

Habenicht, Horst

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Fund, and the economic cost which would be related to the opportunity cost of the capital (i.e. the interest earned on the alternative uses of that amount). On the basis of a Common Fund with an initial subscribed capital of \$ 1 bn, the contribution of the Federal Republic of Germany is not likely to exceed \$ 80 mn under the various formulae which have been discussed. The interest foregone on this amount would be less than \$ 5 mn annually, or a little over one thousandth of one percent of its GNP — an infinitesimal amount in comparison with the benefits it would bring.

Instead of maintaining the ideological opposition to the Integrated Programme, the organizations representing the German trade and industry would do well to study its implications carefully and to

make a constructive contribution to its implementation, to which incidentally their Government is already committed, by ensuring that in the process the legitimate interests of both producers and consumers are adequately taken into account. The whole concept of the Integrated Programme is predicated upon the concept of cooperation between producers and consumers. It is this concept which is being put to the test in the series of negotiations which are now under way. If the negotiations succeed, the concept will gain a new vitality. But if they fail the concept itself will be called into question. Such an outcome would be detrimental to the interests of producers and consumers alike and would do incalculable harm to the cause of international cooperation for development.

Processing Mineral Raw Materials

by Horst Habenicht, Bonn *

Processing of raw materials by the producer countries themselves has frequently been recommended as an appropriate way for developing countries to increase their domestic value added and achieve positive employment effects. As against that, the following article suggests that Third World governments should not take hasty investment decisions in favour of processing raw materials since the effects on the national economy in terms of the cost-benefit ratio could well be more favourable in other branches of industry.

The Federal Republic of Germany is the third largest consumer of metallic raw materials among the industrialized countries. Since we no longer have any domestic mining output to speak of, we are almost 100 p.c. dependent on imports. The cost value of these imported mineral raw materials is about DM 10 bn each year. Fifty percent of these raw materials come from other industrialized countries and fifty percent from developing countries.

Admittedly the resources of developing countries amount at present to only 30 p.c. of international mining output. But since they neither consume nor process their output themselves, the raw materials they mine represent some 60 p.c. of the amount available for export on the international market. One-third of the deposits so far discovered lies in developing countries while two-thirds are in industrialized countries, and of these again one-third is to be found in East Block countries.

If natural gas and crude petroleum are included in the calculation, then almost 80 p.c. of the Third

World countries' export earnings are earned by supplying raw materials to industrialized countries.

Raw Materials Policies

Under the prevailing circumstances in the raw materials sector, it is understandable that the developing countries want to make more gains from supplying raw materials in order to improve conditions for the industrialization of their own countries. This method is being more forcibly promoted at international conferences since the oil exporting countries successfully raised prices and, on the other hand, since the limitations to the transfer of resources via development aid have become clear to the developing countries. While the developing countries therefore want to increase the value added to their raw materials, the Federal Republic of Germany must, in discussions on raw materials policies, concentrate primarily on securing its own supplies, especially as it is a country dependent on imports in this field. Neither can we be interested in a constant subsidization of raw materials aimed at achieving

* Federal Ministry for Economic Cooperation.

higher prices. When some 70 p.c. of international mining output is to be found in other Western and East Block industrialized countries, it is not reasonable to support or to push up metal prices for these countries and thus to put ourselves in a less favourable competitive position. The Federal Government therefore supports, within the framework of the north-south dialogue, solutions to the stabilization of export earnings which is intended to be of direct benefit to the developing countries.

It is not intended in this article to go into detail on the manifold problems of the integrated commodity programme and the suggestion of forming a common fund. Its purpose is to explore the question of whether the integration of metal production and mining is technically and economically possible and realistic in the Third World countries and, if so, under what conditions.

Development Policy Concept

The export-oriented ore mining industry has to date not been in a position to initiate, or to carry, a satisfactory overall process of economic growth in those developing countries where mining is undertaken.

Since prices for ores and concentrates sometimes fluctuate considerably, the endeavours of developing countries are aimed at breaking down the often one-sided dependence on raw materials exports. In achieving this aim, they have a choice between two basic growth strategies. Apart from substituting imports by means of increased domestic industrial production, there is also the possibility of developing a processing industry based on domestic deposits of raw materials. In the case of non-ferrous metals, this means expanding activities beyond mining to include smelting and refining. This seems reasonable and logical at first sight because the country with raw materials not only has income from exporting ores and concentrates, but can also raise export earnings by means of the more valuable smelted and refined products and can create additional jobs.

As early as 1973 the following statement was made in the context of the Federal Government's development policy concept: "The Federal Government will promote, in terms of personnel and financial cooperation, research, planned prospecting and the development of economically operated mining and processing concerns, in order to achieve a lasting increase in the proportion of the added value which remains to the

country producing raw materials. Mining and processing projects which incur a relatively large increase in employment must be given preference.

The Federal Government will assist developing countries in detecting their potential in mineral resources and in utilizing them to their own benefit. The Government recognizes the right of the developing countries to determine, with due regard to the principles of international law, the degree and type of utilization of their mineral resources."

This political statement was based — in the context of smelting ores — on the hypothesis that processing concerns in developing countries can operate economically, that the added domestic value will be increased and that positive effects on employment can be achieved. To check this assumption and to gather facts to assist in assessing the qualification of projects for promotion, the Federal Ministry for Economic Cooperation commissioned a distinguished economic research institute to investigate these questions¹.

The commission was delineated by limiting the study to the quantitatively most important non-ferrous metals, aluminium, copper, lead and zinc. In selecting the countries to be studied, the main criteria were the quantity of ore mined and the degree of domestic processing already attained. A comparison of countries with considerable mining activities but with varying degrees of processing appeared particularly suitable for clarifying the basic problems of location and conditions for smelters in the Third World. Thus the two important bauxite producers, Jamaica and Surinam, were chosen for aluminium. In considering copper, the choice fell to Zambia — which due to its geographical position, incurring long transport routes, has been processing its ores domestically for a long time now — and to the Philippines, which have to date exported all their concentrates. And finally Mexico and Peru were the obvious choice for studying lead and zinc ore smelting.

Basic Results of the Study

The Study has been presented to the Federal Ministry for Economic Cooperation and is at present being analysed. It provides significant detailed information on basic technical and economic relationships as well as on location conditions, which are of decisive importance for the economic operation of processing concerns. Although it was not possible to assess the profitability of individual enterprises — which is dependent on a multitude of specific, individual factors — the attempt was nonetheless made to carry out sample calculations. These calculations study the cost structures involved in mining individual

¹ Cf. Gerd Pommerening, Axel Gerberding, Helmut Stodieck, Uwe Harms, Möglichkeiten zur Weiterverarbeitung ausgewählter NE-Metallerze in Entwicklungsländern (New Non-ferrous Smelters in Developing Countries), expert opinion by the Institut zur Erforschung technologischer Entwicklungslinien on behalf of the Federal Ministry for Economic Cooperation, Hamburg 1977.

metals, the cost categories which are effective in the context of investment profitability and the changes which can influence the profitability of a project.

Even though only general statements can be made, inaccuracies cannot be avoided and essential differentiation is neglected, the most important results on the individual metals studied should be put forward:

Setting up an *aluminium* plant with an annual capacity of 150,000 tons involves, without infrastructure, investment costs of some DM 800 mn. The production process is therefore extraordinarily capital-intensive. Effects on employment, at costs of DM 250,000–300,000 per job, are only slight, although more favourable than in the case of other metals. At 44 p.c., the value added through smelting is still favourably related to average metal prices in comparison with the other metals. The availability of cheap power has a decisive influence on the investment decision and the choice of location.

Power costs, at about 24 p.c. of total production costs, are extraordinarily high. Price variations of only 2 German pfennig per kilowatt hour for electricity lead to cost differences which are almost equivalent to depreciation.

Establishing a *copper* plant, including electro-refining installations, with an annual capacity of 100,000 tons involves investment of about DM 530 mn, without taking the infrastructure into consideration. Costs per job of DM 1 mn are so high that there can hardly be any mention of positive employment effects. The 13 p.c. value added through smelting is low in comparison with mining. At 2 p.c. of production costs, power costs play a subordinate part. On the other hand, raw materials costs at 70 p.c. and interest and depreciation costs at 15 p.c. are decisive factors.

Setting up a *lead* plant, including refining installations, with an annual capacity of 100,000 tons means investing DM 210 mn, excluding the infrastructure. Costs per job of about DM 335,000 are therefore the most favourable in comparison with the other metal smelters. The 26 p.c. value added through smelting is still favourable in comparison with mining. As with copper, the raw materials costs here, at 55 p.c., are also the dominating factor in the production costs.

An annual production of 100,000 tons of pure *zinc* means, without infrastructure, an investment of DM 320 mn. Costs per job of about DM 850,000 are again extremely high. The raw materials, with a 57 p.c. share in production costs, are again the dominant factor. But since they follow the metal prices – which is also the case with the other

metals – they do not represent a quantity which influences the profitability of the enterprise. Power costs, at 10 p.c. of production costs, are also very high, without, however, attaining the same significance as in aluminium production.

Conclusion

The assumption that smelting non-ferrous metals in developing countries can in general contribute to a distinct increase in domestic value added has unfortunately not proved to be watertight. Even if functioning infrastructures, full exploitation of capacity and sufficient, trained staff are taken for granted, the value added through smelting per ton of metal is less than 20 p.c. of the investment costs required per ton and year. That means returns which can well be surpassed in other branches of industry. The effects of investment in the smelting field on subsequent sectors of industry are as a rule also slight in developing countries.

Direct employment effects caused by non-ferrous metal smelting are also not very pronounced. They are contrasted to costs of DM 250,000 to 1 mn per job, depending on the metal involved.

The effect on the balance of payments can on the whole be assessed positively, even if the national balance of receipts and expenses shows only a slight positive influence through the development of a smelting industry. If the state itself takes an active part, its contribution will be compensated only in the long term due to the prolonged maturing process of the projects. Participation and financing by foreign investors means repayment and interest in foreign currency. In the case of limited profit expectations, the application of taxation methods meets with difficulties if all inducement for investors is not to be lost.

This study therefore ~~supplies~~ ^{supplies} the governments of developing countries with information which shows that they should not take hasty decisions in favour of processing raw materials, without first checking other industrial sectors with more favourable effects on the national economy in terms of cost-benefit ratio. New emphases are set for the Federal Government's national development policy to check personnel and financial cooperation projects in the light of specific location conditions, and to take alternative projects in other industrial sectors into consideration when making decisions. The thesis that the smelting of metallic raw materials can be carried out more advantageously at the mining location than at the consumption or processing location has not turned out to be generally correct. On the contrary, a miners' maxim has been underlined: money is earned in the pits – that is, in mining.