1. Identification of Benefits and Costs

Direct benefits

When we speak about the prosperity or poverty of a country we often refer to the real per capita income or to the real per capita consumption. These are all attempts to measure the current welfare of the country. The "aggregate-consumption" is very often taken as a rough measure of social welfare. It measures the value of consumption as consumers see it. The aggregation is usually performed in terms of the consumers' willingness to pay.

The basic problem involved in calculating the aggregate-consumption benefits of a project is to measure the consumers' "willingness to pay" for the "net output" of the project. By "net output" of the project, we mean the goods and services made available to the economy that would not have been available in the absence of the project. If the goods and services physically produced by the project add to the supply in the economy, they may appropriately be regarded as the net output for the purpose of our analysis. However, if the goods and services produced by the project substitute for an alternative source of supply, leaving the total supply constant, then the net output of the project is reflected by the resources released from the alternative source of supply. One good example is the recognition that the real output of an import-substitution project is the net foreign exchange saved.
by the project. In the first case we measure the project benefits according to consumers' willingness to pay for the goods and services produced and in the second case we measure the corresponding project benefits according to consumers' willingness to pay for the goods and services released or saved by the project.

Once the project benefits have been identified, the problem is to find a suitable measure of consumers' willingness to pay for the relevant net output. The net output may be either (a) final consumer goods for domestic use, (b) intermediate producer goods or (c) foreign exchange earned when the project output is exported, directly or indirectly, or saved when it substitutes for imports, directly or indirectly.

Direct costs

Opportunity costs

The appropriate concept of cost is that of the maximum alternative benefits foregone. In the identification of cost as the maximum benefits sacrificed, we must be careful to define the alternative opportunities realistically, bearing in mind the real feasibility and not merely technical possibilities. The technical opportunities that can not be made use of, under given social constraints, are not real opportunities.

Willingness to pay

Since costs are the maximum benefits forgone, we measure costs in the same way as we measure benefits. As with aggregate-
consumption benefits, we measure consumers' willingness to pay to measure the aggregate-consumption costs. The costs of a project consists of its "net inputs", which may be defined as the goods and services withdrawn from the rest of the economy that would not have been withdrawn in the absence of the project.

The first step in measuring costs is to identify correctly the relevant net input of the project. Here we face two possibilities. Firstly, the use of various physical inputs for a project may result in a decline in the total availability of inputs by an amount exactly equal to their consumption by the project. Under such circumstances the net input of the project consists of the actual physical inputs. Secondly, in response to the demand made by the project for these inputs, their supply may be correspondingly increased in the rest of the economy, so that there may be no change in the total availability of the goods and services actually used as inputs to the project. The net input to the project will then consist of those goods and services whose availability to the rest of the economy is reduced because they are used up in producing inputs for the project.

In both the cases, the problem is to identify which goods and services suffer a net decline in availability because of the project. In the first case, we must look to the demand for these goods and services by other potential purchasers in order to measure their aggregate-consumption costs. Here the relevant
margin for measurement is the demand margin. In the second case where the project requirement of inputs is met by increased supply from other sources, we are concerned with the supply margin. It is most likely that out of the variety of inputs that are required by a project, some have to be measured on the demand margin and others on the supply margin.

Once the project costs have been properly identified, the problem of finding a suitable measure of willingness to pay is precisely the problem of measurement of benefits. The relevant project inputs are (i) Producer goods (ii) Foreign exchange (iii) Land and (iv) Labour. The relevant methods of estimation of cost will vary from case to case.

**Indirect benefits:**

Indirect consumption benefits of a project are those, that are not reflected by immediate willingness to pay.

The projects often yield a net gain to society that is not wholly captured by the benefits accruing to the users of the project output. Ideally in such a case the "additional" benefits ought to be added to the over-all contribution of the project to the aggregate-consumption. Such a situation typically occurs when an ancillary good or service produced in connection with the project contributes not only (internally) to the value of the project output, but also (externally) to the supply of output from other enterprise. Additional benefits may accrue to
the society through such factors as construction of a road for the purpose of the project or training of unskilled labour for the project. The measurement of consumption benefits will be seriously distorted if only the purchaser's valuation is considered.

**Indirect cost**

Here we assess the external effects that result in a net loss to society. A typical example is the pollution of air and water by industrial plants. Ideally these things also ought to be included in the assessment of the project.

**Limitations of measuring indirect benefits and costs.**

Practically it is impossible to quantify many of the externalities. Instead of ignoring them, we should recognize it as one of the most serious limitations of social cost-benefit analysis. The project evaluator should clearly be aware of these aspects of a project. He should certainly take into account the qualitative descriptions of these effects. In certain situations such qualitative judgements about externalities may prove to be decisive in the choice of a project.

2. **National Planning and National Parameters.**

**Role of national planning.**

In order to calculate the national economic profitability, project formulators and evaluators have to compute social benefits
and social costs on the basis of parameters which, formally resemble market prices, but are not to be found in any currently published list of prices. These parameters include the relative weights on the relevant objectives of economic development, the social rate of discount, the shadow price of investment, the shadow wage and the shadow price of foreign exchange. Generally these parameters are independent of decisions taken with respect to individual projects. Their calculation is assigned to the national level of the planning process rather than to the project level; they are thus called national parameters.

In the computation of national parameters the key problem is the circularity arising from the sensitivity of decisions about each project to the magnitude of national parameters and the sensitivity of the appropriate magnitudes of national parameters to the decisions about the projects. Ideally, this circularity could be resolved by inferring the appropriate magnitudes of national plan from the 'nearby' alternative plans rejected as inferior. The Central Planning Organisation (CPO) has the role of articulating the value judgements implicit in the national plan, of translating implicit judgements into explicit weights on objectives, weights on consumption over time (The social rate of discount), and the shadow prices of investment, labour and foreign exchange. The CPO would itself make no value judgements.

However, the complexities of the economic and institutional environment make it sufficiently difficult to generate even a single feasible plan, here optimality as well as the possibility of comparing alternative plans are out of question.
This is not to say that national planning is irrelevant to project formulation and evaluation. Even if it is impossible to attain optimality, a well-formulated plan can at least provide a consistent forecast of future economic development. Moreover, a well-formulated plan indicates magnitudes whose relevance for estimation of national parameters depends only on the accuracy of the forecasts, not on the optimality of the plan. The shadow price of investment, for example, depends in part on capital productivity and the propensity to invest, regardless of whether capital productivity and the propensity to invest are optimal. So these magnitudes can legitimately be inferred from any consistent national plan but the remaining determinant of the shadow price of investment - the social rate of discount - can not be.

National planning thus plays a limited but crucial role in project planning.

**National Parameters (meaning, significance and derivation)**

The methodology for calculating national economic profitability requires computation of social benefits and social costs using parameters which, though formally resemble market prices, are actually not the current market prices. These parameters are in general independent of all decisions taken at the project level and are required to be evaluated at the national level. They are thus called national parameters. These parameters include the relative weights on the relevant objectives of economic development, the social rate of discount, the shadow price of investment, the
shadow wage rate, shadow price of foreign exchange and income distribution.

The existence of a national plan does not really imply that the current and future resource allocations are optimal. Still it is not impossible to derive national parameters from the plan, but to implement planning based on those parameters set by the policy makers would require an ability on the part of them to articulate their value judgements in an explicit and quantitative manner. This situation is however unlikely to be existing at present.

There are two categories of national parameters, (I) Weights and (II) Shadow prices.

'Weights' are those national parameters which reflect the marginal importance of various objectives and are derived directly from value judgements. The marginal importance depends on the degree of fulfilment of objectives at the point from which marginal departures are measured. In this category we have (a) Weights on the distribution of income (b) Weights on merit wants (c) Social rate of discount, which reflects the relative weight on aggregate consumption at different times. (d) Other objectives that the Government may consider sufficiently important to be included in the national economic profitability calculation.

"Shadow prices" are prices which reflect better the real costs of inputs to society and the real benefits of the outputs, than do actual prices. The term shadow price has been extended to cover the worth of social benefits or losses that are either unpriced by the market or else unsatisfactorily priced. Unsatisfactorily priced benefits or losses are corrected by accommodating spillover effects.
Shadow prices are treated as functions of unknown weights. In this category we have (a) Shadow price of investment (b) Shadow price of labour (c) Shadow price of foreign exchange.

Before going into detail discussion about the various national parameters, we introduce a concept, known as "Aggregate-Consumption."

Raising the standard of living is a fundamental goal of national planning and this naturally depends upon project selection. An important measure of standard of living is the level of aggregate-consumption per head.

Let there be \( n \) goods \( 1, 2, \ldots, n \) with corresponding prices \( p_1, p_2, \ldots, p_n \) and \( x_1, x_2, \ldots, x_n \) are the corresponding amounts of consumption of each good, then aggregate measure of consumption is given by

\[
C = \sum_{i=1}^{n} p_i x_i
\]  

(1)

Aggregate-consumption involves adding consumption of different persons. These would be added after taking due note of income distribution. For operational convenience consideration of income distribution may also be taken into a separate category of benefits.

The question of aggregating consumption over time involves problems of discounting. If \( a_t \) is the value of a unit of aggregate consumption in year \( t \), then we have to discount the consumption level of year \( t \) at a rate

\[
\delta_t = \frac{a_{t-1}}{a_t}
\]

(2)

in order to bring the consumption level of year \( t \) in line with that of year \( t-1 \) and so on upto the 0th year.
Formally, if $Q_t$ is the contribution to aggregate consumption from a hypothetical project in year $t$, then the over-all contribution by this project to aggregate consumption is $\sum_t a_t Q_t \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots 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all, since composition of the output will be influenced by
demand and therefore by distribution of income.

In principle, it is possible to correct the prices offered
by each purchaser, namely, by attaching a lower weight to a rich
man's money expenditure. The weight on income accruing to a rich
man may also be taken to be less than that accruing to a poor
person. Such detailed corrections are, however, not easy to make,
use of a rough method may be more practicable.

One such measure is to attach an additional weight to income
accruing to, or consumption enjoyed, by, the poorest group.

In this approach, the measure of redistributional benefit is
the amount of consumption that is generated in the poorest region
or enjoyed by the poorest class. In combining this objective with
that of aggregate-consumption objective, a precise weight would
have to be chosen for attaching an additional value to the
consumption of the poor. The choice of this weight is, of course,
ideally a policy decision. However the weight emerge only from the
process of project choice.

Disregard of the redistribution of benefits and costs from
a project can be justified only if it can be assumed that the
desired distribution of consumption is to be achieved independently.
Otherwise for mitigating inequalities the Government should be
prepared to sacrifice some potential aggregate-consumption reali-
zable from public projects in order to improve its distribution.
Redistributional benefits

A redistributional benefit is to be defined with respect to the particular group in question. It is an aggregate-consumption benefit that accrues to that group. The redistributional benefits to a group are equal to the immediate aggregate consumption benefits it receives minus any offsetting payment made to the other groups. Depending upon the associated cash transfer, the direct aggregate consumption benefits of a project may be spread over a number of different groups other than the immediate beneficiaries.

Redistributional cost

A redistributional cost must also be defined with respect to the particular group in question. It is an aggregate consumption cost that accrues to that group. The redistributional costs to the group are equal to the immediate aggregate consumption cost it incurs minus any compensating receipts from other groups. Persons who forgo the use of the goods and services that are used as inputs to a project whose supply is reduced and whose willingness to pay for it measure the corresponding direct aggregate-consumption cost. If such persons are compensated by others or reduce their own payments to others, the ultimate costs may be borne by groups quite distant from those who are most immediately affected by the project.

To measure the net redistributional benefits realized by a particular group, we must examine all the aggregate-consumption benefits and costs—direct and indirect—of a project, as well as
all the accompanying cash transfers and determine to what extent each item affects the group in question.

Regional income multiplier

After the ultimate net redistributual impact of a project on any given group has been calculated, there remains one further adjustment, which is of importance primarily in the case of regional group redistribution. Whether the net benefits accruing to a particular region are consumed or invested, a part of them will be respent within that region. As long as they result in a net transfer of wage or profit income from elsewhere in the economy to the project region, they will result in a new round of benefits to the region. Such a chain of indirect benefits can in principle continue indefinitely, with the benefits on each successive round progressively declining.

If $\gamma$ is the marginal proportion of the direct net redistributual benefits $R^D$, which—when respent—result in additional net benefits to the region, then the value of the indirect net redistributual benefits, $R^I$, can be expressed as:

$$R^I = \gamma R^D + \gamma(\gamma R^D) + \gamma(\gamma^2 R^D) + \cdots = R^D \left(\gamma + \gamma^2 + \gamma^3 + \cdots \right)$$

and the total net redistributual benefits to the region, $R^T$, is given by

$$R^T = R^D + R^I = R^D \left(1 + \gamma + \gamma^2 + \gamma^3 + \cdots \right) = R^D \left[\frac{1}{1-\gamma}\right]$$

The expression $\left[\frac{1}{1-\gamma}\right]$ is known as "Regional income multiplier."
(b) **Estimation of weight of redistribution**

Let us have two variants A and B producing the following net aggregate consumptions:

<table>
<thead>
<tr>
<th>Variant</th>
<th>Net aggregate consumption</th>
<th>Specified groups net aggregate consumption</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>$K_1$</td>
<td>$L_1$ ($L_2$)</td>
</tr>
<tr>
<td>B</td>
<td>$K_2$ ($K_1$)</td>
<td>$L_2$</td>
</tr>
</tbody>
</table>

If we denote the net aggregate consumption and specified group's net consumption by $B_1$ and $B_2$ respectively, and the weight on specified group's consumption by $W$, then planning goal would be to maximise

$$B_1 + WB_2$$

subject to the constraint imposed by the data

$$B_1 = K_1a + K_2(1-a) \quad \cdots (9)$$

and

$$B_2 = L_1a + L_2(1-a) \quad \cdots (10)$$

where $0 \leq a \leq 1$

where 'a' represents the allocation of resources to the variant A and $(1-a)$ represents the allocation of resources to variant B.

**Calculation of the switching value of the weight**

From the above discussion we have

$$B_1 + WB_2 = K_1a + K_2(1-a) + W(L_1a + L_2(1-a))$$

or,

$$B_1 + WB_2 = (K_1-K_2) a + K_2 + W(L_1-L_2) a + L_2$$

or,

$$B_1 + WB_2 = (K_1-K_2) + W(L_1-L_2) \quad a + K_2 + L_2$$

$$\cdots (11)$$
The choice variable of the problem is 'a'. It is clear from the equation (11) that national economic profitability (NEP) is maximised when \( a = 0 \) for \( \frac{(k_1 - k_2)}{(L_2 - L_1)} \cdot \left( L_2 - L_2^* \right) < 0 \)

In other words, with the redistributinal weight in excess of \( \frac{(K_1 - K_2)}{(L_2 - L_1)} \), B alternative is superior. By the same token equation (11) is maximised when \( a = 1 \) for \( \frac{(K_1 - K_2)}{(L_2 - L_1)} \)

Thus \( W = \frac{(k_1 - k_2)}{(L_2 - L_1)} \) is the switching value; algebraically it is the value of \( W \) that makes \( a \left( \frac{(k_1 - k_1)}{L_1 - L_2} \right) + W (L_1 - L_2) \) vanish, so that NEP is insensitive to how the available resource is divided between the two variants.

(c) **Social rate of discount**

The appropriate social rate of discount is the rate at which the decision makers believe that the future benefits must be discounted to bring them in line with present benefits. If \( a_t \) is the value of a unit of aggregate consumption in year \( t \), then we have to discount the consumption level of year \( t \) at the rate \( i_t = \frac{(a_{t-1} - a_t)}{a_t} \)

in order to bring the consumption level of year \( t \) in line with that of year \( (t-1) \) and so on upto the 0th year.

Mainly due to the difference in the numerical value of the market rate of interest and the appropriate social rate of discount the commercial profitability and the national gain, though both expressed by 'Present Value', often differ. Given any series of profits (private or social) the size of the present value depends on the rates of discount. The social rate of discount may
differ from commercial rates of interest for many reasons. An individual may expect to live only a certain number of years and the discounting of future that evolves from this limitation may not be appropriate for social choice, since the planner may wish to take a longer view and give greater importance to the welfare levels of future generations. Policy makers must determine this parameter by making an implicit or explicit value judgement with respect to intertemporal distribution of increments to consumption. Even within the framework of a two-period model, the marginal productivity of capital can be used as a surrogate for the social rate of discount only if it is assumed that the resources required for the project under investigation are drawn entirely from marginal investment in the private sector. Once we shift from two-period model to multiperiod model, only the assumption of optimal growth will justify discounting future benefits and costs at a rate equal to the marginal productivity of capital.

Extending the model to more dimensions

The weight on income redistribution objective and the social rate of discount, as well as the weights on particular merit wants may all vary overtime so that the number of national parameters are proportional to time horizon.

Similarly, we might designate a time horizon $T$ over which the relative weights on the consumption of the group or region in question is constant, and it is zero after time $T$. 
Thus, the observation that the relative importance of objectives may change over time is reflected very pragmatically in national economic profitability calculations. In place of a very general formulation allowing for varying weights and rates of discount, the recommended formulation assumes constancy of these parameters, with a sharp discontinuity at the time at which various objectives are expected to be sufficiently well fulfilled and need not be given prominence any further. We shall now deal with shadow prices.

(a) Shadow price of investment:

An individual who benefits from a project may respond to his improved position by increasing his savings and an individual who incur costs on a project may respond by reducing his savings. Such savings may be translated into changes in investment which will affect future production, consumption and savings. To the extent that a project influences current investment rather than current consumption, it will provide indirect future consumption benefits and not the direct one.

If the Government judges the level of savings of the whole economy to be 'just right' implying no need to attempt special measures to increase (or decrease) aggregate savings and investment, the value of the future indirect future consumption benefits due to a unit of funds devoted to investment would be regarded as being equal to the value of the direct current consumption benefits due to a unit of funds devoted to consumption. In such situations consumption and savings are equivalent.
If, however, the Government judges that the level of savings of the whole economy is insufficient, future benefits, in the form of future consumption, due to investment could be judged to exceed the corresponding present benefits due to consumption. Then it becomes essential to evaluate the over-all effect of a project on the mix of consumption and investment in the economy for every year in which the project is in operation. It is, moreover, necessary to estimate the ultimate aggregate consumption benefits due to a unit of current investment, so as to make these comparable with the benefits due to a unit of current consumption. To do this we require a measure of the value of unit of current investment relative to the value of a unit of current consumption. This measure is known as "Shadow price of Investment" - a national parameter.

If we measure the "Social Value" of a unit of net benefit according to the proportion in which the community divides its net benefits between consumption and savings, it can be shown that the numerical value of the social value lies between 1 and the shadow price of investment. For a group that consumes its entire marginal income (e.g. wage earners), the marginal propensity to save (out of net benefits or their cash equivalent) is zero, so that its social value is equal to one. For a group that saves its entire marginal income (e.g. Government) marginal propensity to save is one and so its social value is equal to shadow price of investment.
If in any year savings are judged to be insufficient, we shall wish to assume that the shadow price of investment is greater than one. It follows that any transfer from a group with a relatively high marginal savings rate to a group with a relatively low marginal savings rate results in indirect future cost (Dasgupta, Sen and Marglin (1972)).

In essence, the shadow price of investment is the present value of the additional consumption that a unit of investment will generate. This shadow price depends on the social rate of discount, productivity of capital over time as well as the propensity to reinvest the output that accrues from capital. If these propensities differ among the various groups of income recipients in the economy, there are many shadow prices of investment. To the extent that the ownership of capital influences the distribution of the income from investment it varies according to who carries out the investment.

Similarly, the shadow price of investment vary with productivity of capital. In so far as capital ownership affects productivity, the shadow price of investment will vary according to ownership even if propensities to invest are identical throughout the economy.

Mathematical derivation of Shadow price of investment

It is appropriate to assume that all returns from investment are not immediately consumed. A fraction, 's' will be reinvested and the remainder (1 - s) will be consumed. Now let the marginal productivity of capital be denoted by 'q'. Thus the direct
contribution to consumption is \((1-s)q\) and the direct contribution to investment is \(sq\).

We can compute the present value of the sum of: (I) Direct contribution to consumption \((1-s)q\) and (II) Direct contribution to investment \(sq\), valuing the contribution to investment at the shadow price of investment \(p^{inv}\). Then the annual return from a £1 investment is \((1-s)q + p^{inv}sq\).

The present value of these returns is equal to the shadow price of investment, which is to say

\[
p^{inv} = \sum_{t=1}^{\infty} \frac{(1-s)q + p^{inv}sq}{(1+i)^t}
\]

\[
\text{or, } p^{inv} = \left\{ (1-s)q + p^{inv}sq \right\} \sum_{t=1}^{\infty} \frac{1}{(1+i)^t}
\]

\[
\text{or, } p^{inv} = \frac{(1-s)q + p^{inv}sq}{i}
\]

\[
\left[ \sum_{t=1}^{\infty} \frac{1}{(1+i)^t} = \frac{1}{i} \text{ an identity that holds for } i > 0 \right]
\]

\[
\text{or, } p^{inv} = \frac{(1-s)q}{(i-\lambda q)}
\]

In a situation where there is no reinvestment, we have \(s=0\) and hence we have, putting \(s = 0\) in the expression for \(p^{inv}\):

\[
p^{inv} = \frac{q}{i}
\]
Shadow wage rate of labour measures the opportunity cost of labour to the public sector, the social value of the goods lost by adding another worker. Under the model of perfect competition, the market wage rate is the appropriate shadow price of labour. Under the neoclassical theory, there is no involuntary unemployment, and the wage is equal to the productivity of marginal worker.

The market wage may fail to measure social cost of labour for three reasons. First, labour is not allocated or rewarded according to the principles of perfect competition. So even in the absence of visible unemployment there may be a gap between the direct opportunity cost and the marginal productivity of labour outside the capitalist sector, and the wage that private capitalists and the Government are obliged to pay.

Second, expansion of public-sector employment generally involves a transfer of income from capitalists to workers, a transfer that reduces investment and expands consumption. So long as shadow price of investment exceeds one, this transfer involves an indirect cost that must be added to the direct opportunity cost in calculating the shadow wage.

Third, the same transfer changes the time distribution of workers' consumption. Present consumption is increased, but future consumption reduced as a result of the reduction in the rate of investment. If a special redistributitional weight is attached to workers' consumption, the present value of the change in workers'
consumption must be included, with an appropriate weight, in calculation of the social cost of labour.

Only the direct opportunity cost of labour can generally be assumed to be smaller than the market wage. Once indirect costs and redistributinal weights are taken into account, it is entirely possible that the shadow wage will exceed the market wage.

(c) **Shadow price of foreign exchange:**

If we first convert all foreign currency values into their domestic currency equivalents, using official rate of exchange, the domestic willingness to pay for an amount of foreign exchange officially equivalent to a unit of domestic currency is known as the shadow price of foreign exchange.

There are two ways of viewing foreign exchange. First, it can be viewed simply as instrumental to aggregate consumption; the value of foreign exchange is then the amount of aggregate consumption that would be obtainable with a unit of foreign exchange. Second, foreign exchange earnings or savings can be regarded as a goal over and above their contribution to aggregate consumption. In the first place value of foreign exchange can be reflected in a shadow price that requires no judgement additional to the basic one that foreign exchange is purely an instrument to aggregate consumption. In the second place the effect at the margin include a reduction of the pressure to export, the increased availability of domestic supplies of exportable goods must be taken into account in calculation of the shadow price of foreign exchange.
It is important to note that the shadow price of foreign exchange measures only the direct impact on aggregate consumption of improvement in the balance of payments. Indirect effect will be significant if the Government rely heavily on imports as sources of revenue for financing public investment, assuming that it is possible to differentiate the propensity and value of public investment from the propensity and value of private investment (Dasgupta, Sen and Marglin (1972)).

It is important to note that the objectives of a project will vary from country to country and within each country from one situation to another. Correspondingly every national parameter will not be important to every project. Accordingly the policy makers pay more attention to the particular parameters important to the project under consideration and less attention to the unimportant.

3. Steps for Project Evaluation

Evaluation of aggregate-consumption benefits

The evaluation of the net aggregate-consumption benefits is carried out best in successive stages of approximation. The first and the most straightforward step is to assess the benefits and costs under the assumption that market prices adequately reflect social opportunity cost and, therefore, the ultimate consumption benefits and costs involved. Let 'Ma' represent the first approximation to the net aggregate-consumption benefits of the project.
The second approximation involves the adjustment of the market prices of specific resources wherever these prices do not reflect the real contribution of the resources to the aggregate-consumption objective—i.e. their "social opportunity cost". In the evaluation of the project three resources are singled out for price adjustment: foreign exchange, skilled labour and unskilled labour. It is tacitly assumed that all the remaining resources of the project are correctly priced by the competitive market mechanism. Let the opportunity cost of foreign exchange relative to its official market price be denoted by \((1 + \phi)\), where \(\phi\) represents the foreign exchange premium. Similarly let the opportunity cost of unskilled labour, relative to market wage rate, be denoted by \((1 + \lambda)\), where \(\lambda\) represents the unskilled labour premium. Also let \(\chi\) be defined as the social premium on the market wage of skilled labour. We assume that semi-skilled labour commands its opportunity cost, and thus no correction is required for this category of labour. After incorporating the opportunity cost premiums we have

\[
\Delta C = MC + \phi F' + \lambda L + \chi Y
\]

where \(F', L\) and \(Y\) are net foreign exchange component, net unskilled labour component and net skilled labour component respectively.

If a portion of the foreign exchange (e.g. salary) is spent in the same country, foreign exchange correction is not necessary for that portion since that part will be converted into official exchange rate and thus the country will not loose the extra value of foreign exchange. Thus the corrected net aggregate-consumption
benefits for the second approximation will be

$$\Delta C = MC + \Delta F + \lambda L + \Delta Y$$

where $F$ is the net foreign exchange component taking into consideration the above point. All other notations have the usual meanings.

The final approximation consists in taking into account that the social value of funds devoted to investment exceeds the social value of the same funds devoted to consumption. This feature arises owing to the inability of the Government to use its fiscal and monetary powers to bring about the rate of investment is deemed optimal for the country as a whole. To evaluate the indirect future benefits (and costs) of the project, we shall have to assess the net effect on the mix of consumption and investment in the economy due to the project. If the project results in a net increase of investment relative to consumption in any given year, the corresponding aggregate-consumption benefits, evaluated at the relevant social rate of discount, are increased above the level measured by the second approximation "SC". To evaluate the net effect of the project on the rate of investment, it is necessary to distinguish all the benefit: and cost flows that make up SC, as well as any accompanying cash transfers, according to the group that gains or loses, and to estimate the respective marginal savings propensities of each group.

For this purpose three broad groups of gainers and losers may be distinguished: Semi-skilled and unskilled workers ($L$), Government ($G$) and private sector ($P$). Each of the benefit: and cost flows that enter into SC, can be identified with one of these three groups.
The distribution by group of the second approximation to net consumption benefits, $SC$, can now be summarized as follows:

$$SC = SC^G + SC^P + SC^L$$

where $SC^G$, $SC^P$, and $SC^L$ denote the value of net consumption benefits flowing to $G$, $P$, and $L$ respectively.

To arrive at the final social value of net aggregate-consumption benefits, $C$, it is necessary to correct $SC^G$, $SC^P$, and $SC^L$ according to proportions in which each is divided between consumption and investment. Thus, if the average unskilled (and semi-skilled) worker saves a proportion $s_L$ of his marginal gains, the "Social Value" of the net consumption benefits flowing to unskilled labour is

$$C^L = \left(1 - s_L \right) + s_L p^{\text{inv}} \right] \cdot SC^L$$

where $p^{\text{inv}}$ is the shadow price of investment. Similarly if $G$ and $P$ save proportions $s_G$ and $s_P$ of their marginal gains, respectively, then the social value of net consumption benefits flowing to $G$ and $P$ are:

$$C^G = \left[1 - s_G \right] + s_G p^{\text{inv}} \right] \cdot SC^G$$

$$C^P = \left[1 - s_P \right] + s_P p^{\text{inv}} \right] \cdot SC^P$$

We may now write the third and final approximation to the value of net aggregate-consumption benefits, $C$, to the country as a whole in any given year as the sum of the social value of net benefits flowing to each distinct group

$$C = C^G + C^P + C^L$$
Redistribution to a region (or group)

The second national objective that we consider in the evaluation of the project is the objective of redistributing benefits to a particular region (or group). Some of the benefit and cost flows are relevant to the welfare of that region (or group) and some are not. Moreover, the relevant items may affect the redistribution objective differently from the way in which it affects the aggregate-consumption objective.

Let us denote the total value of net aggregate-consumption benefits redistributed to the particular region (or group) in any year by $DR$. $DR$ does not have to be corrected for the social opportunity cost of foreign exchange, unskilled labour and investment vis-a-vis consumption for following reasons:

1. What is an opportunity cost with respect to the aggregate-consumption benefits of a country is not necessarily an opportunity cost for a particular region (or group). Thus, although some foreign exchange is spent in the given region, the gain due to extra social value of the foreign exchange spreads over the whole country, and its effect on the particular region (or group) can be assumed to be negligible. Similarly, the benefits to the region (or group) of employing unskilled labour are not limited to the excess of the market wage over the amount actually necessary to attract the labour; the latter represents a cost to the country as a whole, and very little to the particular region (or group).

II. Investment is valued higher than the equivalent current consumption in calculating aggregate-consumption benefits,
because the increased consumption flow provided by investment is a gain to the country as a whole. The fraction of the gain reaching the particular region (or group) is negligible.

One important adjustment is however necessary for DR. We know that whether the direct benefits measured by DR are consumed or invested, a part of them will be respent within the region; if they result in a net transfer of wage and profit earnings from elsewhere in the country to the particular region or activate otherwise idle resources in the particular region, they will result in a new round of benefits to the region. If \( \gamma \) represents the proportion of marginal benefits to the region which, when respent, results in additional benefits to the region, then the total value of net regional consumption benefits in any year is given by:

\[
R = DR \left[ \frac{1}{1-\gamma} \right]
\]

**Evaluation of the Project:**

In connection with the evaluation of aggregate-consumption benefit and redistribution, various parameters have been introduced for which values are required to evaluate the project. In principle, each of these parameters is a function of time, and the appropriate values may therefore change according to the year in which the benefits and costs are being measured.

All the time flows are then converted into their equivalent present values by discounting back to year 0 at the suitable rate of discount, and the present values of each flow item can then be used to compute the project's total contribution to the different objectives.