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DETERMINING INVESTMENT PRIORITY  
RATINGS :-

1. On the Social Marginal  
Product Method of Allocation  
(SMP)
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tion of the Social Return on  
Investment Based on the Exper-  
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Investment Priority Ratings  
Based On the Experience of the  
Philippines.

By Dr. Aziz El Din El Tigi  
(June., 1, 1964)



( I )

On the Social Marginal  
Product Method of Allocation  
(SMP)

ON THE SOCIAL MARGINAL  
PRODUCT METHOD OF ALLOCATION  
(SMP)

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1. Introductory note :-

In the previous lecture we have discussed the benefit-cost criterion in its simplest form. This lecture proceeds to shed some light on the social marginal productivity method of investment allocation as worked out by Professor H.B. Chenery. The rule however has been advocated by many economists of repute. For instance, Professor A.E. Kahn has pointed out that from the point of view of the society as a whole, the correct criterion achieving the maximum social return is the social marginal product, related to the national income as a whole.

The SMP criterion has also been recommended by Profs. J. Tinbergen who has conceived the idea that priority figures generally will have to be the ratio of net results (defined as the difference between returns and total costs) to total costs, all taken at accounting prices.

The SMP method is also recommended by Professors F. Holzman, R. Nurkse and others. In this lecture we will only concentrate on Professor Chenery's explanation. To begin with may I remind you that according to the economic theory of allocation; an efficient allocation of investment is achieved by equating the social marginal productivity of capital in its various uses.

In view of the above-mentioned theory investment projects are to be ranked according to their SMP's. Those projects which achieve a high rate of social return are to be selected for implementation up to the exhaustion of the available investment funds. But in an over-all invest-



ment programme, it is enough to rank projects in order of their social value. And then one has to determine the marginal project from the total funds available. All projects having a lower-rank to the marginal project have to be excluded. Clearly the SMP criterion serves here as a cut-off point.

Our task in this lecture however is to give you a brief description of the SMP method and the need formulae of its practical quantification. A numerical example based on the work of Professor Chenery will also be included.

## 2. Formulae :-

$$\text{SMP} = \frac{X + E - M_i}{K} - \frac{L + M_d + O}{K} - \frac{r}{K} (a B_1 - B_2) \quad (1.1)$$

where :

SMP = is the "social marginal productivity" or the total net contribution of the marginal unit to national product, plus "balance of-payments" equivalent;

X = the increase in annual production value originated by the project, at market prices, after excluding tariffs, taxes and subsidies;

E = value added to production due to external economies;

$M_i$  = the cost of imported materials;



- L = labour cost;
- $M_d$  = the cost of domestic materials;
- O = fixed costs, including administration costs and depreciation;
- r = units of national income equivalent to an improvement of one unit in the balance of payments owing to over- or under-valuation of the exchange rates. (r is to be obtained by subtracting the official from the real rate of exchange and dividing the difference by the official rate);
- K = capital increment (investment)
- a = combined rate of amortization and interest on foreign loans;
- $B_1$  = effect of the project's installation costs on the balance of payments (that part of the investment which is carried out in foreign currency);
- $B_2$  = the effects of the project's operation upon the balance of payments (foreign exchange receipts and expenditure in the construction and operation of the project).



Formula (1.1) may also be expressed in the following form :

$$SMP = \frac{V}{K} - \frac{C}{K} + \frac{B_r}{K} \quad (1.2)$$

$$V = X + E - M_1 \quad (1.3)$$

$$C = L + M_d - O \quad (1.4)$$

$$B = aB_1 + B_2 + B_3 \quad (1.5)$$

where

$V$  = gross production value of the project<sup>‡</sup>, modified by subsidies, taxes and external economies, and from which imported input factors have been deducted;

$C$  = total costs of national factors;

$B$  = total net effect on the balance of payments;

$\frac{V}{K}$  = value added in the domestic economy per investment unit or the rate of turnover;

$\frac{C}{K}$  = operation cost per investment unit, excluding imported materials;

$\frac{B_r}{K}$  = premium per investment unit due to the effect of over-or under-valuation of the balance of payments, expressed in national income units

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<sup>‡</sup> OR the project's total production value, socially priced including external economies but excluding imported materials.

Finally, equation (1.2) may be presented as follows :

$$SMP = \frac{V}{K} \cdot \frac{V - C}{V} + \frac{B_r}{L} \quad (1.3)$$

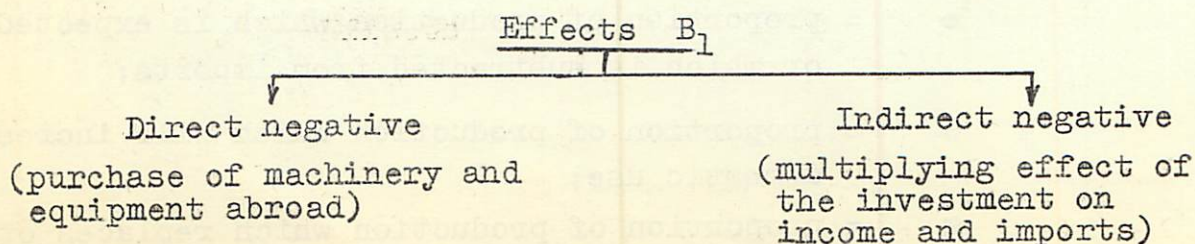
That is to say in words, social marginal productivity is the addition of two terms : (1) the result of multiplying capital productivity by the ratio of profits to value added in production; and (2) the balance of payments premium. If the effect on the balance of payments remains constant, low capital productivity  $\frac{V}{K}$  in a given project can be offset by a high value  $\frac{V - C}{K}$  as it can be observed from the above formula.

Balance of payments effects : Further analysis :-

Let the total effects on the balance of payments  
be  $a B_1 + B_2 + B_3$

where

- $a$  = the capital recovery factor (combined amortization and interest rate);
- $B_1$  = effects of the installation of the project (direct and indirect);
- $B_2$  = direct effects of the operation of the project, and
- $B_3$  = indirect effects of the operation of the project.





B<sub>1</sub>Equals

$$mi.k - mz(I - mi)K$$

in which

mi.k = the investment component in foreign currency

mi = that proportion of the investment requiring imports, directly or indirectly,

k = total investment

m = ratio of increase in imports to increase in gross national product (marginal propensity to import)

z = multiplier =  $\frac{1}{m+s}$  y

s = marginal propensity to save

(I-mi)k = the investment component in national currency with a multiplying effect (z) on income.

z(I-mi)k = the increase in income that would result from investment in the project

mz(I-mi)k = the secondary increase in imports caused by the investment.

B<sub>2</sub>Equals

$$e(I-\overline{mp}) X - \overline{cmp} X + g (\overline{mp}' - \overline{mp}) X$$

in which

e = proportion of production which is expected or which is subtracted from imports;

c = proportion of production which will increase domestic use;

g = proportion of production which replaces other goods formerly consumed.



The sum of these partial outputs is total production, so that  $(e + g + c = 1)$

$\overline{mp}$  = marginal ratio between imports required for the project (direct and indirect) and the output of the project in question;

$\overline{mp}'$  = marginal ratio between imports required for the project (direct and indirect) and the output of the project in question

$\overline{mp}'$  =  $\overline{mp}$ , for the production of the other commodities which the project's output replaced

$X$  = total production

OR :

$\frac{B_2}{\text{Equals}}$

$$eX - \overline{mp} X + \overline{mp}' g X$$

in which

$eX$  = production exported or replacing imports, which represents a positive effect on the balance of payments;

$\overline{mp}X$  = the effect on imports, considering the project's direct and indirect requirements;  $\overline{mp}$  is the direct and indirect need for imports per unit of the project's output; note that the effect is negative.

$\overline{mp}' gX$  = the effect resulting from the replacement, by the project's output, of other goods formerly consumed;  $gX$  is that part of the project's output which replaces them, and for each unit of production of those replaced goods  $\overline{mp}'$



units of direct and indirect imports are needed; the product of both factors represents the amount of imports superseded by that part of the project's production which replaces other goods formerly consumed.

$$\frac{B_3}{\text{Equals}}$$

$$mzf(1 - \overline{mp}) X - mz B_2$$

in which

$f$  is the fraction of production financed by inflationary means; note that  $B_3$  measures both the multiplying effect of inflationary financing of consumption (negative effect) and the multiplying effect of the change in the foreign trade balance (positive or negative)

$$(1 - \overline{mp}) X$$

or  $(X - \overline{mp} X)$  = domestic component of production; since  $X$  is the project's annual production and  $\overline{mp}$  is the amount of direct and indirect imports per unit of  $X$

$zf(X - \overline{mp} X)$  = the increase in income brought about by the assumed inflationary finance

$mz B_2$  = balance-of-payments effects of the multiplying power of income resulting from the balance  $B_2$  which has previously explained.



SMP of Industrial Projects in greece

|                                      |                 | (1)    | (2)                                  | (3)    | (4)                               | (5)                    | (6)   | (7)                    | (8)   | ... | (n)  |
|--------------------------------------|-----------------|--------|--------------------------------------|--------|-----------------------------------|------------------------|-------|------------------------|-------|-----|------|
|                                      | Symbols         | Mining | Nitro-<br>genous<br>Ferti-<br>lizers | Cement | Phos-<br>phate<br>Ferti-<br>lizer | Sulph-<br>uric<br>Acid | Glass | Refr-<br>acto-<br>ries | Soda  |     | etc. |
| Investment<br>(000's)                | k               | 23,350 | 17,000                               | 6,750  | 2,450                             | 1,450                  | 2,800 | 650                    | 3,500 |     |      |
| a) Capital<br>Turnover               | $\frac{V}{K}$   | . 83   | . 62                                 | . 93   | . 74                              | . 52                   | . 86  | 1.16                   | . 41  |     |      |
| b) Cost<br>Ratio                     | $\frac{C}{K}$   | -. 36  | -. 29                                | -. 37  | -. 37                             | -. 11                  | -. 43 | -. 82                  | -. 27 |     |      |
| c) Balance<br>of<br>payment          | $\frac{B_r}{K}$ | . 33   | . 35                                 | . 07   | . 07                              | -                      | -. 04 | -. 03                  | . 09  |     |      |
| d) Value<br>Margin                   | $\frac{V-C}{V}$ | . 56   | . 56                                 | . 60   | . 49                              | . 79                   | . 50  | . 29                   | . 34  |     |      |
| SMP                                  |                 | . 80   | . 73                                 | . 63   | . 44                              | . 41                   | . 39  | . 31                   | . 23  |     |      |
| Rank<br>based<br>on SMP              |                 | 1      | 2                                    | 3      | 4                                 | 5                      | 6     | 7                      | 8     |     |      |
| Rank based<br>on capital<br>turnover |                 | 4      | 6                                    | 2      | 5                                 | 7                      | 3     | 1                      | 8     |     |      |

Source : H.B. Chenery (1953)

$$SMP = (a) + (b) + (c) = (a) \times (d) + (c)$$



( II )

Questionnaire For the Calculation  
of the Social Return on Investment  
Based on the Experience of Turkey



Questionnaire For the Calculation  
of the Social Return on Investment  
Based on the Experience of Turkey

A. INVESTMENT :-

1. Value of fixed assets
  - a. Site
  - b. Buildings and construction
  - c. Machinery and equipment
  - d. Installation costs
2. Working capital
3. Total investment
  - a. Domestic cost
  - b. Foreign exchange cost

B. SALES :-

1. Value of sales, by product
2. a. Exports
  - b. Substitutes for goods at present imported
  - c. Other domestic goods

C. COSTS :-

(All costs are included except for purchase of office supplied and other miscellaneous overhead items which amount to less than one percent of total costs. Imported components of each item are tabulated separately)

1. Raw materials
2. Energy
3. Auxiliary materials
4. Maintenance
5. Labour
  - a. Administrative



- b. Technical
- c. Skilled
- d. Unskilled (less than six months' training required).

D. FOREIGN EXCHANGE EFFECTS:-

1. Foreign exchange costs
  - a. Annual cost of the foreign exchange component of investment.
  - b. Cost of imported materials (from C)
  - c. Indirect import component of domestic materials.
2. Foreign exchange earnings (from B. 1a)
3. Net foreign exchange effect (D. 2 minus D. 1)

E. SOCIAL PRODUCTIVITY:-

1. Gross private profit (sales minus costs, exclusive of taxes and interest)
2. Corrections for social value:-
  - a. Price corrections for protection, subsidies, etc.
  - b. Foreign exchange value
3. Increase in social value (B. 1 plus E. 2)
4. Rate of private return on investment (E. 1 divided by A. 3)
5. Rate of social return on investment (E. 3 divided by A. 3)

F. MATHEMATICAL EXPRESSION OF THE ECONOMIC PRIORITY FORMULA:-

From a theoretical point of view the comparison of value of output to cost of input can be stated in any one of the following forms :-

$$(a) \quad \begin{array}{l} \text{Social return on total} \\ \text{resources used throughout} \\ \text{the economy} \end{array} = \frac{\text{Total value of output}}{\text{cost of total labour, capital and natural resources}}$$



- (b) Social return to resources used in a given sector =  $\frac{\text{Value of output minus cost of purchased materials and depreciation}}{\text{Cost of direct labour and capital}}$
- (c) Social return to capital used in specific sector =  $\frac{\text{Value of output minus cost of materials, depreciation and labour}}{\text{Investment}}$

Note that the only difference between formula (a) and (b) is that labour cost is subtracted from the value of output in (c) to give the return to investment alone.

In practice, formula (c) is applied as it can be seen from the empirical evidence cited in table (1.1). The formula used can be mathematically expressed as follows:-

$$= \frac{(X P_x - L P_e - M P_m)}{I} + \frac{(X P_x - L P_e - M P_m)}{I}$$

where the notations denote the following

Social average return on investment

X Output

L Labour

M Purchased materials plus maintenance and depreciation.

$P_x$ ,  $P_e$  and  $P_m$  = market prices for factors and products

$P_x$ ,  $P_e$  and  $P_m$  = Price corrections measured by the difference between market prices and accounting prices in order to compensate for the divergence between market and social values.

I = investment



The Turkish study however applies three corrections to the private profit of an investment in order to compute its social profitability:

- (i) a price correction to the value of output to allow for the effects of tariffs and export subsidies;
- (ii) an exchange rate correction to the prices of imported inputs and outputs representing the difference between the actual exchange rate (2.80 lira per dollar) and an estimate of the accounting price of foreign exchange (3.64 lira per dollar);
- (iii) a labour cost correction representing the difference between the opportunity cost of unskilled labour and its wage rate (only in agriculture)

G. NUMERICAL EXAMPLE:-

Table (1.1) shows the procedure for computing the private and social return on investment in each project selected.

Item 1, 2 and 3 in that table provide the data needed for the estimate of the private rate of return on investment (line 5b), which is the first part of the measurement of social return on investment. Item 4 shows a breakdown of the total foreign exchange effect into

- (a) the annual cost of the foreign exchange component of the investment,
- (b) the annual cost of imported materials (including an allowance for exchange earnings or savings. Foreign exchange earnings or savings were only credited to a project in cases where the domestic price was less than the import price valued at the accounting exchange rate, since otherwise the protected domestic price already reflected the value of foreign exchange.



Table (1.1)  
Calculation of the social return on investment  
in Turkey (Thousands of Turkish Lira)

|  | Canning | Cotton<br>fabrics | Wool<br>text-<br>iles | Fiber<br>board | Wire<br>goods | All<br>indust-<br>rial<br>projects |
|--|---------|-------------------|-----------------------|----------------|---------------|------------------------------------|
| Number of Plants   | 7       | 3                 | 3                     | 2              | 4             | 126                                |
| Total sales  | 4,370   | 39,050            | 14,470                | 3,460          | 4,390         | 251,400                            |
| (a) % import substitutes<br>or exports (a)                     | 0       | 0                 | 50%                   | 100%           | 0             | 10%                                |
| Total investment   | 3,270   | 27,490            | 12,180                | 2,250          | 3,390         | 192,500                            |
| (a) Raw materials (%)  | 46%     | 70%               | 67%                   | 20%            | 79%           | 74%                                |
| (b) Labour (%)   | 11%     | 14%               | 18%                   | 20%            | 9%            | 12%                                |
| (c) Energy, auxiliary<br>materials, mainten-<br>ance and other | 43%     | 15%               | 15%                   | 60%            | 12%           | 14%                                |
| Total investment   | 3,300   | 39,020            | 10,340                | 5,000          | 2,530         | 195,000                            |
| (a) Foreign exchange<br>component                              | 1,010   | 16,107            | 3,500                 | 3,076          | 700           | 80,900                             |
| Total foreign exchange<br>effects (b)                          | -1,275  | -4,843            | 7,818                 | 2,561          | -846          | -15,400                            |
| (a) Investment cost  | -91     | -1,450            | -315                  | -268           | -62           | -7,300                             |
| (b) Annual operating<br>cost                                   | -1,181  | -3,393            | -4,098                | -629           | -784          | -29,600                            |
| (c) Annual earnings (c)  | 0       | 0                 | 7,231                 | 3,458          | 0             | 16,500                             |
| (a) Private profit (1-2)                                       | 1,100   | 11,560            | 2,350                 | 1,210          | 1,000         | 58,800                             |
| (b) Private returns on<br>investment (d)                       | .333    | .296              | .277                  | .241           | .394          | .302                               |
| (c) Ratio to industry<br>average                               | 1.11    | .98               | .75                   | .80            | 1.31          | 1.00                               |
| (a) Price correction (e)                                       | 0       | -.113             | 0                     | 0              | 0             | -.035                              |
| (b) Foreign exchange<br>effect (f)                             | -.116   | -.037             | .081                  | .154           | -.160         | -.034                              |
| Social return on invest-<br>ment (5b+6a+6b)                    | .217    | .146              | .308                  | .395           | .294          | .233                               |
| (a) Ratio to industry<br>average                               | .93     | .63               | 1.32                  | 1.70           | 1.26          | 1.00                               |

Source:- Turkish Investment and Economic Development op.cit (13)

(a) Only items included at import or export cost at official exchange  
rate

(b) 9 percent of (3a)

(d)  $(5a) \div (3)$

(f)  $.30 \times (4)$

(c) Percentage (1a) applied to (1)

(e) As ratio to (3)



Lines 6a and 6b of the table give the price correction and exchange correction as percentages of total investment so that they can be added directly to the private profit. The price correction is the difference between the output value and the world price (i.e. the landed cost of imports evaluated at the accounting rate of 3.64) and the Turkish market value. This correction reduces the profit rate on the investment in cotton fabrics, for example, by 11.3 per cent. The exchange rate correction is equal to 30 per cent of the net foreign exchange effect in item 4, representing the difference between the accounting exchange rate and the actual exchange rate. In canning, for example, the effect of foreign exchange cost reduces profits by 383,000 lira or 11.6 per cent whereas in woollen textiles, the result of foreign exchanges earnings is to increase profits by 8.1 per cent of the investment.

The five examples shown here illustrate the substantial changes in priority that result from considering social profit instead of private profit. The ratios of social profit to the industry average shown in item 7a are quite different from private profit ratios in line 5c. Even the partial application of accounting prices that was possible in this case probably gave a better picture of social priorities than did the private profit rate, which was affected by a number of arbitrary elements.



( III )

Questionnaire For Determining  
Investment Priority Ratings Based  
On the Experience of the Philippines.

( May 25, 1967 )



Questionnaire For Determining  
Investment Priority Ratings Pased  
On the Experience of the Philippines. (1)

A. Diagramatic Representation  
of The Economic Priority Formula

The sum of

| National Income<br>Ratio<br>Y/K | Balance of<br>Payments Ratio<br>B/K | Domestic Material<br>Utilization Ratio<br>D/K | Domestic Labour<br>Employment Ratio<br>L/K |
|---------------------------------|-------------------------------------|---|--|
|---------------------------------|-------------------------------------|---|--|

Multiplied by  
1000

(1)  
For further details see, "Economic Development Problems, Principles and Policies" by B. HIGGINS, (N.Y., 1959), pp. 653 - 686 and pp. 741 - 749.



Determination of :-

$$(1) \text{ National Income Ratio } Y/K = \frac{E(w + r + i + z)}{F + c}$$

Essentiality Factor E

- Depending upon :
- (1) Economic importance of domestic or export product
  - (2) Source of raw materials and supplies
  - (3) Source of capital equipment
  - (4) Source of Financing

: multiplied by the sum of :

| (W)   | (r)  | (i)                                     | (z)   |
|---|--|---|---|
| Compensation of all officials, employees and labourers, including salaries, wages, bonuses, commissions, allowances and others            | Rent for the use of land, buildings and other facilities not belonging to the firm | Interest payments on borrowed capital   | Anticipated returns on paid-up capital                                  |
| <u>Minus</u>  | <u>Minus</u>   | <u>Minus</u>                            | <u>Minus</u>  |
| a percentage of the compensation of officials and employees who are not nationals, or who remit salary savings abroad in foreign exchange | Equipment and process rentals and similar payments remitted abroad                 | Interest payments on foreign borrowings | Dividends and returns remitted abroad by the firm and its stock-holders |

divided by  $K = F + C$

Total investment in the firm which is equal to fixed assets (owned or rented) plus circulating capital.



## (2) Balance of Payments Ratio

$$B/K = \frac{S - R}{F + C}$$

S = Foreign exchange that will be received by the country for products to be exported, or foreign exchange value of ~~import~~-substitute products to be sold for domestic use or consumption, expressed in the national currency equivalents. Worth noting that an ~~import~~-substitute product is :-

- (1) any product of any kind that was imported at some time in the past, or
- (2) any product which, although never imported, will serve a useful purpose or;
- (3) any product to be considered as essential for economic development.

R = Foreign exchange costs incurred in production (to be expressed in national currency equivalents), including (by way of example)

- (1) Value of imported materials and supplies
- (2) Amortization of assets acquired with foreign exchange
- (3) Salaries of alien personnel
- (4) Technical and consulting services and royalties
- (5) Business trips abroad, etc.

K = as defined in (1)



(3) Employment Ratio

$$L/K = \frac{L \cdot \bar{w}}{K}$$

L = Number of nationals employed regularly by the firm including all the labour force engaged (officials, employees and labourers).

$\bar{w}$  = Accounting wage-rate per annum (measured by the average working days per year).

(4) Domestic Material Utilization

$$\text{Ratio } D/K = \frac{md}{Mt}$$

md = value of domestic materials and operating supplies used in production by the project;

Mt = value of total raw materials and operating supplies used in production by the firm;

The coefficient  $\frac{md}{Mt}$  represents a measure of the additional economic value to be generated by the utilization of domestic materials.

B. Mathematical Expression of The Economic Priority Formula :-

$$Q = \frac{E(W + r + i + z)}{K} + \frac{s - R}{K} + \frac{L \cdot \bar{w}}{K} + \frac{md}{Mt} \times 1000$$

$$= Y + B + L + D \times 1000$$



where :

Q { is the industrial priority additive ratio;  
is the serial number of the project;  
indicates investment direction ;

Y = national income effect per unit of capital resources utilized;

B = balance of payments effect per unit of capital resources utilized;

L = employment effect per unit of capital resources utilized;

D = the social value derived from domestic materials utilization per unit of capital resources utilized.

### C. Other Qualitative Consideration

It should be mentioned that the determination of industrial priorities in the light of the Philippines experience would be based not entirely on the quantitative method outlined outlined here, but also on other qualitative consideration such as the following :-

1. Overcrowding of an industry;
2. Established government policy for specific projects;
3. Effect of abnormal factors such as the pricing of labour, materials and products;
4. Possible effect on increased domestic production of raw materials.



Although the abovementioned considerations do not easily lend themselves to quantification they are pertinent to industrial priority determination. Accordingly a proposed investment project should not be considered if the industry to which it belongs is relatively overcrowded or if the aggregate productive capacity in the industry was in excess of the demand for the product save for the case where the new project would improve the competitive conditions in the country for the benefit of the public.

#### D. Price Criteria

It was understood that the purpose of the Philippines investment priority system was to measure the social profitability of the proposed investment projects. The contribution to national income was taken as a measure of the benefits arising from the project. In a first approximation the national income profitability is assessed on the basis of market prices, then price corrections were applied to costs and benefits whenever the available data permitted in order to compensate for discrepancies between market and social values. In the case of the Philippines two methods of corrections are used. The first method corrects the market prices of foreign exchange. This correction was intended to reflect the scarcity of foreign exchange. Corrections for the use of domestic raw materials and for increasing employment was also made. The former correction was included to stimulate domestic production of such materials; the latter, to provide for a preferential treatment of employment creating projects.

A second method of correction has been also applied in the Philippines. This method consists of attributing additional benefits to a project which has a beneficial impact upon the rest of the economy, either forward or backward. The rational



underlying these corrections is that, in so far as a project produces commodities which are used as inputs elsewhere in the economy, or uses commodities which are produced by other sectors, it stimulates economic activity and consequently gives rise to additional benefits that should be attributed to the project considered.

The abovementioned corrections however are tantamount to using instead of market prices, "shadow" or "accounting" prices, which measure the social value of factors and products.