can be evaluated on the basis of the following criteria:-

4.2.1 Non-Time Value Approaches

4.2.1.1 These only attach financial importance to cash flows. Some of it are:-

i) Simple rate of return method

ii) Pay back period.

4.2.2 Time value approaches recognise that if a project is expected to yield Rupees hundred after a year from now, the present value of those hundred rupees is somewhat less today, depending upon the interest rate it could earn. Cash flows should reflect the time value of money. This is done by "discounting". Some of the approaches are listed below:

a) Net Present Value (NPV)

b) Internal Rate of Return (IRR)

c) Benefit Cost Ratio (BCR)

4.2.3 Social Cost-Benefit Analysis

4.2.4 Cost-Effectiveness Analysis
4.3 SIMPLE RATE OF RETURN

4.3.1 It is worked out by either of the two following formulae:

\[ R = \frac{P}{E} \times 100\% = \frac{P \times E^{-1}}{L+I} \times 100\% \]

Where
- \( P \) = Profit in a year
- \( E \) = Equity Capital
- \( L \) = Loan Capital
- \( I \) = Interest on loan
- \( R \) = Return on Capital

4.3.2 Limitation

Generally profit is taken for a representative year, which should be a normal year. Obviously both these terms representative and normal are vague and subjective.

4.3.3 Advantage

The advantage of this method is that it is very simple and easy to calculate.

4.4 PAY BACK PERIOD (RECOUPMENT PERIOD)

4.4.1 It is the number of years required for the earnings from the investment to equal the investment with no interest. It is a measure of speed with which invested funds are returned to the business. The earning figures used in the calculation should be cash earnings after taxes.
4.4.2 Advantages

a) Simple to calculate
b) Intuitively appealing

c) It gives an approach to risk - consideration because it is an estimate of the length of time over which funds will be at risk.

4.4.3 Disadvantages

a) It is not a good tool for measuring risk.
b) It is not adequate if used by itself because it completely ignores all earnings beyond the pay back years. It may, therefore, result in the selection of a short term project rather than one that offers good returns over a long period of time.
c) It will not be a good measure for comparing project with different gestation periods.
d) It does not take into account the time value of money.

4.4.4 However, pay back period can also be used by equating the present value of the cash earnings after taxes for different years and the present value of the investment during different years.
NOTE: This method is popular in Japan and other developed countries where the technology is changing fast and the obsolescence of technology takes place fast.

4.4.5 The following rules should be remembered while applying the technique:

a) Depreciation is not to be deducted as an expense.

b) There is generally a period of construction followed by the productive life of the project. Both the periods should be considered while determining the pay back period.

c) Assets like land, which appreciate in value, are not to be included for pay back period.

4.5 NET PRESENT VALUE

4.5.1 This term originated in USA. In UK it is known as Excess Present Value. It expresses the total net cash flows for each alternative as a single equivalent value which reflects the time value of money. To calculate NPV, one should sum up the present value of all cash outflows and inflows separately and find the difference between the two; mathematically it is the same as
finding the present value of all net cash inflows. (If money is put in a bank, instead of being invested in business, it will earn a compound interest over the years, and hence the present value of money is greater than its value in the subsequent years in direct proportion to the rate of interest given by the bank).

4.5.2 The Net Present Value of a project can be calculated by the following formula:

\[
NPV = \sum_{n=0}^{N} \frac{F_n}{(1+i)^n}
\]

Where 
- \( F_n \) = The net cash flow from the project in nth year.
- \( i \) = Discount rate in decimal
- \( N \) = Life of the project in years

4.5.3 The interest rate chosen for discounting future cash flows is usually taken to be either the prevailing rate of interest in the money market or Cost of capital + a notional value of risk (say 2%) or the rate of return that the company is currently earning on its own invested capital. If the NPV of the project is positive, it implies that the investment is desirable since the return is greater than the discount rate.
4.5.4 If the selection is to be made from amongst a set of projects, then that project is considered better which has higher NPV.

4.5.5 Advantages

a) It considers the time value of money according to the value of \( i \), selected for the calculation.

b) It is simple for decision making as it gives a single value for particular point of time.

4.5.6 Disadvantages

a) It assumes that inflows and outflows can be forecast for the entire life time of the project.

b) It requires equal life spans of alternative projects for comparison of various alternatives.

c) The choice of discount rate can affect the ranking of the alternatives.

4.6 INTERNAL RATE OF RETURN (IRR)

4.6.1 This term originated in USA. The corresponding term in UK is 'Yield Rate'. The internal rate of return is a widely accepted index of profitability. It is defined as the interest rate which equalises the present value of cash inflows and outflows. Alternatively it is that
rate of discount at which the net present value of benefits of a project becomes zero.

4.6.2 Advantages
a) Administrator and planners are familiar with IRR and therefore it is readily accepted.
b) It does not require the prior determination of discount interest rate, and
c) It can be directly related to profit goals.

4.6.3 Disadvantages/Limitations
a) The criterion of average rate of return is not enough for acceptance/rejection on alternative.
b) It is a valid measure of comparison of alternatives only if the financial conditions under which the capital can be borrowed and invested are identical.
c) It is dependent on the investment base. A return of 15 per cent on an investment of Rs.1000/- is not necessarily preferable to a return of 12 per cent on a Rs.10000/- investment.

4.7 BENEFIT/COST RATIO (BCR)
4.7.1 It is similar to NPV criterion. The difference is that expenditure (costs) and income
(benefits) are treated separately and an index is obtained by obtaining a ratio of their present values \( BCR = \frac{B}{C} \).

4.7.2 The usual situation is that several alternatives are competing for limited funds and only one is to be selected. In this situation, the correct use of the BCR is an incremental analysis.

4.7.3 For this, first find BCR for alternative projects and eliminate those which have BCR below one. Next the incremental BCR is calculated and those alternatives are rejected which have an incremental ratio (BCR) below one. This can be repeated till we are left with only one project having an incremental BCR greater than one. The rationale of this approach is that investment may be made so long as the discounted incremental BCR exceeds unity.

4.7.4 Advantages

a) It considers time value of money according to the value of \( i \) (discount rate) selected for the calculation.

b) It is simple for decision making and it gives a single index for a particular point of time.
4.7.5 Disadvantages/Limitations

a) It assumes that inflows and outflows can be forecast for the entire lifetime of the project. It requires equal life for the alternative projects.

b) The choice of discount rate can affect the ranking of the alternatives.

4.7.6 IRR and NPV Relationship

Every project involves a stream of costs and returns. These costs and returns arise at different points of time. We need some device for comparing projects involving different time profiles of costs and returns. One way to do this is to use what is called a discounting procedure. In this procedure a weight specific to each time period called 'the discount factor' is applied to the stream of costs and returns before they are added up. Thus if $C_t$ and $B_t$ denote costs and returns arising in $t$th year, each $C_t$ and $B_t$ is multiplied by a discount factor $D_t$ and subsequently all these weighted costs and returns are summed over $T$ years, with costs taking a minus sign and returns a plus sign:

$$NPV = \sum_{t=0}^{T} B_t D_t - \sum_{t=0}^{T} C_t D_t$$
The discount factors are related to some rate of interest and are defined as

\[ (1 + i)^{-1} \]

where \( i \) is discounting rate in decimal.

4.7.7 At some rates of discount the NPV will be negative and at some it will be positive. The IRR is defined as that rate of discount at which the NPV becomes zero. The diagram on the next page illustrates the relationship between the NPV and IRR of any project. (Please see next page).

4.7.8 Generally as the rate of discount rises the NPV of a project falls. The point at which the NPV curve crosses the horizontal axis defines the IRR.

4.8 COST-BENEFIT ANALYSIS

4.8.1 It may be defined as a systematic comparison between the costs of carrying different services or activities and the value of the output of these services or activities, quantified as far as possible with all relevant costs and benefits being taken into account. The main purpose of this analysis is to compare the merit (or return or profitability) of various propo-
Relationship Between N.P.V. & I.R.R.

FIGURE 2
sals for investment on the basis of some common and quantifiable criterion. The cost-benefit analysis carried out from the viewpoint of an individual firm is often referred to as 'capital budgeting' or 'managerial economics' or 'engineering economics'. The term 'financial return' is often used to summarise the net financial return (net benefits) to the enterprise. When carried out from the viewpoint of the economy as a whole, such an analysis is called economic analysis of the project. When carried out from the viewpoint of the society, it is often called "social-cost benefit analysis". The net benefits in this context are often described as economic returns or social returns. While financial returns give the operational efficiency of a project, economic analysis gives the net gain to the economy and the social cost benefit analysis gives the net benefits to the society.

4.8.2 India has taken the socialist pattern of society as the goal of planning and therefore, the main objective of the Government is to enhance the welfare of the masses. In view of this, social cost benefit analysis assumes great
importance as a tool for the selection of projects for the public sector. However, it would be advisable to work out the financial return also so that when the project becomes operational it may be seen whether it gives the expected financial return.

4.8.3 The basic difference between the measurements of financial profitability and the social cost benefit analysis is as follows:-

a) The financial appraisal gives direct costs and benefits in monetary terms, which appear in the books of accounts. While in social cost benefit analysis Social and economic cost and benefits are also considered and are added to the financial appraisal figures to arrive at the overall picture.

b) The costs and benefits from the viewpoint of society will differ from the costs and benefits from the viewpoint of the investor.

c) While in financial appraisal the prevailing market prices of the input and output will be considered, in the social cost-benefit analysis the actual prices (accounting prices) will be considered after taking due
care of the distortions in the market and the economy.

d) There may be some benefits and costs which may result from the project operation but do not appear as input or output while calculating the commercial profitability.

e) While financial appraisal takes into account only direct financial costs and returns of the project, the social cost-benefits of the project from the point of view of society/economy whether direct or indirect and whether quantifiable in financial terms or intangible.

4.8.4 There would be direct costs which would relate to the inputs of the project and there would also be indirect costs which would relate to harmful effects of the project on the society. Some costs will be tangible, others would be intangible. Some cases would be measurable in terms of money, others may not be measurable. Some cases may be quantifiable, others may not be quantifiable. Similarly, there would be direct benefits to the society from the product of the project. These are called intended benefits. There may also be
indirect benefits from the product of the project which are called unintended benefits. Direct benefits of the products of the project will have direct visible effect. Then there are secondary benefits which may be intangible and therefore are also called controversial benefits.

The discount rate in the social cost-benefit analysis would be different from that taken for the financial appraisal. In the former, the social rate of discount would be taken and in the latter, the cost of capital plus a notional risk rate will be taken as the discount rate.

4.8.5 The social cost would include investment (sacrifice of present consumption), loss of time, lost of energy, unpleasantness, social disparity, etc. The social benefits would include increase in physical production, improvement in quality of products, cost reduction, reduction of losses, additional employment, reduction of disparity, etc.

4.8.6 The objective of social choice is to maximise the social gain. For this purpose the economic profitability alone is not enough. The social cost-benefit analysis provides:
a) a basis for evaluation by providing value that will be appropriate to social calculus (shadow prices as opposed to market prices).

b) it serves as a substitute for ad hoc decision making in respect of selection of the best of the alternative projects for social good.

4.9 SENSITIVITY ANALYSIS

4.9.1 Parameters and variable like life of project, cost of inputs, project implementation period, quantity and price of outputs, rates of discount, etc. are used for the economic evaluation of projects. This requires not only the available information of these parameters but also forecasting of their future behaviour pattern. Generally the data available are either inadequate or imperfect. Hence the data based on forecast are even more imperfect. It therefore becomes essential to take into account the uncertainties of the future and obtain a set of probable values of NPV, BCR or IRR, instead of depending on a single value of these criteria.
Uncertainties are of two types and are discussed below:

a) We talk of 'risk' when there is enough information to justify assignment of probabilities to different outcomes for calculating the "expected" value of the outcomes.

b) "Uncertainty" is the situation in which it is felt that even subjective probability cannot be assigned to the various outcomes. However, the "uncertainty" situation can be changed into 'risk' situation by assigning some probabilities based on personal experience or wise guess work.

4.9.3 In sensitivity analysis, a systematic effort is made to ascertain those parameters to which the final outcomes, i.e. NPV, IRR & BCR are most sensitive. This helps in,

a) better understanding of the working of the project,

b) improving the design of the project so as to increase NPV, etc, and

c) reducing risk by suggesting suitable precautions.

4.9.4 The details of the technique are given in the chapter on 'Social Cost-Benefit Analysis'.
4.10 COST-EFFECTIVENESS ANALYSIS

4.10.1 In infrastructure projects like transport projects, in particular railway projects, the common objective is to save time or to carry a fixed amount of cargo. It is better to find out effectiveness on such non-monetary output per unit of money spent. Cost-effectiveness analysis is also used for the investment required for generating a given level of employment. Thus, generally in the case of cost-effectiveness analysis, the inputs are measured in monetary terms but outputs (effectiveness) are measured in non-monetary terms. The values of the inputs should no doubt take into account the economic scarcities.

4.10.2 In the cost-effectiveness criteria, we can either maximise the output for a given input (efficiency) or we can minimise input for a given output (economy).

4.10.3 Break even analysis or minimum cost analysis is used for minimising the cost for a given output.

4.10.4 Many a time, an alternative may possess two or more cost components that are affected differently by a common variable. Minimum cost point
is that value of the common variable which will result in the minimum cost for the alternative.
4.10.5 The details of the technique are given in the chapter on "COST EFFECTIVENESS ANALYSIS".

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