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# Environmental Protection and the International Raw Materials Economy

*All production of mineral raw materials necessarily involves interference with the natural environment. National rules and regulations on environmental protection are intended to ensure that prospecting for, and the extraction and processing of, raw materials are conducted with as little damage as possible to the ecosystem. The following article surveys the effects of such measures on the international raw materials economy.*

For many of the industrial and developing countries which extract and/or refine mineral raw materials – whether in the form of ore, concentrate, crude or refined metal, semi-finished products or other basic industrial inputs – these activities are of great significance for overall economic performance. Conflicts arise between the need to utilize the raw material potential or existing plant on the one hand and the increasingly urgent task for the decision-makers of pursuing an efficient policy of environmental protection on the other hand. The same conflicts also have a direct effect on executive decisions taken by raw materials companies in individual industries, which generally assess environmental protection regulations first and foremost in terms of increased future production costs. In some circumstances differences between national regulations lead to changes in the viability of different locations on an international level or, in other words, can lead to shifts in world trading relations.

## Areas of Environmental Damage

The extraction or processing of raw materials always puts pressure on the environment in at least one of the following ways:

- ☐ by requiring the use of frequently considerable quantities of land (e.g. for mining and quarrying, processing plant, transport and various other facilities);
- ☐ by impairing the quality of the air (dust, emission of heavy metals, etc.);

☐ by creating noise;

☐ by leaving what may be substantial amounts of mining debris and waste;

☐ by polluting waters.

Added to the above problems there is the fundamental question of whether particular mineral deposits should be conserved for future generations rather than exploited immediately. Yet another important factor is the energy consumption involved, for negative environmental effects arise whether fossil fuels or nuclear energy are used.<sup>1</sup>

Studies so far carried out by the Institute of World Economics and International Management in Bremen have covered environmental problems associated with the metals of titanium (or ilmenite and rutile), nickel, lead, zinc, copper and aluminium, and the resultant economic effects which are discernible.

## Effects of Specific Raw Materials

The rough matrix of ways in which environmental damage can occur (Figure 1) shows by examining the various stages of raw material exploitation, namely

<sup>1</sup> A systematic approach to assessing environmental damage has already been provided by R. Woodbridge and J. Lajzerowicz: *Minerals and the Environment*, Ottawa 1977, p. 5 ff.

<sup>2</sup> A research project entitled "Raw Material Extraction and Environmental Protection" (under the direction of Prof. A. Lemper) is paying particular attention to the conditions found in raw material projects in the field of non-ferrous metals. The investigation covers both developing and industrial countries.

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- ☐ prospecting,
- ☐ mining,
- ☐ ore dressing and
- ☐ further processing to form metals or basic industrial inputs,

that the types of damage caused vary considerably from one raw material to another. This is a fact of which practical environmental policy in the raw material supplying countries – to the extent that such a policy exists – has largely taken account. However, the reports so far available also indicate that environmental protection measures concentrate primarily upon particular types of emissions (e.g. SO<sub>2</sub>, NO<sub>x</sub>, noise levels) and pay less attention to broader-reaching effects, that is to say they do not take account of long-term changes in habitats, concepts for the supply of energy, or conservation aspects.

The main controls applied are:

- ☐ norms on emissions, the violation of which leads to raw material production being restricted or shut down,

- ☐ legal stipulations on environmental matters (e.g. on the disposition of overburden, waste dumps, transport methods and volumes, land rehabilitation),

- ☐ technical provisions for the plant,

- ☐ fees, contributions and duties (e.g. to be paid into a fund for dealing with environmental damage).

There are very few measures, on the other hand, which set out to achieve the internalization of externalities in the broadest sense of the expression.

## The Example of Bauxite

The form taken in practice by environmental measures in the raw materials field can be shown by taking open-cast bauxite mining as an example. During the mining stage, by far the greatest problem is that of the destruction of the geomorphology and vegetation. Hence mining operators in almost all current projects are compelled under contract to recultivate the area affected. In Australia, for example, all proposed recultivation measures have to be specified before the project commences (including a list of the number of

**Figure 1**  
**Environmental Damage Matrix for the Production of Non-ferrous Metals**

Significant Environmental Damage	Raw Material				
	Bauxite/ Aluminium	Copper	Nickel	Lead/Zinc	Titanium
<b>Prospecting:</b> Land/Water	x	x	x	x	
<b>Mining:</b>	Open-cast	Open-cast	Open-cast	Deep mining	Open-cast (poss.)
<b>Water</b> – Surface water	x	x	x		
– Ground water		x		x	
– Water-bearing strata		x		x	
<b>Air</b> – Dust emissions	(slight)	x		x	
<b>Land</b> – Later re-use impaired	x	x		x	
– Recreational value impaired	x				x
– Serious threat to habitat/wild animals		x	x	x	x
<b>Subsequent Processing:</b>					
<b>Dressing</b> – Dumping problem for waste	x			x	
– Inevitable by-products of sulphuric acid and similar toxins		x			x
– Pollution due to dust, gases, waste water	x	x		x	x
<b>Reduction</b> – Dumping problem for waste	(poss.)		x		
– Inevitable by-products of sulphuric acid and similar toxins				x	
– Pollution due to dust, gases, waste water	x	x	x	x	
<b>Refining</b> – Dumping problem for waste					x (esp. in pigment production)
– Inevitable by-products of sulphuric acid and similar toxins					
– Pollution due to dust, gases, waste water		x	x	x	x

Source: Compiled from information given in J. S. Abnor: COSMAR, Phase 2 – The Mining Industry Responds, in: Mining Congress Journal, 5/1980; Federal Ministry of Research and Technology: Rahmenprogramm Rohstofforschung 1976-1979, Bonn 1976; R. Woodbridge, J. Lajzerowicz: Minerals and the Environment, Ottawa 1977, p. 5 ff.; S. Iwersen-Slotssids: Ergebnisse von Befragungen des Instituts für Weltwirtschaft und Internationales Management.

each species to be planted out, or released in the case of animals, at which locations). There are other countries which require "impact studies" to be prepared, setting out all the directly resultant secondary investments in rehabilitation. There are reported to have been cases in which the level of such costs meant that the bauxite mining project no longer appeared viable.<sup>3</sup> A specific problem which frequently arises with bauxite projects is a, sometimes extreme, salination of surface and ground water. A very strict approach is taken in Australia to avoid such environmental damage: mining is prohibited in principle in all regions established to

have "salinity risks", the sole exception being made if the operator can prove beyond doubt to a commission that he is able to prevent salination by technical means.

#### Effects on Individual Businesses

The case of bauxite illustrates clearly that environmental protection measures have a direct impact on the microeconomic decisions made by raw material producers. It will be readily apparent that operators are affected, firstly, in terms of the type and volume of production they may undertake and secondly – via duties payable, legal requirements to fulfil, etc. – in terms of the level and structure of their production costs. For an individual raw materials company, environmental regulations may mean

<sup>3</sup> Cf. UNEP: Bauxite, Alumina and the Environment, in: Industry and Environment, Vol. 4 (1981), No. 3, p. 2 ff.

#### PUBLICATIONS OF THE HWWA-INSTITUT FÜR WIRTSCHAFTSFORSCHUNG-HAMBURG

Kay-Michael Schanz

### AUSLANDSVERSCHULDUNG UND DIE ROLLE VON IWF, BIZ UND PARISER CLUB

Inhalt und Grenzen der Verpflichtungen des Internationalen Währungsfonds sowie der Bank für Internationalen Zahlungsausgleich und der Teilnehmer des Pariser Clubs

### FOREIGN DEBTS AND THE ROLE OF IMF, BIS AND PARIS CLUB

Extent and Limits of the Obligations of the International Monetary Fund, the Bank for International Settlements and the Members of the Paris Club

Large octavo,  
369 pages, 1988,  
price paperbound DM 65,—  
ISBN 3 87895 344 5

The discussion on foreign debts often neglects or ignores the legal aspects of the participation of the IMF, the Paris Club and the BIS in the solving of debt problems, in particular the question to what extent these institutions are legally obliged to support debtors and creditors. These problems are dealt with in this study by Kay-Michael Schanz, written as his doctoral thesis for the faculty of law of the Johann Wolfgang Goethe University, Frankfurt. The method of procedure of the Paris Club in particular is closely connected with the question of the necessity of an international law on debt rescheduling. The author develops various approaches to an international arbitration procedure which raises the hope that rescheduling can be speeded up.

VERLAG WELTARCHIV GMBH-HAMBURG

- ☐ that capital needs to be invested in new plant and equipment or in improving older plant,
- ☐ that changes occur in operating and maintenance costs,
- ☐ that specific research and development costs are incurred or
- ☐ that it is necessary to close down operations or move to another location.

Thus environmental protection regulations and their controlled implementation may influence not only the output of raw materials but also, via changes in product prices and associated changes in market shares, the profit situation of the raw material producer. This in turn is significant for the economy as a whole because it gives rise to shifts in the structure of the domestic market and affects the country's international competitiveness with regard to that particular raw material.

### National and International Economic Implications

Value added is created directly at all stages in the production of raw materials; given current levels of profitability in the international raw materials markets this is largely manifested in wages and salaries. The amount of value added varies from one stage of the production process to another and also, at least as far as non-ferrous metals are concerned, shows quite considerable differences from one raw material to another.<sup>4</sup> Furthermore, raw material projects differ from many other investment projects in that they generate a relatively large amount of "indirect value added" (linkage effects in other sectors of the economy).<sup>5</sup> Linkage effects too, though, need to be assessed very differently depending on the raw material involved, the method of extraction and the stage of production. It has been shown by the investigations so far completed that environmental protection regulations applied either to new projects or to those already under way do not necessarily, as is generally assumed, have a negative effect on value added – often cited examples are operations which had to close down or suffered losses on export markets due to unduly high prices. There are in fact many examples of positive effects on value added

because carrying out the necessary measures led to increases in employment or improvements to the infrastructure.

Because of the variation in environmental protection policy regulations between individual raw material producing countries there is a corresponding variation in locational advantage for raw material operations. This is by no means insignificant at the world economic level. Given the extent of international interrelationships, especially pronounced in the raw materials sector, changes in the utilization of facilities as a result of changes in environmental protection regulations have had a strong influence on trade flows and the international division of labour. Two effects have been clearly apparent up to now:

- ☐ the shifting of production, at *one* stage, to less strictly regulated locations (e.g. a multinational corporation shifting production from deposit A in country X to deposit B in country Y),
- ☐ the encouragement of vertical integration, i.e. transferring processing and refining industries to a mining location which is more advantageous as far as environmental controls are concerned (provided that the necessary infrastructure can be established).

Particularly the second effect is significant from the point of view of the "more favourable" environmental conditions in developing countries: a purportedly more favourable investment climate due to less restrictive environmental stipulations serves as a vehicle for realizing the goal of the Integrated Commodity Programme that further processing of raw materials should be transferred to developing countries. In view of the pronounced tightening of the requirements facing iron and steel works in industrial countries it seems certainly possible that such effects occur. Moreover, it has also been shown by our own researches that there are developing countries where strict environmental laws do exist but are evidently difficult to enforce or can be circumvented with the aid of "special licences". Nevertheless, the underlying question as to whether such shifts of location are made *primarily* on the strength of environmental control considerations must remain unanswered for the time being, especially if one also considers the findings of the ITE study on the overall problem area of transferring production to developing countries.<sup>6</sup> Another question which is still open after individual companies have decided that it is more profitable to make such a shift is whether the benefit to

<sup>4</sup> Cf. A. Iwersen und U. Harms: Rohstoffgewinnung in Entwicklungsländern, Hamburg 1981, p. 256.

<sup>5</sup> This refers to the value added which is generated mainly in other sectors via employment, infrastructure measures, education, etc. Especially in raw material producing developing countries, such value added effects flowing from a single or a small number of raw material projects can have a vital influence on the development of the economy as a whole.

<sup>6</sup> Cf. G. Pommerening et al.: Möglichkeiten zur Weiterverarbeitung ausgewählter NE-Metallerze in Entwicklungsländern, Hamburg 1977, p. 202 ff.

the developing country still outweighs the costs in overall economic terms when the heavier burden placed on the environment is considered.

## Costs for the Overall Economy

Both nationally and internationally, what must still be seen as an unresolved problem for the raw materials sector is that consequential costs of sometimes massive proportions are imposed on the economy. According to the "pay as you pollute" principle raw material producers really ought to bear all costs resulting from damage they have directly or indirectly caused. However, both on an international and even on a national level, "internalizing externalities" in this way runs up against practical difficulties.

"Beggar-my-neighbour" policies with regard to the environment are familiar in Europe; metal and other basic industries in Great Britain, for example, are responsible for considerable damage to vegetation in Norway, Denmark and northern Germany by virtue of prevailing climatic conditions. A similar problem also exists between Canada and the USA with regard to SO<sub>2</sub> emissions. In these cases there are no satisfactory solutions yet available for controlling, in a manner which "does justice" to the environment, raw material extraction which causes environmental damage in other countries.

On a national level, too, trying to solve the problems of resultant damage from raw material extraction leaves more questions open than settled. An example of the basic problems involved is shown by the community of Barsbüttel in Schleswig-Holstein. For several decades the district was a centre for the quarrying industry. The disused quarries were then "recultivated" by acting as a landfill site for domestic and industrial refuse, and years later were converted into building land. About 170 detached houses now stand on the site which was used for the largest refuse dump. It eventually emerged that even at a depth of just 50-70 cm the ground was so badly contaminated that the houses were no longer habitable, and it has now proved necessary to clean up the entire complex. This is a classic case of consequential damage when the final phase of a raw material project has been inadequately concluded. As is also the case with many other raw material projects, in formal legal terms the current users of the land are required to meet all costs with the exception of cleaning up the refuse dump; in other words, the home-owners concerned are saddled with costs actually caused by the raw material producer, by the party which generated the toxic refuse or by the property or construction company which

against its better judgement had the houses built on that site. The typical effect, though, which also occurred in Barsbüttel, is that the political and moral pressure is so great that the public (in this case the *Land* of Schleswig-Holstein) has to accept the burden of these consequential costs. The *Land* government closed down the estate, paying the residents the current market value for their houses when it moved them out; over and above that, both the responsible district council and the *Land* face additional costs at an as yet unknown level for rehabilitating the affected area. Finally, the immediate local authority will face the loss of 500 inhabitants, with an estimated tax revenue loss of 8%.<sup>7</sup>

There are many examples of such a train of events associated with raw material projects, with resultant costs to the economy ultimately being paid by the public at large, or the state. One needs only to consider whether an individual entrepreneur or operating company would even be in a position to pay the immense consequential costs of, say, an ill-conceived waste dump in a salt mine. Consideration therefore ought to be given to whether a contribution to an environmental fund should not generally be made from the proceeds of raw material production of whatever kind in order to meet the costs of environmental damage. This would at least alleviate some of the burdens arising in cases such as the above.

## Summary

There will always be a conflict between ecology and raw material production. Many problems can be dealt with by means of specific regulations for individual types of emissions or effects. Because the "pay as you pollute" principle is not practically enforceable in the raw materials sector, the problem which occurs on the national level is that the state or the public ultimately have to bear consequential costs. Consideration should be given to compensatory levies to be paid by the raw materials sector. However such payments, in the same manner as environmental protection regulations of differing severity, also have an effect on international competitiveness and thus on the locational distribution of raw material operations (especially in the further processing stages); investigations have shown that this may exert considerable influence on individual raw material producing economies as well as on world trade flows.<sup>8</sup>

<sup>7</sup> Cf. J. Kube: Kompromißlosigkeit der Landesregierung schädigt Barsbüttel, in: Barsbütteler Benzol-Bote, April 1987, p. 2.

<sup>8</sup> A good example of this is provided by changes in the world asbestos market. Cf. S. Iwersen-Sjoltsidis: Der Weltasbestmarkt im Wandel, Lasbek 1986.