2. ECONOMIC EVALUATION

2.1 Evaluation Method

Whereas the object of the financial evaluation is to assess a private enterprise or an individual project, the economic evaluation aims at evaluating a project from the viewpoint of national economy.

The existence of a fertilizer plant in the country is presupposed in the financial evaluation, since the mining of phosphate ore cannot be feasible without a manufacturer of artificial manure in an accessible range of distance. The same assumption is set forth for the present economic evaluation and the method of internal rate of return is similarly utilized.

The benefit is measured by a value at the fertilizer plant, yielded from the consumption of domestic resources and is compared with the economic cost at the mine-site derived from the production of apatite concentrates.

2.2 Assumed Parameters

(1) Benefit

When the domestic raw materials are not available, the fertilizer plant has to import the apatite concentrates from abroad. The benefit originated from implementation of the mining is calculated with the economic cost of importation.

The price of apatite concentrates of 36.4% P_2O_5 produced as the by-products of copper mining, has been indicated to be of US$40 per tonne on the term of f.o.r. Phalaborwa, South Africa. The total railway tariff will amount to $69.16 per tonne and the price of concentrates at the Zambian border would be,

$$\$40.0 + \$69.2 = \$109.2$$

The grade of contents is then changed from 36.4% to 30%, and the price comes to:

$$\$109.2 \times \frac{30.0}{36.4} = \$90.0$$

Consequently, the utilization of domestic raw materials of 30% P_2O_5 can be deemed to bring the benefit at the rate of $90 per tonne of concentrates.

(2) Cost

Sunk Cost: The economic analysis compares a benefit created, with a cost newly added. The amount spent in the past is dealt with as a sunk cost and is excluded from the calculation.

Commodity Price: In the economic analysis, the prices of domestic supplies are provisionally reduced by a 10% to eliminate an effect of the sales tax.

Labour Cost: For skilled labourers, the market theory functions and the same amount of salaries used in the financial evaluation can be applicable for the economic evaluation. During the production period, a number of unskilled labourers is limited to be small and the most of labourers are deemed to be the skilled labourers after an education and training. The expenses in the education and training shall be excluded from the initial investment of the economic evaluation to make an adjustment of labour cost.

As for the construction period, an amount of labour charge forms a part of basis of the calculation for an estimation of payments for contractors.

The latest statistic show that, in 1980, an average cash earning of employees in the field of agriculture, forestry and fisheries was K688 per annum in the private sector. To estimate the labour cost of unskilled labourers, the average cash earning was fixed and converted into U.S. dollars using the exchange rate at the time of the study.

Among the construction expenses of a power line, the wiring fee has been given by an electric company in a form of contract basis. The price probably involves a surplus deductable in the economic evaluation but the amount of it is not known. Provisionally, a 5% of the total wiring fee is assumed to be reduced.

Power Cost: A sales tax, being at 12.5% of a power charge, is excluded from the cost.

Currency: The officially announced exchange rate is deemed not necessarily to represent the practical rate. A conversion factor is designated by R and is expressed by a formula,

$$R = \frac{(1+D)+(E+M-S)}{1+E}$$

where, I .... the total amount of imports
E .... the total amounts of exports
D .... the total amount of import duties
M .... the governmental mineral revenues
S .... the subsidies

when the amounts for 1983 are applied,

I = K 1,382.2 million (provisional)
E = K 1,300.8 million (provisional)
D = K 175.3 million (provisional)
M = K 56.5 million (provisional)
S = K 82.6 million (provisional)

then, the factor would be,

$$R = 1,056.$$

The amounts payable in the national currencies in the cost of economical evaluation are discounted by this factor and then expressed in dollar using the exchange rate at the time of the study.

2.3 The Economic Internal Rate of Return

The economic internal rate of return stands at 12.8% as follows:

Year	Benefit	Cost	Flow	in $1,000 Present Value
1st		9,533	−9,533	−8,451
2nd	590	2,607	−2,017	−1,585
3rd	3,150	1,095	2,055	1,432
4th	3,150	1,081	2,069	1,278
5th	3,150	1,096	2,054	1,124
6th	3,150	1,081	2,069	1,004
7th	3,150	1,427	1,723	741
8th	3,150	1,258	1,892	723
9th	3,150	1,253	1,897	641
10th	3,150	1,428	1,722	516
11th	3,150	1,258	1,892	503
12th	3,150	1,848	1,302	307
13th	3,150	1,081	2,069	432
14th	3,150	1,096	2,054	380
15th	3,150	1,081	2,069	339
16th	3,150	1,056	2,094	305
17th	2,070	−342	2,412	311

EIRR = 12.8%

2.4 Sensibility

When the value per tonne of the concentrates of 30% P_2O_5 at the national border is changed, the economic internal rate varies as follows:

+20%	($108)	18.2%
Model	($90)	12.8%
−20%	($72)	6.8%

Variation of the rate in fluctuation of the costs for the fixed assets and the commodity inventories is,

+20%	10.0%
Model	12.8%
−20%	16.9%

The economic internal rate is affected mainly by a change of the import value, similarly in the case of the financial internal rate.

2.5 Discussion

In the evaluation of apatite mining, a comparison has been made on the premises that there is a fertilizer plant in the country and that the delivery cost of products is equivalent to a cost, with which imported materials are brought into a plant from the border.

If the delivery cost, in the meaning of economic evaluation, of the domestic products exceeds the transportation cost of imported materials from the border, the difference between two costs pushes the internal rate downward.

Whereas the financial internal rate stands at 5.9%, the economic internal rate stands at 12.8%. The results indicate that a profit of the private enterprise would be marginal and that, at the same time, somewhat a high benefit can be expected in point of view of the national economy.

If a situation develops where the domestic products meet difficulty in competition in price with foreign materials, a possibility, which requires an introduction of the national policies, will arise. That is, an imposition of import duties or a grant of subsidy to protect the domestic industry must be considered.

The mining of apatite forms a part of the domestic production of phosphatic fertilizer and a resulting benefit, which arises from a home production of phosphatic manure, has not been woven into the present evaluation. The economic benefit that is brought in from fertilizer itself should be reviewed from the point of view of the phosphatic industry.

In this case, an overall revision is warranted with re-examination of the premises and the provisions excluded.

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