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**Regional Expert Group Meeting on the Development
of the Non-Ferrous Metals Industry in Latin
America and Possibilities for Complementarity***

**Córdoba, Argentina
27 to 30 March 1989**

DISCUSSION DOCUMENT

**THE PROMOTION OF A MORE COHERENT PRODUCTIVE SYSTEM IN THE
FIELD OF NON-FERROUS METALS IN LATIN AMERICA:
POSSIBILITIES FOR COMPLEMENTARITY****

**Prepared by
the System of Consultations Division**

* This meeting was organized by UNIDO together with the Government of Argentina.

** This document is the translation of an unedited original.

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1. Introduction

This meeting arises from the main apprehensions expressed by the various persons concerned during the preparation of the First World Consultation on Non-Ferrous Metals, which took place in Budapest (Hungary) from 30 November to 4 December 1987, as well as from the principal recommendations stemming from that Consultation.

During the preparation of the First Global Consultation several expert meetings were held, one of which took place in Caracas (Venezuela) between 23 and 26 February 1987. At that meeting there was discussion of alternative development strategies for the region in the field of non-ferrous metals with a view to promoting a more integrated and self-sustained development of that industry in Latin America against the background of the world economic situation and the restructuring process that the non-ferrous metal industry is undergoing.

The meeting referred to made a critical examination of the development "paradigm" dominant in the region, which is based mainly on large plants exporting concentrated and/or refined products to the world market. The meeting recommended gradual development of the non-ferrous metal sector in the region principally on the basis of existing resources and capacities, with special emphasis on the small- and medium-scale production of semi-finished and finished products. 1/

The First World Consultation on the Non-Ferrous Metals Industry, which took place in Hungary in 1987, stressed in its recommendations the need to promote regional and interregional co-operation as well as a permanent dialogue between the various actors taking part in the different non-ferrous metal production operations. At the Consultation referred to it was also brought out that there was need to step up the complementarity of production between the different countries within different regions (Latin America, Africa and Asia). Along these lines it was recommended that UNIDO should play an active role as co-ordinator in the process of identifying possibilities for intraregional and interregional complementarity of production.

The present meeting has the central aim of identifying potential opportunities for production complementarity and examining the viability of their implementation and the ways and means of doing so. The whole of this process is contained within the context of achieving a more coherent productive system in the Latin American region.

For this purpose studies have been carried out for certain countries of South America and the Caribbean, including Mexico. These studies have identified several possibilities for complementarity for certain metals that may improve the use of the present installed capacity, together with a number of investment projects. This effort should be seen only as the beginning of a long and complex process that will go on involving more and more countries and metals in the region, together with new factors for horizontal integration, first and foremost as relates to the capital equipment industry. Similarly, in future studies and/or at future meetings, opportunities for stepping up the level of co-operation with Africa and Asia will have to borne in mind.

1/ For more information see the report of the meeting IPCT.21(SPEC.) dated 24 March 1987.

As can be appreciated from what is described, this meeting seeks to give more specific shape to the various strategy and policy plans that have been outlined at different regional and international forums, which have pointed out in different forms the need for this industry to centre its dynamic development more and more around the region. 2/

2. Some comments on the non-ferrous metals situation

In this section we shall confine ourselves to emphasizing a few main points with regard to the dynamics and development of non-ferrous metals to be borne in mind when examining more specific complementarity and investment themes. 3/

The non-ferrous metals industry has been affected by the fluctuations in the world economy on account of its role as supplier of basic inputs for the capital equipment industry. The structural changes that have been occurring in the world economy have in general terms tended to run counter to the growth of the non-ferrous industry. Nevertheless, the process of world restructuring has had different effects on the individual non-ferrous metals. Non-ferrous metals associated with the leading sectors have undergone higher growth rates, while the more "traditional" non-ferrous metals have shown limited or adverse growth rates. 4/

The decrease or low growth of the consumption of non-ferrous metals as a whole, and in particular that of the most traditional kind, is due to a major drop in the growth of the capital equipment industries which traditionally used to use

2/ "Strategies of development and financial implications of the non-ferrous metals industry" (ID/WG.470/7), UNIDO, August 1987; "Report of the Consultation Workshop on Strategies for Developing the Mining Resources in Latin America and the Caribbean" (IC/G.1530), ECLAC, August 1988.

3/ For more detail refer to the following UNIDO publications: The development and restructuring of the non-ferrous metals industries (ID/WG.470/9), and Mining and Mineral Processing in the developing countries (ID/WG.470/1(SPEC.)). Also "Projections and prospects for mining by the year 2000", La Paz, Bolivia, 1988.

4/ During the 1970s the annual consumption of tantalum in the United States rose by 19.5 per cent, beryllium by 11.9 per cent, zirconium by 8.0 per cent, silicon by 6.9 per cent, titanium by 6.2 per cent and lithium by 5.2 per cent. Over the same period the annual consumption of tantalum in Japan increased at an annual rate of 13.6 per cent, titanium 12.9 per cent, lithium 11.7 per cent, silicon 10.3 per cent, and zirconium 8.4 per cent. Pierre-Nöel Giraud, "Geopolitics of mineral resources", Economica, Paris, 1983, pp. 326 and 327.

In the 1970s the increase in consumption of non-ferrous metals known as the traditional type was much lower than for non-ferrous metals associated with the most advanced sectors. Over this period the world annual consumption of primary aluminium rose by 5.5 per cent, refined copper 2.9 per cent, refined tin 0.2 per cent, refined nickel 2.4 per cent, zinc ingots 2.1 per cent and refined lead 3.8 per cent.

During the period 1983-1986 the consumption levels for most traditional non-ferrous metals remained virtually stable and as far as tin is concerned were lower than those reached prior to 1983. It should be pointed out, however, that the world consumption of aluminium in 1985 exceeded the levels for the first years of the 1980s, and was slightly higher than the maximum consumption recorded in 1979.

non-ferrous products, 5/ together with technological changes which tend to diminish the quantity of non-ferrous metals used to make machinery and equipment. Similarly, there is a trend towards replacing non-ferrous metals by other materials such as plastic, fibreglass and so on.

The prospects for growth and consumption of the non-ferrous minerals and metals that had most effect on the Latin American economies (aluminium, copper, tin and nickel) do not appear very promising for the limited scope of export growth. 6/ To this should be added the fact that an increase of any significance in the price of these metals up to refinery cannot be expected. 7/

2.1 The trends in non-ferrous metals in the countries of Latin America and the Caribbean 8/

2.1.1 Aluminium

The production of primary aluminium by the five main producers in the region 9/ more than quadrupled over the period between 1976 and 1987. 10/ Consumption alone over that period increased by 92.3 per cent, 11/ turning the region from a position of deficit to one of surplus.

5/ The steel industry, which consumes large quantities of non-ferrous metals (nickel, zinc), underwent a strong recession. The production of agricultural machinery and heavy equipment for public works dropped considerably. The most important capital equipment industry, which is that of machine tools, showed a decline in production in two of the largest producer countries of the world: the Federal Republic of Germany and the United States. Production in those countries dropped around 20 per cent between 1970 and 1977, made a slight recovery between 1977 and 1978, and then declined again.

6/ A scenario prepared by ECLAC for Latin America proposes an annual growth of 3.5 per cent for the OECD countries in the medium term, which might bring about an increase in exports from the region by 3 per cent. This increase in Latin American exports would alone produce a per capita product in 1990 similar to the one for 1980. Similarly, unemployment will reach a figure of 35 million, which is higher than the unemployment level for 1980. The external debt continues to increase, reaching a figure of approximately \$451,000 million.

7/ The prices of the raw materials, excluding oil, since their decline in 1987, are expected to increase in 1989 and then to decrease again. On the other hand, the prices of manufactured products will tend to grow steadily. For more detail, see: Grof, T. and Eva, A., "Identification of specific projects for the production in Latin America of semi-finished non-ferrous metals" (ID/WG.481/2(SPEC.)).

8/ This brief analysis is mainly concentrated on the countries which have been studied for the present meeting.

9/ Brazil, Venezuela, Argentina, Mexico and Suriname.

10/ Production was 316,000 tons in 1976 and 1,494,700 tons in 1987.

11/ Consumption was 410,200 tons in 1976 and 788,800 tons in 1987.

The increase in bauxite and alumina production has not been as high as that of aluminium. Between 1972 and 1986 bauxite production underwent a slight decline. ^{12/} Alumina increased from 3.2 million tons in 1976 to 5.7 million tons in 1987.

The production of semi-finished goods in the region between 1976 and 1986 doubled, rising from 375,000 tons to approximately 783,000 tons. An approximate calculation of the semi-finished exports and imports shows that in 1986 there was a negative balance for the region of \$112.2 million in rolled products, excluding foils, and in the case of the latter there was also a negative balance at 9.1 million. In the case of extruded and drawn products, the region had a positive balance of \$79.2 million. ^{13/}

2.1.2 Copper

The production of primary copper over the period 1982-1987 increased at an annual rate of 3.6 per cent. ^{14/} As far as refined copper alone is concerned, production rose over the same period at an annual rate of 4.3 per cent. Consumption of refined copper for this period increased at an annual rate of 2.4 per cent. The refined copper surplus in the region in 1987 was approximately 956,500 tons. ^{15/}

The production of semi-finished copper from the principal producers ^{16/} attained a figure of 331,800 tons in 1983 and 507,900 tons in 1986. The region experienced a negative balance in its trade in bars, profiles and wire of \$25.6 million in 1986. The trade balance for sheeting, plating and strips was positive, at \$6.1 million for the same year. As far as tubing and piping were concerned, the trade balance was negative at \$1.3 million in 1986.

2.1.3 Nickel

The mining production of the five producer countries in the region ^{17/} increased by 51 per cent over the period between 1976 and 1987, while the production of refined nickel underwent a growth of 89 per cent over the same period. The region saw an increase in the consumption of primary nickel by 58 per cent for the period 1976-1987, while the developed market economy countries increased consumption by only 30 per cent over the same period. It should be pointed out that the consumption of refined products from the region alone represented 21.5 per cent of production, whereas in 1976 the figure was 26 per cent.

^{12/} Bauxite production was 20.3 million tons in 1976 and 19.2 million tons in 1988.

^{13/} For greater detail see the UNIDO study "Identification of specific products for the production in Latin America of semi-finished non-ferrous metals" (ID/WG.481/2(SPEC.)).

^{14/} The production of primary copper was 2.6 million tons in 1982 and 3.1 million tons in 1987.

^{15/} By the year 1992 a consumption of refined copper of 577,000 tons is predicted for the region.

^{16/} Includes production in Brazil, Mexico, Argentina, Chile and Venezuela.

^{17/} Cuba, Dominican Republic, Colombia, Brazil and Guatemala.

2.1.4 Tin

The region contains two countries which are major tin producers, namely Brazil and Bolivia. The production of tin concentrates in Brazil reached 29,000 tons in 1987, having increased at an annual rate of 20 per cent over the previous eight years. With regard to primary tin, the production in Brazil was 288,000 tons, with an uptrend from 1981 at an annual rate of 25 per cent.

In Bolivia, the production of tin ores and concentrates declined in a marked fashion in the 1980s. From a figure of 30,000 tons of fine content in 1981 it dropped to only 9,000 tons in 1987. A similar situation is to be seen in the production of primary tin, which decreased from 20,000 tons in 1981 to less than 2,000 tons in 1987.

Other producer countries studied are Argentina and Peru. Primary tin production in Argentina was 400 tons, showing an upward trend over the 1980s. Peru does not produce primary tin, confining its production to ores and concentrates. Output of these products attained 5,263 tons of fine content in 1987.

As far as the consumption of tin is concerned, Brazil consumed 8,200 tons of primary tin in 1987. The consumption of it increased between 1981 and 1987 at an annual rate of 15 per cent. In Bolivia, primary tin consumption dropped from 1983 onwards, moving from 2,400 tons in 1983 to 1,100 tons in 1986. In Argentina, the consumption of primary tin in 1987 was 1,200 tons, showing a tendency to oscillate in the 1980s. In Peru, the consumption of this product attained 500 tons in 1987, and it is expected to decrease in the near future on account of the economic situation prevailing in the country. In Venezuela, the consumption of primary tin shot up over the period 1983-1985, rising from only 300 tons to 1,000 tons. Chile consumed 250 tons of tin in 1986.

3. Trade relations in the field of non-ferrous metals

The predominant development "style" in the region in non-ferrous metals and the form in which this industrial activity is incorporated into the world economy has meant that the commerce between the different countries in the region has been relatively limited. Most of the non-ferrous products are intended for extraregional markets, the principal ones being the United States, Japan and Europe. In the logic of the trade relations of the region it can also be understood that although large quantities of products are exported, their level of processing is basically that of refined products, whereas the region's imports are mainly concentrated on semi-finished products, though especially finished products.

This type of structure affects the terms of trade in the region through the way in which the prices of concentrates and refined products, on the one hand, and semi-finished and finished products on the other, are established. If we add to the above the imports of machinery and equipment and extraregional inputs for the expansion and operation of non-ferrous metal plants in the region, we find that the terms of trade in this industrial activity is becoming even more unfavourable for Latin America.

Gross aluminium exports from the producer countries in the region within Latin America amounted only to approximately 10 per cent for 1986, while the rest was geared to the markets of the United States and Japan. As far as imports of the same metal are concerned, 45 per cent came from North America and Europe.

Refined copper is exported mainly to Europe. Of the total exports of 1.1 million tons for the region in 1986, 0.6 million were destined for Europe. 18/ As far as extraregional imports of this metal are concerned, they were relatively limited and represented for the same year approximately 11.2 per cent. The region from which most was imported was Africa. 19/

Exports of refined tin went preferentially to Europe and North America. In 1986, Europe took 54 per cent of the exports and North America 41 per cent. The needs for this metal in Latin America were satisfied mainly by production inside the region (68 per cent), the necessary remainder being imported from North America (30 per cent). 20/

The trade in nickel between the countries of the region is very limited. Nickel exports from Cuba to the region are very few as compared with Cuba's total exports. In 1985 this country's exports to the region alone were 286 tons of sinter and 31 tons of nickel oxide went to Mexico. Cuba's exports went preferentially to other CMEA countries. 21/ The Dominican Republic exported virtually all its nickel to Europe (47 per cent) and North America (35 per cent). 22/

Up to refined products, the non-ferrous exports from the region exceed the imports. In the case of semi-finished and finished goods, it is the other way around, and the region's imports are much higher than its exports, the latter being oriented preferentially to the region.

As an estimation of the commercial flow of semi-finished aluminium goods from the region we see, as already pointed out in 2.1.1, that the balance in 1986 was negative, at \$42 million, and in the case of semi-finished copper at \$21 million. 23/

4. Structure and production capacity of non-ferrous metals

The production structure for non-ferrous metals in Latin America is characterized, generally speaking, by an important output of minerals and primary metals and relatively limited manufacture of semi-finished and finished products.

18/ Intraregional exports were only 0.16 million tons.

19/ 8,992 tons of refined copper were imported from Africa in 1986.

20/ The rest was imported from Europe (1.2 per cent) and Asia (0.8 per cent).

21/ Cuban Statistical Yearbook, 1986: State Statistical Committee.

22/ The percentages of nickel exports from the Dominican Republic refer to 1987.

23/ For more details see the UNIDO report: "Identification of specific projects for the production in Latin America of semi-finished non-ferrous metals" (ID/WG.481/2(SPEC.)).

In some non-ferrous metal producer countries in the region the production structure possesses the features of an "enclave" having few links with the rest of the economy. The complementarity of production between the various countries of the region is limited despite the fact that there exists idle installed capacity.

Against this general background there is a great diversity of situations among the producer countries. As such they produce minerals and different metals as well as having different levels of processing, thereby creating objective conditions for promoting the complementarity of production.

Among the countries of South America studied we have countries that are relatively important producers of aluminium either in its primary form or as semi-finished products, such as Brazil, Venezuela and Argentina. Furthermore, there are important producers of copper such as Chile and Peru, although their production of aluminium is virtually non-existent or very limited. With regard to tin, there are important producers such as Brazil and Bolivia, but as in the case of the latter they do not produce aluminium and copper production is rather insignificant.

As far as Mexico and the Caribbean countries are concerned, we find that Mexico and Jamaica produce aluminium in both the primary and semi-finished form, although the production of such is limited in Jamaica. The Dominican Republic and Haiti produce only bauxite. With regard to nickel, Cuba shows a more integrated production process, producing primary nickel and semi-finished products. Mexico does not produce any primary nickel and is limited to semi-finished and finished products, while the Dominican Republic produces only primary nickel.

4.1 Aluminium

4.1.1 Brazil

This country has one of the largest reserves of bauxite in the world, exporting its surpluses partly to Venezuela for subsequent processing by that country into alumina and aluminium. With regard to its capacity for producing primary aluminium, the installed capacity of Brazil is at present insufficient and it has had to import 285,000 tons of alumina to meet the increasing demand that in 1986 reached a figure of approximately 1.5 million tons, chiefly for the production of refined aluminium.

The production of semis basically falls the lot of three large plants and around 70 medium-scale and small-scale enterprises. ^{24/} The cold rolled capacity of the three major enterprises is approximately 160,000 tons. Considering the production capacity of the other enterprises, the total production capacity for cold rolled products would be 200,000 tons. With regard to the production of foils, the total capacity is approximately 40,000 tons per year. In the area of extruded products the production capacity is estimated at 131,000 tons. A similar capacity is shown by drawn products. With regard to die casting, powdered metals and metal pastes, the production capacities are 75,000, 18,000 and 12,000, respectively. Utilization of the production capacity for semi-finished products is higher than 90 per cent, which would call for expansion of this type of production in the near future in order to be able to maintain a high grade of integration with the primary aluminium output.

^{24/} The three large enterprises are ALCAN, ALCOA and CBA.

4.1.2 Argentina

Argentina's capacity for primary aluminium production is 150,000 tons. This is concentrated at one single plant ALUAR, which operates with alumina imported from Australia.

A quantity of 110,000 tons of primary aluminium was processed for the production of semi-finished commodities. The installed capacity for semis is reckoned at approximately 200,000 tons 25/ of which about 140,000 tons will be used, leaving a surplus of approximately 60,000 tons.

Among the highest production capacities for semi-finished commodities is the cable industry with 70,000 tons of cables and conductors. The production capacity for extrusion and rolling is 60,000 and 50,000 tons, respectively. As regards the foil production capacity, the figure attains 10,000 tons.

4.1.3 Venezuela

Up till now the aluminium industry has shown a deficit of bauxite for producing alumina and aluminium. 26/ The Interalumina plants can process approximately 3,200,000 tons.

A rapid expansion in primary aluminium production has been accompanied by an increase in the semi-finished installed capacity. It is estimated to be 400,000 tons per year, which will be utilized to roughly 50 per cent. 27/ The greatest capacity for semi-finished products relates to the cable industry, which has a capacity to produce 230,000 tons of wire and cable. At the present time, however, this industry is turning out at a relatively low level. The extrusion capacity is 50,000 tons, with rolled products at a similar level. The capacity for die casting is 70,000 tons and that of foils 10,000 tons.

4.1.4 Mexico

The primary aluminium production capacity in 1987 attained 66,000 tons. Mexico's alumina requirements for subsequent processing are covered by ALCOA's Port Comfort Refinery under a long-term contract which runs until the beginning of 1990.

The capacity for producing semi-finished commodities is estimated at about 168,500 tons, which includes cables, rolled products, foils, extruded products and forgings. 28/

25/ There are several calculations for the installed capacity which attain a figure of 220,000 tons.

26/ Venezuela has already begun mining bauxite at the Pyiguaos deposit, which will produce enough mineral to do away with the need for imports.

27/ The production of semis in Venezuela reached a figure of approximately 190,000 tons in 1987, which were produced by about 495 medium-scale and small-scale plants. Of the 495 plants, about 100 produced rolled products, 90 extruded products, 81 worked with castings, 43 produced wire and conductors, while 32 processed scrap. The other 150 partly covered the production of finished goods.

28/ Mexican Aluminium Institute, World Bank, IBI.

The semi-finished production attained a peak in 1980, and then declined, especially in 1987, which leaves an idle capacity of more than 50 per cent. 29/

4.1.5 Jamaica

The rise in the price of oil had an adverse effect on the aluminium industry in Jamaica, which depends on imports for 97 per cent of its oil. Added to the process of restructuring under way in that industry at world level, this has meant a closing down of plants with repercussions for the country's production capacity. In 1975 the Revere alumina plant was shut down, and there was a drop in production by the remaining enterprises. In 1984 and 1985, the ALCOA and ALPART refineries were shut down. Later on the ALCOA refinery was started up again on the basis of a joint venture between CAP and ALCOA. 30/ The whole of this process of closing down plants meant that the production of alumina dropped from 2,550 tons in 1981 to 1,572 tons in 1987.

As far as semi-finished products are concerned, Jamaica has an extrusion plant with an installed capacity of 4,300 tons, which belongs to ALCAN. In order to expand the processing capacity for semi-finished and finished products there are design studies under way for a plant with a capacity of 20,000 tons of cast, rolled and finished products. This production capacity would be accompanied by a 15,000 ton production line for manufacturing foils.

4.1.6 Other countries producing aluminium

Peru has a limited installed capacity for turning out semi-finished and finished products. For the semis it has an extrusion mill with a capacity of 2,500 tons per year. 31/

Chile is in much the same situation as Peru. For semis it has an installed capacity of 1,000 tons for rolled products, 1,500 tons for extrusion and 1,000 tons for foil production. 32/

In Bolivia, just as in Peru and Chile, there is no installed capacity for bauxite or alumina production, but it has an installed capacity of 4,000-6,000 tons for converting aluminium bars, which is totally idle.

As far as the Dominican Republic and Haiti are concerned, as already pointed out, they possess only an installed capacity for the production of bauxite. In the Dominican Republic the output of this mineral was begun in 1959 by ALCOA, which used to send its entire production to its alumina plant at Point Comfort. Production operations came to a standstill in 1982 and then started up again in 1987 through a local enterprise known as Ideal Dominicana.

29/ Production attained 141,344 tons in 1980, while in 1987 it was only 97,271 tons.

30/ Clarendon Alumina Production Ltd. (CAP), a State enterprise which owns 50 per cent of the ALCOA shares.

31/ The total semi-finished and finished capacity is estimated at approximately 13,000 tons, which would be 50 per cent utilized.

32/ The installed capacity for semi-finished and finished products is estimated at 15,000 tons, which would be 50 per cent utilized.

In Haiti bauxite production started in 1957 through the Reynolds plant, which exported its entire product to its alumina plant in the United States - Reynolds Corpus Christi in Texas. Operations came to a standstill in 1982 and the Government of Haiti is now negotiating with Reynolds on starting them up again.

4.2 Copper

4.2.1 Chile

On the basis of its enormous high-grade resources, this country has undergone considerable expansion of its production capacity, up to refined products, which has not been accompanied by a similar expansion in terms of semi-finished and finished product capacity.

Chile exports approximately 270,000 tons of copper in the form of concentrates since it does not have sufficient capacity to refine them. As far as semi-finished products are concerned, the capacity is approximately 110,000 tons, which breaks down into 20,000 tons of rolled products, 30,000 extruded products and 60,000 tons of cabling. This production capacity is concentrated mainly in three enterprises, of which MEDECO is the most significant. Semis production attained 50,000 tons, which means an installed capacity utilization factor of approximately 45 per cent. ^{33/}

4.2.2 Peru

Like Chile, Peru focuses its production efforts mainly on primary production operations. The copper industry in Peru exported around 46,000 tons of copper contained in concentrates on account of the imbalance with the refined production capacity.

As regards semi-finished capacity, it is reckoned that the country has an installed capacity of approximately 110,000 tons. Of this overall capacity, 30,000 tons relate to rolled products, the same capacity for extrusion and a production capacity for cabling and drawn products of 50,000 tons. It is estimated that the installed capacity is about 50 per cent utilized.

4.2.3 Other countries producing copper

In Venezuela and Argentina the production of primary copper is virtually non-existent. Venezuela imports all its metal in the form of cathodes and billets for the production of semis. Semi-finished production attains 21,000 tons, of which 60 per cent relates to electrical conductors. The output of rolled products represents 20 per cent and extruded products are in the same proportion.

Argentina imports 90 per cent raw material from Chile and 10 per cent from Peru for its production of semi-finished copper. The production capacity for semis attains approximately 90,000 tons, of which 30,000 are rolled products, 20,000 extruded and 40,000 drawn. The installed capacity is reckoned to be 70 per cent utilized.

^{33/} About 17,000 of the 50,000 tons produced are exported.

4.3 Nickel

4.3.1 Cuba

This country has an installed capacity of approximately 59,000 tons. ^{34/} The Perdro Sotto Alba plant has a capacity of 26,000 tons, the René Lamos La Tour plant 23,000 tons, and the Punta Gorda plant 10,000 tons, which is expected to reach 30,000 tons by the year 1990. ^{35/} Cuba is at present setting up pilot plants and small-scale plants for the output of high-grade semi-finished and finished products.

4.3.2 Other countries producing nickel

Mexico, as mentioned, does not produce primary nickel, but manufactures electroplated products and steels alloyed with nickel. Sixty-five per cent of the primary nickel is reckoned to be used for the output of the above products.

The Dominican Republic began producing nickel in 1971 through the Falconbridge Dominicana enterprise, which had a production capacity of 30,000 tons. ^{36/} Peak production was attained in 1987 ^{37/} after the serious decline experienced in 1982.

4.4 Tin

4.4.1 Bolivia

This country possesses an installed capacity of up to 30,000 tons of tin ^{38/} refined from concentrates and minerals. Utilization of the installed capacity is approximately 27 per cent. There are now projects for improving the economic yield by a steady reduction in installed capacity. It is reckoned that the capacity should be reduced to 7,000 tons per year.

All the refined tin produced is exported since Bolivia does not have a production capacity for manufacturing semi-finished and finished products.

4.4.2 Brazil

Brazil has a production capacity for minerals and concentrates of approximately 30,000 tons per year. The capacity for refined products is similar. All the exports take the form of metal since the export of concentrates is prohibited.

^{34/} Mining production in Cuba reached 38,000 tons in 1987, and refined products attained 20,000 tons (World Metal Statistics).

^{35/} Metals and Minerals Research Service Ltd., The Winning of Nickel, Joseph R. Boldt, Paul Queneau.

^{36/} The cost of the plant's mining and smelting facilities was approximately \$180 million.

^{37/} In 1987 the production attained was approximately 30,000 tons.

^{38/} This installed capacity relates to the Vinto refinery.

4.4.3 Other countries producing tin

Peru only produces tin concentrates and exports its production since it does not have any foundries for smelting them. It is planned to start up a foundry in 1989, which would have an installed capacity of 6,000 tons and would operate with Peruvian and Bolivian concentrates.

In Venezuela only exists recovery of tin from scrap for small-scale welding. In Argentina only exists concentrate production, which attains approximately 1,000 tons; the concentrates are exported since there are no foundries to process them.

5. Complementarity and investment

Before proposing some of the possibilities for complementarity and investment that have been identified, we will briefly describe some points which have been affecting the chances of bringing about greater co-operation in the region in non-ferrous metals.

As a first approximation to the problems of the complementarity of production in the region it has been possible to bring to light a set of elements which could help to reinforce regional co-operation in non-ferrous metals, but there have also been identified some points which could slow down the integration process.

When tackling the subject of production capacity for different output operations and countries, it was pointed out that for some minerals, metals and semi-finished products there was idle capacity and/or production imbalance that created objective conditions for promoting complementarity.

It was also mentioned that the production structure differed between certain countries in terms of the type of mineral, metal or grade of processing, which is also another objective condition favouring complementarity.

The structural aspects of the non-ferrous metal industry already mentioned are further strengthened by other features such as the rather unencouraging trend in the demand for these metals on the world market, together with the prices of them; also through initiatives in certain countries in the region to negotiate preferential commercial contracts and the establishment of novel forms of trade tending to minimize the use of currency. Equally, some producers are showing interest in undertaking joint ventures between firms in the region as well as conversion agreements (tolls). ^{39/}

To all the mentioned points that might promote complementarity within the non-ferrous metal industry, we have to add the objective and specific opportunities that other industries in the region may offer in supplying capital equipment and inputs. In the region, for example, Brazil has a production capacity for supplying the industry with machinery and equipment. Similarly, the region could create a production capacity for replacing imports of inputs using that industry, for example caustic soda and petroleum coke to mention some of the possibilities not yet explored.

^{39/} For greater detail on these points see the UNIDO documents presented at the meeting and also: "Situation and opportunities for mining co-operation in the Andean Group", prepared by the Board of the Cartagena Agreement.

Among the aspects tending to negatively affect the attempts at complementarity are, inter alia, the tendency to promote an outward development for the non-ferrous metals industry in order to acquire the necessary foreign currency to buy capital equipment, basically, and to cope with the problem of the debt. To this we should add the existence of financial systems and mechanisms that are not conducive to regional co-operation although efforts are being made to improve and strengthen it. ^{40/} There are also other constraints such as the lack of co-ordination in tariffs at the entire Latin American and Caribbean level, the lack of a permanent dialogue between the entrepreneurs in the region, and also obstacles of a political nature.

5.1 Possibilities for complementarity identified through improved use of the existing installed capacity and investment

On the basis of an analysis of commercial flow, structure and production capacity, future expansion programmes and the general situation in the countries studied, an initial identification has been made of possible complementarities and investments in the field of primary production, as well as for semi-finished products. In this initial effort the complementarities in the case of finished products appearing to be relevant have not been undertaken.

5.1.1 Some possibilities for complementarity detected, up to refined production

5.1.1.1 Aluminium

Venezuela is planning a vast programme to expand its production capacity. The firm CVG is intending a significant increase in the installed capacity of the Inter-Alumina refinery, which will reach an output of 2 million tons by the middle of or end of 1990. It is still being discussed whether to expand the production capacity for alumina to approximately 3 million tons or to import between 1 and 2 million tons. ^{41/}

What has been planned opens up various possibilities for complementarity and a detailed economic analysis will show which are most viable. One possibility would be to cover a possible deficit in Venezuela with alumina coming from Jamaica, ^{42/} payment for which could be made with oil, since that country imports all its oil. Another alternative would be to exchange Jamaican alumina by products refined in Venezuela in view of the objective constraints in Jamaica on the production, at acceptable cost, of refined commodities, since it depends to a large extent on imported oil. Interest in alumina contracts has already been shown by Jamaica Bauxite Mining (JBM) and Clarendon Alumina Production (CAP) in Jamaica, and by ALCASA and VENALUM in Venezuela.

Another possibility for complementarity in alumina production would be to supply alumina from the region to the firm Aluminios Argentinos (ALUAR), which currently imports 350,000 tons of alumina from Australia. This situation originated by the fact that when the plant was set up, the region could not

^{40/} For greater detail see the documents submitted by UNIDO to the meeting as well as the report: "Financing of the Mining Promotion Bank (Banca de Fomento a la Minería) in the Andean Group", Board of the Cartagena Agreement.

^{41/} MBM Aluminium Supplement, November 1988.

^{42/} Jamaica has supplied 900,000 tons of alumina to Venezuela under a long-term contract (1977-1986).

guarantee a supply of alumina, as a result of which ALUAR was led to sign a long-term agreement with Australia. The agreement will lapse in 1994, creating chances that either Brazil, on account of the progress which it will have made by that date, and/or Jamaica could provide it. To this we should add the fact that it would also be worth while exploring the possibility of complementarity between Mexico and Jamaica in the area of alumina. Jamaica would be able to provide alumina and Mexico could offer semi-finished and/or finished products. 43/

In the field of bauxite there are also possibilities for complementarity, such as to supply bauxite from Brazil and/or Guyana as well as from other Caribbean bauxite producers to Venezuela. Nevertheless, it should be pointed out that this country has already begun mining bauxite at the Pyiguaos deposit, which might in the future cover its needs.

Between the stage where Venezuela has its own domestic supply of bauxite and the stage where Brazil completes the expansion of production capacities for alumina and aluminium, Venezuela could be able to transform Brazil's bauxite surplus.

5.1.1.2 Copper

In the case of copper several possibilities for complementarity between Brazil, Peru and Chile have been identified.

In Brazil the Caraiba foundry, which requires approximately 450,000 tons of copper concentrate to operate, has domestic supply of only 120,000 tons, and has to import the rest from such countries as Canada, Africa, Peru and Chile. The plant has to pay for its imports with foreign currency, which it can save if agreements are concluded with Peru and/or Chile for supply of concentrate by the latter and acceptance of processed products as the payment. Those agreements could be facilitated by the fact that the plant has been recently sold and that the new administration could renegotiate the concentrate supply agreements.

Another possibility for complementarity that should also be explored is to utilize an idle capacity of approximately 70,000 tons at the Caraiba continuous casting plant. 44/ The idle capacity could be exploited by processing Peruvian and/or Chilean copper cathodes which could be placed on the Brazilian market or in other countries of the region, or else exported to extra-regional countries. This would make it possible for Peru and/or Chile to place products with greater added value on the market, or to process the cathodes at European or Asian plants.

5.1.1.3 Other metals

During the field studies made we identified possibilities for complementarity in the case of other metals that were not investigated as a first approximation to the problems of complementarity in the region. Among them we should mention the

43/ In 1974 a joint venture (JAVEMEX) was planned for an alumina refinery with a capacity of 600,000 tons in Jamaica in partnership with Mexico and also Venezuela. Likewise, it was proposed in the same year to put a refining plant in the Caribbean into effect (120,000 tons), using Jamaican and Guyanese alumina with energy from Trinidad and Tobago. These projects were discontinued because of economic difficulties in those countries at the end of the 1970s.

44/ The continuous casting plant has a production capacity greater than the refinery.

possibility of processing Peruvian, Bolivian and/or Argentine zinc concentrates at the Paraibuna metal refinery in Brazil. At the present time this refinery imports approximately 100,000 tons of zinc concentrates from Peru and outside the region, and has to pay for them in foreign currency. These concentrates could be supplied by Peru and the payment could be processed products which could be placed on the Brazilian market.

There is also a possibility of processing about 50,000 tons of Peruvian and/or Argentine lead concentrates at the Kasachipampa foundry in Bolivia, which are currently being exported to extra-regional markets. The Kasachipampa plant is completely ready but has never started up through lack of a supply of concentrates.

5.1.2 Semi-finished products. Better use of installed capacity and investment possibilities

5.1.2.1 Semi-finished aluminium products

It was shown in section 4 of this document that among the countries of the region studied some had significant idle capacities, other had a high use of its production capacity, while others had only recently entered the production sphere.

Mexico, Argentina and Venezuela have a sizeable idle capacity that should be utilized by analysing the various alternatives for complementarity within the region.

Among these countries some do not have any plans for expanding production capacities, as does, for example, Argentina, and they are concentrating more on making better use of their existing facilities; others do have expansion plans, for example, Venezuela.

Venezuela is planning an expansion of its rolled products capacity with a view to replacing imports of approximately 20,000 tons of material for manufacturing containers. It is also planned to duplicate the foil production capacity, making it 20,000 tons. There are also plans for expanding the installed capacity for castings, where in a relatively short period it is intended to reach a production figure of 1,000,000 items per year. The extrusion capacity will be expanded by 3,000 units. No expansion is foreseen in the installed capacity for cables. Venezuela is promoting several joint ventures in Central America and the Caribbean. ALCASA has a 60 per cent share in the social capital of the rolling mill belonging to ALUNASA in Costa Rica. It also intends to explore the possibility of joint ventures for semi-finished products in the Dominican Republic and Jamaica.

Brazil, as pointed out, has at the present time a limited idle capacity, which has led to the planning of projects to overcome the most important bottlenecks. The ALCAN plant in Brazil is installing a hot rolling mill to replace imported material for making containers. The production capacity of this plant is approximately 30,000 tons a year. The new plant, together with future expansions in cold rolling, will enable ALCAN to turn out about 140,000 tons of rolled sheets and strips. In its long-term plans ALCAN intends to install a new rolling mill with a capacity of 500,000-600,000 tons per year. Furthermore, ALCOA will step up its production capacity for rolled products by 20,000 tons. CBA is planning to install a hot rolling mill for the capacity of 12,000-13,000 tons a year. ^{45/}

^{45/} The rolling capacity in Brazil will reach 300,000 tons a year between 1992 and 1993.

For foils an expansion of capacity by 20,000 tons is planned. 46/ In the area of extruded products an additional capacity of 7,000 tons is in view. 47/

According to available information, Chile has no plans for expanding its semi-finished production capacity. Peru has a project for expanding the installed capacity for extruded products by 2,000 tons at the METINSA plant. As pointed out in section 4.1.5, Jamaica is also planning to expand its semi-finished product installed capacity.

To make better use of financial resources and currency in the region it is important to analyse in detail all these plans and projects for expansion within the context of improved use of existing idle capacities, and avoidance of expansion programmes which lead to duplication in the countries, since such would generate inadequate use of region's scarce resources. 48/

Having stated this, we will describe some of the opportunities for investment identified that could help to create a more coherent productive system in the region. Below we give the most important of them:

(a) Press forging plant

The purpose of this plant will be to produce forgings. Forgings are used abundantly in the machine and equipment industry and in the car industry. The plant should have a production capacity of around 3,000,000 units a year, which will require an investment of \$5,500,000.

(b) Powder-pigment plant

This plant would be designed to produce around 2,000 tons of aluminium pigments and metal powders for use in the pharmaceutical and chemical industry. The plant could operate with scrap coming from the production of foil and the investment is estimated at \$3,000,000.

(c) Small foil-producing plant

This facility of 2,000 or 3,000 units of production each year would serve to alleviate the problems of raw materials for the container industry of Peru, for example. The remainder of the output could be exported to other countries in the region, particularly to Bolivia and Colombia.

46/ The expanded capacity will relate to the firms CBA and ALCAN.

47/ These expansions will be made by CBA (5,000 tons) and ALCOA (2,000 tons).

48/ When the studies for this meeting were being made some enterprises indicated their interest in promoting closer regional co-operation in semi-finished aluminium products. Among these one should mention the Mexico Aluminium Group, JBM, BATCO and CAP in Jamaica, and ALCASA and VENTALUM in Venezuela.

5.1.2.2 Semi-finished copper products

In the semi-finished copper production there are countries like Argentina and Brazil which have an idle capacity of some size and which for the moment have no expansion plans. Instead, their efforts are geared to making more rational use of their existing installed capacities. As far as Chile and Peru are concerned, several projects for expanding existing installed capacity were identified. In Chile, the firm MADECO has it in mind to make new investments in the production of Cu-Ni alloys and courage strips. Similarly, this enterprise is planning to put a new billet plant into production, jointly with COCESA and COVISA. Likewise, COPLASA is expanding its production capacity in billets by 30,000 tons a year. Colada Continúa Chilena S.A. plans to acquire an additional production capacity of 40,000 to 50,000 tons of billets in 1989.

As one of the joint ventures outside the region which Chile is engaged in, the firms CODELCO and MADECO have set up the Beijing Tubing Company jointly with the People's Republic of China, to be located in the latter country and designed to produce 10,000 tons a year of copper tubing.

Peru had planned to expand some of the installed capacity for semi-finished copper products, but implementation of the project has been postponed on account of the financial constraints affecting the country. Among the identified projects for increased installed capacity is a rolled products project by the company COBRES LAMINADOS for 3,500 tons per year, and one by the company METINSA for expansion of its extruded and rolled product facilities by 10,000 tons a year.

Within this context there should be analysis of possibilities of complementarity so as to make better use of Brazil's and Argentina's idle installed capacity, for example by supplying primary copper from Peru and/or Chile. Similarly, one should look into possibilities for improving and stepping up production of bars, shapes, tubing and piping in the region.

In Chile there came to light the contrast between the high technological level of primary copper production and the level of technology used for the production of semi-finished products, especially as regards drawn products. It would be worth while examining the viability of using the alternative technology of continuous casting in place of hot rolling which is being employed. 49/

In Peru it would be advisable to study the feasibility of replacing the present process of making wire from billets by the continuous production process. It would also be advisable in Peru to introduce the output of special copper-nickel alloys that are being used in the advanced sectors, such as electronics.

5.1.2.3 Other possibilities for complementarity and investment

Within the context of conceiving the complementarity of non-ferrous metals in the region as part of a continuous and ever-expanding process, we can point out other possibilities for complementarity and investment. Among these new factors one should bear in mind other activities related to non-ferrous production activity, so as to see this industry against the background of an entire production subsystem, rising above the commercial or technical category of a branch.

49/ Drawn products should be supplemented by Cu-Ni alloy products and special alloys for the electronics industry.

Below we suggest some of the possibilities for complementarity and investment which require study:

(a) More detailed examination in future studies of the possibilities for complementarity for nickel, above all in the area of semi-finished and finished products. Such production could be developed at small-scale plants that do not require high investments, but which manufacture high-value products.

(b) Study of possibilities for complementarity and investment in the field of finished copper and aluminium products, an aspect which, as pointed out, has not been gone into in the documents submitted to this meeting. It would be advisable in such a study to place special emphasis on the finished products linked with the priority capital equipment industries in the region. Such studies could generate completely new dynamics in the output of semi-finished products.

(c) Examination of the possibilities for encouraging the production, in a co-ordinated manner, of the non-traditional, non-ferrous products in the region, such as those associated with the development of the advanced sector, for instance, electronics.

(d) Study of the possibilities for complementarity and investment in the field of machinery and equipment for non-ferrous production. The region has at the present time the production capacity and the technical know-how needed to step up the use of machinery and equipment in the region.

(e) Examination of the possibilities for replacing imports of the inputs used by the non-ferrous metals industry in the region. In the studies presented at this meeting we have identified possibilities for replacing caustic soda and petroleum coke imports, which are two important inputs used in the aluminium industry.

The alumina industry of the region consumes approximately 600,000 tons of caustic soda. At the present time the region depends largely on imports. ^{50/} Only Venezuela has plans to step up the production capacity for caustic soda by 134,000 tons by the year 1991, which means that the region will continue to depend to a large extent on extra-regional imports.

Regarding petroleum coke, which is the principal input for making carbon anodes for the manufacture of aluminium, among other things, it is being imported likewise to a large extent from outside the region. At present we only have information on one project for producing this input in the region, namely ALCASA in Venezuela is planning a plant with a capacity of 140,000 tons. In Venezuela alone it is calculated that the consumption of this input will exceed 400,000 tons if the expansion plans foreseen are put into effect, leaving a broad margin for other investments for making this input in the region.

(f) The region should strengthen co-operation among the different research centres and between the latter and industry so as to make use of the extensive experience accumulated in non-ferrous metal production. The region should also promote greater co-ordination between the entrepreneurs of different countries. Similarly, the region should co-ordinate efforts to improve the financial mechanisms and the tariff and non-tariff arrangements helping to foster a coherent development of this industry.

^{50/} Venezuela (45,000 tons) and Brazil are the main producers.

6. Final considerations

In the light of what is discussed in this document and other documents presented and the proposals that will be made by participants during their accounts, we consider it would be worth while focusing the interventions and the conclusions and recommendations of this meeting on a set of points that we describe in detail below; this does not in any way rule out the incorporation of other topics that may be considered of relevance in promoting specific activities for the consistent development of this sector in the region.

Among the issues to discuss are the following:

(a) Impact of the development strategies implemented in the region. First and foremost, the strategy geared to extra-regional exports. ^{51/} Possibilities for progressively focusing the dynamics of this industry on the region.

(b) Review of possibilities for complementarity and investment and ways of effectively implementing them.

(c) Mechanisms for strengthening co-operation in technological innovation and information.

(d) Ways and means of financing and trade aimed at strengthening the process of regional co-operation.

With the aim of putting all this effort in the field of complementarity of production in the region into practice, the participants will be able to use the time allotted for informal contacts by which to promote specific partnerships agreements. It will be very useful if we could be kept informed of the agreements reached during the informal meetings so as to analyse UNIDO's possibilities for providing technical assistance.

^{51/} In its various forms the strategy based on exports to the world market has not always brought positive results from the economic and financial standpoint. In certain instances this fact has not depended on the degree of transformation of the exported products. Better processing does not necessarily guarantee improvement in the foreign currency balance, despite the higher unit price that might be obtained for the export product. This is due to the need in many cases for more intermediate imports and the need to incur debts at significant levels in order to create the new production capacity. For greater detail see Pierre-Nöel Giraud "Geopolitics of mining resources", *Economica*, Paris, 1983.