CHAPTER I

INTRODUCTION

Investment in water resources development claims an important share in the planned investment in several developing countries. Development of water resources substantially helps agricultural production. Such investment has been regarded as infrastructural investment\(^1\), which affects different areas by generating large external economies\(^2\). The ECAFE report on flood control states that most of the projects which United

\[^1\] Infrastructural projects are generally defined as those basic facilities which are essential for primary, secondary and tertiary economic activities. In a wider sense, these include all public services from law and order through education and public health to transportation, communication, power and water supply, as well as such agricultural overhead capital as irrigation and drainage systems. These projects are of vital importance for economic growth without which investment in different sectors cannot be fully productive. Investment in irrigational project not only helps agricultural sector to increase its production but also affects secondary and tertiary sectors from the productivity point of view. See, Hirschman, A.O., *The Strategy of Economic Development*, New Haven, 1958, p. 83. Healy, J.M., *The Development of Social Overhead Capital in India, 1920-60*, Oxford, 1965, pp. 1-6.

\[^2\] Similar to infrastructural investments, external economies are defined as these effects of the project which accrue to the areas other than the one sponsoring a project. All the infrastructural investments, including investment in irrigation, are bound to generate larger external economies which, apart from increasing productivity within the sector, have technological and pecuniary spill over effects in other sectors. See, Prest, A.R. & Turvey, R: *Cost-Benefit Analysis: A Survey*, in *Surveys of Economic Theory, Vol.III*, Prepared for American Economic Association and the Royal Economic Society, Macmillan, St. Martins Press, New York, 1965, pp. 160-161.
Nations agencies scrutinise for the purpose of technical and financial aid show that although a careful consideration is given to engineering and technical aspects of the project, investigation of economic matters is not given adequate attention. This is equally true of the irrigation projects reports in our country. It will be readily agreed that evaluation of these projects is necessary. Also, economic consistency and productivity of the respective projects should be carefully examined to maximise returns from the scarce resources.

The present study aims at economic evaluation of a medium type of irrigation project, viz., the West-Banas Project in Rajasthan. The reason for selecting a medium type of irrigation project is that with the expansion of irrigation development programme in our country, the emphasis is likely to shift to the medium and minor type of irrigation projects. During the past plan periods, practically all the major river valley development projects have either been completed or are under construction. Now there is a greater scope for constructing dams on small rivers or tributaries in

3 ECAFE, Flood Control Studies No.9. pp,102-104.
4 For instance, in the reports prepared by the Committee for Plan Projects, we find that geological, hydrological studies, engineering analysis and technical investigations are conducted in detail while on the economic side little analysis is attempted.
various regions. The study indicates the scope of application of benefit cost analysis with reference to such projects. In the following chapters an attempt will be made to examine this issue in all meaningful details.

The first (i.e. the present) chapter of the study describes the relevance of investment criteria for making choice among public investment projects. Various investment criteria have been discussed and in the end it has been shown that benefit cost analysis is the most useful tool for taking investment decisions regarding various projects in different sectors, especially in regard to the water resource development projects.

The second chapter is devoted to the discussion of the conceptual framework and issues pertaining to the measurement of benefits and costs. The third chapter reviews some of the important benefit-cost studies in the field of irrigation and water resource development in India. The chapter also explains the approach and criterion followed in the present study. The fourth chapter gives the profile of the region in which the West Banas Irrigation Project is located and also traces its development at various stages. Besides the economic feasibility, the financial feasibility of the project is also of crucial importance. Keeping this point in view, the financial working of the project is
reviewed in the subsequent fifth chapter. The sixth chapter is an attempt to study the overall impact of the project. In the seventh chapter, direct primary benefits and direct primary costs have been analysed and direct primary benefit-cost-ratio is calculated. The eighth chapter discusses the indirect primary, secondary and tertiary benefits of the project. The summary of the main findings of the study is given in the last chapter in which conclusions of methodological and practical importance are also highlighted.

II

INVESTMENT CRITERIA AND SOCIAL WELFARE

The basic goal of public investment is to increase social welfare. While formulating an investment criterion we impute some kinds of values on costs and returns in consonance with the welfare function of the society. Thus, social welfare function gets implicitly included in the investment criteria.

On the more immediate plans, certain other objectives, viz., social, institutional, cultural, political and economic, are sought to be achieved. The form of investment criteria used cannot remain unaffected by the objectives which have to be appraised.

Generally, social welfare has been regarded as well-being of the society, reflected in its tangible welfare. In reality social welfare has many other implications, social and economic, over and above tangible welfare. But for the sake of simplification, generally the efforts of economists have remained limited to evaluating economic welfare, especially of pecuniary nature, which results from the development programmes.

Social welfare, broadly conceived, consists of a set of propositions, or alternative situations, open to a society which may be ranked on the scale of "better or

6 Though to identify welfare by changes in money income is not wholly appropriate it is, nevertheless, accepted as a tentative approximation since there is no other precise measurement.

7 Oxenfeldt Alfred R, has suggested that an individual level economic welfare should be defined in terms of a) quantity of goods and services consumed, b) sacrifice for acquiring it and c) the desire for goods and services. From the practical point of view only "a" is the tangible while others are subjective in nature and therefore "a" alone can be considered for precise measurement. See Oxenfeldt Alfred R., Economic Principles and Public Issues, Holt, Rinehart and Winston, Inc., New York, 1960, p. 20.

8 Mostly social welfare has been regarded as a summation of individual welfare. In fact, it need not be so. There are many effects which cannot be derived at the individual level. Therefore, for the sake of simplicity Mellor's division of these concepts can be accepted while formulating social welfare. These are: a) those aspects of welfare which are commanded by, and therefore, measured by individual monetary income, b) those which are also reasonably well measured by money yardstick, but which are readily commanded by individual action in regard to expenditure of income and c) those less tangible aspects which are not readily measured by a money yardstick. See, Mellor, J.W., The Economics of Agricultural Development, Cornell University Press, N.Y., 1966, p. 120.

8. These propositions and variables are discussed in the later part of this section.
worse". This concept has been developed from the concept of individual well being where the individual, and no one else, is the best judge of his own well being. The individual welfare according to this notion depends upon utilities of goods and services to him; former can be shown by alternative situation/situations on his indifference map. By implications, according to this view, social welfare—which is often described as community welfare—depends on the welfare of the individuals comprising it, and criteria have been developed to see whether from a given project society as a whole is better off or not. The society is supposed to be better off if at least some persons are better off, while no one is worse off.

Pareto has formalised these optimum conditions (or allocative rules), based on the assumption of perfect competition, which can be obtained when exchange and production optima are reached. These can be divided into three sets of optimum conditions: (1) The exchange optima, which requires that for each individual the rate of substitution be the same for all pairs of goods in the economy. (2) The production optima, which requires that for each product the rate of substitution between any pair of factors be the same. (3) Built on these two 'lower level' optima, each of which is a locus of "efficient points" is the top level optima. These conditions have been regarded as necessary conditions for a position of maximum welfare.

In the light of the above logic, welfare criterion known as "compensation test" has been formed.

It has been contended that no one can be made better–off without making some one worse off. Efforts of government should be such that losers are compensated. This is a post–Paretian concept.

10 Mishan, E.J., ibid, pp.163–169
11 Mishan, E.J., ibid, p. 175.
To realise these conditions, which leads to a better state of welfare, one has to accept certain norms of an 'improved state' or 'improved welfare' to judge whether these conditions have been met.

Bergson, who propounded a social welfare function, suggested a rule for combining the utility function of the different members of the community to obtain an index of social welfare where individual tests are given (i.e. expressing a particular distribution of goods and services to various members of the community)\(^{12}\). Little's interpretation based on interpersonal comparisons shows that there is a social process of evaluation as a decision making process. Samuelson, Scitovsky and Arrow further developed this line of analysis and showed that one has to have different social welfare functions for different groups based on their respective value ordering\(^{13}\). With this end in view, they constructed community indifference map and utility possibility curves through which 'better' situation could be judged. However, conception of social welfare as independent of real decision making process has little empirical content\(^{14}\).

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14 Rothenberg, J. op.cit., p. 397.
Without entering into the controversy about theoretical and empirical description of welfare conditions, we may note that welfare economics aims at testing the efficiency\(^{15}\) of economic institutions in making use of productive resources of a community. At the same time such propositions are not independent of value judgement about alternative income distribution patterns. Thus, two primary determinants of social welfare are economic efficiency and its effect on distribution of income in the society\(^{16}\). There are a few economists who believe that while taking decisions, it is the economic efficiency (reflected in an increase in national income, or production, or consumption) which should be considered the real test for the selection of the projects. They suggest that a few tariff measures can take care of the problem of income inequalities, or the political process can modify it\(^{17}\).

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This may be true for the programmed sector where such objectives might be given importance with production objectives. In reality decision making process has to take into account multiple goals, but in the developing countries it is the economic efficiency which is generally set as the major goal in the case of productive investment.

This is particularly so because these countries have scarcity of resources and, therefore, optimum utilisation of the resources is necessary in order to achieve maximum welfare. However, other objectives i.e. equitable income distribution, employment generation, attainment of self sufficiency in key sectors etc., cannot be ignored. Investment criteria to be used for project selection should be capable of taking proper care of all these objectives, in lesser or greater degree, so that fruits of investment projects may be realised in the form of tangible social welfare. Apart from the primary effects, secondary and tertiary effects; even if they are non-tangible in nature, should also be evaluated.

18 A few Indian studies have shown that many development programmes have led to equitable distributions of income. Rajkrishna, Presidential Address to III Rajasthan Economic Association Conference, held at Udaipur, 1969, p. 3.

19 Such effects differ from project to project. In the case of irrigation projects such variables are defined in 2nd Chapter.
Some of these welfare elements have been sought to be included in an investment criterion known as "integrated criterion", while other criteria cover the problem partially by emphasising one or few selected objectives.

Coming to empirical evidence, generally, the attempts to quantify these welfare components have been in the direction of judging the impact of the project on economic efficiency and on income distribution. Among these two also, the measurement of efficiency has taken a precedence. Most of the studies done in the U.S.A., for example, have covered only this aspect while evaluating the projects. Only a few studies have attempted to judge the impact of the projects on income. To the extent that community well being has wider connotation than merely an increase in economic efficiency, the least that should be done is to include income distribution as one of the important aspects of project evaluation. Thus, well being may be measured in terms of national income, present and future, with possible correction for its distribution over social groups or regions.

Investment analysis can be grouped into three major categories:

1. Physical appraisal;
2. Financial appraisal;
3. Economic appraisal.

The last one can be divided into

i. Partial economic analysis, and,
ii. Integrated economic analysis.

Physical appraisals attempted with the help of many formal criteria e.g., product maximization and input minimization, material balancing and, physical input output analysis etc., have been rejected on the ground that such appraisals cannot facilitate comparison among options which involve different input or product mix. This is particularly so if one were to follow the criteria of product maximization and input minimization, since various commodities have to be expressed in non-comparable physical inputs. Similarly, material balancing may not ensure the objective of consistency with regard to need of intermediate goods for different projects. The integrated analysis, though theoretically a superior approach, is generally not used, because it
requires comprehensive and complicated data which are just not available. Incomplete or faulty data may turn out to be unreliable indicators for choice of investments, if the integrated approach is followed.

Financial appraisals have been regarded as appropriate for entrepreneurs to enable them to appraise ventures in terms of what they invest on factors of production and receive from the sale of products. Such appraisal is attempted with the help of rate of return criterion, net income criterion, pay back period criterion, value added criterion and, discounted cash flow criterion. In the case of public investment projects these criteria have been found inadequate because the financial feasibility, in the narrow sense, cannot be achieved for many of the public projects, since these projects are meant for achieving "higher level" objectives contributing to the welfare of the nation. The reasons often given for preferring social to financial calculations are: i) investments are large and indivisible, ii) there are secondary costs, which a private firm or individual can avoid (i.e. the cost to the neighbourhood of smoke from a factory chimney),

22 Muthoo, M.K., ibid., pp. 21 - 23.

23 For example, a large dam will have a low marginal income when it is built, which if made equal to price, would not yield enough revenue to cover costs, but it has high total (gross) value and therefore, may equalize to be built on other considerations.
as well as ancilliary benefits which are not paid because of imperfections of markets and (iii) there are certain social goals, such as the relief of unemployment, which may be sought to be achieved.

In the literature on investment criteria, what are often termed as social investment criteria, are related to partial analysis. Substantial contribution in this field have been made during past two decades or so. These criteria can be grouped into the following categories: (1) Capital intensity criterion, (2) Balance of payment criterion, (3) Social marginal productivity criterion, (4) Maximum capital accumulation criterion, (5) Maximum employment absorption criterion, (6) Marginal growth contribution criterion and, (7) Multiple goals criterion.

While evaluating any criterion, basic questions to be answered are (a) whether it provides sufficiently clear indicators as to the areas in which investment should be directed in order to achieve the specified objectives, (b) the assumptions from which the criterion is derived are compatible with the fundamental nature of the problem on hand, and (c) in case they are not, it is necessary to know in what respect it needs modifications.
Capital Intensity Criterion:

There are two variants of this criterion: (i) capital-output ratio, and (ii) capital intensity criterion. Let us first look into the capital-output ratio version of this criterion.

It has been said that underdeveloped countries have acute scarcity of certain factors of production, particularly capital. Therefore, efforts should be made to obtain maximum returns from the allocation of these scarce resources. Therefore, in these countries the project with lower capital-output ratio should be preferred (i.e., a low value of \( \frac{k}{y} \), where \( k \) is the capital and \( y \) is the output). Based on similar argument, Polak has suggested capital turnover criteria i.e. \( \frac{y}{k} \) which is inverse to capital-output ratio\(^2\). According to Buchanan, if the investment funds are limited in the absence of special considerations, it would be a wise policy to undertake first those investments which have a high value of annual productivity\(^3\).

This criterion is valid only under certain conditions, viz., (i) when capital is the only scarce

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\(^3\) The same logic has been extended to the choice of sectors of production. The underdeveloped countries are advised to produce and export commodities that use relatively low capital per unit of output and imports items requiring more capital. Chenery, H.B., Comparative Advantage and Development Policy, in Surveys of Economic Theory, Vol. II, op. cit. p. 133.
inputs in the system or other factors are abundant in quantity, so that the prime determinant of cost differences is capital; when the same output could be produced by each investment alternative; (iii) when the market rates used to compare the different products coincide with their social values and; (iv) production takes place under constant cost.  

None of these conditions exists in the real world. Even assuming labour as a surplus factor in the less developed countries (LDC), the results of using this criterion will be the selection of development projects that would require relatively little capital compared with the investment in terms of labour. In such cases, capital will be invested in the cheapest possible implements which may deprive the economy with the advantages of the latest technical processes.  

Besides, it should be recognised that this criterion was developed for evaluation of industrial and manufacturing units where the return from the projects over their economic life would be somewhat uniform. The implicit assumption is that projects should have a uniform rate for depreciation. It is  

26 Chenery, H.B., ibid, p. 133.  
obvious that social overhead investments do not have such kind of uniformity because of uneven length of maturity period, heterogeneous area under influence etc.

A closely related criterion is the capital intensity criterion i.e., the ratio of capital to labour. If the same production function exists and capital is scarce to labour then the project with low capital-labour ratio can be preferred. This does not assume zero productivity of labour, as is the implicit assumption in capital-output ratio version.

A principal criticism against both these ratios, (\(k/y\) or \(y/k\) and ratio of capital to labour) is that they ignore the role of other factors of production such as natural resources. If either labour or natural resources has/have a significant opportunity cost, the capital output measure must be replaced by a more general marginal productivity criterion. Similarly, in this criterion no distinction has been made between average and marginal capital-output ratio. For achieving maximum returns from scarce resources the marginal capital output is important, and not the average capital-output ratio.

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Polak's criterion can be subjected to similar criticism, because in his case the marginal productivity of capital is not correlated with the rate of turnover. In sum, due to many unrealistic assumptions, criteria of this nature are not useful for project evaluation.

The Balance of Payment Criterion:

This criterion assumes that the basic objective in less developed countries is to minimise or to correct balance of payment deficits. In the process of development, need for foreign exchange increases due to, (a) the 'direct-drain' - i.e. the requirement of capital imports and (b) 'the circuitious drain', arising from the increase in imports due to increase in income as a result of the investment. Only if the actions of the state reduces the marginal propensity to import to zero, or there is corresponding increase in foreign loans and grants, the problem of adverse balance of payment will not arise. Otherwise, if the problem is to be avoided, the value of exports must be increased by emphasising the allocation funds to those projects which contribute to a positive foreign exchange balance, whether by producing imports substitutes or by increasing range and volume of exports. However, public opinion may insist upon projects of 'social overheads', even if they result in a net drain of foreign exchange.

29 Kahn, A.E., ibid., p. 132.
This criterion is partial in nature and can be applied only in the case of those projects which influence foreign exchange transactions. To reduce the balance of payment deficit is only one aspect of the economic planning which can be taken care of with the execution of projects with different basic goals. Therefore, it should be combined with the major goals wherever it has some relevance. In other words, it should be recognised as a constraint but not as a criterion.

**Social Marginal Productivity Criterion:**

The concept of Social Marginal Product (SMP) propounded by Kahn is a general equilibrium concept. It is defined as the net contribution of marginal unit (project) to the national product. According to this concept, investment should be in the projects from which the highest marginal returns are anticipated. This criterion deals with the relative efficiency of capital in different uses. According to this criterion optimum allocation of the resources can be achieved if the social marginal productivity of capital is approximately equal in different uses. Kahn, while criticising

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30 In fact, this criterion is not dealt with separately in the literature but is being included in the subject matter wherever different objectives are attributed to investment criteria. See, Kahn, A.E., ibid., pp. 156-157.

31 Kahn, A.E., op.cit., pp. 131 - 158.
Buchanan and Polak, wanted to show that the existence of a particular natural resource, some specialised skills, particular climatic conditions, or the importance of particular products or services, may make the SMP of capital higher in a project which is more capital-intensive than in another which is less so.

SMP criterion proposed by Kahn can be summed up in the form of equation:

\[
\text{SMP} = \frac{V - C}{I}
\]

Where:
\( V \) is annual value of output,
\( C \) is total cost of output,
\( I \) is investment.

This criterion is useful to compare relative merits of projects but it has many limitations, too. Vaidyanathan while commenting on Kahn's formulation pointed out following demerits of this criterion; (i) this criterion does not take into account possible secondary benefits; (ii) no attempt has been made to identify as to what proportion of income is solely due to factors under consideration, i.e., the alternative costs of factors used in project are not allowed for; (iii) it is not clear whether all net value added will be credited to capital; and, (iv) marginal unit of investment is not clear.

32 Kahn, A.E., ibid, p. 133.
This criterion has been further developed by Chenery. He has constructed an index of social value to be used as the basis of the choice between alternative investments, where social marginal product is defined as average annual increment in national income (plus balance of payment equivalent) from the marginal unit of investment in a given productive use. At the outset he clarified that since the productivity criteria are usually applied to investment projects rather than to single unit of capital, they are 'marginal' only in the sense that a project normally constitutes a small fraction of the total capital invested in a given year. The equation derived by Chenery is:

\[ SMP = \frac{V}{K} - \frac{C}{K} + \frac{rB}{K} \]

Where, \( V \) = Social value of products sold domestically,
\( C \) = Total cost of domestic factors, labour and material etc.
\( B \) = Total balance of payment.
\( K \) = Capital investment
\( r \) = Ratio of social value of foreign exchange to its market value or its regulated price.

34 Chenery, H.B., has also developed an integrated criterion where various effects have been taken care of. This is discussed in latter parts of this discussion.

35 The equation is written in another form as

\[ k \cdot SMP = \left( \frac{V}{E} \right) \frac{V}{E} - \frac{C}{E} + \frac{rB}{E} \]

where, (i) \( V \) is the capital turnover rate (the inverse of capital output ratio), (ii) \( V-C \) is the value margins or social profitability and (iii) \( B/k \) is the balance of payment effect, the importance of which will depend upon parameter \( r \) (the premium attached to foreign exchange earning). See, Chenery, H.B., The Application of Investment (cont....
This criterion is based on assumptions similar to Kahn's SMP criterion and, therefore, has similar limitations. The only improvement is that in this formulation other effects (i.e. national income and balance of payment) have been taken into account. It is clear that what this formula will measure is the average product for the project as a whole, and not the marginal product. The formula is not proper for finding the scope or scale of an individual project. As Eckstein has stated, the formula is a marginal concept only in so far as it reveals the contribution of any one project to the programme, assuming that choices are defined in terms of adding or subtracting projects. Chenery's formula fails to measure productivity of input-complex and only measures capital productivity. Thus, if the social cost of employing labour is zero and \( r \) is equal to 1, this criterion will be similar to capital output ratio. For applying this criterion corrections are necessary where there is divergence between market and social value specially due to (1) tariff, subsidies or taxes, (2) external economies and, (3) idle resources. It

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37 Mobesary, F. op. cit., p. 19.

will be unrealistic to assume away all these complications.

'Social Marginal Productivity criterion has also been criticised by Galenson and Leibenstein\(^{39}\) because (i) emphasis in this criterion is on productivity of capital whereas the goal of economic development should be to maximise per capita output, (ii) the criterion emphasises the rate of output and not the rate of investment and (iii) no account is taken of changes other than the increase in output, e.g. population growth is ignored.

Besides, the criterion is static in nature and seeks to maximise immediate output. It is important to note that in investment planning, dynamic context should not be forgotten because different rates of capital accumulation may arise in future depending on different types of investment. Finally, this criterion fails to include the effects of investment upon savings\(^{40}\).

No doubt, this criterion is an improvement over the earlier versions of capital-output ratios, yet it needs significant modification in order to be useful as an aid for investment planning.

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Maximum Capital Accumulation: Reinvestment/Quotient Criterion:

Galenson and Leibenstein have suggested *Marginal per capita reinvestment quotient* as the criterion for investment planning. These two economists subscribe to a different social welfare function, in which aim is to maximise per capita output at some time in distant future rather than to maximise a discounted stream of income overtime.

The model suggested by them can be summarised as follows: national income can be divided into two parts, i.e. (i) wages and (ii) profits. All wages go into consumption while all profits are reinvested. Under this condition apart from human factor it is the capital-labour ratio that determines output per capita. In other words, availability of capital per worker will determine the extent of per capita output. From this point of view the criterion to be adopted is the one that leads ultimately to the maximum capital labour ratio. The maximisation of per capita consumption at specific future dates requires that the amount of investment in each preceding period should be maximised. To fulfil this

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41 It is concerned with two aspects of development, (1) that the rate of investment shall be as great as possible over time and (2) repercussion on population growth should be taken into account, See., Galenson, W. & Leibenstein, *op. cit.*, p. 191.

requirement the marginal per capita reinvestment quotient of capital in its various alternative uses has to be equal. If this criterion is used, project which has the greatest capital intensity, and, therefore, has very high capital-labour ratio, will get priority. This is just opposite to what capital-output ratio criterion recommends.

In determining marginal per capita reinvestment quotient, the basic factors involved are: 1) gross productivity per worker, 2) 'wage goods' consumed per worker, 3) replacement and repair of capital, 4) increments in output as a result of non-capital using innovations, such as improvements in skill, health, energy, discipline and maleability of the labour force, 5) decline in mortality, 6) decline in fertility and 7) direction of reinvestment. The first six factors determine per capita amount for reinvestment and the last factor deals with its allocation. It is said that with the pace of development, mortality rate decreases and, therefore, consumption increases and hence less capital is available for reinvestment.

The basic criticism against this criterion is that such social welfare function (as is implicit in this criterion) does not do justice to the poor masses; because this criterion emphasise reinvestment in order to maximise the

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reinvestment quotient, consumption might have to be curtailed to increase the rate of savings. In reality the goal of an economy should be optimisation of saving and not the maximisation of it. In underdeveloped countries for a large mass of population the level of consumption is generally equal to subsistence and for a few it might be even below the subsistence level, and therefore, exclusive emphasis on saving is undesirable.

Further, the assumption that the propensity to save out of wages is zero but the propensity to save out of profit is equal to unity seems far from actual situation in underdeveloped countries.

Some economists, e.g. Eckstein, accept the validity of the fundamental points of the Galenson – Leibenstein argument, but they believe it would be more desirable to employ monetary and fiscal policies to achieve an optimum rate of savings (through taxation, price, monetary and tariff policies and so on). The correct policy should be to invest in the most productive projects regardless of their influence upon savings and then through fiscal and monetary means, the economy may achieve the desired rate of savings.

45 Eckstein, O. op.cit. p. 66.
46 Mobesary, F. op.cit. p. 23.
In this criterion also we see that capital has been given the major role and it is the capital-output ratio which determines per capita output. However, there are many economists who believe that the level of aggregate capital formation (and, therefore, the capital labour ratio) is not the key variable. Other variables such as entrepreneurship, institutional arrangements, attitudes etc. have considerable influence on productive efficiency of economy although the role of capital has to be recognised.

Maximum Employment Absorption Criterion:

One of the important characteristics of underdeveloped countries is the existence of a large number of surplus labour under these circumstances, the technique of production that uses the maximum amount of labour per unit of development will be economically efficient and desirable from a social and political viewpoint. This concept is very close to minimum capital output ratio and favours projects with low capital intensity.

In the interest of long term development this criterion may not be found valid, as it is possible that the


(3) Mobesary, F., op. cit. p. 23.
"maximum labour absorption criterion" may lead to low labour productivity. A capital intensive investment may lead to increase in capital accumulation in the long run which may create more and more employment opportunities in the economy in subsequent rounds. However, the existence of a high rate of unemployment may have undesirable political and social effects. Therefore, the better solution would be to have projects of both kinds (labour intensive as well as capital intensive). For example, light capital intensive projects can be suggested for agricultural sector while higher capital intensive projects for industrial sector. The former may provide more of employment opportunities and the later may provide more of savings and, therefore, more of reinvestment possibility.

The Marginal Growth Contribution (MGS) Criterion:

Eckstein reconciled the Kahn-Chenery SMP approach and the Galenson-Leibenstein reinvestment approach, and followed a mid way of generalisation. Firstly, he assumes that the social objective is to maximise the present value of future consumption streams. With zero discount rate it leads to Galenson-Leibenstein approach and with high discount rate it leads to Chenery's approach.

49 Mobesary, F. ibid., p. 23.
50 Mobesary, F. ibid., p. 24.
Secondly, he assumes that there is a different saving (reinvestment) coefficient associated with each project, but he allows any saving rate out of wages and profits. From these assumptions he derives a measure of Marginal Growth Contribution, MGC, of a given project, consisting of two aspects (a) an efficiency term, consisting of the present value of consumption streams (b) a growth term, consisting of the additional consumption to be achieved by reinvesting savings.

The results of this criterion largely depend upon the rates used for discounting respective values. Much controversy exists over the discount rate to be used; this will be discussed in second chapter in detail since benefit-cost analysis also implies use of such rates. However, in the ultimate analysis these are matters of value judgement.

**Multiple Objectives and Integrated Criterion:**

From the above discussion one can infer that there is a remarkable difference in the viewpoints of several economists on deciding as to what is the correct criterion for allocating the productive resources. However, one thing is clear, i.e., whatever criterion is selected largely depends on social objectives. These objectives are multiple and of varying character. Under such conditions one possible approach can be to assume
maximisation of national income as the main objective\textsuperscript{52}, and the remaining objectives can be treated as constraints\textsuperscript{53}. These objectives are concerned with the question how far the project satisfies conditions such as the following.

1) \[ \frac{\text{net earning of foreign exchange}}{\text{total capital investment}} \] 
2) \[ \frac{\text{saving generated by project}}{\text{total capital investment}} \] 
3) \[ \frac{\text{wages for unskilled labour}}{\text{total capital investment}} \] 
4) \[ \frac{\text{Present value of benefit received by rural sector}}{\text{total capital investment}} \]

The magnitude of coefficient 'a' to 'd' is determined by trial and error, after taking into consideration available historical data, the economic conditions of the country, the type of development project and, the weight that policy makers attach to various national objectives.

The principal criticism of this approach is that it is highly rigid in nature. There is every possibility of rejection of even the most efficient project because of some of the constraints. It becomes quite difficult to decide between two types of projects when they have

\textsuperscript{52} Mobesary, F. op.cit. p. 24.

some effect on national income but affect other constraints in varying degree. The U.N. experts, keeping in view these limitations, have suggested partial criteria where effects of the project upon each objectives, such as net return to national income, balance of payments, employment etc., is estimated separately. However, the national income objectives is considered as the prime factor, while for other objectives exact quantifications are not carried out. Thus, with the separate estimations for different objectives a project enjoying first rank on the basis of national income may or may not enjoy the similar position with respect to other criteria if its contribution to the fulfillment of other objectives is less than that by other competing projects. The major short-coming of this criterion is that it does not require policy-makers to be consistent in their value judgement.

Due to these limitations and difficulties it has been recognised by most of the economists that a single formula should be constructed for measuring the effect of a project upon the multiple aims. With this end in view Chenery has constructed index of social welfare where different national objectives have been reconciled in one common measures. If $U$ is the index of social welfare then:

U = U (Y, B, D,...)

where Y = effect of project on national income;

E = total net effect of the project on balance of payment.

D = effect of the project on distribution of income.

then the increment in U corresponding to a given increment in investment may be written as

\[ U = \frac{du}{dy} \Delta Y + \frac{du}{dy} \Delta B + \frac{du}{dy} \Delta D \]

\( \frac{du}{dy} \) is equal to one if U is measured in national income units. Therefore, the previous equation becomes

\[ U = \Delta Y + \frac{dy}{dB} \Delta B + \frac{dy}{dD} \Delta D \]

then the problem is reduced to determine relative weights of \( \frac{dy}{dB} \) \( \frac{dy}{dD} \) which represents not only economic value judgement but also political and social value judgements.\(^56\).

A modified version of Chenery's formula has been actually used in the economic planning and resource allocation in Philippines.\(^57\). There the formula used was:

\[ IP = R_1 R_2 + R_3 + R_4. \]

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56 Higgins, B. ibid., p. 655.

57 However, Chenery dropped income distribution objective from his analysis for simplicity and tried to give weight to balance of payment along with national income objective.
where \( IP = \) Industrial priority.

- \( R_1 = \) Value added to the national income
- \( R_2 = \) impact of the project upon the country's balance of payments.
- \( R_3 = \) the extent of additional economic values derived from the use of domestic material,
- \( R_4 = \) the social value derived from employment of Philippines's labour.

Such formulae can be misleading if the quantification is crude and the value judgements made are not explicit.

Under such conditions, the right policy would be first to select various fields on the basis of general priority for allocation of funds. They can be optimally allocated among different projects with the help of specific criteria relevant for different sectors. For example, balance of payments criterion or industrial productivity criterion may be suitable for industrial field, while capital turnover criteria may be useful in land reclamation, and so on\(^5^8\).

In our country, Prof. K.N. Raj\(^5^9\) has suggested a criterion which compares i) differences in the volume and type of labour required for construction, ii) differences in the volume and type of material equipment required for construction, iii) differences in period involved in construction and life of the project, and,


\(^{59}\) Raj, K.N., op.cit. p. 17.
(iv) differences in the volume of output consequent on the investment for selection of alternative projects and project designs, especially for water resource development. In this analysis he has considered 'social cost' to mean the opportunity cost, from the social point of view incurred by the use of scarce resources, and "social returns" to mean the addition to the output of the community taken as a whole. Its application in real life, apart from the practical difficulties in estimating various coefficients, becomes difficult because as the author himself has admitted, the role of externalities makes analysis invalid.60

Benefit-Cost Analysis and Its Relevance:

The investment criteria discussed so far do not solve the problem of balancing all kinds of economic benefits (gains) and costs (losses) of an investment option61. As mentioned in the beginning, developing countries invest large amounts in various productive and social fields through public agencies. It is fair, therefore, to study the probable benefits and costs streams of development programmes to the society. The criterion known as benefit cost criterion has been recognised to be the most relevant criterion where the bundle of costs and benefits of alternative projects are compared within

60 Raj, K.N., op.cit., pp. 15 - 35.
61 Even the criterion known as integrated criteria also fails to cover all aspects.
the sector and in between the sectors. In fact, this tool has been frequently utilised by various agencies. The concept and its application will be discussed in detail in next chapter. However, it would be desirable to sum up its relevance for investment planning.

This criterion has been utilised for project selection in developed countries, more frequently in U.S.A., and also in a few underdeveloped countries (including India). Some times it is held that this tool is less suitable for investment decisions in developing countries since in these countries divergence between social and private costs and benefits is larger because of imperfection of market, role of externalities, nature of secondary benefits, social choices, collective goods etc. But now with the help of 'shadow analysis' it has become possible to reflect multiple national goals and structural disequilibrium of the developing economies.

The criterion is sometimes criticised for its limited application, since it ranks projects and programmes in terms of economic efficiency only. This is not correct since this criterion has been further

64 By shadow analysis, we mean adjusted variables used in the criterion e.g., shadow price, shadow rate of interest, social time preference rate etc.
63 In fact, work of Eckstein, Krutilla and McKean has remained limited to this extent. It has been criticised in a number of studies. See, Maass, A. op.cit., p. 311, Muthoo, M.K., op.cit. p. 11.
developed to accommodate other social goals like income distribution, self-sufficiency etc. Moreover, 'secondary benefits' calculated under this criterion are in fact, benefits much broader than the value of efficiency.

The major advantage of this criterion is that it can be made consistent with the welfare goals of the community. As has been rightly remarked, the word 'benefit' (and the work 'cost' too) has no meaning by itself, but it acquires meaning only in association with an objective, there are benefits in terms of efficiency, income distribution, etc.

This criterion, in its comprehensive form, takes care of all primary, secondary and tertiary effects on present and future generations, whether tangible or intangible. It also takes care of the scale of the development as it implies that to get maximum returns out of scarce resources, investment should be made to the point where marginal benefits equal to marginal cost. All the tangible benefits are made comparable for different projects, while the description of intangible benefits, involved in the criterion, may prove helpful as extra information for making better informed judgement.

The major limitation of benefit-cost analysis lies in its incapability for practical application in the case

of comparison of two distinct productive sectors (like agriculture and industry), and in the case of comparison of productive and social sector (like agriculture and education)\textsuperscript{68}. This is because of the lack of common yardsticks and weights ascribed to different objectives. However, in the case of productive sectors this limitation can be overcome by use of opportunity costs. Moreover, sectoral allocation can be made with the help of programming approach and it is in the intra-sectoral allocation that this criteria can be helpful. Finally, even in the case of regional allocation of investible funds though the backward areas are to be brought to the level of developed areas by investing in infra-structural facilities, the important question to be answered is the evaluation of individual projects from consistency and productivity points of view, and in this respect this criterion can be helpful.

In the case of water resources development especially in the irrigation field\textsuperscript{69}, where benefit cost analysis is frequently applied, most of the effect envisaged from the projects are tangible and can be included in the analysis. Irrigation development deals with the development of different areas on more or less similar lines. Under such

\textsuperscript{68} Sen, S.R., Inaugural Address to Third Annual Conference of Rajasthan Economic Association, Oct., 1969, p.3.

\textsuperscript{69} In fact irrigation is the old field where this analysis has been applied since its inception.
circumstances benefit-cost criterion helps in judging consistency and efficiency of different projects.

As stated previously after the development of all the larger river basins, possibility of development of minor and medium projects in large numbers has to be reckoned. In terms of economies these projects have similar effect irrespective of geographical locations. These projects are relatively less capital intensive, and they contribute in the fulfilment of social goals of increasing production, equalising distribution of income by aiding depressed areas or communities and, by providing more employment opportunities. Hence they constitute important plank of the developmental programme. A proper evaluation of such projects, to assign them relative priority is possible with the help of benefit cost analysis. Wherever investment is heavy and has overall effect on the economy, its contribution from various angles, e.g., balance of payments point of view, reinvestment potential, etc., can be studied by using the basic concepts of cost benefit criterion. Where multipurpose projects have been developed and large parts of the community have benefitted in varying ways and in different degrees, this analysis

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70 However, this view is not shared by all economists. See, Prest, A.R. and Turvey, R., op.cit., p. 157. It is argued that this tool is least relevant to large size investment decisions, which alter output and prices over the whole economy. It is more possible in the case of developing countries which may involve larger structural changes. However, adjustments can be made about these changes in the analysis.
helps to furnishing a basis for apportioning the cost of such a project between various sections of society.

India has adopted a perspective of economic development wherein the achievements of specified objectives in different sectors are made part of the planning process. This process consists of the successive stages of setting objectives allocating resources among sectors and, deriving criteria for designing individual project. Even under such conditions it may help in evaluating individual projects, and to compare them with other projects within the same sector.

71 Marglin, S.A., cp.cit., p. 15.