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# Restructuring of the Aluminium Industry: Implications for Developing Countries

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## Introduction

The 1980s have brought the most dramatic changes in the 100-year history of the world's aluminium and bauxite industry. Traditionally viewed as a classic oligopoly of vertically integrated multinational corporations (mncs), the market has rapidly assumed the more fragmented character of numerous other primary product markets such as the rival metal copper, with which it was long contrasted. While not lost entirely, the oligopoly's market power has been greatly weakened as new producers have appeared and the producer-dominated pricing system has been destroyed. Among the new producers are numerous smelters in developing countries, several of which are gradually creating integrated industries alongside the six previously dominant corporations. The overall role of developing countries, formerly limited largely to the provision of bauxite and alumina inputs within the vertical structures of the mncs, has therefore changed radically.

Many of these changes were foreseen, but few if any commentators expected such a rapid transformation of a previously stable industry. Both the effective transfer of smelting capacity to the Third World and the resulting changes in strategy by the leading aluminium mncs mirror broader trends in the world economy, and some appraisal of the implications for developing countries in the aluminium sector is due. This article embarks on such an appraisal.

## Aluminium and bauxite in the past

The historical structure of the aluminium industry can be largely explained with reference to the techniques of aluminium production

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and the metal's late emergence on to the economic scene by comparison with others such as steel, copper, lead and zinc. Although the second most widely distributed metallic element, composing 8% of the earth's crust, aluminium was only discovered in the nineteenth century and went into commercial production in the 1880s. But the metal's physical properties — a rare combination, alone or in alloys, of lightness, strength, ductility, conductivity and uncorrosiveness — enabled it steadily to gain markets at the expense of longer established materials.

Aluminium is economically available only in bauxite ore, which is refined to produce aluminium oxide ('alumina'), which in turn is smelted into aluminium metal. Although much improved over 100 years, the basic processes used in both stages of production have been unchanged since the 1880s. Both refining and smelting are very capital- and energy-intensive and enjoy substantial economies of scale. The technological requirements and the large capital costs have placed high barriers against entry into the market. The techniques also impose a markedly different cost structure for primary aluminium production<sup>1</sup> from that for most non-ferrous metals, with roughly 60% of costs arising at the third, smelting stage, and only 8–10% in mining the ore. More typically, at least 40% of copper's production costs arise at the mine and only 10% at the third stage (Graham, 1982: 31; Brown and Butler, 1968).

In the early years the market was almost a monopoly of the Pittsburgh-based Aluminum Corporation of America (Alcoa), but this gradually extended into a six-company oligopoly covering all the capitalist world. Alcoa's major Canadian affiliate, Alcan Aluminium Ltd, was hived off between the two World Wars, while in the 1940s the US Government sponsored the emergence of two new competitors, Reynolds and Kaiser, on anti-trust grounds. Two major European producers, Pechiney of France and Schweizerische Aluminium AG (Aluisse) of Switzerland, then gradually increased their market shares to become more or less equal to the two newer American companies.

From the beginning Alcoa was keen to protect its monopoly by capturing available sources of both bauxite ore and the hydro-electric power which is required to produce cheap electricity for smelting. Hence the establishment of a vertically integrated industry, which the major producers remained keen to maintain to sustain their market power. At first the ore was mostly mined near where the markets were (in the US and France) but as these resources were worked through

convenient deposits elsewhere were developed. Until the 1970s these were mainly around the Caribbean and in West Africa. These overseas mines were owned and controlled by the major corporations. They limited downstream processing in such mining countries as far as possible and almost never allowed the smelting process — where the greatest proportion of value was added — to occur outside the leading industrial countries. This ensured that control over the industry as a whole remained firmly in their own hands.

The major firms' relationship with the bauxite-exporting countries is readily understood as a form of neo-colonialism, in which the bauxite exporters were used as a source of cheap raw materials. Vertical integration ensured that there was virtually no open market in either bauxite or alumina, and the companies manipulated the internal transfer prices paid for bauxite and used other accounting devices to repatriate as much profit from the mines as possible. There was little that Jamaica, Guyana, Guinea and the other bauxite-exporting nations could do to reduce this state of dependency.

After independence in the 1950s and 1960s these countries slowly came to resent such external control and exploitation of a major industry. In 1971 Guyana nationalized its bauxite mines, three years later Michael Manley's newly elected socialist government in Jamaica attempted to increase national earnings by imposing a special levy on bauxite exports, and in 1975 the major exporters established the International Bauxite Association (IBA) to co-ordinate policies towards the aluminium majors. But these seemingly radical actions did little to change the countries' underlying dependency, which remains little altered to this day.

Whether the oligopoly should properly be described as a cartel is a matter of debate. In certain respects the corporations openly cooperated (as in the 'gentlemen's agreement' which limited East European exports of aluminium to the West in the 1960s and 1970s), and they have a statistical association, the International Primary Aluminium Institute (IPAI), at which they meet and discuss. Their pricing policies have remained markedly uniform. In recent decades, however (unlike the early years of this century) there is no evidence of any formal agreements to divide the market as a cartel; important elements of competition, or at least rivalry, have existed.

But as Chamberlin argued, an oligopoly does not need to establish formal agreements in order to behave in a monopolistic fashion. Where a small number of companies dominate a market, each is likely to recognize that its own decisions will bring forth a direct

response from the others, which might cancel any gains it will make from them. It will therefore be keen not to 'rock the boat' and a tacit uniformity of pricing and other policies will emerge. An oligopoly's behaviour can therefore resemble that existing in a monopoly even when there is no collusion (Chamberlin, 1949: ch. 3; Stuckey, 1983; Scherer, 1980). Since the aluminium majors' pricing behaviour was so stable and uniform, we can regard them as having formed an effective cartel whether or not there was any formal agreement. Both Stuckey (1983: 87-9) and Rodrik (1982: 197) also point to reasons for concluding that the six firms *have* co-ordinated their activities.

### **Market changes since 1980**

Since the late 1970s there has been a series of major changes within this previously tightly controlled industry. The changes have tended to feed off each other, and in this section they will be described under three headings:

- the decline in concentration of ownership of primary aluminium capacity to below the point of oligopoly;
- the change in method of primary aluminium price determination, from a stable system administered by the dominant producers to one based on fluctuating London Metal Exchange (LME) values;
- the closure of many smelters in developed market economies, simultaneously with the opening of new ones in cheap-energy areas such as Brazil, Norway, the Arabian Gulf and Australia.

### *An end to oligopoly?*

The degree of concentration on the world aluminium market has been in progressive decline for at least 60 years. As we saw, earlier this century the market was dominated by Alcoa which had a monopoly in the US and, via its former Canadian affiliate Alcan, substantial influence elsewhere. Since the late 1940s six companies have dominated the market, but, as can be seen from Table 1, their combined share of worldwide smelting capacity has steadily decreased: new companies have entered the field and smaller long established firms have expanded. During the 1960s and 1970s the two European firms among the six increased their market shares while the North American ones declined. During the 1980s, however, every one

**TABLE 1**  
**Industrial concentration in the world aluminium market. Firms' shares of primary smelting capacity in market economy countries (%)**

	Ranking of firm					
	Biggest	Second	Third	Fourth	Fifth	Sixth
1956: Individual	27	23	14	13	5	3
<i>Cumulative</i>	27	50	64	77	82	85
1963: Individual	18	17	14	12	6	3
<i>Cumulative</i>	18	35	49	61	67	70
1970: Individual	16	16	12	10	7	5
<i>Cumulative</i>	16	32	44	54	60	66
1975: Individual	14	13	10	8	8	5
<i>Cumulative</i>	14	26	36	45	53	58
1982: Individual	15	14	9	9	7	6
<i>Cumulative</i>	15	29	38	47	54	60
1988: Individual	13	11	6	6	6	4
<i>Cumulative</i>	13	24	30	35	41	45

Cumulative totals may not add precisely, owing to rounding. The ranking orders were as follows:

*1956, 1963:* Alcan, Alcoa, Reynolds, Kaiser, Pechiney, Alusuisse;

*1970, 1975:* Alcoa, Alcan, Reynolds, Kaiser, Pechiney, Alusuisse;

*1982:* Alcan, Alcoa, Pechiney, Reynolds, Kaiser, Alusuisse;

*1988:* Alcan, Alcoa, Reynolds, Pechiney, Kaiser, Hydro. Alusuisse's share of world capacity had fallen to 2.8%. If it is retained as one of the 'Big Six' instead of Hydro, the combined share is 43.7%. The cumulative 1988 figure may be underestimated by up to 0.8 percentage points due to the omission of a few small plants in the US and western Europe.

*Sources:* 1956–75 figures: Rodrik (1982:196); 1982 figures: GRESEA (1983:34); 1988 figures: derived from Anthony Bird Associates (1988), *Mining Annual Review* and press reports.

of these firms has seen its share decrease, with Pechiney and Alusuisse the most heavily hit.

Indeed, Alusuisse has lost its place among the top six firms to Hydro Aluminium of Norway. Alusuisse remains more vertically integrated and has a broader international presence than Hydro. Yet if we add to Hydro's own 1988 capacity of 628,000 metric tons per year the 200,000 tons which are toll-refined for it by small US companies, its share of overall capacity rises to 5.8%, putting it in fourth place after Reynolds.

It may seem surprising to find a global industry which has become deconcentrated like this. A more familiar picture to most economists is one of progressive concentration, as larger firms outcompete

smaller ones by exploiting economies of scale. The world motor industry provides a well-known example over the same period, but this is a familiar process in many manufacturing sectors. However, in the minerals industries — where markets have been globalized for longer than any manufactures — the picture of deconcentration seen in aluminium is by no means rare. Over the last 30 to 40 years the same tendency has existed in both the copper and nickel industries, and there is evidence of it more recently in the oil market too.

One cannot precisely specify at what level of industrial concentration an oligopoly emerges — or when, in the case of aluminium, it disappears. For guidance we can go to F.M. Scherer, who states as a rule of thumb that: 'When the leading four firms control 40 percent or more of the total market, it is fair to assume that oligopoly is beginning to rear its head'. (Scherer, 1980: 67). Even though the aluminium oligopoly comprised six firms, this remains a useful guideline. In 1956 just two firms, Alcan and Alcoa, controlled 50% of world aluminium supply, while the four-firm concentration ratio was 77.3% (see Table 1). But between 1982 and 1988 the two-firm concentration fell below 25% while the four-firm ratio crashed through Scherer's 40% barrier, collapsing from 46.7 to 35.4%.

Supporting this statistical argument is clear behavioural evidence that by the late 1980s the cohesion of the aluminium majors had broken down. In November 1989 Alcoa shocked the rest of the industry by announcing that it would in future provide production and stocks data to the IPAI only every quarter, rather than monthly. The *Mining Journal* of 24 November 1989 (p. 431), a leading trade journal, suggested that if other producers did likewise this could lead to the demise of the IPAI. Alcoa gave as its reason its concern at the way traders and speculators used the IPAI's monthly statistics to the disadvantage of aluminium producers. However, others countered that the reduction in information would create more, not less, volatility on the LME. However that may be, Alcoa's decision to pool less information implies a replacement of co-operation by a go-it-alone stance.

Meanwhile, the growing use of joint ventures helped both to sustain the oligopoly and, paradoxically, to undermine it. Many of the aluminium mncs, including the six majors, have combined in this way at all levels of mining, refining and smelting. They have found various advantages in this. There are substantial economies of scale at all three levels, hence investments of a sufficient scale to serve the world market are lumpy as well as having the long pay-off time which

characterizes most minerals operations. Financially, participation in a joint venture spreads both the lump sum of the investment and the risk it entails. Joint ventures have also helped the leading firms to retain some of their market power even when their market shares have reduced, in two ways: the collaboration leads to the sharing of information about broad technical and market developments, while via joint ventures each company can spread its net across a greater number of the world's aluminium facilities. On the other hand, participation in a joint venture with a 'newcomer' can reduce their market power by giving that new firm access to technology which it would otherwise have great difficulty in acquiring.

### *A new pricing basis*

An important consequence of the former cartel of vertically integrated companies lay in their control over aluminium ingot prices. Traditionally a contrast was made with the world copper market, which even when dominated by an oligopoly earlier this century based all its trade on the often violent fluctuations of LME prices. The aluminium corporations were in a position to impose their own prices on the market. There was a recognized price leader, Alcan, whose international ingot price was changed infrequently and was followed by the rest of the world.

However, even at its peak the aluminium oligopoly never behaved in the way most commonly expected of monopolistic and oligopolistic markets: the six firms did not aim to maximize the price at which they sold aluminium. On the contrary, they were always aware that aluminium was a relatively new metal which, if developed shrewdly and priced judiciously, could make inroads into the markets of other materials. They therefore abjured short-term profits in favour of investment in new plant and research into aluminium uses, while keeping the price of aluminium competitive in order to sustain the rapid expansion of the market. In the post-war decades the most important competitor was copper, whose markets in wire, cable and tubes came under sustained attack from the lighter metal. The aluminium price was generally kept somewhat below that for copper.

This is the converse of the strategy pursued by the tin producers until 1985, which kept the price high relative to other metals at the cost of little or no expansion in market volumes. Indeed, a major segment of the tin market, that for beverage cans, was lost to

aluminium over the last 20 years. Mikesell (1988: 39; Takeuchi et al., 1986: 41) shows primary aluminium as having had the fastest rates of growth in consumption among seven leading metals in both the periods 1961–73 and 1973–84, at 9.1 and 1.4% respectively on average. The slowest consumption growth was achieved in the first period by tin, averaging 1.4% a year, and in the second by steel, at minus 2.6%.

A further feature which made aluminium attractive to consumers was the relative stability of prices. According to the UNCTC (1981: 24), producer list prices for aluminium ingots over the period 1945–79 fluctuated, in constant 1978 dollars, between a low of US\$800 per metric ton in 1973 and a high of \$1,413 a ton in 1957 — a range of 77% above the low point.<sup>2</sup> In a graph Mikesell (1988: 60, 64; Takeuchi et al. 1986: 10; World Bank, 1983: 45) shows LME copper prices (in 1983 dollars) fluctuating between about 62 US cents a pound in 1945 and 212 cents in 1965 — or 242% more than the low point.<sup>3</sup> Expressed another way, between 1955 and 1981 real copper prices fluctuated the most among nine leading metals and ores, deviating by 15.3% on average from a five-year moving average; aluminium prices deviated the least and those for bauxite the third least, by 4.6 and 5.6% respectively.<sup>4</sup>

Price fluctuations were reduced by the cartel's ability to counter cyclical trends by holding and releasing stocks, matching production carefully with demand, and exchanging metal between producers in order to smooth over particular supply difficulties. In winning customers from other metals, this was a great selling point. A risk-averting industrial consumer will always prefer a raw material whose price can be foreseen months or years ahead to a similar one whose price is liable to sharp and unpredictable movements. Hedging facilities on the LME or elsewhere can provide protection from such price movements only in the short term.

The aluminium price system, however, broke down in the early 1980s. With a growing diversity of sources of supply, merchants developed a limited 'free' market in aluminium during the 1970s. This covered a tiny fraction of transactions in the metal but proved very influential. The LME's strategists spotted it and, to the consternation of the major producers, in 1978 the exchange introduced a contract in primary aluminium ingots.

Its timing could not have been better, for no sooner had the new contract been weaned than the recession of the early 1980s set in. Between 1979 and 1982 primary aluminium consumption in market

economy countries fell from 12.6 million to 10.8 million tons and total commercial stocks increased from 1.5 million to 3.7 million tons (World Bureau of Metal Statistics, 1989). This had an inevitable impact on free market prices, with the annual average LME cash quotation falling from 80.8 US cents per pound in 1980 to 45 cents in 1982, while the Alcan list price was unchanged after October 1980. The LME price recovered in 1983 but fell back again in 1984, and by October of that year it stood at \$1,020 per ton, compared with an Alcan price of \$1,750 (*Mining Annual Review*, 1989; *Financial Times*, 30 October 1984). By then it was generally agreed that the list prices were meaningless since the producers universally provided discounts against them, and in that month Alcan ceased to endorse the system. Aluminium joined all other major non-ferrous base metals at the time in having its international prices based on LME transactions.

The price stability of the aluminium market was shattered. As demand recovered, annual average LME prices more than doubled in four years, from 56.5 cents a pound in 1984 to 117.3 cents in 1988.<sup>5</sup> Such sharp price movements, new to aluminium, may already have introduced the type of 'boom-and-bust' economics which plague copper and many other primary commodities. One reason for high prices in 1987-9 lay in inadequate investment in new capacity in previous years, when producers were more concerned with closing uneconomic plant at a time of low prices than opening new capacity. A flurry of new investment then emerged, but at the time of writing there was debate among industry analysts whether this would only exacerbate an excess supply in the early 1990s (*Mining Journal*, 17 November 1989).

At all events, this is a far cry from the steadily planned introduction of new capacity under the old cartel. Without the slacker secular rate of growth in aluminium consumption since the 1970s, free market prices would have had much less leverage to undermine the producer price system in this way. But the change in pricing system is in turn liable to make the boom-and-bust cycle more extreme.

### *Transfer of aluminium smelting*

A major factor underlying the restructuring of the aluminium market has been the closure for cost reasons of primary smelting capacity in the US and Japan, replaced by new capacity elsewhere. This process started with the government-inspired closure of most Japanese

smelters from the late 1970s, owing to oil price increases. The US industry was also compelled to restructure but in a different way, with the initiative resting with the private aluminium firms. Primary aluminium production in Europe did not decline as in these two countries, but it expanded less fast than the market and imports increased. Over the period 1979–88, Table 2 demonstrates a static volume of aluminium output in Western Europe (where individual country variations were also muted), a notional transfer of a large share of US and Japanese production to Canada and to Australia and New Zealand respectively, and nearly all the net growth in output arising from a doubling of production in developing countries.

**TABLE 2**  
World primary aluminium production by region, 1979–88

	1979		1988	
	'000 metric tons	% of total	'000 metric tons	% of total
Europe	3,593	30.0	3,762	27.2
North America:				
Canada	864	7.2	1,558	11.3
US	4,557	38.1	3,945	28.5
Sub-total	5,420	45.3	5,502	39.8
Japan	1,010	8.4	35	0.3
Australia, New Zealand	424	3.5	1,407	10.2
Africa, rest of Asia, Latin America	1,517	12.7	3,131	22.6
<b>Total</b>	<b>11,964</b>	<b>100.0</b>	<b>13,838</b>	<b>100.0</b>

Totals may not add precisely, owing to rounding.

All figures exclude centrally planned economies.

*Source: World Metal Statistics Yearbook, 1989.*

The countries where capacity has rapidly expanded can be placed in three groups:

- (i) developing countries with cheap sources of energy, usually in the form of natural gas, but lacking other appropriate natural resources, e.g. Bahrain, Dubai;
- (ii) partially industrialized countries with cheap energy, usually hydro-electric power, and generally with domestic bauxite supplies enabling the development of an integrated industry, e.g. Brazil, India, Venezuela;

(iii) developed countries enjoying cheap, usually hydro-electric, power supplies, whether with indigenous bauxite resources, e.g. Australia, or without them, e.g. Canada.

This has accelerated a previously existing trend in which developing countries' share of world primary aluminium production rose from 0.6% in 1955 to 9.5% in 1978 (UNCTC, 1981), and then to 25.1% by 1988, placing Brazil, Venezuela and India among the top ten producing nations<sup>6</sup> (see Table 3). With the major exception of India, the developing countries where new capacity has been established are of 'middle income' or above as defined by the World Bank (see Table 4). Some of them, such as Brazil and India, have been criticized for investing in aluminium because of the environmental destruction caused by hydroelectric power. Of course environmental damage

TABLE 3  
Top ten primary aluminium producing nations (1988)

Total rated capacity of smelters			Production		
Country	'000 metric tons/year	% of world	Country	'000 metric tons	% of world
1. US	3,940	27.8	1. US	3,945	28.5
2. Canada	1,577	11.1	2. Canada	1,558	11.3
3. Australia	1,188	8.4	3. Australia	1,142	8.2
4. Norway	901	6.4	4. Brazil	874	6.3
5. Brazil	874	6.2	5. Norway	827	6.0
6. West Germany	735	5.2	6. West Germany	744	5.4
7. India	600	4.2	7. Venezuela	454	3.3
8. Venezuela	435	3.1	8. India	335	2.4
9. Spain	358	2.5	9. France	328	2.4
10. France	319	2.3	10. U.K.	300	2.2
Total	10,927	77.2		10,504	75.9

Totals may not add precisely, owing to rounding.  
All figures exclude centrally planned economies.

Sources: *Aluminium Databook 1988*; *World Metal Statistics Yearbook 1989*.

should be limited as far as possible, and the costs of achieving this are bound to remove some of the cost advantage accruing to these countries. However, hydroelectric power and aluminium smelting affect the environment wherever they are situated, and development of the industry in Brazil or India need be no more damaging than at alternative sites in Canada or Norway.

**TABLE 4**  
**Primary aluminium producing countries in the Third World (1988)**

Total rated capacity of smelters			Production		
Country	'000 metric tons/year	% of world	Country	'000 metric tons	% of world
1. Brazil	874	6.2	1. Brazil	874	6.3
2. India	600	4.2	2. Venezuela	454	3.3
3. Venezuela	435	3.1	3. India	335	2.4
4. Indonesia	225	1.6	4. Indonesia	185	1.3
5. Ghana	200	1.4	5. Egypt	184	1.3
6. Egypt	181	1.3	6. Bahrain	183	1.3
7. Bahrain	180	1.3	7. South Africa	172	1.2
8. South Africa	172	1.2	8. UAE (Dubai)	163	1.2
9. UAE (Dubai)	156	1.1	9. Ghana	160	1.2
10. Argentina	150	1.1	10. Argentina	157	1.1
11. Iran	120	0.8	11. Cameroon	80	0.6
12. Cameroon	84	0.6	12. Mexico	68	0.5
13. Mexico	66	0.5	13. Turkey	60	0.4
14. Turkey	60	0.4	14. Iran	40	0.3
15. Surinam	30	0.2	15. South Korea	16	0.1
16. South Korea	18	0.1	(Surinam	—	—)
Total	3,551	25.1		3,131	22.6

Totals may not add precisely, owing to rounding.

All figures exclude centrally planned economies.

Sources: *Aluminium Databook 1988*; *World Metal Statistics Yearbook 1989*.

Linked with the geographical change have been changes in the nature of ownership of smelting plants, some of which have already been mentioned. Ever since the 1940s a progressively increasing number of firms have invested in aluminium, and a feature of the 1980s has been the importance of international mining conglomerates which previously were not involved with this metal. The US firm Amax, RTZ of the UK and Billiton of The Netherlands have all participated in joint venture companies which have become major international forces in aluminium.

In addition, many of the Third World smelters, for example those in Egypt, Bahrain and Dubai and several in Brazil, India and Venezuela, are either state-owned or have substantial equity participation from either the national government or a state-owned company like Brazil's CVRD. The state also has a stake in some new capacity in developed countries, most notably Hydro Aluminium of Norway. The military nature of many end-uses of aluminium (e.g.

aircraft bodies), among other reasons, has led developed capitalist governments to intervene extensively in the aluminium market for many years; but with the exception of France in 1982, they did not seek equity in the six major firms. Where state-owned companies have participated in new smelters in the Third World, it has often been in participation with one or more foreign-owned mncs in a joint venture.

### **Nature of the new market**

If one thing stands out from the previous section, it is that the aluminium and bauxite market is much more complex than in the past. The simple dependency view of a stand-off between poor countries supplying bauxite and a tightly-knit group of aluminium corporations no longer tells more than a part of the story. There are more producers in a greater variety of countries; vertical integration, while still important, is reduced; and ownership is more varied, with the entry of general mining conglomerates and state-owned firms and the growing use of joint ventures. The stand-off will, however, continue as long as Guinea, Guyana, Jamaica, Surinam and other countries depend on the vertically integrated owners of their bauxite mines and alumina refineries. The prices they receive are often inadequate, and transfer pricing abuses can occur, but they are locked into the situation.

The six leading firms have responded in diverse ways to the market changes. Insofar as they show any general pattern, it seems to have three poles:

- (i) a move of emphasis away from standardized 'commodity' aluminium production into more specialized products with higher value added — either complex aluminium-containing materials or downstream products;
- (ii) allied with this, a divergence in emphases among the six, with some reducing their vertical integration but in different directions;
- (iii) in several cases, at least a profitable sideline in supplying technology to other aluminium plants around the world.

The current literature provides two alternative explanations of the new strategic courses being pursued by the majors. Although drawing on different analytical traditions, they can be seen as complementary. The first is provided by the Belgian research group GRESEA (1983)

and *Raw Materials Report* (Vol. 3, No. 3), who use Vernon's product cycle theory to discuss the stage of development of the aluminium market. They see a move downstream by major producers in any market as an important sign of the market's maturation. But their detailed study did not conclude that the aluminium market would soon reach this point: they placed it still within the previous, mass-diffusion stage of the cycle.

The second explanation is provided by Kaounides and falls within the 'neo-Fordist' or 'flexible specialization' camp which has grown up since Piore and Sabel's seminal book (1984). Piore and Sabel discussed, among others, heavy industries such as steel and chemicals, where they identified a withdrawal by leading firms from large-volume, low value-added production of undifferentiated basic materials and an increasing concentration on products specially developed for high-value niche markets. Kaounides (1989b), in an unpublished paper for UNIDO, uses a similar analysis in discussing strategic moves by the aluminium majors, with Alcoa as a particular example. He sees such niche markets as being of growing importance in the supply of raw materials to all industries in decades to come, requiring investment by the big corporations in high-powered research activity to produce a range of complex materials using laminates, ceramics and modern synthetics. Third World producers are replacing these companies as bread-and-butter suppliers of low-value 'commodity' materials to volatile mass markets. Although this new role for developing countries may be inevitable, Kaounides seems unsure how desirable it is. For although it provides some industrialization, he argues that unalloyed basic metals — however high-grade — will in time be superseded even for mass consumer products by the new materials.

However valid his general view of materials markets, Kaounides can be accused of overstating his case with regard to aluminium. He perhaps concentrates too narrowly on the actions of one company at a particular time. For like each of the majors, Alcoa has special features. It is used to dominating the US industry, and remains strongly vertically integrated with the world's largest shares of both bauxite and alumina capacity, despite its relative decline in ingot production. However, by late 1989 it was *not* clear that Alcoa was withdrawing from a 'commodity' aluminium emphasis, as appeared to be the case a few years earlier when the market was weak. Under a new chairman it was instead developing an emphasis on becoming a *global* competitor, by broadening its market presence particularly in

Europe. It was Alcan that became more vocal in calling for policies such as increased recycling of the metal and the development of metal matrix composite materials.

Kaounides also exaggerates the novelty of the aluminium majors' present research orientation in seeking new uses for aluminium in such fields as food cans, car body frames and trains. A large part of the industry's past success arises from the fact that the majors have always devoted considerable effort and money to finding new uses for the metal, ever since Alcoa designed aluminium kitchen utensils in the 1890s.

Nevertheless, Kaounides's care in setting developments in the industry among worldwide industrial trends is welcome. It can be used to gauge the political-economic relationships which now characterize the aluminium sector across the world. Where before there was a binary structure of dependency, the market is developing a new, three-tier form — reflecting a broader set of divisions within the world economy. This separates the traditional bauxite-exporting countries from the new aluminium-smelting nations of the Third World.

The bauxite exporters are nearly all small countries in West Africa or the Caribbean region, largely dependent on primary product exports, having little secondary industry and lacking the finance and technical skills to develop it. They depend on sales of bauxite and alumina to the integrated producers of the North. The new smelting countries are generally at a higher stage of development. One group, with the resources to develop a vertically integrated industry, are relatively large nations with fairly broadly based economies and an industrial tradition. In this camp alongside Brazil, Venezuela and to some extent Argentina can be placed India, even though it is much poorer. Although richer, Australia is also comparable, given its primary product-based export structure — and the debt problems it now shares with Latin America. A second group comprises the relatively undeveloped but capital-rich oil-exporting nations of the Arabian peninsula, which are developing aluminium industries as part of an industrialization programme. All the new smelting countries (including Australia) have to rely on outside sources for much of the capital and technology required by the industry, and so the development concerned is of a dependent sort.

This analysis matches a view of the world economy which sees a developing three-way split with the 'Fourth World' of poor, underdeveloped nations falling progressively further behind a middle

group of countries. Many leading firms in the industrialized world are moving into the production of high-value, high-technology, specialized products, leaving 'commodity' production of basic materials to the group of partially industrialized middle-income countries. (The latter are most frequently exemplified by the newly industrializing countries of South-East Asia, but the group is broader than that. Interestingly, none of the South-East Asian 'NICs' has moved significantly into aluminium smelting.)

### **Possible Third World policy responses**

Despite the growing economic differentiation among developing countries, they still share many interests (as well as economic problems such as foreign debts) in common. It is therefore worth considering whether a common strategy, or at least certain lines of co-operation, could be pursued to advance their joint interests within the political economy of the aluminium and bauxite sector. Three main objectives should be pursued in such a strategy:

- (i) to reduce further the market power of the aluminium cartel, leading to its final collapse so that developing countries in the sector may have greater freedom of manoeuvre;
- (ii) to enable the continuation of bauxite mining among the 'traditional' exporting countries which constitute the bulk of International Bauxite Association membership, and as far as possible to achieve higher bauxite export prices and downstream development within their industries;
- (iii) to further the development of aluminium and aluminium-related industries among other Third World nations.

The underlying aim of the smelting countries should remain much what it has been in recent years. Primarily this should be to promote industrialization and thereby provide incomes and employment for their people, boost exports or save imports, and develop forward and backward linkages with other industrial sectors. It is important, as countries such as Venezuela are aware, to build industries that can compete within the world industry rather than just providing protected import substitutes. It is for cost reasons that aluminium smelting has moved into parts of the Third World, and the new comparative advantage created by the changing economics of the industry must be retained.

However, there is a potential conflict of interests between the two

groups of developing countries identified. Many of the new smelting countries have bauxite deposits of their own and are developing integrated industries, while most of the traditional bauxite-exporting countries are among the highest-cost miners. They consequently risk being slowly squeezed out of the market as their traditional partners reduce their upstream integration while alternative buyers — whether in developed or developing nations — are hard to come by. Insofar as they also want to move downstream, expanding alumina refining and moving into aluminium smelting and even fabrication, this may cut across expansion plans among the smelting countries. However, these problems are not insuperable, and the aim here is to identify ways in which the two groups might work together to advance the interests of both.

There is, however, another major obstacle to such co-operative plans: the continuing powerful role of multinational corporations within the market. As we saw in the previous section, aluminium in the Third World in recent years has provided a case of *dependent* development. It would be good to think that the governments concerned could be advised how to target industrialized markets for their new industry's produce. But neither the governments nor most of the producing companies within their jurisdictions enjoy such autonomy. Ownership of the sector in many cases is highly fragmented, with India's industry divided among five companies — two having equity dominated by the state, two by Indian private sector companies, and one by Alcan. Even where no equity stake is held, the mncs generally possess strong leverage, whether through long-term sales contracts, licensing agreements or other means.

In economic terms, the industry is now dominated by a system of quasi-oligopoly games. Although the concentration of ownership and market shares has been much reduced, a relatively small number of firms still control access to many key points, such as technology supplies and access to markets. The lesson for countries interested in developing their aluminium sectors is to play the same games of cat-and-mouse as the mncs will pursue. Despite the deconcentration of ownership, the sector remains riddled with thin and narrow markets, for example in access to alumina for non-integrated aluminium smelters.

Most often there is at least minority ownership by one of the mncs. They can provide capital, production technology, management skills and access to world markets. Poor countries such as India and highly indebted ones like Brazil or Venezuela often require the

immediate financial strength and the access to capital markets that is provided by mncs; many of the Caribbean and African bauxite exporters need such support because they are *both* poor and highly indebted.

In technology, the position of the majors appears to have strengthened in recent years. The basic technology for both refining and smelting has been unchanged for 100 years and in the past it could be acquired from independent sources. The USSR supplied smelting technology to India and mining technology to Guinea, while the Italian firm Montecatini-Edison supplied smelting plant to other firms. But such non-captive sources seem to have dried up, at least for the time being. Pechiney, Hydro Aluminium and other major firms are now supplying the baked anode technology required to re-equip old-fashioned 'Soderberg' smelters. Kaiser will provide the computer technology required by the USSR for a new smelter in which it will also take a major equity stake (*Financial Times*, 15 December 1989). Like the USSR, new Third World producers either depend on joint-venture partners for technology or, if the plants are locally owned, they must acquire it under licence.

A Soviet official said he preferred to acquire equipment for the projected plant via a joint venture rather than by purchasing it because that way the USSR could export more aluminium by calling on the marketing expertise of Western partners. With so many of the industry's internal markets still attenuated by vertical integration, the need for marketing partnerships is felt even by the most sophisticated of new Third World producing countries. The Venezuelan state owns 80% of the country's major aluminium firm, Venalum, but much of its output goes to the Japanese firms which own the remainder. In 1988 Venezuela produced over 450,000 tons of aluminium and exported nearly 270,000 tons — most to those Japanese firms (*Mining Journal*, 17 February 1989). Brazil's Albras plant is 51% owned by the state firm CVRD but exports 49% of its output to the Japanese minority shareholder (*Mining Magazine*, January 1988). In some cases a mnc shareholder takes product more than proportional to its ownership, either buying it or taking it in compensation for the capital, technology or other services it supplied but which the domestic shareholder could not pay for at the time.

In an industry which was so wholly dominated by a handful of mncs, such strong vestigial sources of mnc dependency must be no surprise. Also unsurprisingly, many countries have continued to accept full mnc control over their aluminium, alumina or bauxite

installations. An industry so closely tied in with foreign partners is not readily amenable to national co-ordination, although the government will always have levers of influence. One of the main aims of government policy, at both national and international levels, should therefore be to reduce the leverage and control over the domestic industry which mncs at present enjoy. Just as the Third World over a generation has built up its primary smelting capacity from almost nothing to a quarter of the non-communist world total, so it can tackle this problem and slowly wear away these insidious means of control. There is local ownership (state or private) in many of the new Third World smelters, often amounting to formal control. Mnc participation may have been required because of the host country's economic weaknesses, but local ownership does provide a bargaining lever.

The state also has other levers, such as taxation and investment permits, to influence the behaviour of all firms. These can be pulled at critical times to assert national interests, for example when revising electricity tariffs or permitting new investments. Even governments which seem in the weakest position can improve their position in this way, at least to some extent. An example was the renegotiation of electricity tariffs at the Volta Aluminium Co (Valco) smelter in Ghana. This plant, 90% owned by Kaiser and 10% by Reynolds, was assured for 30 years an electricity tariff which was cheap even when negotiated in the 1960s. The Rawlings government which seized power in 1981 succeeded in renegotiating the contract to increase the tariff — even if not up to full international norms (Graham, 1982, 1986).

Alliances and partnerships between developing countries, whether at the same or different points in the production stream, should form part of their game plans in this situation. A start in such co-operation was made by the aluminium producers in the Arabian Gulf, who in 1989 decided to publish joint product standards, co-ordinate pricing policies, ensure 'adequate' customs duties to fight dumping, and purchase raw materials collectively. Further meetings were planned to take place annually. Other parts of the world — notably Central and South America — do not have the same tradition of economic co-operation as the Gulf states, but there is no reason why it should not be attempted. At present there are contacts between the bauxite exporters and aluminium smelters in the Caribbean and South America but so far they are largely on commercial terms. Thus, a Venezuelan company is to mine bauxite in Guyana while Brazil's

Albras imports alumina from Surinam, Jamaica and Venezuela (*Mining Journal*, 21 April 1989; *Mining Magazine*, May 1989). But Venezuela is planning a major expansion in its own bauxite mining, with the aim of producing a largely vertically integrated industry, while Albras plans to run down its imports from 1992 as Brazil's large Alunorte project comes on stream.

Whatever the immediate commercial outlook, it should profit all these countries around the Caribbean basin to co-operate in enhancing their ability to compete with the aluminium majors. Kaounides (1989a) has proposed the establishment of a pan-African materials research centre to develop complex materials for world markets which can be supplied from African resources. In similar vein — though in a different technical area — it would be useful for the American nations (outside North America) involved in the aluminium and bauxite sector to set up a joint institute to research into production techniques at all parts of the supply chain, in order to overcome their technological dependency.

As the aluminium oligopoly fragments, there should be increasing opportunities for new participants in the market to exploit differences of interest between the major producers — i.e. play the quasi-oligopoly games mentioned above to divide the dominant group. For example, Norway's Hydro Aluminium had great difficulty securing adequate alumina supplies during the bull market of 1987-9, but is an exporter of smelting technology. Alumina-refining firms which want to secure aluminium technology might well acquire it on good terms by offering Hydro a secure share in their alumina production — as long, of course, as they were not inhibited by existing sales or technology tie-ups with competing mncs. Other favours might be acquired from Alusuisse and Reynolds, which have both declared an intention to buy in some of their aluminium ingot requirements and may be glad of an opportunity to avoid buying it from Alcan and Pechiney, which will be selling ingot on the market.

On some issues it may be possible to drive hard bargains initially with weaker mncs such as Kaiser, and then replicate them with the stronger members of the group. However, it will be important not to overplay the bargaining hand: the large extent of aluminium-related investment in Australia and Canada in recent years is partly due to mncs' view of Third World suppliers as politically and economically unreliable.

Third World smelters should also think carefully about what they want to sell and how to sell it. They should beware of the danger of

relying too heavily on the sale of basic 'commodity' aluminium. This produced good returns as prices were high in the late 1980s, but given the new volatility of the market there is little reason to suppose that will always be the case. Following Kaounides, opportunities should be sought wherever appropriate to move into more specialized areas of production that create a more assured and higher value added. Such a policy was pursued by Dubai Aluminium Co (Dubal) — 80% state-owned — which was due to phase out in 1988 its production of commercial grade aluminium ingot, which had accounted for 20% of total output. The aim was to produce only billets, foundry alloys and high-purity metal, which produce greater value added (*Mining Magazine*, January 1988).

Another route has been adopted by Venezuela, now the world's lowest-cost smelting country, which has ambitious plans to expand its primary aluminium capacity to 2 million tons per year. To assure itself of markets it has started acquiring downstream capacity abroad, buying a 20% stake in the US extruding firm Wells Aluminum, also in 1988. It is often better for semi-fabricating firms like Wells to be close to industrial markets, where they can have closer contact with customers and respond more rapidly to changes in demand.

All else being equal, such pursuit of value added is highly desirable. But it is important to choose national priorities, and for most developing countries the freeing of the ties made by the mncs appears more urgent. It is therefore more desirable, for example, to carry out research into basic production technologies than into specialized products — Kaounides notwithstanding. Venezuela's approach poses the further risk of reinforcing the unequal worldwide division of labour. Even if manufacturing were largely to remain in North America, Japan and Europe, should Third World raw material producers not seek to maximize the amount of downstream processing carried out in their own countries, rather than sponsoring such operations in the North?

And there is more specific danger here in the context of the Third World's debt crisis. As we have seen, in the aluminium boom year of 1988 Venezuela exported more than half of its output. Brazil also increased its exports by 50% in value over the previous year to \$1,500 million, representing more than 500,000 metric tons and about 5% of already massively increased national exports. The export drive is provoked by the need to meet debt-service payments, but in the aluminium industry it had the perverse effect in both Brazil and

Venezuela of leading to a shortage of aluminium for domestic fabricating companies. This is a good example of the anti-developmental bias which the export orientation engendered by the debt crisis can have: domestic industries are starved of inputs by the pressure to export those primary products that they were set up to exploit.

A final comment on policy issues relates to the position of West African bauxite-exporting countries, which may, as so often in the modern world, have the fewest options open to them. The new smelting countries such as Brazil, Bahrain and India are inherently stronger because of their cost advantage in aluminium production. But the traditional bauxite exporters cannot enhance their positions in the same way. Their production costs are reported to be among the highest in the world, in spite of their ownership and control by the dominant corporations in the industry. Such reports need to be treated with some caution without close knowledge of the accounting figures which underlie them; it benefits the bargaining positions of the mncs in the mining countries if they can represent the mines as of high cost. But if the reports are true, that clearly poses a major problem for their future in the industry.

Opportunities for several Third World bauxite producers, however, do exist. Those in Brazil, Venezuela and India can feed into vertically integrated domestic industries, while India has also found a source of export revenue in selling alumina to supply Bahrain's Alba smelter. At least to some extent, we have also seen opportunities presented to Caribbean bauxite and alumina producers by the fast expanding aluminium industries in neighbouring countries of South America. The West African suppliers enjoy no such prospect. As bauxite is a high-bulk, low-value item, transport costs are important and its markets are largely regional. They have traditionally supplied the European industry, which has restructured much less in recent years than those in North America and Japan. Meanwhile there is not a growing aluminium industry near to them such as exists near the Caribbean, so prospects for regional co-operation appear limited.

## **Conclusions**

Over the last decade the world's aluminium and bauxite industry has exhibited the rapid breakdown of an apparently solidly entrenched market structure. The emerging new structure is in line with broader trends in the world economy, even if the changes on the aluminium

market have an independent rationale. Developing countries are now involved at all levels of aluminium production and consumption. They not only mine bauxite and refine alumina but smelt primary metal. A number are also significant consumers of the metal, for use in their own construction, telecommunications, aerospace and other industries: Brazil and India are good examples.

Developing country interests in an increasingly complex economic sector, however, have diverged. Some, like Dubai and Venezuela, are engaged in smelting aluminium and enjoy bright prospects even in the event of a weak market in the 1990s. But long-established bauxite- and alumina-producing countries in Africa and the Caribbean are in a much weaker position. In general, all Third World nations engaged in this sector face the continuing strength of aluminium mncs despite the rapid worldwide deconcentration of ownership of the industry in recent years.

This situation of dependency is hard to fight but need not last for ever. Strategies can be pursued both nationally and internationally to weaken the old oligopoly's grip. This grip grasps numerous levers of economic control — the provision of capital, technology, management expertise and market access most notably — and it would be a mistake to try to confront them all at once. In present circumstances access to investment capital is the developing countries' Achilles' heel, and there is little prospect of remedying that either individually or collectively by any means which are peculiar to the aluminium market. But alternative ways can be found to enter the market and to manage a complex industry.

The biggest source of continuing mnc dominance lies in their control over profitable production technologies at all levels in the supply chain. The biggest priority for developing countries in the industry must be to develop their own technological capabilities. This might be done in some cases by astute bargaining with some of the aluminium majors, who might be persuaded to provide licences that would enable the licensees over time to develop and appropriate the technologies concerned. Otherwise, substantial research efforts will be required by the developing countries themselves. These are most likely to bear fruit if carried out co-operatively, whether at the regional level or co-ordinated by broader international agencies. These might be Third World-controlled like the Non-Aligned Movement, or form part of the United Nations constellation, or rise from a revamped and broadened version of the International Bauxite Association.

## Notes

1. Primary aluminium is that produced from ore, as opposed to 'secondary' production from scrap metal.
2. The years 1946-9 and 1951-4 are omitted from the table concerned.
3. List prices do not perfectly reflect actual prices paid because in times of metal shortage or glut, premia can be demanded or discounts granted.
4. The other products detailed by Mikesell are lead, zinc, tin, manganese, iron ore and nickel, in that order of price volatility. Interestingly, lead, zinc and tin, whose prices deviated on average between 14.7 and 8.1% p.a., were all based on LME quotations (the tin price in this period having been modified by the International Tin Agreements). Nickel on the other hand, which shared with aluminium an average deviation of 4.6%, was determined on a similar producer pricing system in a market dominated by one producer, Inco of Canada.
5. The 1988 quotation is based on the LME's new 'high-grade' contract specifying aluminium of minimum 99.7% purity, compared with 99.5% under the old contract.
6. Based on the figures and assumptions used in Anthony Bird Associates, *Aluminium Databook 1988*.

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