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**Natural Resources and  
International Business:  
the role of foreign  
direct investment in  
Brazilian mining**

**Flavio E. Novaes Hegenberg**

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**Natural resources and  
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*I dedicate this book in memory of Iris  
Vivienne Roberts (1934-2003)*

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# Table of Contents

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<b>Resumo</b> .....	<b>6</b>
<b>Abstract</b> .....	<b>7</b>
<b>1. Introduction</b> .....	<b>9</b>
<b>2. Introducing foreign investment matters</b> .....	<b>12</b>
<b>3. The scale of FDI in the Brazilian mining sector</b> .....	<b>23</b>
3.1 First considerations .....	23
3.2 Trade performance .....	37
3.3 Technological performance .....	40
<b>4. The reasons for shifts in the pattern of FDI over the past twenty years</b> .....	<b>44</b>
4.1 First considerations .....	41
4.2 Government policy .....	47
4.3 The case of aluminium .....	57
4.4 The gold sub-sector .....	58
4.5 Iron & steel sub-sectors .....	60
4.6 FDI and the energy sector .....	64
4.7 Closing remarks .....	66
<b>5. The contribution of shifts in FDI to the sector's development</b> .....	<b>68</b>
5.1 Opening remarks .....	68
5.2 Iron-ore and transportation and logistics technology .....	68
5.3 Bauxite-alumina-aluminium and energy use and process technology .....	70
5.4 Gold and advanced metallurgical processing technologies .....	74
5.5 The metallurgy of aluminium and steel for cans .....	76
5.6 Issues of capital goods imports .....	79
5.7 Indigenous technological development .....	80
5.8 Export performance .....	83
5.9 FDI opportunities and possibilities in Brazilian mining .....	85
<b>6. Concluding remarks</b> .....	<b>89</b>
<b>Bibliography</b> .....	<b>95</b>
<b>Appendices</b>	
1. Brief history of mining	
2. Glossary of terms and expressions	
3. Acronyms and abbreviations	
<b>Acknowledgements</b>	

## Resumo

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Este trabalho trata de algumas das principais questões relativas ao papel que o investimento estrangeiro direto desempenhou na mineração brasileira nos últimos 20 anos. O texto sugere que a investigação das características e determinantes dos investimentos estrangeiros no Brasil, juntamente com um maior conhecimento da política nacional voltada para o setor mineral, representa um dos principais caminhos na direção de um maior entendimento das potencialidades do setor. Conclui também que a adoção de práticas de desenvolvimento sustentável e a promoção de inovações tecnológicas nacionais possam evitar o antigo “modelo de enclave” de desenvolvimento mineral.

**Palavras-chave:** Indústria Mineral, Brasil, Investimento Estrangeiro Direto, Desenvolvimento Sustentável, Geografia Industrial.



## Abstract

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This book tackles some of the main issues concerning the role of foreign direct investment in Brazilian mining during the past two decades. It suggests, among other things, that competition from other countries is reducing Brazilian attractiveness as an investment location. The investigation of the characteristics and determinants of foreign investment in Brazil, together with greater knowledge of the framework for mining laid down by the government, represents the main line of action in order to enhance Brazilian mining sector attractiveness. In the conclusion it is suggested that one interesting way to attract more investment into domestic mining is to comply with Sustainable Development practices and to promote industrial upgrading together with greater and more positive social impacts, avoiding the old-fashioned “enclave model” of mining development.

**Key words:** Mining Industry, Brazil, Foreign Direct Investment, Sustainable Development, International Business, Development Studies, Industrial Geography.

# 1. Introduction

This text concentrates its discussion on the following research question: 'what is the role of foreign direct investment (FDI) in Brazilian mining?'. This will be tackled by developing an understanding of some basic issues such as: the scale of the FDI in the Brazilian mining sector; the reasons for shifts in the pattern of FDI over the past twenty years; the contribution of shifts in FDI for mining development; FDI flows and mining's trade and technological performance. These issues will be dealt with individually and will also be analysed within the scope of other (inter)related aspects listed in the following sections. Their interconnections enhance an understanding of the role and importance of foreign direct investment for Brazilian mining. These issues are discussed in order to better understand how, by fostering FDI, there will be (or not) economic growth and greater welfare for Brazil.

The concept of FDI used here is of "conventional FDI", *i.e.* not including debt-equity conversions, loans (money, commercial papers, bonds), or other forms of credit inflows through contracts for the supply of technology and equipment or the result of joint-venture agreements built on other contractual bases, or portfolio operations, or also due to exchange mechanisms, or re-investments, or stock exchange investments, or financing for imports. FDI here is viewed as only one type of investment. Other investment types (in addition to those already mentioned above) also include privatisation. FDI is, as the name implies, a 'direct investment' (and must not be viewed as an 'indirect investment').

This text examines some of the main characteristics of foreign investment in mining and, to some extent, in Brazil as a whole. It suggests, among other issues, that competition from other 'newly liberalised economies' may have (or in fact still are) reduced (reducing) Brazil's attractiveness as an investment location. Apart from that, we should also remember that FDI must be viewed as one type (among numerous others) of foreign investment. This distinction is also clear when undertaking studies regarding the consequences of privatisation (which is not the

scope of this book). The diversity of the foreign investment phenomena (and its typologies) will be better clarified in the remaining sections of this text when the importance of New Forms of Investment (NFI), of loans, of finance for the importation of equipment (or other needed products, technologies, services or resources), will be examined.

This text attempts to investigate some of the characteristics and determinants of foreign investment in Brazilian mining during the period between 1978 and 1998. Although the country's mining industry is an old and established economic activity, Brazil is not described as being a 'mining economy'<sup>1</sup>. Brazil is usually described as being an 'industrial economy'. However, it is recognised that a large part of its industry is based on the exploitation of natural resources. Of the natural resources, agribusiness is the most important in terms of its economic presence, but mining and its related activities (such as metallurgy and heavy-metallurgy<sup>2</sup>, chemicals and petrochemicals) are also arguably very important for the national economy.

Brazil has traditionally ranked high in FDI flows to developing countries, for example: 5th in 1994 (US\$ 3 billion), 4th in 1995 (US\$ 4.8 b), 2nd in 1996 (US\$ 9.5 b). In 1996 the Brazilian economy absorbed around 2.7% of total world direct investment. This corresponds to about half its share in total world direct investment flows observed in the early 1970s but around three times as much as its share in the late 1980s (see **Table 1**). However, our main concern in this chapter is to better understand the importance of FDI in mining and to answer basic questions such as: "Do increased FDI flows have a positive impact on the

<sup>1</sup> Auty (1995: 183, 184) writes that "The mineral economies are defined by Nankani (1979) as those developing countries which generate at least 40 per cent of their export and 10 per cent of their GDP from minerals". This author also indicates that there are two main types of mineral economies, i.e., the "oil exporters" (e.g. Ecuador and Venezuela), and the "ore exporters" (e.g. Bolivia, Chile and Peru).

<sup>2</sup> 'Metallurgy' (= "metalurgia" in Portuguese language); 'Heavy-metallurgy' (= "siderurgia"). Metallurgy is related to the industrialisation of metal products; heavy-metallurgy is related to the production of the metal itself (smelting; production of metal which will be used in the industrialisation of metal products).

sector's trade and technological performance?" and "Was there a renewed wave of FDI for mining in Brazil in the 1990s?"

To link issues of foreign investment and mining in Brazil we have to consider the following range of inter-related issues: (1) the general role of FDI in Less Developed Countries (LDCs), (2) the general role of FDI in mining, (3) the impacts that FDI has generated over trade, and (4) the impacts of FDI over technology. The discussion of these issues will then allow us to form specific hypotheses for examination.

**Table 1: Total World FDI and Brazil's Share, 1970-1996**

<b>Period</b>	<b>Brazil / Total World FDI ( % )</b>	<b>Total World FDI (US\$ billion)</b>
1970 - 1975	5.09	19.85
1976 - 1980	6.29	43.26
1981 - 1985	4.38	47.98
1986 - 1990	1.20	169.66
1991 - 1995	1.32	245.70
1996	2.72	346.80

Source: UNCTAD, *World Investment Report* [US\$ 1995 constant values].

## 2. Introducing foreign investment matters

Empirical research on the determinants of foreign investment, in most cases, lacks a strong theoretical background (Schneider & Frey, 1985; Lucas, 1993). The generally poor quality of the data, and especially the diversity of the foreign investment phenomenon are certainly among the main reasons for this deficiency. The problem is that most studies are too exploratory and they do not take, as they probably should, an 'a priori' account of the fact that "the significance of the variables influencing the *where* to produce vary with the type of FDI and the stage of development of both the investing [home] and recipient [host] countries" (Dunning, 1993b: 143; Buckley & Castro, 1998). With respect to the diversity of foreign funds in Brazil, that includes money loans, FDI, imports financing and others, see **Table 2**.

**Table 2: Gross inflow of foreign funds into Brazil and their typology (US\$ million)**

Type of investment	Year to Dec. 1995	Year to Dec. 1996	Year to Dec. 1997
Money loans	15,883	28,079	35,535
-Commercial papers	377	633	451
-Bonds	9,709	18,039	20,448
Investments	28,010	35,152	56,719
-Direct (FDI)	3,285	9,580	17,864
-Stock exchange	22,559	24,684	37,190
Imports financing	4,576	6,828	24,191
Other	5,168	8,752	12,539
Total	53,516	78,999	128,984

Source: *Banco Central do Brasil-BACEN* [US\$ 1995 constant values].

In the specific case of Brazil, for the understanding of recent activities in the foreign investment determinants, we have to point out that the mining sector was affected by the 1988 Constitutional regulations that resulted in negative consequences to the sector in respect of its investment levels and investment perspectives. This was because there was no stimulus for foreign capital to promote businesses in Brazilian mining, mainly during the 1988-95 period (the attractiveness of the country was then well behind other Latin American counterparts). As a result of the general lack of interest of foreign investors to develop mining projects in Brazil after 1988, the government ended by introducing

Constitutional changes in 1995 and after (returning to the more liberal system that prevailed between 1964 and 1987). This was supposed to once again bring back and restore some of the attention that Brazil wanted to have among the community of Less Developed Countries (LDCs).

The patterns of foreign investment are specific according to the country and the industry under consideration. In Brazil, for example, the auto-industry behaves strongly according to the 'internalisation' mode. This is the case as the main enterprises controlling car sales in Brazil decided (stimulated, of course, by Import Substitution Industrialisation (ISI) policies promoted by the Brazilian Government) that it was better to open subsidiaries ('*internalising* trade' within the firm) - as is the case with Volkswagen, Fiat, General Motors and Ford (to cite the most important names). As regards the mining and metallurgical industries, it appears that the case for moving into Brazil was more the result of forces to exploit and defend oligopolistic and ownership advantages in foreign markets. This came about as a consequence of businesses: (1) undertaking verticalisation (as was the case with the steel and aluminium industries), (2) promoting long-term supply contracts for raw materials (as with Japanese investment in the iron-ore sector<sup>3</sup>), (3) exploiting and protecting proprietary technologies<sup>4</sup>.

The discussions about foreign investment in Brazil lead us to consider some related issues such as 'portfolio investment'. This is relevant to an understanding of some of the most important characteristics of foreign investment in Brazil. This is also particularly pertinent for discussions concentrating on the period

<sup>3</sup> For a brief idea of this issue see Kenji Takeuchi (1990).

<sup>4</sup> As in the case of several equipment producers established in Brazil, e.g. ABB (a Swedish-Swiss enterprise), ATLAS COPCO, SVEDALA, and VOLVO (from Sweden), CASE and CATERPILLAR (from USA), LIEBHERR and SIEMENS (from Germany).

since the beginning of the 1990s when note was taken of a situation of “increasing portfolio diversification by foreign firms and institutional investors” (Baumann, 1998: 2). With regard to Portfolio Investment Flows (PIF), “the opening up of the [Brazilian] economy to international capital flows had a turning-point in 1991 [as the result of the policy changes of that year], represented basically by Annex IV to Resolution 1289/87 which allowed foreign investors to operate in domestic stock exchanges, coupled to larger facilities to attract foreign resources via bonuses, notes and other means<sup>5</sup> ...” (Baumann *op cit*, p. 7).

**Tables 3, 4, 5 and 6** provides evidence of how much change the main sectors of the Brazilian economy underwent during the 1990s, and the extent to which they are controlled by national private capital, foreign capital, and Brazilian State capital - which provide data for debate concerning where international capital is being invested (assets), and the proportion of these investments as compared to local capital (private and State), *i.e.* the “tri-pé” (tripod)<sup>6</sup> by sector in Brazil. In some sectors - [such as transport equipment and auto-industry, metal products, machinery and electrical and electronic goods, Information Technology (IT), pharmaceuticals] - Multinational Enterprises (MNEs) play a *leading role*, determining most of the value-added and taking the decisions regarding investment, whereas in other sectors - [such as food and beverages and commodities] - MNEs play a *supporting role*, often operating in association with local firms. One important feature for understanding business arrangements in Brazil is to contemplate how far the economy is controlled by each of the members of the “tri-pé” (tripod).

<sup>5</sup> The first bond issuances were made by large State-owned firms, such as PETROBRAS, CVRD and BNDES. In 1991 they corresponded to 56% of total issuances authorised by the Central Bank. By 1993 that share had already been reduced to 19%.

<sup>6</sup> For information on the “tri-pé” or the “triple alliance” see Evans (1979; 1982; 1983); and Evans *et al* (1985).

**Table 3: The "tri-pé" by sector in Brazil, 1993 (\*)**

SECTORS	National	Foreign	State
<b>National Predominance</b>			
1 Agro-industry (including animal raising)	100	0	0
2 Commerce, retailer (= "varejista")	100	0	0
3 Building and civil construction	100	0	0
4 Heavy building ("construção pesada")	100	0	0
5 Vehicle distribution	100	0	0
6 Clothes manufacturing ("confeccões")	94	6	0
7 Heavy-metallurgy ("siderurgia")	94	6	0
8 Fertilisers	91	9	0
9 Wood and furniture	90	10	0
10 Textile	90	10	0
11 Commerce, wholesale (= "atacadista")	81	19	0
12 Paper and cellulose	81	19	0
13 Supermarkets	75	25	0
14 Hotels	74	26	0
15 Transport services	73	1	26
16 Electro-electronics	67	33	0
17 Non-metallic minerals	67	33	0
18 Food	63	37	0
19 Transport materials	49	44	7
20 Metallurgy	49	44	7
<b>Foreign Predominance</b>			
1 Auto-industry & parts	6	94	0
2 Hygiene, sanitary and cleaning products	10	90	0
3 Pharmaceuticals	23	77	0
4 I.T. ("informática")	32	67	1
5 Plastics and rubbers	41	59	0
6 Beverage and tobacco	45	55	0
7 Machines and equipments	44	56	0
8 Oil distribution	23	45	32
<b>State Predominance</b>			
1 Public services and utilities	0	0	100
2 Chemicals and petrochemicals	23	11	66
3 Mining	31	6	63

Source: *Exame* ("Melhores e Maiores"), August 1994: 46. (\*): The participation (%) of state-owned enterprises (or the State), foreign, and national private capital in the main sectors of the Brazilian economy; considering the sales of the 20 largest corporations in each of the 31 listed sectors.



**Table 4: The “tri-pé” by sector in Brazil, 1995 (\*)**

SECTORS	National	Foreign	State
<b>National Predominance</b>			
1 Building and civil construction	100	0	0
2 Clothes manufacturing (“confecções”)	92	8	0
3 Textile	88	12	0
4 Commerce, retailer (“varejista”)	82	18	0
5 Paper and cellulose	81	16	3
6 Metallurgy [1]	75	21	4
7 Transport services	75	2	23
8 Commerce, wholesale (“atacadista”)	75	25	0
9 Construction material	69	31	0
10 Mechanical sector	56	44	0
11 Electro-electronics	55	45	0
12 Beverages and tobacco	51	49	0
13 Plastics and rubber	51	49	0
14 Food	50	50	0
<b>Foreign Predominance</b>			
1 Auto-industry and parts	7	93	0
2 Hygiene, sanitary and cleaning products	11	89	0
3 I.T. (“informática”)	20	78	2
4 Pharmaceuticals	37	63	0
<b>State Predominance</b>			
1 Electricity	2	0	98
2 Telecommunications	3	0	97
3 Chemical and petrochemical	14	22	64
4 Mining	34	7	59

Source: *Exame* (“Melhores e Maiores”), August 1996: 45.

(\*): The participation (%) of state-owned enterprises (or the State), foreign, and national private capital in the main sectors of the Brazilian economy; considering the sales of the 20 largest corporations in each of the 22 listed sectors.

[1]: Includes metallurgy (“metalurgia”) and heavy-metallurgy (“siderurgia”).

**Table 5: The “tri-pé” by sector in Brazil, 1995-1996 (\*)**

<b>SECTORS</b>		<b>National 1995 ; 1996</b>	<b>Foreign 1995 ; 1996</b>	<b>State 1995 ; 1996</b>
<b>National Predominance</b>				
1	Building and civil construction	100 ; 100	0 ; 0	0 ; 0
2	Transport services	75 ; 96	2 ; 4	23 ; 0
3	Clothing (“confeccões”)	92 ; 92	8 ; 8	0 ; 0
4	Mining [1]	34 ; 86	7 ; 7	59 ; 7
5	Textile	88 ; 85	12 ; 15	0 ; 0
6	Paper and cellulose	81 ; 84	16 ; 16	3 ; 0
7	Commerce, wholesale [2]	75 ; 79	25 ; 21	0 ; 0
8	Commerce, retailer [3]	82 ; 77	18 ; 23	0 ; 0
9	Construction material	69 ; 71	31 ; 29	0 ; 0
10	Metallurgy [4]	75 ; 70	21 ; 26	4 ; 4
11	Electro-electronics	55 ; 60	45 ; 40	0 ; 0
12	Mechanical sector	56 ; 55	44 ; 45	0 ; 0
13	Beverages and tobacco	51 ; 52	49 ; 48	0 ; 0
<b>Foreign Predominance</b>				
1	Auto-industry and parts	7 ; 2	93 ; 98	0 ; 0
2	Hygiene, cleaning, sanitary	11 ; 13	89 ; 87	0 ; 0
3	I.T. (“informática”)	20 ; 22	78 ; 76	2 ; 2
4	Pharmaceuticals	37 ; 27	63 ; 73	0 ; 0
5	Plastics and rubber	51 ; 49	49 ; 51	0 ; 0
6	Food	50 ; 44	50 ; 56	0 ; 0
<b>State Predominance</b>				
1	Public services	0 ; 0	0 ; 5	100 ; 95
2	Chemical and petrochemical	14 ; 16	22 ; 17	64 ; 67

Source: *Exame* (“Melhores e Maiores”), July 1997: 11.

(\*): The participation (%) of state-owned enterprises (or the State), foreign, and national private capital in the main sectors of the Brazilian economy; considering the sales of the 20 largest corporations in each of the 21 listed sectors.

[1]: Already considering the privatisation of CVRD; [2]: “Atacadista”;

[3]: “Varejista”;

[4]: Includes metallurgy (“metalurgia”) and heavy-metallurgy (“siderurgia”).

By studying **Table 6** we see that the Brazilian State today does not take an active role in many sectors of the economy, such as building and civil construction (and construction materials), transport services, beverages, textiles, paper and cellulose, metallurgy, retailer commerce, auto-industry, hygiene (and cleaning & cosmetics) products, electro-electronic, pharmaceutical, mechanical industries, plastics and rubbers, food,

and also two important sectors that until recently were state owned - mining and telecommunications. The Brazilian state today holds significant stakes only in two areas, public services and chemicals & petrochemicals, and some relevant interests in two other sectors: computer technologies (Information Technology) and foreign commerce.

**Table 6: The “tri-pé” by sector in Brazil, 1997-1998 (\*)**

SECTORS	National 1997;1998	Foreign 1997;1998	State 1997;1998
<b>National Predominance</b>			
1 Building and civil construction	97 ; 96	3 ; 4	0 ; 0
2 Transport services	96 ; 96	2 ; 4	2 ; 0
3 Beverages	85 ; 85	15 ; 15	0 ; 0
4 Clothing and textiles	87 ; 84	13 ; 16	0 ; 0
5 Mining	85 ; 83	12 ; 15	3 ; 2
6 Paper and cellulose	82 ; 82	18 ; 18	0 ; 0
7 Services	0 ; 78	0 ; 9	0 ; 13
8 Metallurgy [1]	76 ; 72	24 ; 28	0 ; 0
9 Construction material	71 ; 66	29 ; 34	0 ; 0
10 Commerce, retailer (“varejista”)	74 ; 62	25 ; 37	1 ; 1
11 Commerce, wholesale [2]	47 ; 46	34 ; 35	19 ; 19
<b>Foreign Predominance</b>			
1 Auto-industry and parts	5 ; 7	95 ; 93	0 ; 0
2 Hygiene, cleaning and sanitary	13 ; 11	87 ; 89	0 ; 0
3 Electro-electronics	52 ; 21	48 ; 79	0 ; 0
4 Telecommunications	2 ; 24	0 ; 75	98 ; 1
5 Pharmaceuticals	21 ; 25	79 ; 75	0 ; 0
6 Mechanical sector	55 ; 27	45 ; 73	0 ; 0
7 I.T. & computers (“informática”)	17 ; 19	81 ; 67	2 ; 14
8 Plastics and rubber	38 ; 37	62 ; 63	0 ; 0
9 Food	43 ; 44	57 ; 56	0 ; 0
<b>State Predominance</b>			
1 Public services	10 ; 21	7 ; 14	83 ; 65
2 Chemicals and petrochemicals	22 ; 20	22 ; 25	56 ; 55

Source: *Exame* (“Melhores e Maiores”), June 1999: 11. (\*): Participation (in %) of the sales of the state, foreign and private national enterprises in the total sales of the largest enterprises within each of the listed sectors. [1]: Includes metallurgy and heavy-metallurgy; [2]: Includes wholesale (“atacadista”) and foreign commerce.

The importance of foreign participation is greater today in Brazil in a range of sectors. "Since 1995 growth in the participation of foreign enterprises and foreign players in the list of the 550 largest companies registered in Brazil (including private and state companies) has been observed: from 170 foreign companies in 1997 growing to 209 in 1998. Foreign participation today represents 42% of the largest companies in Brazil, the greatest participation level in all of the 26 years of the "Melhores & Maiores" (*Exame*) records. To this numeric participation growth corresponds an even more impressive growth of the share in total sales of the largest 550 registered enterprises - foreign enterprises were responsible for 43.5% of sales in 1998, exceeding the 1975 historic record of 41.8%" (*Exame*, June 1999, p. 13-4).

The sectors with large (dominant) stakes under foreign control today in Brazil are the auto-industry, hygiene products, pharmaceutical, information technology, plastics and rubbers, food, and very importantly in recent years, electro-electronics, telecommunications, and mechanical industries. These last three sectors are probably about to influence very decisively the growth of foreign participation in other sectors with (still) minority foreign control such as metallurgy, commerce, textiles, beverages, building & construction materials, chemicals, and also mining. For a better understanding of future scenarios for foreign participation in the Brazilian market an understanding of 'how' and 'why' foreign investment takes place are needed.

Considerations of how and why external investment happens, and one of its main agents - the multinationals<sup>7</sup> - must now be cited. Schoenberger (1989: 91) writes: "The study of multinational corporations came of age during the period of US dominance of an expanding global economy. In this context, explanations of the determinants of foreign direct investment - why firms invest abroad - focused to a great extent on questions of market power. Firms moved abroad to exploit (or defend) their oligopolistic or 'ownership' advantages in foreign markets,

<sup>7</sup> In this text we will use the terms Multinational Enterprises (MNEs), Multinational Corporations (MNCs) and Transnational Corporations (TNCs) interchangeably, with the same meaning.

including proprietary technology, greater resources and product differentiation (Caves, 1971, 1974, 1982; Dunning, 1971, 1974, 1981; Hymer, 1976; Kindleberger, 1970; Kindleberger and Audretsch, 1983; Vernon, 1966, 1974). Alternatively, it was argued that firms invest abroad to maximise efficiency by internalising trade within the firms (Buckley and Casson, 1976; Teece, 1981). Both lines of analysis implicitly suggest that direct investment will be oriented principally to major market areas, hence, in all likelihood, other developed countries”.

Dunning (1993b: 54-7) describes some of the reasons prompting firms to undertake FDI, and distinguishes between four main types of production financed by such investment activities: (1) natural resource seekers, (2) market seekers, (3) efficiency seekers, and (4) strategic asset or capability seekers. This same author (*op cit*, p. 142) also lists other related motives for FDI: growth of markets; the protection of a global competitive position (in the case of FDI in oligopolistic sectors); the availability of indigenous resources and capabilities; the avoidance of cross-border transportation and other transfer costs; the sustaining or advancing of a firm’s competitive position; the acquisition of technology and markets; and also, as one of the steps towards globalisation of business.

The development model used by Brazil in past years, mainly since 1990-1991, has been one that is trying to create greater international exposure and one where opening the economy was one of the main priorities. However, this is now showing serious structural limitations. The overall growth of the national economy has recently displayed signs of decline (with the R\$ crisis of 1998-99)<sup>8</sup> as exposure to international markets has steadily grown, and private investment has not (at least yet) brought all the benefits that were expected and predicted by most of those favourable to liberalisation and more liberal policies. Private investment is showing signs of weakness and this is reflected in national and international bourses (with stock exchange fluctuations and instability). A greater understanding of ‘how’

<sup>8</sup> R\$: Real (Brazilian currency). ‘Real’ (singular); plural = ‘Reais’.

and 'why' external investment takes place will provide the basis for furthering our discussions.

The idea of the "triad" composed of the USA, the European Union, and Japan as the main markets for business activities and which invest and absorb the greater portion of international foreign investment is now more evident. Although this is really what happens - most investment in the world is originated by and directed to the members of the *triad*<sup>9</sup> or to 'First World' countries - there is still some space for "emerging economies" to obtain a share of this available external capital. In Latin America, countries such as Argentina, Brazil and Mexico were relatively important in absorbing foreign investment, particularly during the last decade or so. In the specific case of Brazil it may be argued that the interests of external capital were directed according to the two main reasons already described above: (1) to exploit and/or defend oligopolistic or ownership advantages (including proprietary technology and its related matters such as brand name, use of equipment, etc.), and (2) to maximise efficiency by internalising trade within the firm.

The general role of FDI in LDCs is to promote and/or own or control productive ventures in LDCs (through MNEs operations and business links) that bring economic rewards for the investors, i.e. by unlocking opportunities in the international and domestic markets (export-import<sup>10</sup>). As a consequence of this, business links between LDCs and the international economy are promoted (e.g. by access to capital resources and international capital movements). FDI will be placed in LDCs if there is some type of advantage to be exploited in these countries. For example, if there are (1) country-specific or locational advantages (e.g. such as iron-ore in Brazil), (2) industry- or market-specific advantages (e.g. the importance of the Brazilian metallurgical industry for

<sup>9</sup> UN (1992) describes the dominant position of the developed countries as both sources of, and recipients of, FDI (and the special position of the 'Triad'). See also K. Ohmae, 1985a, 1985b.

<sup>10</sup> Trade characteristics will affect balance of payment issues.

<sup>11</sup> For example: some specialist equipment to be used for controlling and/or mitigating impacts on the environment such as chemical pollution.

Mercosur and South American broader industrial development), (3) firm-specific or technological advantages (e.g. as in the application of technology that is well developed by some MNE but is not produced by indigenous firms within the host-country domestic market<sup>11</sup>).

The effects that FDI exerts over LDCs trade patterns (exports-imports) are diverse and include impacts over their own capacity to create or take advantage of market opportunities in the domestic (host country) productive sector. Extractive or industrial activities will progress (or not) depending on their comparative advantages in relation to prices, the labour market and also their supply-capacities and transport & distribution capabilities. Trade opportunities are intimately dependent on technology. The questions: "What are the major impacts that FDI has generated over trade?" and "What are the impacts that FDI has generated over technology?" are part of this discussion of the relationship between trade, FDI and technology (chapter 3 will expand a little more on these issues so that the influence and importance of FDI in Brazil is better understood).

How are economic activities arranged in Brazil and who is in control? There is a clear integration of some local industries with the 'MNEs / foreign capital' model of capital accumulation. This is quite evident in some sectors, such as the auto-industry (already cited above as having a 'direct'/'leading' foreign participation). In other sectors, such as the mining industry this is not so obvious - and here it may be advocated an 'indirect'/'supporting' foreign participation through the provision of technology, machinery, equipment, loans, finance, contracts for the provision of part of the production, direct investment, etc. There are more complex relations between national and foreign capital in the latter cases (mentioned as *supporting foreign participation*). Chapter 3 will consider the particular case of the mining sector.

## 3. The scale of FDI in the Brazilian mining sector

### 3.1 First considerations

The general role of FDI in mining is to provide profit for investors through the production and trade of mineral commodities. There are four main reasons stimulating FDI in mineral resources (apart from the obvious reason of the consumption needs of society). First, locational rigidities with regards to where minerals are found (the possession of mineral reserves). Second, the fact that by investing in a greater number of locations investors spread their risks and possibly maximise the conditions for promoting better levels of profit and/or by promoting greater competition (which would result in a better allocation of resources and cost-minimisation). Third, the promotion of internalisation of operations through corporate control (which is supposed to reduce costs and promote greater security of supply and greater control over supply-chain management for downstream consumers). Fourth, technological issues, i.e. in cases where the provision of technology, engineering processes, equipment, etc. are essential for developing mining ventures, and where these technologies are only available through the development of businesses or agreements with foreign investors.

The general structure of FDI into Brazilian mining during the past decades is set out in **Table 7** where we observe that despite the growth of the Value of Mineral Production in Brazil (VPM-PMB<sup>12</sup>; viewing the industry as a whole and including metallic minerals, non-metallic, gemstones, and also energy minerals such as oil, gas and coal), and also despite the growth of FDI in the Brazilian economy, there was no relevant growth in FDI specifically in mining. In fact, with respect to FDI and mining alone, a significant decline is seen when the 1970s and early

<sup>12</sup> VPM-PMB: "Valor da Produção Mineral / Produção Mineral Brasileira".



1980s are compared with the 1990s. As for total FDI in Brazil in relation to GDP ('b/a' in **Table 7**), 1975 and 1980 were important years, while from 1985 until 1995 there was a period of depression, and from 1996 onwards another period was observed where foreign inflows started to be a little more significant again.

**Table 7: Long-run evolution of FDI stock in Brazil and Brazilian mining (US\$ million)**

Year	GDP (a)	Total FDI (b)	FDI in mining (c)	VPM [1] (d)	(b) / (a) %	(c) / (b) %	(d) / (a) %	(c) / (d) %
1970	106,409	510	25.3	5,831	0.48	4.96	5.48	0.43
1975	137,272	2,700	66.7	5,200	1.97	2.47	3.79	1.28
1980	250,315	3,050	51.4	7,700	1.22	1.69	3.08	0.67
1985	210,844	1,348	21.0	11,100	0.64	1.56	5.26	0.19
1990	440,201	748	6.1	13,018	0.17	0.82	2.96	0.05
1995	717,164	3,285	10.6	13,539	0.46	0.32	1.89	0.08
1996	775,400	9,580	29.5	13,848	1.24	0.31	1.79	0.21
1997	805,700	17,864	12.4	14,600	2.22	0.07	1.81	0.08
1998	803,400	26,100	9.5	14,800	3.25	0.04	1.84	0.06
1999	800,000	21,500	10.0	15,000	2.69	0.05	1.87	0.07

(e)

Source: Arthur Andersen Langston Clark; *Brasil Mineral* (several issues); W. Baer (1995); Banco Central do Brasil (BACEN); R. Bielschowsky (1999); CEPAL/ECLAC (*Economic Survey of Latin America and The Caribbean 1995-1996* ; *Anuario Estadístico de América Latina y El Caribe 1996*); DNPM (see: [www.dnpm.gov.br](http://www.dnpm.gov.br)); The Economist Group (E.I.U.); FGV (*Conjuntura Econômica*); *Gazeta Mercantil*; Instituto de Relaciones Europeas - Latino Americanas (IRELA, Madrid); Inter-American Development Bank (IADB); L. A. C. Lago (1987); UNCTAD (*World Investment Report*); Instituto Brasileiro de Geografia e Estatística (IBGE).

[1]: VPM indicates the Value of Mineral Production of the Brazilian Mineral Industry (VPM-PMB).

Obs.: All values (GDP, total FDI, FDI in mining) are based on Constant 1995 US Dollars (using the USA consumer price index deflator, 1995 adjusted US\$ IPC); FDI here is the 'conventional FDI' (see main text for explanation); Estimated (e) values for 1999.

As for the proportion of total FDI in Brazilian mining<sup>13</sup> in relation to total FDI in Brazil ('c/b'), it is clear that investors were more interested in mining ventures in the 1970s and 1980s but in the 1990s mining got out of their "menu" as other sectors (and other countries) proved to be more interesting. From 1990 onwards, this decline is very noticeable (reaching levels of between 0.04 and 0.07 for the 1997-1999 period). And even though the VPM-PMB showed growth for the overall period between 1970 and 1998, the value of mining in relation to total Brazilian GDP ('d/a') also revealed a decline, with mining decreasing in importance for the national economy from levels of between 3% to 5% for the 1970-1985 period, to 2.96% in 1990, and then dropping even more to around 1.8% for the 1995-1998 period.

Total FDI in Brazilian mining as a proportion of value of production ('c/d', see **Table 7**) was never very high, and recent data for 1997 and 1998 shows that this will probably remain at low levels (of between 0.06% and 0.08%). It should be noted that measuring the performance of the mining industry (or even of the Brazilian economy as a whole), by analysing the importance and levels of FDI is a tricky business as FDI was not always the most important parameter for Brazilian mining (or for the Brazilian economy). Taking 1980 as an example, it is known that FDI represented only 30% of total investments (as a percentage of total net inflow of capital resources into Brazil) during that year; and the remaining 70% was due to debt, portfolio investments and other 'indirect' contractual arrangements (e.g. joint-ventures where capital was made available for importing equipment) and stock exchange operations. The 1990s show a similar pattern where FDI is just part (and definitively not the most important part) of total net capital inflows into Brazil.

FDI is considered here as "conventional FDI" (as mentioned earlier in the introduction). In **Table 7** one observation important to make is that from 1970 up until 1996 privatisation was not a vital element of FDI; this changed in 1997 when the CVRD was privatised and the FDI value for that year [of 1997] included the

<sup>13</sup> Total FDI in Brazilian mining views item 'c' (FDI in mining, **Table 7**) as total FDI in geological prospecting and mineral exploration & research.

privatisation of this major company. For total FDI in Brazil as a whole, mainly from 1995 onwards, values grew significantly as privatisation was included in their accounts. As one of the most important examples of the great part played by privatisation in total FDI we may cite the year 1998 which showed around US\$ 26 billion of FDI thanks largely to the US\$ 19 billion privatisation of telecommunications company TELEBRAS.

Dr. Juarez Fontana dos Santos (personal communication) considers that when studying investments and FDI in the Brazilian mining sector we must be very cautious about using the available data provided by the DNPM or any other source (including the mining companies themselves) as most information serves only as an indication of what may be taking place. "The DNPM makes no distinction between risk investment (mineral prospecting and geological research) and investment in development and implantation of mines. The companies of the mining sector themselves help further in making statistics even more confusing by considering as operational costs what should be considered as pre-investments risk costs". Dr. Francisco R. Chaves Fernandes (Economist from CETEM) also speculates about the problems in data collection and statistical analysis for the mining industry in Brazil (Fernandes, 1997).

One additional element of confusion is that the DNPM considers the entire mining industry when calculating the VPM-PMB, but data on FDI is not collected at all (i.e. is not part of the *Anuário Mineral Brasileiro-AMB / Brazilian Mineral Yearbook*), or when it is collected, it usually takes into account only investments in the metallic sub-sector - not mentioning what goes on in other sub-sectors due to several circumstances, as for instance: the oil & gas sector statistics are the 'monopoly' of PETROBRAS; the gemstones sector operates largely in the "underground" or 'non-official' (informal) sector; the non-metallic sector is mostly controlled by domestic players and it is also largely informal with much activity of the construction sector being undertaken with no tight control; the water sector is only recently organising itself and statistics on water resources and water companies are non-existent on a long-term basis. Methodological problems are also another complicating element in understanding what goes on in the mining sector, as data collection, when it exists, is undertaken

by different groups of people using different systems of accounting and diverse methodologies.

The FDI into Latin American mining for the past 10 years was more concentrated into copper & gold. The 'Andean countries' were the most important locations for these businesses, with Chile as their main representative. With regard specifically to Brazil, since 1990, mining has shown a general decline in total investments, mainly foreign (see **Table 8**), and also in mineral exploration (geological prospecting). **Table 9** shows that "it was mainly Brazil which lost its attractiveness as an investment location. Traditionally by far the most important recipient of FDI inflows in the [Latin American] region, Brazil saw its share of these inflows dwindle to about 12% during 1991-1995" (Nunnenkamp, 1997: 54-5). Foreign agents decided to drastically reduce their investments because of a combination of the six main factors described below.

**Table 8: Investments in mineral exploration and research in Brazil, 1982 - 1996 (in US\$ 1,000 of 1996 and %)**

Year	Investments by Brazilian private initiative	Investments by Brazilian SOEs	Foreign Investments	Total Investments
1982	94,751 ; 35.83%	75,878 ; 28.69%	93,806 ; 35.47%	264,434
1983	57,959 ; 35.85%	48,650 ; 30.09%	55,081 ; 34.06%	161,690
1984	69,198 ; 32.93%	43,420 ; 20.67%	97,486 ; 46.40%	210,104
1985	34,603 ; 23.70%	41,591 ; 28.49%	69,804 ; 47.81%	145,998
1986	50,059 ; 47.18%	17,859 ; 16.83%	38,189 ; 35.99%	106,107
1987	47,012 ; 29.21%	29,368 ; 18.25%	84,560 ; 52.54%	160,940
1988	56,661 ; 35.13%	40,372 ; 25.03%	64,262 ; 39.84%	161,295
1989	38,805 ; 35.24%	52,948 ; 48.08%	18,368 ; 16.68%	110,121
1990	20,509 ; 34.47%	33,831 ; 56.86%	05,162 ; 08.67%	059,502
1991	17,150 ; 32.29%	30,130 ; 56.73%	05,831 ; 10.98%	053,110
1992	23,013 ; 33.46%	35,205 ; 51.19%	10,559 ; 15.35%	068,777
1993	22,499 ; 33.99%	41,646 ; 62.92%	02,043 ; 03.09%	066,189
1994	20,796 ; 27.86%	43,877 ; 58.78%	09,972 ; 13.36%	074,645
1995	23,907 ; 31.50%	41,348 ; 54.49%	10,629 ; 14.01%	075,884
1996	16,211 ; 17.96%	44,482 ; 49.27%	29,587 ; 32.77%	090,279

Source: DNPM / SIPEM, by Fontana dos Santos.

**Table 9: FDI flows to major Latin American countries as a share of total flows to the region, 1980-1995 (in percentage)**

1980 - 1985		1986 - 1990		1991 - 1995	
<b>Brazil</b>	<b>33%</b>	Mexico	29%	Mexico	27%
Mexico	22%	<b>Brazil</b>	<b>15%</b>	Argentina	17%
Argentina	9%	Argentina	10%	<b>Brazil</b>	<b>12%</b>
Colombia	8%	Colombia	5%	Chile	7%
Chile	4%	Chile	4%	Colombia	5%
Venezuela	2%	Venezuela	2%	Venezuela	4%
Others	22%	Others	36%	Others	28%

Source: UNCTAD, In: Nunnenkamp, 1997: 55.

First, the 1988 Constitutional restrictions worked as a disincentive for greater FDI flows into Brazil at a time when other countries such as Mexico, Argentina, Chile and Peru were promoting their mining sector in a more aggressive manner in order to attract greater levels of investment from abroad. Second, added to this scenario there was also the problem of economic recession and high inflation in Brazil as the period from 1988 up until 1994 was a very difficult one which also experienced political uncertainties. The election of Fernando Henrique Cardoso to the presidency brought some stability for Brazil as a whole, but the mining sector was not a priority for his government and major decisions concerning the role and future of mining were postponed. In 1995 the already mentioned Constitutional restrictions were abolished and a recovery for mining was expected, but this really never took place. The privatisation of CVRD in 1997 was another indication that the Government wanted to promote more private-initiative participation; what actually happened was that CVRD fell into private hands, but apart from this ownership change, nothing else of much significance happened in the mining sector as a whole.

Third, with respect to taxation, Brazil has a complex system of Federal, state and municipal taxes including taxation over turnover (ICMS, COFINS / FINSOCIAL, PIS / PASEP, CFEM) and taxation over profits (CSOC, IRPJ, AEIR, ILL), which makes Brazil a less competitive country according to the DNPM (Vale *et al*, 1992; Braz, 1993). The PPDSM (1994) suggests that Brazilian fiscal procedures should be simplified, as one of the main problems of the national taxation system is its large number of taxes and contributions, and also the lack of consistent public policy with

respect to fiscal management. Fourth, in addition to this complicated tax system we also have the problem of the demarcation of Amerindian reserves in the Amazon region; this causes a degree of uncertainty to mining as it reduces the areas available for mineral development and investors may get the impression that this limits their ability to find and open new mines. Fifth, uncertainties related to the regulation of the "garimpeiro" activities also have the potential to affect the work of foreign investors and foreign companies as their measurement of 'risk' runs contrary to Brazilian developments because of fears of losing good areas and large sections of land to informal miners.

Sixth, to complement our discussion of some of the main factors why foreign agents have decided to reduce their investments in Brazil, it is always important to know that there are attractive projects and attractive opportunities elsewhere. Brazil is certainly not as appealing to the development of mining ventures as it once was. Apart from the motives indicated above, the fact is that in the 1990s the most developed economies of the world are increasingly looking to develop businesses among themselves and also that mining is not a sector attracting much attention. Mining is also redirecting itself to more developed countries - with greater importance increasingly given to Australia, Canada and the USA. The transition of communist USSR to capitalist Russia has also affected world mining as Russia recently (mainly during the 1990-1995 period) directed greater volumes of mineral commodities to the global and European markets (as opposed to the communist period when it absorbed most of its production domestically).

Reasons such as political risk and policy environment among LDCs - i.e. macroeconomic conditions, trade rights, foreign exchange rates, regulatory conditions (e.g. dealing with access to land, licensing criteria, mineral legislation, government royalty), fiscal environment (mainly with respect to the tax code, profit-related taxes and profit remittances), and institutional factors (for example, the support that key institutions such as the Ministry of Mines or the national Geological Survey can provide) - determine the degree to which one country's competitiveness compares with others. This is probably why, when observing where geological *exploration & development programmes* expenditures were taking

place, it was noticed that “from 1980 to 1989 some US\$ 2.5 to US\$ 3 billion per year was spent on exploration, with 85% to 90% coming from private sources. Of that sum, US\$ 600 million was spent in Canada, US\$ 560 m in Australia, US\$ 360 m in the United States, US\$ 300 m in Latin America, US\$ 200 in Asia, US\$ 180 m in South Africa, and US\$ 100 m elsewhere” (E&Mj, 1994: 14). It is clear from this data that three First World countries alone (Canada, Australia and USA) accounted for around 50% of the total expenditures for the 1980-1989 period.

**Tables 7, 8 and 9**, by displaying the volume and scale of foreign investment in Brazilian mining since the 1970s (and to an extent comparing this to other Latin American countries), together with **Tables 10 and 11**, and with textual information provided in this book, allow us a more comprehensive view of the state of investments in Brazilian mining in the past 20 years. This helps us to explore issues relating to the qualitative and quantitative assessment of the scale of FDI in the Brazilian mining sector, i.e. the facts & prospects about FDI and Brazilian mining. This provides relevant indications concerning the main facts of FDI in Brazilian mining and also reveals the main prospects for the future.

**Table 10: Investments in Brazilian mining, annual averages (US\$ million and %) for investments in mineral research and geological prospecting**

	1978-85 US\$ m	1978-85 %	1986-89 US\$ m	1986-89 %	1990-94 US\$ m	1990-94 %	1995 US\$ m	1995 %
State [1]	36.7	27.39%	34.7	56.51%	34.1	37.23%	40.1	54.41%
Local [2]	45.9	34.25%	20.6	33.55%	46.8	51.09%	23.2	31.48%
Foreign	51.4	38.36%	6.1	9.94%	10.7	11.68%	10.4	14.11%
Total	134.0	100%	61.4	100%	91.6	100%	73.7	100%

Source: BNDES, 1997 (*Relato Setorial n. 6 / Área de Operações Industriais* 2). [1]: Brazilian State capital; [2]: Brazilian (national) private capital.

**Table 11: Investments in Brazilian mining, annual averages (US\$ million) for investments in the implantation and expansion of mines, and mineral extraction and production**

Period	1978-85	1986-89	1990-94	1995	1996
Total (*)	544.0	636.0	310.0	480.8	589.7

Source: BNDES, 1997 (*Relato Setorial n. 6 / Área de Operações Industriais* 2). (\*): Indicates the total of State, local and foreign capital.

In order to analyse the scale of FDI in the Brazilian mining sector we must recognise the distinction between (and the relevance of) investments in (1) mineral [geological] prospecting, i.e. *mineral exploration*, and (2) mineral [mining] production, i.e. *mineral exploitation*. The first will be conditioned mainly by the need (or not) to expand the 'reserve base' of mineral commodities. The second will be shaped mainly by the levels of short-term consumption of mineral commodities. Of course these are inter-linked issues, but, for example, taking the case of iron ore in Brazil, there is no immediate (or even medium-term) need to invest in mineral 'exploration' for the expansion of the reserve-base for this metal. However, there is a need to invest in mineral exploration for several other minerals.

This is due to the fact that large reserves of iron-ore are available for 'exploitation' in Brazil, but several other minerals do require more research in order to *transform resources into reserves*. This 'transformation' of resources into reserves is highly dependent on the conditions of mineral trade and technology, and this includes taking into account the way international commodity markets work, the importance of some major stock and commodity exchanges and also the activities of MNEs. Supply, demand and prices of minerals all depend on these players and also on the way distribution systems, transportation and logistics are arranged and which equipment, machinery and engineering processes are used.

The major impacts that FDI has generated on mineral trade has resulted in, first, more developed trade structures, where the international commodity market is closely monitored (and to an extent controlled) by a few stock exchanges (such as, for example, the London Metal Exchange-LME<sup>14</sup> in the UK, the Vancouver Stock Exchange-VSE<sup>15</sup> in Canada<sup>16</sup> - all with significant international influence and power), and also a small number of MNEs (with market concentration usually stimulated by high degrees of integration so as to exert greater control over prices

<sup>14</sup> Web-site: <http://www.lme.co.uk> (LME).

<sup>15</sup> Web-site: <http://www.vse.com> (VSE).

<sup>16</sup> Also important in Canada is the Toronto Stock Exchange.



and supply of minerals). Second, more developed trade and distribution systems of mineral resources where a greater number of mineral suppliers have promoted wider options for the consumers of these resources. This was also one of the results of the impacts occasioned by FDI. Third, FDI has also led to increased reliance on foreign technology, equipment and machinery due to the closer relations between investors and host country players. Fourth, a certain preference for the promotion of "big business" because of foreign investment being mostly allocated to *world-class mineral deposits* which has as one of its main characteristics the ability to generate large-scale and high-volume production. The main results of these four impacts or consequences of FDI have been basically that of cost reduction and greater control of supply for the purchase of most mineral commodities during the last 15 to 20 years.

The impacts that FDI has caused to technology are diverse and expressed in issues of: transportation and logistics; energy-use & process technology; geological and mineral resources evaluation methods; metallurgical processing; product research leading to 'differentiation'-'diversification' innovations and 'purpose-made'-'performance-built' products with advanced design technologies and/or the discovery of new uses and applications for a range of minerals. If a wider definition of technology is used, where one includes *project co-ordination and managerial "technologies"*, as e.g. with the use of sophisticated cash-flow studies, budgetary project management, industrial organisation tools, cost-benefit analysis and risk analysis, much more can be said about the influence of FDI in host and home countries.

Technological implications caused by FDI, and also by other types of arrangements with foreign agents (such as the acceptance of loans or joint-venture contracts), imposing conditions on the use of equipment and engineering processes which need to be imported or need licensing (or require some form of royalty payment) for the use of developed-country technologies and/or industrial systems, is something that typically affects industrial activities. One example is transportation and logistic use of imported conveyor-belt systems for carrying ores from mines to ports or loading areas; a second example is that of process

technologies, such as the Carbon In Pulp (C.I.P.) gold technology, that require a diverse range of specialised equipment which are not manufactured in Brazil (and if they are, their operations are usually controlled by MNEs). Several geological and mineral resource evaluation methods currently in use were originally developed in other countries, and are used to carry out work in Brazil (for example, those with American, Canadian, German, Swedish participation, and many metallurgical processing technologies require the importation of equipment).

As well as this already complicated situation we have the characteristics of the main international scenario for commodity investment - emphasising structural or other changes in the aluminium, iron & steel, and gold markets. In the case of aluminium a condition of "reverse migration" is noticed in the pattern of the aluminium industrial activities where investments were during the 1990s (as opposed to the 1970s and 1980s) going by preference to more developed economies and away from less developed countries. As for the iron & steel sub-sectors, it is to be noted that increasingly these operations are to a greater extent influenced by (and subjected to) what goes on in the auto-industry in Brazil, which is mainly a foreign-controlled industry, and which determines the amounts of steel to be used in their plants according to the dictates of the international car markets. The situation of gold is particularly sensitive due to its diminishing economic importance in recent years. Gold is losing much of its attractiveness for investors, the price is low, and several countries are selling (or planing to sell) large parts of their reserves accumulated in their Central Banks.

All this adds to the already slow pace of evolution of the mining sector in Brazil in the late 1980s and all through the 1990s, something that is apparent as "old" projects are now being referred as "new" projects (the Salobo Copper-Gold project in the Amazon region being a typical example of this "rejuvenating" process). With respect to the importance of the Amazon region for the future of mining in Brazil, one of the main locations for new developments will certainly be that of the CVRD's "North System" where plans, both private and State, abound for the creation of new ventures in sub-sectors such as steel, aluminium, gold, copper and many others. All these activities will need large sums of money for their development and foreign investment is

considered to be essential for this "new stage" in Brazilian mining.

However, recent data by Bielschowsky (1999) indicates a continuity in the relatively small importance of foreign-owned mining in the Brazilian economy<sup>17</sup>. This author pointed out that the share (%) of FDI stock for 1995 (for minerals & oil) was equivalent to only 1.1% of the total, and that the share of FDI flows into the minerals & oil sector was only of 1.6% for the 1996-97 period. When viewing the share of the minerals & oil sector in the overall Brazilian fixed capital investment (as a % of GDP), a decline is observed from around 1.1% to 1.2% for the 1971-80 and 1981-89 periods to only around 0.5% for the 1990-94 and 1995-97 periods. The behaviour of MNEs is classified as "stagnant" for the 1995-98 period, and it is believed that the 1999-2003 period will be characterised by a situation of "lack of interest" when taking into account the expected participation of MNEs in Brazilian mining (though for the oil sub-sector "fast growth, possibly through partnerships with PETROBRAS" is expected for the 1999-2003 period).

The low levels of foreign investment in Brazilian mining since 1990 were partially compensated for by investments made by the CVRD's transnational partners<sup>18</sup> to finance the expansion of *productive capacities*<sup>19</sup> in the country. This explains the continuing and even progressive importance of CVRD in maintaining (and even increasing) its high participation levels in overall Brazilian mineral production. The behaviour of CVRD alone may determine much of what happens in Brazilian mining in the near and medium future (including considerations about the composition of investment and the distribution of power in domestic mining). The influence of CVRD and of the other major

<sup>17</sup> Considered only on the basis of the importance of FDI for the 'extractive' sector; not including 'mining-related' activities and also not including loans and other forms of investment.

<sup>18</sup> CVRD's *transnational partners* through portfolio investment, loans, minority holdings, mineral-supply contracts, agreements with equipment suppliers and suppliers of technological and/or engineering processing systems.

<sup>19</sup> But not research or risk investment.

domestic iron-ore producers (MBR, SAMARCO, FERTECO, SAMITRI) is essential for understanding the role of foreign capital and trade in minerals in Brazil.

The influence and importance of foreign capital for raw materials is directly related to the commodity needs of investor countries. Several commodities are traded internationally and this constitutes one of the oldest forms of business. The presence of money or loan capital ('credit') from foreign sources in the international mining industry shows differing patterns according to different periods. During the 1950s, for example, 'credit' capital from external sources and MNEs themselves were dominant in international mining. During the 1960s and 1970s, a period of *nationalisation*, foreign participation was not viewed as "ideal" by LDCs in the raw materials industries. The late 1970s and early 1980s was a period of transition and of acceptance of finance from abroad in most of the *periphery*. The 1980s showed the fragility of this process (of borrowing, of availability of international finance capital) when the debt crisis came to existence. From the 1990s onwards, the mining sector and business players are searching for new forms of "adaptation" and "acceptance" (a new "contract" to be made) for 'credit' capital from abroad.

If we are to answer the question: "Was there a renewed wave of FDI for mining in Brazil in the 1990s?", we must consider that the answer is "no". However, if we rephrase the question so that it reads: "Was there a willingness for a renewed wave of (*potential*) FDI for mining in Brazil?" - then the answer could be "yes", but mostly considering the oil & gas sub-sector and/or the "paramineral" sectors (e.g. environmental technologies). The period of *panic of supply* of the 1960s and 1970s<sup>20</sup> was important for developing international links for mining activities in Brazil. The *transition* period of the 1980s was, to some extent, a period of continuity of foreign participation in the ventures undertaken during the previous decades (and of strengthening of the foreign contribution to the iron-ore sub-sector). The *no shortage* times

<sup>20</sup> As the 'Club of Rome' predicted a gloomy scenario for global shortages of resources.

of the 1990s provided increased possibilities for furthering internationalisation of the most competitive sub-sectors. The liberalisation and privatisation of the domestic productive sectors (even if the privatised companies fall under national control), is assumed to generate the appropriate conditions for a new wave of FDI in mining and mineral-related industries in Brazil<sup>21</sup>.

While financial management in Brazil is highly developed and to a large extent able to cope with the high degrees of complexity of the global market, industrial operations are usually viewed as being "out of date", or "lagging behind" when compared with the standards of the developed world. Mainly since 1990 Brazil has undertaken (or attempted to) a process of "picking-up" and "modernisation" in order to tackle this problem of its relative backwardness with regard to its industrial and technological apparatus. Here lie great opportunities and risks for both domestic and foreign firms. As the domestic players working with their own (indigenous) technological capabilities are still not well placed (or not well organised) to compete with international players, this indicates a trend towards a greater reliance on foreign participation in industrial activities. This participation will take the form of greater use of, for example, foreign suppliers of equipment, technology, engineering processes, quality programmes, etc.

The prospects for this in the national mining industry indicate that FDI may exert a greater impact on technology. Signs of this may be shown by analysing some important sub-sectors such as: (a) iron-ore, where improvements and greater participation of FDI are expected to take place in transportation and logistics technology (in the management of the delivery of high-volume production), (b) bauxite-aluminium, with energy-use & process technology (in vertically integrated stages of production), (c) gold, with 'gold-specific' geological evaluation & metallurgical processing technologies (in gold producing operations of all sizes - but that

<sup>21</sup> These issues will be discussed further in Chapter 4.

will particularly impact on medium-sized projects), (d) metallurgical products of steel and aluminium, with important effects on product 'differentiation'-'diversification' and 'purpose-made'-'performance-built' technologies (in higher-value niche markets for higher-quality metal products requiring more complex and more advanced design technologies). Examples (case-studies) of these sub-sectors are provided in Chapter 5.

The study of the scale of FDI in Brazilian mining allows us to discuss the ways by which FDI flows affected national trade and technological performance (the examination of the question: "Do increased FDI flows have a positive impact on the mining sector's trade and technological performance?"). The following sections will explore these issues.

## 3.2 Trade performance

The performance of Brazilian trade (trade balance, imports-exports) suggests a relatively greater importance for the commodities sector in the 1980s and the 1990s (even though that the mining sector performed below expectations; with relatively poor results and poor performance during most of the 1990s).

A trend analysis for Brazil is provided by Bielschowsky & Stumpo (1995: 162-3) who considered that: "In the 1980s, TNCs contributed not only to the adverse trends observed in the country - low investment levels and relative technological backwardness - but also to the positive ones, especially those associated with the expansion of exports. In the 1990s, TNCs are taking a very active part in the adjustment process and are thereby reinforcing a trend that appears to be leading to the preservation and modernisation of Brazil's industrial complex. During the 1980s, when the approach taken was a fairly "passive" one, an important factor was the increase in the proportion of total output, and especially of exports of manufactures, accounted for by the intermediate goods sectors - largely the result of a series of investments that were originally intended for the domestic market. These investments formed part of a cycle which began in the mid-1970s and matured in the early 1980s. Foreign capital was a

very active component in these investments and played a leading role in the aluminium industry (ALCAN, ALCOA, BILLITON / SHELL) and a supporting one in petrochemicals (RHONE-POULENC, DOW CHEMICALS, DUPONT, BAYER, HOECHST), wood pulp (CHAMPION, ARACRUZ / BRITISH TOBACCO, CENIBRA / MITSUBISHI), and iron and steel (MANNESMAN and BELGO-MINEIRA, with Japanese investors in TUBARÃO and in USIMINAS)”.

The changes that were partly brought about by the presence of foreign capital in Brazil are very clear when reading Machado (1989: 187), as this author provides two tables indicating the radical changes that occurred in the Brazilian exports structure of the mineral sector between 1943 and 1985 (see **Tables 12** and **13**). While quartz represented 42.3% of the exports of the mining sector in 1943 (and iron-ore had almost no importance at all during that period), in 1985 iron ore was responsible for 87.6% of the total share of exported mineral commodities. These changes were largely directed by opportunities for iron-ore in the international market - which in turn were boosted by important inflows of foreign capital into this sub-sector in Brazil.

**Table 12: Brazilian exports of the mining sector in 1943, main minerals and participation (%) in the total exported**

Mineral / Sub-sector	%
Quartz	42.3 %
Diamonds	23.7 %
Manganese	8.8 %
Gemstones	5.5 %
Iron ore	3.8 %
“Pig iron”	3.3 %
Mica	2.6 %
Coal	1.0 %
Rutile	1.0 %
Carbonates	0.6 %
Zirconium	0.3 %
Other minerals and ores	7.1 %

Source: Souza, 1944; In: Machado, 1989: 187.

**Table 13: Brazilian exports of the mining sector in 1985, main minerals and participation (%) in the total exported**

Mineral / Sub-sector	%
Iron ore	87.6 %
Bauxite	5.1 %
Manganese	2.0 %
Gemstones	1.2 %
Kaolin	1.0 %
Magnesite	1.0 %
Other minerals and ores	2.7 %

Source: Machado, 1989: 187.

Trade performance is highly influenced by what Bartlett & Ghoshal (1989: 89; also in: Dicken, 1992: 193-4) describe as globally integrated structures. They state that "some firms are now moving towards a globally integrated network structure in which increasingly specialised units (distributed, specialised resources and capabilities) world-wide are linked into an integrated network of operations<sup>22</sup> that enables them to achieve their multidimensional strategic objectives of efficiency, responsiveness, and innovation ... The strength of this configuration springs from its fundamental characteristics: dispersion, specialisation, and interdependence (with large flows of components, products, resources, people and information among interdependent units)". This means that MNEs and other enterprises in general are now better organised, from a functional point of view, for foreign investment (what includes FDI).

However, for trade to achieve better performance, a clearer international institutional infrastructure is needed (e.g. with regard to legislation, country-company relations), and clearer policies and regulations for companies and governments. In an article concerning the growing interdependence between TNCs and governments, for example, Stopford (1994: 53, 73-4) argued that "the rapid growth of *foreign direct investment* (FDI) has

<sup>22</sup> Complex process of co-ordination and co-operation in an environment of shared decision-making.



brought the transnational corporation to centre-stage in the international political economy. FDI has significantly increased the economic interdependence of nations and has made key factors of production more mobile. To support the development of national capacity for intelligent bargaining and to provide some form of insurance against welfare and other shocks, the global economy needs a stronger international polity to foster greater clarity, consistency and credibility in policy development. Progress will only be made possible by strong States that understand the new competitive realities and that are prepared to develop the needed new resources. Markets alone are unlikely to assist those processes”.

The effort of the Brazilian government to promote a clearer legislative framework for trade was partially demonstrated in 1996 by Law 9279. This law brought Brazilian legislation into line with the Trade Related Aspects of Intellectual Property Rights (TRIPS), created by the World Trade Organisation (WTO). The law regulated rights and duties pertaining to intellectual and also industrial property through the granting of patents on inventions and utility models, registration of industrial designs, trade marks and innovations. Known as the Patents Law, it is supposed to foster innovation by securing a share in the economic gains derived from the exploitation of a patent. This will probably make the performance of trade of the mineral sector more dependent to its technological performance.

### 3.3 Technological performance

Probably the greatest challenge for technological improvement in the performance of the mining and mineral-related sectors is that of environmental protection. Environmental protection challenges must take into consideration the interaction between the environment and mineral resources exploration, exploitation, use, recycling, energy consumption, pollution, etc. For this purpose a series of procedures should be followed, such as working within a framework that applies some “tools for environmental planning and management” (Sánchez, 1995: 157): such as Environmental Impact Assessment (EIA), Risk Assessment (RA), Environmental Auditing (EA), Environmental Management

Systems (EMS), and Life Cycle Assessment (LCA). Warhurst (1995a) calls attention to problems such as “pollution prevention” and “waste management” and argues that “pollution prevention *a priori* requires that change is made to either the technology or organisation of the production process, or both”.

These changes in technology and/or organisation “requires, to differing degrees, the development of new technological and managerial capabilities within the firm, technological alliances with equipment suppliers and collaboration with R&D organisations ... the successful implementation of pollution prevention [programmes] will require that regulatory approaches are underpinned by technology policy mechanisms designed both to stimulate technological innovation and best-practice in environmental management within firms, and to encourage the commercialisation and diffusion of these innovations across the boundaries of firms and nations” (Warhurst, 1995a: 282).

Another important technological challenge to be tackled is that of increasing the geological knowledge of the Brazilian territory. This challenge is to be supported by technological and scientific activities that help increase geological-mineralogical information and provides a better framework for mining activities (developing ‘mineral resources’ up to the point where ‘mineral reserves’ are ready for extraction). Most developed countries are prepared to finance these activities through the public sector. Brazil went through a phase when the public sector was more active in financing projects that were important for the natural resources sector, such as the well known instance of the multidisciplinary RADAM<sup>23</sup> project (which included mining) that was set up in the early 1970s. The 1980s saw a relative “neglect” of most natural resources projects and in the 1990s projects were in a great extent dependent of external participation or foreign investment (which did not materialised at the expected degree desired by the government).

<sup>23</sup> Radar Imagery Project in the Amazon Region (RADAM).

Because of the large land area of Brazil, the government and its specialised agencies have always been short of accurate information with respect to the resource potential of the national territory. For areas such as the Amazon - largely unpopulated and unknown, and of difficult access - the government has not yet gathered the minimum information commonly considered necessary for national planning objectives, something essential to the implementation of a long-range planning programme to improve the natural resource information base (including geological) and land use (including mining activities). This concern is thought to be partly addressed by a high-tech mega-project that the Brazilian Government is promoting, the "Sistema de Vigilância da Amazônia-SIVAM" (the Amazon Surveillance System), designed to achieve multi-purpose monitoring of the entire Amazonian region, involving several activities - from the detection of mineral resources, the action of *garimpeiros* and mining companies, deforestation, biological resources (flora and fauna), and other activities such as identifying cocaine merchants operating illegal airstrips and working with drug distribution.

The SIVAM is counting on ERICSSON's 'Erieye Airbourne Early Warning and Control' system (known as ERIEYE or AEWAC), which has been chosen by Brazil for use in the Amazon region as a long-range and high-performance system that can be installed in relatively small commercial and/or military turbo-prop aircrafts. The system can detect small aircrafts at a range of up to 350 km. Five ERIEYE systems worth US\$ 145 million were ordered (in June 1997) for use in the SIVAM (source: [www.ericsson.com](http://www.ericsson.com)).

Technological performance issues were dealt with in Law 8661 of 1993. This law was designed to boost the technical capacity of Brazilian industrial enterprises through a project called Industrial Technological Development Programme-PDTI. The main provisions of this law are (a) to promote a partial deduction of corporate investments in S&T from taxes due, (b) to introduce technological management as an essential, non-transferable corporate activity, and (c) to encourage the development of enterprises' own technology programmes by means of contracting and participation of third parties (with priority being given to co-operation schemes between companies and R&D institutions). Fiscal incentives include a reduction of up to 8% on income tax

due to the government for investment in R&D, and exemption from tax on industrial products, charges on machinery, equipment and other instruments purchased for use in R&D initiatives.

The impact of foreign firms on the Brazilian market is expected to show a strong pace of growth if a wider definition of technology is used, which includes managerial and/or environmental techniques, with an intense use of *project coordination and managerial "technologies"*, as for example with very detailed cash-flow analysis and studies, with budgetary project management, more advanced accountancy systems, new industrial organisation processes, cost-benefit analysis using complex mathematical models and advanced IT capabilities, use of ISO total quality systems management tools, and environmental technologies such as those dealing with waste, recycling and pollution. The increasing use of international "best-practice" standards is supposed to improve the competitiveness of Brazilian industry, to further its international integration and trade relations in the world markets, and also to increase the share of foreign participation in the Brazilian domestic market (for more detailed information on some of these issues see Souza, 1995 and PwC, 1999).

## 4. The reasons for shifts in the pattern of FDI over the past twenty years

### 4.1. First considerations

The main purpose of this chapter is to outline the reasons for shifts in the pattern of FDI over the past twenty years, but in particular to pay attention to the role of regulatory changes that were introduced in 1988 and 1995. This means analysing FDI and Brazilian economic policy and uncovering their relationships.

We will start by providing a brief review of the international circumstances that have affected mining since the 1960s. The 1960s and 1970s can be described as a period of “panic of supply” for mineral commodities. This is explained and was reflected partly by the nationalisation of mining in several countries (e.g. Mexico in 1961, Chile from 1965 to 1971, Zambia and Zaire in the late 1960s), and with this, the consequent creation of several State Owned Enterprises (SOEs) and certain “government arrangements” (or producer arrangements) such as the CIPEC<sup>24</sup> (organised between Chile, Peru, Zaire and Zambia in 1967). These developments posed a degree of uncertainty to most of the ‘free-market-oriented’ countries of the First World, partly because of the expectations occasioned by the predictions of the Club of Rome (regarding the rapid depletion of several, if not most, non-renewable resources), partly by the effects of the energy crisis of 1973 and 1979.

One very important historical event in Latin America during 1971, that was to give rise to important consequences as to how the region (and particularly its mining sector), was to be viewed internationally, was the nationalisation of foreign copper-producing companies in Chile. The Chilean Government took-over these

<sup>24</sup> CIPEC: Conseil International des Pays Exportateurs de Cuivre.

mining enterprises on the 12th of May of that year. The nationalisation of the iron-ore industry in Venezuela (following the Chilean example), was another blow to the place of the MNEs and FDI in Latin American mining. The 1980s were a period of transition (from nationalisation to open markets), but also a period of declining commodity prices, a time of weakening bargaining power for commodity producers (even more for those LDCs with large debts). The 1980s were characteristically a period of 'structural adjustment', of debt re-negotiation, of reduced autonomy of the State for Third World countries under the directions of the IMF and the World Bank.

"From the mid 1980s onwards the process [of nationalisation and creation of SOEs] has been reversed. Existing mines have been privatised, mining codes liberalised, tax regimes made more accommodating and foreign investment welcomed. The accessible reserves have consequently expanded, particularly in Latin America. A country's legislative framework is, however, only one aspect of its accessibility [of resources for profitable mining]. The administrative system may be too chaotic or corrupt, or the political system too unstable to attract investment. Potentially profitable ore deposits will then languish as resources" (P. Crowson, In: *Mining Journal*, no. 8519, 1999: 10). The 1990s, as a consequence, showed itself to be favourable to a situation of a renewed wave of FDI, a time of "no shortages" of commodities and "no shortages" of countries in which to invest. As a result, there is an extensive list of countries that have "liberalised" their economies, their laws and their business activities.

Since 1995, when the Brazilian Government abolished the Constitutional restrictions imposed by the 1988 Constitution (restrictions related to foreign involvement in mining), there has been an expectation of increased interest on the part of international investors. The 'Salobo Metais', made up of CVRD with AAC, MITSUBISHI and IFC, is expected to invest US\$ 1.5 billion for the development of a copper-gold deposit in Pará state; RIO TINTO to spend US\$ 230 million in its new nickel project at Serra da Fortaleza in Minas Gerais state; INCO from Canada will probably invest some US\$ 200 million for a nickel mine; ECHO BAY (via SANTA ELINA) to spend US\$ 300 million for the development of gold mines in Mato Grosso and

Goiás states. CVRD, RIO TINTO, and AAC are also expected to spend an additional US\$ 500 million to guarantee expansion of their gold mines.

When the issue is FDI and economic policy, the main impetus to furthering private investments and private initiative was supposed to be the deregulation of the economy, with an increasingly more outward looking mood actively seeking greater insertion into the world economy by welcoming private initiative. Reforms have been made (and other new projects are under consideration) to dynamise the economy and make it more efficient so as to allow it to become increasingly linked [tied?] to world trade and global capital flows. In the past decade the government dedicated efforts to the re-examination and re-evaluation of its activities with a view to changing the way state institutions work. This has been based, to a large extent, on the provision of more attractive conditions for private investors to take advantage of opportunities within the national economy. And this was done partly by promoting privatisation, and partly by exposing the economy to greater imports levels.

The increasing liberalisation of the economy has tried to combine efforts to keep inflation under control (and avoid devaluation of the currency), to maintain high levels of international reserves, to best manage the balance of trade and not allow the external debt/GDP ratio to increase (which arouses concern over increasing vulnerability to foreign forces). Macroeconomic planning was assumed to be one of the most important "fronts of control" of the economy. This also included (and still includes) cutbacks in public spending and export promotion as some of the ways by which the economy could be stabilised and prepared to achieve higher growth levels.

To tackle more systematically the issues related to the reasons for shifts in the pattern of FDI over the past twenty years, this Chapter will be divided into sections dealing with

government policy, and the specific instances of the aluminium, gold, iron & steel, and energy sub-sectors.

## 4.2. Government policy

In the particular matter of government policies for the mining industry the most important reasons for changes and shifts in the patterns of FDI since the 1960s were: the 1967 Mining Code (Executive Law n. 227 dated February 28, 1967); the 1988 Constitution; the publication of the DNPM Development Plan in 1994 (PPDSM, 1994; the “Plano Plurianual para o Desenvolvimento do Setor Mineral”); the 1995 Constitutional Amendment number 6 (six)<sup>25</sup> (of 15th of August); the 1996 document “Mining in Brazil: Basic Information for the Investor” by the National Department of Mineral Production (DNPM, 1996); and, the 1997 privatisation of CVRD. These developments concentrate on the State’s ability to act in areas where the main guidelines and priorities for developing and promoting the mining sector in Brazil were being put into practice. The consequences of these policies were mainly characterised by two distinct and opposing commitments - to open up mining to foreign players (as in 1967), to restrict foreign players’ mining capacities (as in 1988), and again to open up mining (1995, 1996, 1997, to the present date).

It is important to view the issues listed above as part of a historical process that had been influenced by previous plans and government initiatives. More specifically, we refer to the 1972 Brazilian First National Plan for Development (“Primeiro Plano Nacional de Desenvolvimento”, the PND-I), and the Decree of 11th October 1972 (“Decreto-Lei” n. 1240) through which the government prepared the concession of incentives to export minerals that were abundant in Brazil. Another Decree (“Decreto” no. 71248 of 13th October 1972) introduced the incentives for the mining industry and for those industries working in the transformation (e.g. beneficiation) of primary mineral products which were scarce and needed in Brazil (encouraging import-

<sup>25</sup> This Amendment revoked article 171 of the 1988 Constitution.



substitution within the mining industry), and hence trying to foster private initiative (national and foreign) to develop domestic mining so that importation of minerals could be reduced and national production increased.

The 1988 Brazilian Federal Constitution, in its Article 171, defines what is a "Brazilian enterprise of national capital" as one in which "the effective control is under the direct or indirect titularship of individuals resident in Brazil or under the control of enterprises regulated by internal public law, understanding the effective control of enterprises the titularship of the majority voting capital and also the exercise of decision-making power to administrate its activities". The relevance of Art. 171 stems from the fact that in Article 176 (first paragraph), it is stated that: "The research and extraction of mineral resources will only take place with the authorisation of the Government of Brazil, respecting the national interest, by Brazilians or a Brazilian enterprise [composed] of [majority] national capital ...". Research and extraction of minerals by Brazilian enterprises established with majority foreign capital were then prohibited - a situation which was similar to the 1937 Brazilian Constitution in the time of the "Estado Novo".

The 1988 Constitution was also responsible for abolishing the 'IUM' mineral tax ("Imposto Único sobre Minerais", or IUM)<sup>26</sup>, that was replaced by the 'ICMS' tax ("Imposto sobre Circulação de Mercadorias e sobre Prestação de Serviços") according to Article 155. The main purpose of the IUM, a taxation exclusively made for the mining sector, was to link the economic activities directly to their origin, to their source. This was acknowledged as being responsible for a series of advantages for the municipalities developing mining ventures, and for some 'local-state mining enterprises' ("entidades estaduais de mineração", EEMs or SEM<sup>27</sup>). In the past the mining sector had the conditions to monitor if its own tax (the IUM) was effective and if it was channelled to the places where mining activities were located, e.g. through the provision of infrastructure or other types of incentives for the sector.

In the framework of the new legislation (from 1988 onwards), it was up to the government administration (state or municipal), at

<sup>26</sup> The IUM was created by Law 4425 of 1964 (that also created the 'National Fund for Mining' or "Fundo Nacional de Mineração", the FNMin).

<sup>27</sup> "Sistemas Estaduais de Mineração" (SEM).

its own discretion, to direct more (or less) resources to stimulate the growth of the mineral sector. The power that was once embodied in the sector through the IUM (controlled by the Federal Government through the Senate, "Receita Federal" and Ministry of Mines) is now in the hands of administrative agents not directly linked to mining. With the promulgation of the 1988 Constitution the control of mineral taxation was transferred from the Federal sphere (IUM) to the state sphere through the Conselho de Política Fazendária-CONFAZ. The most important incentives given directly to the mining sector by the Federal Government after 1988 were those that included exemption from Income Tax ("Imposto de Renda", IRPJ) for projects developed in the SUDENE and SUDAM regions, and the special incentive regime for the Programa Grande Carajás (PGC) in the states of Pará, Tocantins and Maranhão.

The abolition of the IUM and the adoption of the ICMS meant that mining was now subject to the same taxation system as all other economic activities; it was no more a 'special case'. The changes in the taxation system resulted in some observers considering that (see Melo, 1990) "the high levels of taxation over Brazilian mining activities, which involves 53 taxes and other contributions, is considered one of the main reasons for the low interest of investors for this sector". One of the main concerns expressed by Melo (*op cit*) was that the IUM was a tax calculated on the basis of company results, and that the problem with the ICMS is that it is calculated on the basis of company production - and this resulted in an increase of what was collected by the government.

Braz (1993: 1-7) considered that with the abolition of the IUM and the inclusion of mining in the ICMS capacity, the 1988 Constitution considered the mining sector under the same taxation system as other national economic activities. What resulted was that, except for the case of the 'financial compensation tax' (the "Compensação Financeira pela Exploração de Recursos Minerais-CFEM"), which is not a particularly heavy taxation burden, mining was not receiving adverse treatment when compared to other economic sectors. The matter of taxation inadequacy or confusing tax systems is not something peculiar to the mining sector, it affects the Brazilian economy as a whole.

We will now provide an overview of the main taxes (Federal, state, municipal) that are applied to the mining sector in Brazil. This illustrates very clearly the main pieces of legislation that regulate mining sector activities and influence the ventures of foreign

players and, as a result of this, foreign players' desirability to further participate with higher or lower levels of FDI. As can be seen, government policies in recent years may be divided into three main periods: (1) the 1987-1988 period (when the new Constitution was being designed, written and published), (2) 1989-1994 (a period of transition marked by political turmoil and economic liberalisation), (3) post-1995 (period which corresponds to the Fernando Henrique Cardoso presidency).

*-Taxation over turnover:*

**-ICMS:** This is a state tax (value added tax). It is generated from operations involving merchandise circulation and services. It is based on the principle of 'selectivity', i.e. it is applied according to local state policies (where local government can choose to charge more or less according to the importance of the activity and depending on local priorities - a case by case approach for negotiations). The revenues obtained through the ICMS are destined for the following: 75% for the state that collects them, and 25% for the municipalities where the corresponding activity is undertaken.<sup>28</sup>

**-COFINS / FINSOCIAL:** This 'Fund for Social Investment' is built up by charging a 2% contribution over turnover of mining enterprises (mainly with the intention of financing social security projects and programmes). Exports are exempt from this contribution.<sup>29</sup>

<sup>28</sup> The main rules for the ICMS were first formulated by the "Conselho de Política Fazendária" (CONFAZ), through Agreement "Convênio n. 66" of 14th December 1988.

<sup>29</sup> The main legislation for the COFINS-FINSOCIAL is: Article 195 (I, paragraph 6) of the 1988 Constitution; Law 7611 of 1987; Law 7738 of 1989; Law 7787 of 1989; Law 7894 of 1989 (altered by Law 8147 of 1990); Law 8114 of 1990; Law 8177 of 1991; Law 8212 of 1991; Law ("Lei Complementar") n. 70 of 1991 (following guidance given in Article 155, paragraph 3, of the 1988 Constitution); Law 8398 of 1992; Decree-Law 1940 of 1982 (altered by Law 7611 of 1987 and Law 7787 of 1989 and by Decree-Law 2397 of 1987); Decree 1030 of 1993; Declaratory Act 01 of 1991; Normative Instruction of the Director of the Federal Revenue 03 of 1992; Declaratory Act CST-02 of 1992; Provisional Measure 725 of 1995; Normative Instruction 21 of 1995; Provisional Measure 1025 of 1995.

**-PIS / PASEP:** This 'Programme for Social Insertion' tax, introduced in 1970, was originally designed to promote the welfare of employees in the context of enterprise development. But in 1988 the PIS was given a different purpose, and now at least 40% of its resources are to be used for financing programmes for economic development; while other attributions include providing an extra annual payment of one minimum salary for employees earning less than two minimum wages, and to finance unemployment benefits. Contributions for the PIS are 0.65% of company turnover (total operational revenues).<sup>30</sup>

**-CFEM:** The 'Financial Contribution for the Exploration of Mineral Resources' tax, which was anticipated in Article 20 (IX, paragraph 1) of the 1988 Constitution, was regulated through Law 7990 of 28th December 1989, and complemented by Law 8001 of 13th March 1990. This legislation guarantees to the states and municipalities, as well as the Federal administration agencies, their sharing in the results of mineral exploration in the territories under their control through a 'financial compensation' system. The basis for its calculation is net turnover<sup>31</sup> resulting from the sale of the mineral product under consideration (in its final stage of beneficiation, but before its industrial transformation). Different mineral commodities will have different levels of taxation, for example, gold<sup>32</sup> will have a 1% aliquot charge over net turnover, while iron will have 2% and aluminium 3%.<sup>33</sup>

<sup>30</sup> The PIS-PASEP is regulated by: Law 7714 of 1988; Law 8177 of 1991; Law 8398 of 1992; Law 9004 of 1995; Decree-Law 2397 of 1987; Decree-Law 2445 of 1988 (altered by Decree-Law 2449 of 1988; Complementary Laws 07 and 08 of 1970; Normative Instruction of the Director of the Federal Revenue 03 of 1992; Normative Instruction of the Secretary of the Federal Revenue 21 of 1995; Declaratory Act CST-02 of 1992; Provisional Measure 725 of 1994; Provisional Measures 1025 and 1026 of 1995.

<sup>31</sup> Net turnover is calculated by subtracting from the total of sales revenues the amount of taxation due on the commercialisation of the mineral product, the expenses of transport and also expenses of insurance.

<sup>32</sup> Gold is dealt with in two different ways by the 1988 Constitution. It is considered (a) as a financial asset or an exchange instrument, when it is exclusively subjected to the Federal IOF tax, with a 1% charge over turnover, and (b) as merchandise, when it is subject to the ICMS, of local state competence, regulated by Law 7766 of 1989.

<sup>33</sup> The main legislation regulating the CFEM comprises (apart from what has already been mentioned): Normative Instruction n. 83 of 23rd May

-Taxation over profits:

-**CSOC:** The 'Social Contribution' tax was created to finance social security expenditures. Its rates are equivalent to around 9% to 10% of profits (before tax).<sup>34</sup>

-**IRPJ:** 'Income Tax for Companies'. The basic working rate for this tax is around 25% on 'taxable profit' ("lucro tributável"). These mainly include deductions related to costs, indirect taxes, depreciation, amortisation, expenses with non-capitalised research, and the *real exhaustion quota* ("quota de exaustão real").<sup>35</sup>

-**AEIR:** 'Additional local-state Income Tax'. The 1988 Constitution (Article 155, II) introduced this tax for the government of local states, and it comes to 5% on the income tax paid to the Federal Government for individuals, or 5% on profits for companies. This non-compulsory tax can be used as an instrument for fiscal incentive to attract new investments (and it is administered locally

1990; Decree 01 of 11th January 1991; Decree n. 1 of 11th December 1991; Edict ("Portaria / DNPM") n. 6 of 6th July 1992; and Law n. 8876 of 1994 (Article 3). The resulting CFEM proceeds are distributed as follows: 65% for the mineral producing municipality, 23% for the state where production is being carried out, and 12% goes to the Federal Government (being shared among the DNPM and the Brazilian Federal Agency for the Environment-IBAMA).

<sup>34</sup> The main legislation for CSOC: Law 1598 of 1977; Law 7689 of 1988 (altered by: Law 7856 of 1989; Law 7988 of 1989; Law 8034 of 1990; Law 8114 of 1990); Law 8383 of 1991; Law 8541 of 1995; Decree-Law 2413 of 1988 (altered by Law 7988 of 1989); Decree-Law 2426 of 1988 (altered by Law 7856 of 1989 and Law 8114 of 1990); Decree 85.450 of 1980 (revoked by Decree 1041 of 1994); Normative Instruction SRF 198 of 1988; Normative Instruction 38 (Departamento da Receita Federal) of 1991; Portaria 468 of 1991; Resolution of the Federal Senate 11 of 1995.

<sup>35</sup> The main legislation for the IRPJ is: Law 7714 of 1988; Law 7988 of 1989; Law 8167 of 1991; Law 8034 of 1990; Law 8383 of 1991; Law 8541 of 1995; Decree-Law 2397 of 1987; Decree-Law 2413 of 1988 (altered by Law 7988 of 1989); Law 2426 of 1988 (altered by Law 7856 of 1989); Law 8114 of 1990; Decree 85450 of 1980 (revoked by Decree 1041 of 1994).

by the states, which determine its value from 0% to 5%).

**-ILL:** 'Tax on Net Profits'. The shareholders, partners and owners of enterprises are subject to an 8% tax on net profits at the end of the legal (financial) year. This tax is charged independently of profits being distributed or capitalised (it is not deductible from income tax). Regulated by Law 7713 of 1988.

A study about the effects of taxation on the national mining sector was published by the DNPM (Vale *et al*, 1992). It concluded that with the changes implemented by the 1988 Constitution, the number of taxes on mining grew with the founding of the CFEM; and also that, even knowing of the methodological complications of making international comparisons, when Brazil was compared to other countries the level of taxation in Brazil was considered higher than that of other important mineral producing countries. The PPDSM (1994) also considered that taxation should not be a determining factor in the international competitiveness of minerals, whether in the form of excessively heavy taxation, or of the excessive promoting of the subsidisation of the industry. The PPDSM suggested that fiscal procedures should be simplified, both for internal and for external (exports) transactions.

One of the main problems of the Brazilian taxation system is its large number of taxes and contributions. Not only is this a problem, but also the fact that several of these taxes were devised with the idea of alleviating social problems (the revenues were supposed to be used for social matters). But in reality, what actually happens is that society at large is forgotten and the money from taxes is used to cover excess expenditures and to cover part of the national budget, which in principle is not what is supposed to happen. One of the main problems in Brazil is the lack of a consistent public policy determining what to do (and how to do) in respect to its fiscal management. This problem is complicated by the fact that most of the time Brazil is also subject to weaknesses in its monetary management as well. Public administration always proves to be inefficient, complicated and confusing<sup>36</sup> - and this is reflected in the wealth of laws that are in

a number of cases devised to change some previously determined course of action, and generally harmful to organisation and stability.

Mackenzie (1998) considers that: "From the perspective of corporate investment strategy for mineral exploration and mine development, the ranges of mining tax criteria associated with the ten selected South American nations [Argentina, Bolivia, Brazil, Chile, Colombia, Ecuador, French Guiana, Guyana, Peru, Venezuela] are found to compare favourably with the eight selected Australian and Canadian jurisdictions [Northern Territory, Queensland, South Australia, Western Australia, British Columbia, Manitoba, Ontario, Quebec]. In fact, the stronger South American tax competitors - particularly Chile and Brazil - have a decided edge on their global rivals. Nevertheless, there is much scope for improving the efficiency of mining tax policies in South America, particularly with respect to the harmful consequences of regressive revenue-based royalties. For example, our analysis demonstrates that between 14% and 35% of the potentially economic deposits discovered are rendered uneconomic by the existing South American tax systems. Realisation of the full economic potential of South America's great mineral wealth will require progressive reforms in mining taxation".

Competitiveness based on taxation positions can also be explained by the fact that several companies do not pay tax. Rose (1999: 3) illustrates this by stating that: "Major companies in Brazil who *pay all their taxes* are estimated to pay on average some 43% [of their] revenues in taxes and "contributions". But according to the head of the Federal Tax Service, half of Brazil's 530 largest firms [which includes many MNEs] pay no tax at all - having either good lawyers, good accountants or political cover".

Since 1995 a number of changes have been introduced in the 1988 Constitution, reducing or eliminating several constraints to FDI flows into Brazil. Among the most important measures

<sup>36</sup> In the matter of mining, the lawyer William Freire points out that Law 7990 of 1989 (which introduced the CFEM tax) is against Constitutional principles, violating Article 155 (third paragraph); In Freire (1996: 222). The Government was able to make laws that go against Constitutional principles.

were: (1) suppression of the constitutional definition of *Brazilian firms of domestic [national] capital*, so that all firms based in the country are to be considered 'domestic', with the important consequence of improving access to official credit, and are allowed to exploit mineral resources as well as electric power supply; (2) private firms are allowed to participate in the distribution of urban gas; (3) private firms are also permitted to participate in the oil industry, competing with PETROBRAS; (4) foreign firms are authorised to participate in domestic navigation; (5) the constitutional reform dropped the prohibition on private firms playing a part in the telecommunication business; (6) differentiation between domestic and foreign-owned capital in the financial sector was abolished, both in terms of limits to participation in financial institutions and for taxation purposes.

In the light of constitutional rights, the legal framework for mining activity states that mineral resources may only be explored and mined under the 'authorisation' or 'concession' regimes stipulated by the Federal Government. This might be pursued by a Brazilian citizen or incorporated in Brazilian law by a company which has its head office and administration in Brazil, the mining product ownership being guaranteed to the concessionaire. Exploration will always be authorised for a fixed period. Exploration and mining concessions may not be assigned or transferred, wholly or partially, without prior consent by the Federal Government (e.i. responsible for legislating on mineral deposits, mines, other mineral resources and metallurgy). The systems for 'exploration' and 'exploitation' of mineral resources and reserves in Brazil are defined and regulated by the 1967 Mining Code and its regulations and corresponding legislation, which are still in force with the amendments and innovations introduced by laws subsequent to the enactment of the 1988 Constitution.

One of the main changes introduced into mining in recent years was the publication of Law n. 9249 (of December 1995), which stipulates new legislation for income tax. The basic legislation on foreign capital in Brazil was incorporated in Law n. 4131 (of 1962) and Law n. 4390 (of 1964), and regulated by Decree 55762 of 1965 - complemented by the 1995 Law n. 9249 quoted above. For the purposes of law, the concept of foreign capital is expressed as assets, machinery and equipment received in Brazil from overseas, invested in the country and destined for producing assets and services. Financial or monetary resources (i.e. capital) brought into Brazil (for investment in the economic activity) and belonging to individuals or companies whose holders



reside abroad (or have their head office overseas), also fall under the heading of foreign capital. Because the definition of foreign capital is too broad, it is hard to evaluate its inflow and its importance for the domestic economy.

The setting up of the National Privatisation Programme (PND) under Law n. 8031 of April 1990, constitutes one of the main steps towards encouraging private investment in Brazil. Although the participation of foreign players was important in many sectors, and although President F. H. Cardoso started promoting the PND more aggressively from 1995 onwards, eager to see more inflow of capital into the Brazilian economy, the PND was not a success (with respect to foreign capital) for the mining sector. This was mainly due to the government's biggest trump card, which was the CVRD, as this enterprise did not attract the desired interest from foreign capitalists. Although the privatisation of CVRD has been an important landmark in the privatisation programme, the resulting revenue [from its privatisation] totalled around US\$ 3.3 billion, or 19.1% of the total of US\$ 17.3 billion collected through the PND from April 1990 to May 1997 (see **Table 14**). [CVRD went to national players with international connections<sup>37</sup>].

**Table 14: PND (\*), share per sector and corresponding values in US\$ billion (considering the period from April 1990 to May 1997 inclusive)**

Sector	Share (%)	Value
Steel	32.2 %	5.56
Mining	19.1 %	3.30
Electricity	16.7 %	2.89
Petrochemicals	15.6 %	2.70
Railways	8.5 %	1.47
Fertilizers	2.4 %	0.42
Others	5.4 %	0.96
<b>Total</b>	<b>100%</b>	<b>17.3</b>

Source: BNDES, 1997; ANDIMA, 1997. (\*): Brazilian Privatisation Programme (PND).

<sup>37</sup>i.e., under Mr. B. Steinbruch's control and with the help of American financing through 'Nations Bank'.

## 4.3 The case of aluminium

In the specific case of the aluminium sector in the 1990s, it is thought that the influx of FDI into Brazil was reduced on account of the large amounts of aluminium sold by the Community of Independent States-CIS (ex-USSR) to European and North American markets mainly up until 1995 - which also contributed to the depression of international prices for the metal, which, in turn influenced several producers to drastically reduce or cancel new investments to upgrade the capacity of installations. Regarding FDI in the mining industry, the main projects and interests for the members of the aluminium sector are associated with the fact that the foundations of the aluminium industry are related to the economic availability of bauxite and of energy. And this favours new projects not in Brazil, but elsewhere, in other "more attractive" regions. The USA is at present, for example, considered a better environment for mining-related businesses than Brazil when contemplating new developments and projects for the aluminium industry.

The end of the 1990s witnessed a certain "migration" of industrial activities in the opposite direction to that of the past three decades, i.e. now activities are going from the 'emerging markets' to the 'developed countries' (a "reverse migration" of capital and industrial resources). In the specific case of ALCOA, for instance, it can be seen that during the past few years (of the 1990s) this company has directed its investments to the European region (e.g. Hungary, Italy, and more recently Spain). Several European countries are today able to produce energy at lower prices than a number of emerging market countries (including Brazil). As for the European countries, bauxite is usually bought from Africa (e.g. Guinea). It is also relevant to recall that between 1991 and 1995 the ex-USSR sold off a large amount of mineral commodities and products (including bauxite, alumina and aluminium) that were often bought by European countries. This made the European market very attractive for businesses in the aluminium sector during the 1990s (at least until 1995), contributing to the enlargement of European industrial productive capacity in this sector.

The North American market is also gaining greater

importance and one event that is certainly going to bring several changes to this market (and to the world market as well) is the merger agreement between ALCOA and REYNOLDS (Reynolds Metals Company) of August 18 (1999), where ALCOA will acquire all outstanding shares of REYNOLDS in a tax-free stock-for-stock transaction. ALCOA's president Mr. Alain J. P. Belda said that "The new company will be better positioned to address the ongoing globalisation of the metals industry and the new competitive landscape this is creating. It will permit the greater efficiencies and cost reductions required by an environment that has seen the lowest prices in many years for our commodity products" ([www.alcoa.com/news/latest/merge](http://www.alcoa.com/news/latest/merge)).

## 4.4. The gold sub-sector

In the specific case of gold, the characteristics of recent investment plans in Brazilian mining clearly show a high degree of preference for gold exploration (see **Table 15** for main producers in 1996). The importance of this metal is confirmed by the fact that a number of foreign companies are interested in developing and expanding business in this sector, e.g. BARRICK GOLD, ECHO BAY, NEWMONT, PLACER DOME, TECK Corporation. There is also an interest on the part of 'junior companies' from Canada and USA. Of the 15 companies listed in the Vancouver Stock Exchange (VSE) in Canada that have interests in Brazilian mining (see **Table 16**), ten are only interested in gold (and in another two cases gold interests are shared with diamonds).

Known gold reserves in Brazil are not impressive if compared with countries such as South Africa or the USA. However, this is due to the absence of geological studies and surveys, and to low levels of investment rather than to geological potential. 'Resources' may be extensive, but they are still largely unknown; they still need to be *transformed* into 'reserves'. This "transformation" is done with investment. Because CVRD is a company with years of accumulated geological knowledge of several parts of Brazil - because of the work done by DOCEGEO (CVRD's subsidiary for mineral exploration), it is thought that most 'proven resources' (= reserves) of gold are in the hands of this company. Today, CVRD probably controls around 350 to 450 tonnes of gold reserves.

But if CVRD wants to substantially increase its production - since it was reported that its target for gold production for the year 2000 was 31 tonnes - and reach higher levels in the international rankings, much has still to be done to increase gold reserves.

Gold production in Brazil will have two main fronts to develop in the next decade: (1) gold from the Amazonian region and/or (2) gold as a by-product of other ores. The case for gold exploitation from mines with other ores is really important to mention. As gold on its own can be a risky venture, companies will be more prepared to discover and exploit mines with two [or more] minerals. This is the situation, for example, in developments such as the 'Salobo Project' in Pará state and the 'Chapada deposit' in Goiás. The Salobo project is a partnership between CVRD and MMV (the main shareholders of MMV are Banco Bozano-Simonsen and AAC). This is a business that is being researched so as to produce 8 tonnes of gold per year together with copper exploitation. The Chapada deposit is a partnership between Mineração Santa Elina (MSE Ltda.) and the Canadian company Echo Bay Mines (EBM) to study the viability of production of copper associated with gold. This deposit could produce 60 thousand tonnes of copper concentrate and 6 tonnes of gold per year.

**Table 15: Main industrial gold producers in Brazil, 1996**

<b>Companies</b>	<b>Production (kg of gold)</b>	<b>% of industrial production</b>
CVRD	18,010.00	38.12 %
Morro Velho-MMV / Anglo American (*)	7,400.00	15.66 %
Rio Paracatu-RPM / Rio Tinto (*)	5,150.00	10.90 %
Serra Grande/Crixás-MSG / Anglo American (*)	3,870.00	08.19 %
São Bento-SBM / Eldorado (*)	3,130.00	06.62 %
Jacobina-JMC / Anglo American (*)	1,318.00	02.79 %
Santa Elina-MSE / Echo Bay (*)	800.00	01.69 %
Others	7,568.00	16.03 %
Total industrial production (IP)	47,246.00	100 % (IP)
"Garimpo" production (GP) (**)	17,000.00	100 % (GP)
TOTAL (IP) + (GP)	64,246.00	100% (IP) + (GP)

Source: *Brasil Mineral* / DNPM. (\*): Indicates foreign control; (\*\*): Values for "garimpo" are estimated.

## 4.5. Iron & steel sub-sectors

The iron & steel sub-sector represent very well the relationship between productive capacities, the domestic market and international capital. The large integrated groups that produce steel in Brazil, namely CSN, USIMINAS, CST, COSIPA, AÇOMINAS, COSIGUA, BELGO-MINEIRA, ACESITA and MANNESMAN (listed in decreasing order of importance with regard to their participation in the total productive capacities for the 1991-96 period), even though only subject to minority direct foreign participation in their ownership structure<sup>38</sup>, e.g. 6.7% of CSN belongs to Citybank, 18.5% of USIMINAS is under Nippon's control from Japan, CST has 10.3% of its shares under Japanese control and other 1.6% belongs to California Steel, BELGO-MINEIRA has 9.28% under direct control of foreign shareholders (see **Table 17**), they are mainly manufacturers of steel products that have a high share of their production destined to the auto-industry and auto-parts sector in Brazil (which is mainly foreign-owned) or to export markets. The auto-industry in Brazil is mainly represented by FIAT, FORD, GENERAL MOTORS, VOLKSWAGEN, MERCEDES-BENS, VOLVO and SCANIA. The domestic consumption of steel in Brazil is highly conditioned to the needs of these MNEs and to their business activities and strategies.

The most important change in the steel and metallurgical sector was its privatisation between 1991<sup>39</sup> and 1993 under the National Privatisation Programme (PND). Through the PND the Brazilian Government transferred eight steel companies to private owners. They were: USIMINAS, COSINOR, AÇOS FINOS PIRATINI, CST, ACESITA, CSN, COSIPA, and AÇOMINAS, which accounted for around 70% of total domestic production capacity. Privatisation, in the words of the government, has *decentralised ownership in the steel sector*. The resulting scenario of this decentralisation of

<sup>38</sup> Apart from MANNESMAN which is under majority German control.

<sup>39</sup> The privatisation of the steel sector really started in 1988; but it is a convention to consider the key year 1991 because it was only from then onwards (beginning with USIMINAS) that the most important companies were privatised.

ownership is shown in **Table 18**. The Government aimed for decentralisation of ownership, productivity and profitability gains, and also the promotion of private businesses (by removing the State from these activities). The Government also had similar plans for the mining industry (which were demonstrated by the privatisation of CVRD).

**Table 16: Listed companies in the Vancouver Stock Exchange with interests in Brazil, 1997 (in alphabetical order of company names)**

Company	Interests
1 America Mineral Fields Inc.	Diamonds
2 Canabrava Diamond Corporation	Diamonds
3 Consolidated Dencam Development Corp.	Gold
4 Deplet Resources Ltd.	Gold
5 Diagem International Corp.	Gold / Diamond
6 Econ Ventures Ltd.	Gold
7 Golden Palm Resources Ltd.	Gold
8 Highgrade Ventures Ltd.	Diamond / Gold
9 Lysander Gold Corporation	Gold
10 Madison Energy Corp.	Beryle / Feldspar / Columbite
11 Ourominas Minerals Inc.	Gold
12 Serena Resources Ltd.	Gold
13 South Duval Gold Corp.	Gold
14 Tapajos Gold Inc.	Gold
15 Vannessa Ventures Ltd.	Gold

Source: *Minério & Minerales*, 1997 / Docegeo / Unicamp / <http://www.vse.com>.

**Table 17: Companies of the steel sector in Brazil - shareholding structure, 1997**

Company	Shareholders
CSN	-Grupo Vicunha (13,9%) -Previ (*) (10,9%) -Bradesco (10,9%) -CBS (10%) -Docenave (9,9%) -Clube de Investimentos CSN (9,5%) -Citybank (6,7%) -Itaú (1,8%) -Emasa (1,1%) -Others (25,3%)
USIMINAS	-Nippon Usiminas (18,5%) -Clube de Investimentos e Caixa Empreg. Usiminas (18,1%) -CVRD (15,5%) -Previ (*) (15%) -Valia (7,7%) -Distribuidores de Aço (5,1%) -Camargo Corrêa (4,3%) -Others (15,8%)
CST	-ACESITA (29,3%) -CVRD (22,7%) -Japanese Shareholders (10,3%) -Funsset / CIEST - Clube de Empregados (3,4%) -California Steel (1,6%) -Others (32,7%)
COSIPA	-USIMINAS (49,8%) -Clube de Investimentos Empregados Cosipa-CIEC (13,5%) -Bozano (12,4%) -Brastubo (11,9%) -Fundação Cosipa Seguridade Social-FEMCO (5,2%) -INDA (4,1%) -Others (3,1%)
AÇOMINAS	-Clube Particip. Acionária dos Empreg. da Açominas-CEA (19,98%) -Cia. Mineira Particip. Industr. e Comerc.-CMPIC (17,17%) -Agropecuária Senhor do Bonfim (10%) -Banco de Crédito Nacional (10%) -Banco Crédito Real de Minas Gerais (9,89%) -Aços Villares (6,21%) -Açominas-Ações em Tesouraria (5,62%) -Banco do Estado de Minas Gerais (5,06%) -CVRD/Docenave (5%) -Banco Real (3,8%) -União Comércio e Participações (2,55%) -Others (4,72%)
COSIGUA	-Grupo Gerdau (100%)
BELGO-MINEIRA	-SIDARFIN S.A. (19,72%) -Previ (*) (10,69%) -ARBED S.A. (10,64%) -Grupo Bradesco (7,7%) -Centrus (7,3%) -Assoc. Benef. Empreg. Belgo-Mineira-ABEBM (5,1%) -Assoc. Assist. Belgo-Mineira-AABM (4,5%) -Other national shareholders (25,07%) -Other foreign shareholders (9,28%)
ACESITA	-Previ (*) (23,94%) -Sistel (**) (16,16%) -Petros (***) (8,19%) -Previ-Banerj (2,31%) -Inst. Segurid. Social Correios e Telégr.-ISSCT (1,26%) -Real Grandeza Fundação Prev. Assit. Social-RGFPAS (1,25%) -Clube Investimentos Empreg. Acesita-CIGA (0,94%) -Others (45,95%)
MANNESMANN	-Mannesmannrören-Werke AG (76%) -Others (24%)

Source: *Brasil Mineral*. (\*): Previ: Caixa de Previdência dos Funcionários do Banco do Brasil. (\*\*): Sistel: Fundação Telebrás Seguridade Social. (\*\*\*) Petros: Fundação Petrobrás de Seguridade Social.

**Table 18: The Decentralisation of ownership of the steel sector in Brazil - shareholder structure after privatisation (October 1993)**

Shareholders	per cent holdings
Financial Institutions	28%
Steel Sector Groups	18%
Employees	16%
Foreign Investors	9%
Pension Funds	8%
Domestic Investors	8%
Clients	7%
Suppliers	6%

Source: BNDES.

**Table 18** shows that as a result of decentralisation of ownership, foreign investors after privatisation directly controlled around 9% of holdings (after September 1993). However, it is difficult to know the real size and importance of foreign capital after the changes brought about by privatisation as there is also an 'indirect presence of foreign capital' through financial institutions, the steel sector itself, clients, and suppliers.

The CSN exemplifies very well the new stage of foreign participation in the metallurgical industry in Brazil. In July 1997, for example, CSN began the construction of a 230 megawatt co-generation thermoelectric power plant at the Presidente Vargas Steelworks. The plant will be powered by gas produced as a by-product of the steel production process that is currently being burned off into the atmosphere and lost. The cost of the plant was budgeted at around US\$ 300 million and was scheduled to begin operations by December 1999. The plant represents an important step towards CSN's energy self-sufficiency since it will be responsible for generating approximately 50% of the steel mill's estimated energy requirements by the year 2000. SIEMENS A. G. of Germany and SIEMENS Ltda. of Brazil are building the power plant on a turn key basis.

Another example of this "new stage of foreign participation" also considering CSN may be given. This major Brazilian steel producer announced in May 26 (1998) the formation of a new company called GALVASUD - to be formed as the result of joint efforts between CSN (51% stake) and THYSSEN (Thyssen Krupp



Stahl A. G. from Germany with a 49% stake). The primary objective of this new company is to supply the automotive sector (destined for the production of automobile chassis) in Brazil and also other MERCOSUL countries. The project will require investments totalling more than US\$ 250 million, with industrial plants installed in Rio de Janeiro state and operations scheduled to begin in the year 2000. The new company will operate a hot dip steel galvanising line, as well as units for the production of blanks (pre-cut sheets of different formats). GALVASUD will also utilise the latest generation laser-welding technology developed by THYSSEN<sup>40</sup>.

## 4.6. FDI and the energy sector

The search for raw materials and their markets is not something simple and straightforward, several factors have to be taken into consideration - and one important factor is that relating to energy (power use) as studied by Furtado & Suslick (1995) and by Suslick & Proença (1995). They refer to some of the major changes that have occurred in the metals industry in the LDCs over the past 25 years. This period allows for the evaluation of the impact of the energy crisis and the changes in the pattern of economic growth, associated with changes in energy and metal production and the consumption profile in the developing and developed countries.

LDCs and developed countries display (up until 1995) a clear divergent pattern after the two oil-shocks (1973-74 and 1979-80) when 'energy intensity' is analysed. These groups of countries reacted in quite different ways after the havoc caused by the two oil shocks. The LDCs followed the track of using technologies that are *energy intensive*, while the more developed countries chose the opposite option, i.e. the use of technologies less intensive and less demanding in the use of energy<sup>41</sup>. This

<sup>40</sup> A strategic alliance between CSN and THYSSEN began in 1997 with the signing of a technology assistance contract in the field of tin plate for the packaging industry.

<sup>41</sup> Studies of this kind are prone to issues of competitiveness analysis.

unevenness in the energy consumption between developed and less developed countries has to be taken into account in order to understand future trends relating to trade, finance, environmental issues, the use of technology, and also, with possible repercussion in all these areas - foreign direct investment (FDI).

This stated unevenness in the types of approach relating to *energy systems* (the different modes for considering industrial energy use) will result in a diverse pattern of power (energy, electricity) production and use (the amount generated and its levels of consumption for mineral-commodity production). This refers to a relatively new type (more recent in its occurrence) of uneven development among countries in relation to the production modes and technologies of the industrial sectors. This unevenness with regard to 'energy systems' means that developed countries are producing and using new methods and new technologies (accompanied by more modern equipment) for raw materials exploration, exploitation and processing. New methods that are less demanding in terms of energy consumption.

The less developed countries (LDCs) are, in several cases, still using older methods for raw materials exploration, exploitation and processing - which implies the use of older technologies (with greater energy consumption). Richer countries have been able to improve and modernise their industrial processes, systems, technologies, while poorer countries need more "support" for acquiring or renewing their processes, equipment and industrial apparatus. This "support" could come in the form of FDI in the productive sector - for the furthering of industrial modernisation and updating. It seems that since 1996-1997 industries in Brazil have been trying to improve their operations (general infrastructure, engineering and technology) and their energy systems and that greater foreign participation is forthcoming in this renewal and upgrading process. In section 5.3 the example of ALCAN is quoted together with its activities and plans to improve its energy usage (its productivity of energy resources). The case of ALUMAR (jointly owned by ALCOA and BILLITON), is also mentioned.

The Brazilian Ministry of Mines and Energy (MME) produced a study of the 'Chacaracteristics of the Brazilian Energy Development'

for the 1970-1998 period and concluded that "The Electrical Sector more than quintupled its installed generation capacity during the 1970-1998 period. In December 1998 it had 65.2 GW in operation (including that of auto producers) proportional to 91% hydraulic generation and 9% thermal and nuclear generation. The installed hydraulic generation capacity of 56.8 GW, as of 31st-Dec.-1998 represented approximately 22% of Brazil's total potential hydraulics". During the period from the 1970s until 1992 a growth trend in the participation of the energy-intensive industries in the consumption of industrial energy was observed. "A great part of this growth was a consequence of the expansion of metallurgy, which targeted the external market (the export of steel, ferro-alloys and aluminium, from 1980 to 1992, increased from 2.3 to approximately 13 million tonnes)." Since 1995-1996, however, "Brazil is placing a higher value on its own industrial products with less energy consumption" (<http://www.mme.gov.br/Sen/dadhist/CARAC>, 5 pages).

## 4.7 Closing remarks

When evaluating the performance of the Brazilian mining industry over the past 20 to 25 years, it can be seen that the industry underperformed (even knowing that it grew in general terms). It is believed that this underperformance came about because growth was not at the levels that could be achieved if a clear mining policy had been in operation: i.e. if a proper 'plan' was in place; one that not only needed to be a written & documented plan (as it was), but also that could be implemented. Until the 1988 Constitution was published, the objectives of Brazilian mining were to *promote intense and immediate use of known mineral resources and the enlargement of the knowledge related to the national mineral/geological resource-base*. These aims were not fully accomplished. The opening up of mining to private initiative (national and foreign), during the period before 1988, did not produce the desired results; and the new 1988 Constitution, by supporting changes that, to a certain degree, restricted foreign participation and "nationalised" mining (what lasted until 1995), brought an even more confusing environment,

making it more complicated to established global objectives for the adoption of a mining policy framework that would work more coherently for the needs of the domestic economy. This resulted in a period of reduced FDI.

The 1990s can be seen as a “period of preparation” (transition) for a renewed wave of foreign investment and participation. MNEs and foreign investors are now building (or trying to build) a better and more organised framework and work in a much friendlier environment where there could be the return of the ‘FDI model’ with denationalisation / privatisation. The reconstructed environment of the world economy with the presence and regulation of the World Trade Organisation (WTO), the Uruguay Round of GATT, and several countries competing with each other for shares of global investment, proposes to work towards building up this friendly environment and under a multilateral framework for FDI in a “consensus-building process” (see Brewer & Young, 1995). In order for Brazil to succeed in obtaining higher levels of FDI inflows, it is now possible to argue that domestic regulatory changes and national economic policy will have to follow more and more those changes promoted at the global level.

## **5. The contribution of shifts in FDI to the sector's development**

### **5.1. Opening remarks**

In order to provide concrete evidence for the discussion on the contribution of shifts in FDI to the mining sector's development, we will expand on those four issues cited at the end of section 3.1 (the 'First considerations' on the scale of FDI in the Brazilian mining sector). This will contribute towards a better understanding of the issues of capital goods imports, indigenous technological development and export performance (which will be dealt with later in this section). These four main case studies are: (1) iron-ore and transportation and logistics technology, (2) bauxite-alumina-aluminium and energy use and process technology, (3) gold and advanced metallurgical processing technologies, and (4) the metallurgy of aluminium and steel for cans.

### **5.2. Iron-ore and transportation and logistics technology**

Minerações Brasileiras Reunidas (MBR), the second largest producer of iron-ore in Brazil (after CVRD) is a good example of the importance of better transportation systems and logistic technologies. MBR is going through a phase of new investments in these areas to enhance its productivity. The main objective is to produce more with greater efficiency on the delivery side of its mines. These plans are important now at a time when some of MBR's mines are becoming depleted and new mines are being brought into operation. There are plans for investing around US\$ 360 million during the 1998-2009 period and this includes providing funds for a complex transport system and its needed facilities - from the mine to the processing plants and then to the railway and from there to the port facilities and installations.

Nowadays MBR produces around 26 million tonnes of processed ores per year and the plans are to achieve levels of 32 million [tonnes per year] by the year 2004. This will have to be done during a period of 'transition' from old mines with declining reserves to the new mines already under development. The Águas Claras and Mutuca mines are giving way to new mines such as Tamanduá and Capitão do Mato, while the already established mines of Pico and Capão Xavier are to continue to be important producers. The new installations at Vargem Grande are being built for mineral treatment (expected completion date 2001 or 2002), and while the Mutuca mine is going to have its reserves depleted the site will still be used for mineral processing (mainly for ores coming from Capão Xavier).

These changes are taking place not only because of geological conditions but also because they are included in MBR's strategic plan for transportation and logistics. Nowadays the ore produced in the Pico mine is sent to the Andaime Terminal, from where it is then forwarded to the "Ferrovia do Aço" Railway. Production from the Águas Claras mine is delivered from its own terminal (which is soon to be closed). Output from the Mutuca mine flows from a third terminal called the "Olhos D'água". In the near future all the ore produced in the Pico and Vargem Grande mines will be delivered through the Andaime Terminal, whilst only the production from the Capão Xavier mine will use the Olhos D'água Terminal. This will bring important logistical gains, as the transportation distances will be reduced and the Ferrovia do Aço Railway will be used more extensively (which will afford genuine economic benefits).

For many years the transportation grid and systems that were in use placed a level of constraint on MBR's production and operations. Because of the need to change, MBR started to depend on the support of the company MRS Logística (which operates the local railway grid) and is also investing to upgrade the operational conditions of local rail transportation (improving the regularity of ore flow from mine to port). Because MBR does not operate a single mine, but a complex of mines located in different areas, transportation and logistics have to be well planned and well integrated in such a way that transport costs can minimise total operational costs. MRS Logística is having success in bringing

down tariff costs because of its more efficient use of the rail grid.

This is also a reason why MBR is building the Vargem Grande treatment plant near the Pico mine (located only around 4 kilometres from the Andaime Terminal). This is all part of the new structure of transportation that will also include long distance transportation of ore by conveyor belts between mines, mineral processing plants and railway terminals. New plans for transportation and logistics started mainly as a result of the successful 1996 bid of US\$ 980 million by MBR to gain the rights for operating the Southeast grid of the 'Rede Ferroviária Federal' (RFFSA Railway). MRS Logística was then created in order to control this local grid of rail operations (and MBR is a shareholder of this enterprise controlling around 33% of its capital). These are the main reasons behind recent improvements and new investment plans in the transportation and logistics area - which will give rise to more efficient channels for the distribution of ores (unprocessed and processed) within the Minas Gerais, São Paulo and Rio de Janeiro states.

MBR is part of the CAEMI Group (CAEMI Mineração e Metalurgia S.A.) and it also has Japanese shareholders. The new plans and new investments can be attributed to recent changes in the shareholding structure which ended by promoting a new managerial structure whereby the Japanese shareholders now have a stronger position in the destiny of MBR. These changes have been taking place since 1997 when MITSUI acquired 40% of the shares of CAEMI and provided around US\$ 290 million for new investments and also for covering short-term outstanding debts. It can be said that enlarged Japanese participation in CAEMI will help to strengthen MBR not only by improving its transportation system but also by bringing into Brazil new technologies and new equipment to support these new plans and improvements.

### **5.3. Bauxite-alumina-aluminium and energy use and process technology**

The ALCAN case is relevant for an understanding of the

relations between foreign capital and industrial operations in Brazil. Recent changes in ALCAN are bringing into Brazil new concepts for managing the aluminium industry such as Full Business Potential (FBP) and Economic Value Added (EVA). The FBP is a process where it is possible to better understand the procedures to be adopted in order to maximise the return on invested capital based on operational and non-operational criteria. Among these are 'operational excellency', 'new technologies' and 'client satisfaction'. The EVA concept consists of financial measures for business management - which aim to bring greater security to the decision-making process of companies when dealing with capital and also building the path for permanent growth of financial results.

The Economic Value Added (EVA) is being advocated as a good performance measurement system, as it encourages managers to act like owners (motivated by EVA-based bonus payments). EVA refers to the amount of earning generated above and beyond the cost of the invested capital used to produce those earnings. The *rationale* is that it is supposed to encourage investments in, for example, R&D and training. This is indeed the case as R&D and training are now classed as 'investments' instead of being traditionally treated as 'expenses'. This helps businesses in encouraging long-term performance (since investments are being made into strategic areas with a longer timescale).

In accordance with these new procedures for tackling businesses, the new objectives for enhancing the competitiveness of the aluminium operations of ALCAN in Brazil - for primary aluminium, packaging, laminated products - will depend to a great extent on the new supply of energy for the Ouro Preto factory (to make viable the primary aluminium operations as a competitive source of metal for ALCAN Brazil). Other targets for ALCAN in Brazil are to continually improve its sources and energy supply providers; to consider operating and managing its own energy generators; to join in consortiums to provide extra electrical energy, and also to improve the engineering of its smelters in order to reduce energy consumption and increase working productivity.

The competitiveness of the aluminium sector is highly



dependent on the availability, price and performance offered by its bauxite mines and also on electric energy. *Minérios/Minerales* (vol. 18, n. 210, April 1996, p. 33) states that "the cost of energy utilised in the production of aluminium was US\$ 14 / mwh in 1980, and this figure increased to US\$ 27 / mwh in 1989". BNDES data indicates that the price of energy for the 1990-1994 period (for the Northeast and Southeast regions of Brazil) oscillated between 26 and 30 US\$ / mwh, which is superior to the world average and affects negatively the competitiveness of companies of the aluminium sector.

When considering the effects of energy prices over production there is an important distinction to be made, as the Northern region of Brazil (the Amazonia) still has a advantageous position compared to the rest of the country. The average price of electric energy in the North is 10 US\$ / mwh. The power (electric energy) provided for the Amazonian region is supplied by TUCURUÍ via ELETRONORTE, which allows for a tariff benefit to be conceded to the companies of the region through long-term contracts that will expire in the year 2004. The aluminium sector enterprises in this region - ALBRAS (51% CVRD and 49% Japanese investors via NIPPON) and ALUMAR (joint-venture between ALCOA and BILLITON) - all take advantage of these contracts.

ALCAN does not benefit from this lower price as its industrial plants are not in the Amazon region; four are in the Southeast (one in Ouro Preto, Minas Gerais state, and three in São Paulo state: Mauá, Pindamonhangaba, and Utinga), and one is in the Northeast region in Aratu, Bahia state. Although paying higher prices for its energy needs, ALCAN is still investing in Brazil and its 1998 investments were divided as follows: US\$ 124 thousand in technological research, US\$ 169 million in the expansion of productive capacity, US\$ 5,101 million for the acquisition of equipment, and US\$ 4,355 million on environmental projects. This illustrates the commitment of ALCAN in further developing and improving process technologies in its industrial plants.

Improvements in ALCAN's technological systems & processes are under way in order to enhance productivity and expand production volumes. Main efforts are being directed to process controls and automation, to cold mill lamination (cold rolling

equipment), recycling and refusion (melting of scrap material), and to the preparation of aluminium plate (flat-rolled products). This also involves a closer relationship with equipment suppliers (e.g. German SIEMENS, Swedish Asea Brown Boveri-ABB, Austrian EBNER) and with other ALCAN plants around the world (e.g. North American plants such as Logan and Oswego in USA). This allows for new technologies to be implemented in ALCAN Brazil.

The case of BILLITON from the UK is also interesting. BILLITON holds interests in the ALUMAR refining & smelting complex (through its Brazilian branch, Billiton Metais S.A.). The ALUMAR facility is an integrated alumina refinery and aluminium smelter complex located close to the city of São Luís in the Northeast of Brazil. ALUMAR has a number of competitive advantages, including a power (energy) contract which is linked to the LME price for aluminium, and also a generally low labour costs structure and energy efficient smelters that use state-of-the-art technology. BILLITON operates ALUMAR together with ALCOA (which provides technical and managerial services). This joint-venture was formed to build the ALUMAR facility which started production in 1984.

The ALUMAR alumina refinery is owned by ALCOA (54%), BILLITON (36%), and ALCAN (10%). The ALUMAR aluminium smelter is owned by ALCOA (53.66%) and BILLITON (46.34%). Each member of the consortium finances and supplies its own raw materials and receives its proportionate share of production, which is then marketed independently. The refinery was originally designed with a capacity of 500,000 tonnes per annum of alumina and, since 1984, the capacity has been more than doubled. With respect to technology it is important here to point out that the ALUMAR smelter has 608 pots - whose design is based on ALCOA's technology - with a total production capacity of 365,000 tonnes per annum (the smelter produces aluminium mainly in the form of ingots for export).

## 5.4 Gold and advanced metallurgical processing technologies

In the matter of technologically-advanced productive processes we may quote the case of CVRD's Fazenda Brasileiro mine in Bahia state. The metallurgical process and the plant used in this mine "was planned to recover gold from *primary ore* by the hydrometallurgical 'carbon-in-pulp' (C.I.P.) process with an expected recovery index of 90%. The first-stage gravimetric cycle comprises crushing and milling followed by cycloning and jigging. After this stage the mill product (80% of bulk volume) is directed to the thickener and its underflow (50% solids) is pumped to pre-aeration and cyanide solution addition tanks. The gold in solution and the pulp resulting from leaching are pumped to carbon tanks for the gold adsorption stage. Gold-enriched carbon goes to a desorption (elution) unit. The impregnate solution is then pumped to electrolytic cells and gold is electro-deposited on steel wool cathodes which are removed from the cells when saturated. Saturated cathodes are acid washed in order to dissolve impurities. The concentrate obtained is filtered, dried and melted in induction furnaces. The gold bullion is afterwards sent to refineries" (Victorasso *et al* 1991: 9)<sup>42</sup>.

As CVRD is investing in more sophisticated industrial processes, such as the North American CIP process, this requires more investment in industrial automation (and this is exemplified in the controlled addition of cyanide solutions undertaken in *real-time*). This clearly indicates that the organised (formal) sector of Brazilian mining is promoting more advanced solutions for their operations and that there will probably be more opportunities for suppliers of these cited mining and metallurgical operational systems. The 1990s showed a general decline in informal gold mining and the pursuit of qualified industrial mining.

<sup>42</sup> I am very well acquainted with these gold and advanced metallurgical technologies as I worked as a geologist in the Fazenda Brasileiro mine from 1989 to 1991 (and also co-authored the paper co-ordinated by E. Victorasso, 1991).

It is important to remember that informal ("garimpeiro") gold production in Brazil is declining. And this is happening partly because the 'easy-to-find' and 'easy-to-exploit' gold deposits are more and more things of the past. Nowadays the mineral deposits that are available are those which are profitable when using industrial operations and plants for their recovery. Mineral deposits can no longer be exploited by primitive processes of 'no' or 'low' technology (as happens with the "garimpo"). The low gold prices are another stimulus for the organised industrial mining that has to find more advanced systems and processes for mineral exploitation (more competitive and with greater operational efficiency). This requires up-to-date technologies and equipment.

As the primitive production of the "garimpo" is declining in Brazil, and at a time when gold prices are also losing ground, it is still possible to increase production when companies use modern technologies. This is the case of Rio Paracatu Mineração (RPM) in Minas Gerais state, a company of the Rio Tinto group (UK-Australia). RPM was able to increase its gold production from 4959 kg in 1997 to 5544 kg in 1998. And this was possible by using modern technologies in gold exploitation and processing.

Another example where technology was one of the main factors for increasing production was that of São Bento Mineração (SBM) in Minas Gerais state. SBM belongs to the Eldorado Gold Corporation from North America and its Brazilian operation includes an underground mine and a processing plant with a range of processes incorporating comminution of rocks, flotation, and even an advanced bacteriological oxidation process designed specially for gold production. For this type of mining to be possible, high levels of investment in equipment, infrastructure, engineering and environmental planning is required. In 1998 alone it was invested by SBM around US\$ 303,000 in geological research, US\$ 1,368,000 in the expansion of mine capacity, US\$ 2,062,000 on new equipment, US\$ 3,828,000 on infrastructure, and US\$

<sup>43</sup> I would like to thank the manager of the Mining and Metallurgy sector of BNDES, Dr. Maria Lucia Amarante de Andrade for information on metallic beverage packaging; also important was conference information from *Aluminium South America 1999* (São Paulo, September 1-3; DMG Exhibition Group) and information from the Associação Brasileira do Alumínio-ABAL.

164,000 on environmental projects. SBM produced 2999 kg of gold in 1997 and 3527 kg in 1998.

## 5.5. The metallurgy of aluminium and steel for cans<sup>43</sup>

For a specific study on the importance of aluminium and the steel sub-sector in Brazil we will consider the use of these metallurgical products in the fabrication of cans for the soft-drink and beer (beverages) sector in Brazil. The beverage sector also uses other materials for drink 'containers' (e.g. bottles made of glass and polyethylene terephthalate-PET), but we will concentrate our attention on aluminium and flandres sheets - used to produce aluminium and steel cans. In Brazil and in South America the use of aluminium cans is greater than those made of steel (just like the North American market). In Europe and Japan the use of steel for can fabrication is greater than in North and South America.

In Brazil's case there is a high concentration on the supply of aluminium and steel sheets for the production of cans for beverages in general, and on the fabrication of cans for other uses. Using 1996 data (only for Brazil) the use of cans for beverages is around 6 billion [cans] (almost all of them made of aluminium). The main domestic producers are ANC, BALL, CROWN CORK, LATASA, and METALIC. METALIC (with one producing plant) is the only maker of steel cans while all the others fabricate aluminium cans; ANC has three plants, BALL and CROWN CORK two plants each, and LATASA four industrial plants.

There are several factors affecting the competitiveness of aluminium and steel cans, among them are: cost of technology, cost of raw materials, commercialisation and marketing, and recycling. If raw materials alone are considered, steel cans have an edge over aluminium cans due to the higher prices of aluminium. But in most respects, the preferred and more widely used material in Brazil is aluminium. One important indication of this preference for aluminium is the expansion of the ALCAN factory (a producer of aluminium sheets for the packaging sector) in Pindamonhangaba in São Paulo state. ALCAN is in fact the only manufacturer of aluminium for the packaging sector in Brazil

(making 88 thousand tonnes of aluminium sheets in 1997). The production capacity of the ALCAN plant in Pindamonhangaba is being expanded from 150 thousand tonnes per year to 200 thousand t/y with "investments of US\$ 350 million for the 1996-1999 period for expansion and modernisation" (*Brasil Mineral*, n. 171, 1999: 34).

With respect to the fabrication of cans, this involves automated processes requiring large investments in machinery and high-performance equipment and technology. The estimated cost for producing one thousand cans in Brazil is somewhere between US\$ 65 and US\$ 85 (with variations between the different producers). The making of modern two-piece metallic packaging for beverages (soft drinks, beers and carbonated drinks) started in 1990 in Brazil when REYNOLDS from USA opened the LATASA factory in Pouso Alegre in Minas Gerais state. LATASA is an association between REYNOLDS (33.6%), BRADESCO (33.6%), J. P. MORGAN (11.8%), and the general public (21%). LATASA is the largest producer of cans for the beverage sector in South America with six factories, four in Brazil, one in Argentina and one in Chile (with total production capacity of 7.9 billion cans per year, and of this total 6.5 billion cans per year are produced only in Brazil).

The LATASA plants in Brazil are located in Pouso Alegre-MG (the first to be built, with capacity to produce 2.4 billion cans per year), in Santa Cruz (Rio de Janeiro state, with 1.7 billion cans per year of capacity), Jacaréí (São Paulo state, with yearly capacity of 1.6 billion cans), and Recife (Pernambuco state, production capacity of 750 million cans per year). In addition to these plants LATASA also developed a can recycling programme and since March 1996 has operated the "Centro de Refusão", a smelting plant in Pindamonhangaba-SP that recovers the metal contained in used cans and re-uses it for newly fabricated ones. The initial capacity of this smelting plants was 21 thousand tonnes per year of scrap metal from cans; the planned capacity is 42 thousand tonnes per year of scrap metal recovery (which is equivalent to around 2.6 billion cans per year).

The remaining beverage can makers in Brazil have only one industrial plant and they are: American National Can-ANC, a

subsidiary of PECHINEY, with a plant in Extrema in the state of Rio Grande do Sul which began operations in 1996 (with a capacity of 2.2 billion cans per year); PETROPAR, a joint-venture with CROWN CORK, with a factory in Cabreúva in São Paulo state, which started up in 1996 (with a productive capacity of 1.5 billion cans per year); LATAPACK BALL, a joint-venture between Mariani Group (BBM) and BALL METALS Corporation from USA, with a plant in the city of Jacareí-SP, which came on line in 1997 (with a productive capacity of 1.5 billion cans per year); and METALIC, a company that belongs to the Steinbruch family (controlled by the VICUNHA Group) which counts on technical support from Companhia Siderurgica Nacional (CSN). METALIC operates an industrial plant in Fortaleza, capital of Ceará state, and has the capacity to produce 700 million cans per year (it began in September 1997).

METALIC is the only one of these companies that works with steel cans. All the others have opted for aluminium. The predominance of aluminium is very clear as 94% of cans are made of this material while only 6% are made of steel. METALIC is also the only one of these companies that is predominantly Brazilian, but even so, it uses technology contracted through PAC International Inc. (from North America). Its main equipment and machinery are also imported.

We must point as an important consideration that all can producers in Brazil use foreign technology. LATASA using technology from REYNOLDS; ANC from PECHINEY; LATAPACK from BALL; PETROPAR from CROWN CORK; and METALIC from PAC International. And the significant growth in production of cans for the beverages sector may be attributed to the growth in investments in this sector and also to the entry of world-class players such as REYNOLDS METALS (USA), CROWN CORK & SEAL (UK), PECHINEY (France), and BALL Corporation. This has brought Brazil to the position where it produces (1996-1997 data) around 10 to 12 billion cans per year.

One of the major implications of these associations and joint-ventures with foreign companies, is that during the 1990s Brazilian industry has increasingly required a greater presence of technologies, equipment, industrial & automation systems, and engineering processes from other countries (mainly from the developed world). As regards the manufacture of aluminium and steel cans, this includes: production technologies (e.g. for sheet metal), aluminium and steel products for factory equipment,

automation and information technology control systems, scrap reutilisation and treatment-recycling technologies, environmental & pollution control systems (clean technology), etc.

## 5.6 Issues of capital goods imports

The contribution of shifts in FDI to the mining sector's development will now be explored with particular reference to capital goods imports. With respect to business relations for the capital goods sector, and more specifically to those aspects concerning the importation of industrial equipment for Brazil, Macedo (1996: 23-4), research data for an analysis of the performance of the Brazilian economy, and more specifically dealing with the production of capital goods and consumer goods, affords us information indicating that there was a 'growth situation' in the "participation of imported equipment as a share of the total amount of machines and equipment acquired" in Brazil (see **Table 19**). This provides indication for the important external (international) influence over domestic (Brazilian) industrialisation. This is a relevant issue for the mineral-metallurgical industries in Brazil (see Hegenberg, 1999a and 1999b).

**Table 19: Imports participation as a share (%) of the total amount of machines and equipment acquired in Brazil, 1990 - 1995**

Year	1990	1991	1992	1993	1994	1995
<b>Imports share (%)</b>	10.55	16.55	18.58	18.69	19.58	24.64

Source: *IBGE, Diretoria de Pesquisas (Departamento de Contas Nacionais)*, in: Macedo, 1996, p. 24.

**Table 20: Brazil, exports (free on board values, US\$ million)**

Year	Basic products	Semi - Manufactured [1]	Manufactured [1]	Total US\$ m	As GDP %
1993	9,357	5,540	23,758	38,655	6.3
1994	11,058	6,983	25,594	43,545	6.7
1995	10,969	9,146	26,391	46,506	6.9
1996	11,900	8,612	27,235	47,747	6.9

Source: *Banco Central do Brasil* [US\$ 1995 constant values]. [1]: Industrialised products.



In more general terms, for the entire national economy, Brazil's international trade witnessed major changes in the 1993-1996 period. Contrasting with almost two decades of continuous trade surpluses, for the last two of those years imports topped exports. Total exports increased by US\$ 9.1 billion over the previous four years, whereas imports rose by US\$ 28 billion in the same period (**Table 20 and 21**). Note the sharp growth in imports of capital goods and raw materials from 1993 to 1996.

**Table 21: Brazil, imports (free on board values, US\$ million)**

Year	Durables [1]	Non- Durables [1]	Raw materials	Fuel and Lubricants	Capital goods	Total US\$ m	As GDP %
1993	1,761	1,449	12,863	4,094	5,089	25,256	4.1
1994	3,129	2,410	15,607	4,356	7,576	33,078	5.1
1995	6,088	4,828	22,393	5,217	11,330	49,856	7.4
1996	4,568	5,151	24,636	6,227	12,704	53,286	7.7

Source: *Banco Central do Brasil* [US\$ 1995 constant values]. [1]: Consumer goods.

Recent industrial and foreign trade policy in Brazil were based on the targets set by the "Pluriannual Plan 1996-1999". This provided the basic guidelines for national industrial policy and also foreign trade policy. Amongst the main aims (the achievement of some basic objectives) are: (1) to foster private investments (both national and foreign) through tax reductions on inputs and capital goods for domestic industry, and (2) to provide support, for example, in importing technology in order to allow for greater S&T developments to take place in the country. This is expected to improve national businesses and provide the basic means for strengthening the Brazilian Quality and Productivity Programme-PBQP, designed to develop quality and productivity by promoting better standards in metrology, technical regulation, and certification (e.g. ISO series).

## 5.7. Indigenous technological development

The contribution of the shifts in FDI to the mining sector's development will now be explored with special reference to indigenous technological development. The development of "indigenous" (= local, national) technology for the mining industry in Brazil is mostly promoted by the oil sub-sector through

PETROBRAS. Some technology is also supported by the steel and metal sector (e.g. CSN, USIMINAS). The iron ore sub-sector is also responsible for some innovation, mainly through CVRD, MBR, SAMARCO and SAMITRI. But overall the development of technology is not very impressive and in several cases it is associated with foreign initiative derived from information, knowledge, services, equipment, intellectual properties and patents from MNEs or other foreign agents.

There is a centre specifically built for developing technology for the mining industry which is the Centre for Mineral Technology (CETEM) in Rio de Janeiro. CETEM is, however, usually constrained by its budgetary limitations, which also affects its capacity to deliver to its own staff the kind of technological advancement that they deserve (at the higher stages of scientific research). What needs to happen, in order to furnish a better framework for technological innovations to be developed and applied, is a greater degree of articulation between mining and other sectors, mostly with metallurgy, metal products, mechanical machinery and equipment, research institutions, etc.; the understanding of the mining industry as a chain of inter-dependent sectors, and also the promotion of a greater collaboration between levels of government (e.g. with local state mining companies providing technical solutions for mineral extraction; and the CETEM and CPRM providing a range of advanced services in geological information, mineral technology and R&D).

Technological development in Brazil is still limited in most areas of knowledge and industry. One way of understanding this is by considering S&T, R&D, innovations and patents. "Patenting is a measure of the strength of the science base as it is designed to protect intellectual property arising from R&D when it comes to potential application. As expected in developing countries, fewer patents have been granted to residents than to foreigners (**Table 22**). Patents granted to residents in Brazil in 1995 accounted for 19.8% of the total" (Bogliolo, 1998: 17-8). Amongst the most outstanding sectors where new patents played an important role were 'primary metals' and 'electronic equipment and components'. Investments in S&T in Brazil are highly concentrated in mega corporations, with MNEs and foreign agents playing a major role; with domestic companies and agents playing a marginal or less important role.

**Table 22: Patents granted in selected countries to resident and foreign applicants**

Country	Year	Resident	% (Resident)	Foreign	% (Foreign)	Total
USA	1993	53,236	54.1 %	45,107	45.9 %	98,343
Canada	1994	853	7.3 %	10,789	92.7 %	11,641
Brazil	1995	526	19.8 %	2,134	80.2 %	2,660
Argentina	1994	448	21.0 %	1,682	79.0 %	2,130
Mexico	1995	230	6.5 %	3,308	93.5 %	3,538
Chile	1992	42	9.2 %	414	90.8 %	456

Source: MICT / INPI (National [Brazilian] Industrial Property Institute); RICYT / CYTED (1990-95); In: Bogliolo (1998: 18).

As for the country's S&T capability, Brazil is classified as having an "incomplete system of technological development"<sup>44</sup>. In the context of Latin America, Brazil is the front-runner, with R&D representing 0.88% of GDP, followed by Chile (with 0.78%), Colombia (0.62%), Mexico (0.40%), and Venezuela (0.34%), taking into account the per centage (%) of their respective GDP figures. Although Brazil has made a tremendous effort to increase its spending on R&D, total outlay while rising from US\$ 3.3 billion in 1992 to almost US\$ 6 billion in 1995, average expenditure per capita, despite being 2.5 times the average for other South American countries, is still three times less than the outlay in Spain, eight times less than in Canada and seventeen times less than in the USA (**Table 23**).

**Table 23: Total R&D expenditure in selected countries**

Country	Year	Total in US\$ million	US\$ per capita
USA	1993	165,849	664.0
Canada	1994	9,452	323.0
Spain	1994	4,464	114.0
Brazil	1995	5,957	38.5
Chile	1995	398	28.4
Argentina	1994	873	25.5
Venezuela	1995	372	17.2
Mexico	1993	1,130	13.4
Colombia	1994	286	8.6

Source: MCT / CNPq (1990-95); RICYT / CYTED (1990-95); In: Bogliolo (1998: 15).

<sup>44</sup> Germany, USA and Japan, for example, are classified as being "mature systems"; Canada, Spain and Italy as having an "intermediate system" of technological development.

Spending on technological advancement in Brazil lags well behind the level of expenditure in developed economies. North American companies invest an average of three per cent of their income on R&D whereas the figure for Brazilian firms stands at about 1.2%. While the average of business enterprise R&D self-financing in OECD countries rose from 82.4% in 1991 to 84.9% in 1995, in Brazil its share dropped from 97.2% to 90.9% over the same period. Government participation in supporting R&D in the business enterprise sector inched up from 2.8% to 3.0% over the same period. Although the Brazilian Government has recently opened many credit lines for funding R&D in the business enterprise sector<sup>45</sup>, there has been weak demand for loans from official credit lines as instruments for promoting S&T. A survey carried out in 1997 by the National Confederation of Industry (CNI) and the Ministry of Science and Technology (MCT) revealed that, on average, more than 70% of the companies surveyed are unaware of the existence of Government instruments for promoting technological capability (Bogliolo, 1998: 37).

## 5.8. Export performance

The contribution of shifts in FDI to the mining sector's development will now be examined from the particular view of export performance. The performance of the export of minerals from 1978 to 1992 is provided in **Table 24**. The value of mineral production in Brazil (VPM-PMB) in 1992 was around US\$ 6 billion (excluding oil & gas), which places Brazil among the 5 most important mineral producers of the Western world. Five commodity groups - iron, gold, granite, limestone and bauxite - represented almost 70% of the total value of production. It is convenient to note that this cited VPM-PMB refers exclusively to the production of raw materials and concentrates, and does not include semi-transformed products such as aluminium ingots ("*lingotes de alumínio*"), pig-iron ("*ferro gusa*") or metallurgical products.

<sup>45</sup>Through the: Financing Agency for Studies and Projects-FINEP; National Scientific and Technological Development Council-CNPq; Ministry of Science and Technology-MCT; National Economic and Social Development Bank-BNDES; Bank of Northeastern Brazil-BNB; and Bank of Brasil-BB.

**Table 24: Value of the Brazilian mineral production and of the national exports of primary mineral commodities, 1978-1992 (US\$ million)**

Year	Value of mineral production (VPM) [1]	Value of mineral exports [2]
1978	5,159	2,512
1979	5,027	2,846
1980	5,641	3,083
1981	5,509	3,164
1982	5,370	2,933
1983	4,708	2,474
1984	4,629	2,536
1985	4,867	2,475
1986	5,063	2,395
1987	5,536	2,278
1988	6,580	2,660
1989	9,975	2,965
1990	8,164	3,058
1991	5,876	3,135
1992	6,017	2,683
<b>Total</b>	<b>88,121</b>	<b>41,197</b>

Source: PPDSM / DNPM-DIPEN (1994: 5). Obs.: The values for mineral production here presented excludes oil & gas; using 1992 constant values. [1]: VPM in US\$ F.O.B. / Mine; [2]: Exports (considering only primary raw materials, i.e. minerals and concentrates only) in US\$ C.I.F.

When mining is tied up with the more advanced stages of industry and industrial transformation, the participation of the mineral sector in the Brazilian economy as a whole assumes greater importance, accounting for around 30% of industrial production and of Brazilian exports. Nevertheless, although mining is important for the performance of industry and of national exports, two negative factors are creating a gloomy prospect for the future of Brazilian mining: (a) the sharp fall in mineral exploration investments (prospecting and research), and (b) signs of stagnation in Brazilian mineral production (PMB) during the last decade (PPDSM, 1994: 4).

The diagnosis of the PPDSM report (1994: 63), related to new directions for the Brazilian external commerce for mining, includes "enhancing the participation of mineral commodities in the external commerce sector, and indicates that it is necessary to reduce the excessive taxation duties ("*carga tributária*") and to stimulate Brazilian Mineral Production (PMB). The lack of incentives for domestic mining and the heavy taxation

commitments that overload exports, inhibit investment in this sector, and place exported Brazilian mineral commodities at a disadvantage in relation to the international markets. Knowing that the GATT [WTO] agreement allows for fiscal exemption of taxes and tariffs, and that this practice is broadly adopted by several mineral producing countries, it is recommended that Brazil start making full use of this condition in order to promote exports”.

## 5.9. FDI opportunities and possibilities in Brazilian mining

This section will briefly list some of the new possible areas for foreign investment in mineral or mineral-related sectors.

### Opportunities in the energy sector:

Important opportunities for future FDI in Brazil includes the energy sector, mainly with the gas sub-sector. In the medium-term, it is hoped to reduce the degree of reliance on hydro-power electric generation in Brazil (together with a large-scale venture to bring gas from Bolivia, already under development). The pipeline “*gasoduto Bolívia-Brasil*” (linking the Bolivian city of Rio Grande with Porto Alegre in the South of Brazil) is a project which makes possible for Brazil to take use of Bolivian natural gas (the pipeline was scheduled to be completed during the first months of the year 2000). This makes available for consumption around 30 million cubic meters of gas per day. It is said that this will “revolutionise” the energy sector in Brazil.

### Opportunities with CVRD’s North System and in the Amazon region:

When considering opportunities for investment, and the possibilities for FDI, CVRD’s “Northern System” and other opportunities in the Amazon region are important to mention. With respect to mining and CVRD more specifically, see **Table 25**. As regards to ‘other business opportunities’, see **Table 26**. This vision of bright opportunities in the Amazon region is shared by the CPRM. The management of the Brazilian Geological Survey considers that mining is the best activity to encourage the occupation and development of the Amazon region; and that

foreign capital is a fundamental element for Brazil to have the opportunity to expand its mineral production (its “mineral frontier”), and also, following this growth, to facilitate the increasing presence of international investment.

**Table 25: Selected mineral reserves under control of CVRD - only those from the “North System” (data in 1,000 tonnes)**

Minerals	Pará state	Piauí state	Maranhão state	Tocantins State	Total “North System”	% over total Brazilian Reserves
Bauxite	2,097,668	-	-	-	2,097,668	79.7%
Copper	1,296,224	-	-	-	1,296,224	76.7%
Gypsum	580,823	3,444	56,085	651	641,003	68.1%
Quartz	63,238	-	-	-	63,238	53.7%
Kaolin	816,799	5,196	-	-	821,995	49.6%
Iron ore	17,625,174	-	-	-	17,625,174	46.5%
Manganese	89,673	-	-	-	89,673	27.4%
Nickel	80,725	20,008	-	-	100,733	26.4%
Marble	-	120,085	-	-	120,085	9.7%
Limestone	1,521,077	205,548	358,657	74,055	2,159,337	2.6%

Source: CVRD - SUPOC.

**Table 26: Some of the business opportunities in the Amazon region**

Sectors for Business	Sub-sectors with greater possibilities
Agro & Foodstuff industries	-Vegetable oils (crude and refined), margarine, other co-products derived from soya and cotton -Meats (animal raising) -Milk (and derived products) -Fish & Crustacea (from sea and river) -Tropical fruits (fresh, juices, etc.)
Forest activities	-Wood & Cellulose -Reforestation (industrial plantations)
Metallurgy & Metal-Mechanical industries	-Steel and steel products -Aluminium and its products -Transport Equipment -Agricultural Machinery
Other businesses based on primary production (raw materials)	-Drugs & Medicine industries -Chemical plants -Leather and other animal skin products -Textile & Clothing -Drinks & Beverages -Perfumes

Source: CVRD.

*Opportunities with mineral-related ventures:*

Possibly the most important opportunities here are those to do with metallurgy. For example, as part of an expansion project undertaken by CSN, a new steel producing plant is being planned in Ceará state in association with the North American company NUCOR. Investments of around US\$ 700 million are becoming available so that the new plant could start production of around 1.2 million tonnes of steel per year in the year 2000.

When dealing more particularly with the importance of the auto-industry for industry and metallurgy in Brazil, the example of CSN's increasing interest in looking for greater participation in the supply of products for car fabrication is worth mentioning. CSN plans to increase its output of galvanised steel so that more of this steel-type can be used in the total composition of materials for the auto-industry in Brazil. This because it is reported that European cars have as much as 50% to 60% of their parts made of galvanised steel - while Brazilian cars use only about 15% to 20% of this material. This shows that important opportunities are available by moving closer towards the (possible / predicted) future needs of car makers (anticipating future trends). These plans will increase the amount of steel supplied by CSN to the auto plants from around 25% (1997 figures) to around 40% (estimated figures for the near to medium future).

USIMINAS is another good example [for opportunities with mineral-related ventures] because of its high degree of business-dependence on the auto-industry players - around 30% of its sales (1995-1996 figures) going to auto-assemblers and auto-parts enterprises (the most important sector for its sales). And this is forecast to increase during the 1997-2000 period and beyond due to new planned expansion of productive capacity directly related to steel products which are to be used by FIAT (in its Minas Gerais auto plant). The expectations are that USIMINAS is counting on expanding possibilities for truck production in Brazil that would support a large proportion of its production until at least the year 2005.

*Opportunities in the gemstones sector:*

There are interesting opportunities mainly in Bahia, Goiás



and Minas Gerais states. In Bahia, the main precious stones are emeralds, amethysts and quartz - but there are also genuine prospects for developing businesses with topaz, diamonds, rubies, feldspar and aquamarine. Goiás state appears to be particularly good for several types of quartz, emeralds and tourmalines. As for Minas Gerais state, CPRM is promoting gemological studies in the Eastern part of the state, the "Projeto Leste / MG". This is being undertaken in collaboration with the Minas Gerais state Secretary of Mines & Energy (SEME-MG), and includes the *gemological province* of the Governador Valadares and Teófilo Otoni regions (including several other municipalities). This is considered to be one of the richest areas containing precious stones in the country (with a great diversity of specimens).

#### *Opportunities with the environmental sector:*

The opportunities in this sector are mainly related to the use of equipment and technology. The equipment needs for production and environmental management in the mineral and mineral-related sectors are being increasingly viewed within a world-wide perspective and involving global corporations. This requires greater use of specialised equipment with sophisticated engineering and technology. Opportunities are also being created through greater use of international standards of production and industrial organisation such as ISO certification series (e.g. 9000 and 14000) and Environmental Management Systems (EMSs) procedures and tools (which include environmental impact assessment, life cycle assessment).

Summarising: There is an increasing tendency in Brazil (and more so since 1992), as observed in the mineral sector, of developing business strategies that are global with respect to the adoption of international standards and certification, and to use imported equipment for managing and operating industrial processes and technologies (and related aspects such as pollution control and mitigation). This is opening up business opportunities for suppliers of equipment, technology and industrial processes for the sector (including oil & gas and metallurgical companies). In turn, this is promoting an increasing pattern of international integration of Brazilian enterprises.

## 6. Concluding remarks

### 'General Comments':

The argument for a renewed wave of FDI in Brazilian mining seems unlikely in the short-term. This is because today what Brazil is offering to investors are mineral *resources*. Investors prefer to put their money in mineral *reserves*, i.e. mineral deposits already defined and requiring less effort and less capital to be transformed into productive mines. It appears that in Latin America, other countries such as Argentina, Bolivia, Chile, Colombia, Mexico and Peru are proving to be more effective in attracting foreign capital because these countries are offering a ready-made "menu" of better defined mineral deposits and mineral projects. They are also providing more complete details of their geological-mineralogical-metallurgical characteristics and are also very competitive with respect to their economic conditions affecting and regulating mining and its related activities.

Changes in Brazilian mining, that would allow for better defining of mineral deposits (offering more complete information about its main operational and economic features), will only come in the medium to long term; and only if immediate action is taken. Nowadays the industry is being restructured and there is little consensus as to what will happen in the short term. The need for action is great and the Government is now dealing with issues that should facilitate changes. This is what is happening with the discussions for the creation of the "National [Brazilian] Mining Agency" (ANM), which is under consideration by the Central Government. Depending on the results, changes could be made so that, for example, the DNPM is transformed into a more effective actor in the regulation of mining; or the DNPM could even be closed down and taken over by the ANM. The outcome is still uncertain.

It appears that the future of investments (which includes FDI) in Brazilian mining and related industries will more likely be linked to the Amazon region, also to metallurgical activities, but mainly to the oil & gas sector. Indications are in the direction of

this scenario. The main supporting evidence for this includes CVRD's interest in increasingly concentrating its activities in the Amazon region in general (and in the Carajás area in particular); the propaganda used by CPRM that assumes that the best way to develop the Amazon is through mining; the prospects for enlarging productive capacity for the national steel industry to increase its share in supplying the auto-industry MNEs; the huge infrastructural changes taking place within the energy sector in Brazil (which is taking over more businesses to develop: for example, the gas sector); and environmental-related technologies for mining, recycling, pollution control and mitigation, industrial effluent and sanitation plants, etc.

Bearing in mind the large diversity of forces and impulses that influence Brazilian development - with some forces following the way the world economy functions, other forces being the result of (internal) domestic characteristics - some components of State behaviour in Brazil must be examined. These components will be determinant in reordering and rearranging the economy in two main ways: through a type of '*autochthonous* development', or through increased foreign participation (including FDI) in the local market (e.g. with privatisation), a kind of '*allochthonous* development'. These components affecting the management of national businesses are supposed to provide new directions for industry by furnishing new systems or new approaches to natural resources management.

In the mining sector these industrial and managerial considerations are important for the understanding of, for example, how pollution-control systems will be administered, and the implications of this in terms of the use of equipment and technology. Also important are accounting issues and standards (which will affect how companies are organised and thus their chances of being the recipients of new investments). PriceWaterhouseCoopers (PwC) is working in this sector and they consider (PwC, 1999) that a move towards international comparability through the harmonisation of accounting standards world-wide is needed, and PwC support the introduction of a mining-specific standard by the International Accounting Standards Committee (IASC). This may provide a clearer environment for investments (and also a greater need for

consultancy work to set new accounting standards).

Additionally, some important questions to be posed for further research include:

-“Is it possible that enhancing membership relations within Mercosur countries will be a way forward in promoting a better framework for developing complementary mining activities amongst these countries? ... and also for establishing a clearer environment for foreign investment flows from the developed world?”;

-“How should government policy be managed to promote greater inflows of FDI?”;

-“How can local state activities be better synchronised with Federal (central) government policy directives?”

-From the year 2000 onwards, will there be greater importance given to: -“International business and the internationalisation-globalisation model of development?”, -“Growth of FDI together with sustainable development policies?”, -“Various sectors and industries of the Brazilian economy developing at the same time and in a more integrated manner?”.

#### ‘Further Comments’:

It has been shown here that weakening support for the Brazilian mining industry by part of the financial community mainly since 1988 was the result of a specific lack of consistent Government initiative for the mining sector, which was also reflected in the State’s decreasing importance and efficiency in maintaining a framework of institutional support that could extricate the country from a situation of “mineral stagnation” (since production levels did not show any signs of significant growth). The late 1980s and early 1990s can be looked upon as a period of stagnation in production levels - partly because of regulatory changes (with restrictions in the participation of foreign capital introduced in 1988), in part because of no significant growth in domestic consumption, to some extent because of the decreasing investments in domestic mineral exploration, in some measure because of over-supply at the international level which decreased demand for minerals and also affected prices (falling prices).

From the mid-1990s, starting with the Cardoso government and the constitutional changes that once again allowed a greater foreign participation in Brazilian mining, the country went through a phase of increased domestic consumption - which to some extent affected the mining industry in those sub-sectors important to the construction industry, such as cement and non-metallic minerals (which experienced a brief period of growth). But oversupply of minerals at the international level and a generalised period of international crisis (e.g. in Asia, Russia, Brazil) meant that a full recovery was temporarily suspended. This resulted in no substantial flow of FDI into mining in recent times and as a consequence it is still not possible to know if FDI inflows have (or would have) a positive impact on the sector's trade and technological performance.

One thing is certain, new technological developments - e.g. those related to recycling, to the reduction in the use of materials (for example: with miniaturisation, processes that cut back on the use of metals and materials), substitution, "new materials", engineering innovations - will increasingly impact on mineral production and trade (on the performance of materials industries). These new technological developments (which have assumed greater importance for industry and innovation since the late 1980s) may explain the low levels of FDI in mining in Brazil, as this sector is to an increasing degree using other sources for capital, for example, loans, mineral supply contracts, credit and programmes for the acquisition of equipment. The fact that minerals are no longer "strategic", means that the most important industries are moving increasingly towards the end of the supply-chain and that mining is more and more a mere provider of commodities. This explains the way the aluminium industry works, and also why the iron and gold sub-sectors (or the metallic minerals sectors in general) are increasingly integrating themselves with metal producers through the use of more sophisticated metallurgical processes.

This is resulting in a greater corporate concentration in favour of large MNEs that are prepared to increase their market domination through their own technological innovation capabilities. This is very clear not only through FDI, but through: (1) technology contracts; (2) the provision of engineering and consultancy services; (3) the increasing importance of computerised

production systems and automation (requiring advanced hard- and soft-ware); (4) the use of more sophisticated equipment for the optimisation of production processes; (5) economy of energy, materials and labour; and also, (6) for environmental control and pollution mitigation. This is affecting the domestic economy on account of the consequent growth of capital goods imports (or also the growing reliance on equipment producers that, although located in Brazil, are in most cases controlled by multinationals). Indigenous Brazilian technological development is increasingly dependent on external agents and their technologies.

The study of the diversity of investment types, of New Forms of Investment (NFI), loans, joint-ventures, etc., as seen in this chapter for the case of Brazil, shows that FDI have to be viewed as only one of a diverse range of forms or types of investment. And FDI in Brazilian mining were in most cases just a small parcel of total investment in this sector. In fact FDI may even be considered as marginal and not very important for the development of Brazilian mining as a whole (considering the past 2 or 3 decades). The Government and the sector aspires to greater FDI inflows and there are some opportunities and possibilities for these developments which can be exploited by international capital, multinational and local players.

Mining 'per se' is today a relatively uninteresting business. For mining to be more interesting and more appealing (and to attract FDI), it needs to be linked to the more advanced stages of the production chain; it also needs to be useful to industry, by providing higher-quality, lower-cost commodities which may be "adjusted" (with regard to their technological specifications, performance parametres, physical and chemical characteristics), according to the demands of other 'user industries'. Mining is having to adapt by using more sophisticated engineering processes, by making products with greater 'quality content' (using ISO series and EMS tools), and by increasing the use of automation and design technologies.

#### "Closing Remarks":

Our investigation has shown that the volume of foreign direct investment in Brazilian mining is very small - and has suffered a clear decline during the period analysed (since the 1970s). The

past 20 to 25 years have shown that other forms of investment, and not FDI, were more important for the domestic mining sector of Brazil as a whole. In order for Brazil to attract more investment much will have to be done, and our analysis tries to offer some pointers (and opinions). In very broad terms we might consider here that, even knowing that we are living in a time of lower prices for commodities in general, Brazilian production needs to expand into other sub-sectors - and this should be undertaken both horizontally and vertically (horizontal and vertical integration). Only by pursuing these objectives will we be able to diversify into other minerals and activities and promote the development that will take us to advance industry and knowledge into other parts of the supply-demand chain.

In terms of the supply-chain of mineral commodities, mining enterprises will need to enhance their ability to plan and advance businesses in order to explore, exploit, process and distribute goods more effectively and they will also need to use higher technological standards with better qualified labour. It is increasingly evident that cost and quality (e.g. in the characteristics of mineral products) of production are the main issues for the mining sector to tackle. A supply-chain management approach might help in promoting more effective supply flows. Investments will be attracted and directed towards those companies and countries which are using and applying these new ideas and principles.

If Brazilian Companies want to attract more investment, they should follow more closely the new practices of Sustainable Development. This implies encouraging businesses to comply with the basic principles of the 'Agenda 21' and also urge the use of Environmental Planning & Management (EPM) 'tools' such as ISO, Environmental Management Systems and Life Cycle Assessment. World-wide the extractive industries will have to follow with greater frequency a path of development which will require greater S&T and R&D applications for resources surveillance and mineral reserve definition in order to promote the exploitation of minerals & ores in accordance with methods and procedures which increasingly requires the use of world-class mineral operations, techniques and processes, and according to a framework where all the 'natural resources' (not just mineral) are viewed together in order to make the best choices about which resources to protect and which resources to exploit.

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<sup>1</sup> See <http://www.bndes.gov.br> (publicações).

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# Appendix 1: Brief history of mining

## **1950s:**

-MNEs: Period of growth for multinationals; International capital growing in importance and influence.

-Post-war: restructuring and investment in several countries.

= Various commodity sectors are developing. [No idea of 'sustainable development'].

## **1960s e 1970s:**

-Countries are "taking over": nationalisation and SOEs.

-Times of "panic of supply" for most commodities.

-Brazil: State (national) capital in mining is strongly represented by CVRD (having a leading role in the development of the domestic iron & steel industry).

= Iron & Steel, probably the most important sector.

## **Late 1970s & early 1980s:**

-Transition period: LDCs starting again to accept external participation in domestic ventures.

-Oil crisis: 1973-74 and 1979-80.

-Brazil: Foreign capital & technology played a leading role in the development of the aluminium industry.

= Aluminium, probably the most important sector.

## **1980s:**

-Period of transition continues: strengthening of foreign participation in the domestic market.

-Debt crisis: starting with Mexico in 1982.

-Economic crisis in Brazil and consequent raising unemployment creates "Serra Pelada" and the increasing problem of the "garimpos" and of "garimpeiros", harsh realities of Brazilian mining (mainly in gold, tin and precious stones sectors).

= Gold, probably the most important sector.

### **1990s:**

-Period of 'adaptation' to new economic realities: liberalisation & privatisation.

-Times of "no shortage" of commodities.

-Business and managerial re-structuring (new methods, procedures and tools).

-Trend towards greater internationalisation in industry in general.

[Idea of 'sustainable development' exists].

= Some commodities sectors are developing (e.g. gas sector increasingly important); various "paramineral" and industrial sectors are coming to existence and growing strong, e.g. environmental services, industrial certification (quality, health & safety, ISO, EMS), recycling.

### **2000 onwards?:**

-Greater importance of international business and the internationalisation-globalisation model of development?

-Growth of FDI?

= Various sectors and industries developing at the same time in a greater range of countries?

**Acronyms used:** CVRD: Companhia Vale do Rio Doce (largest Brazilian mining company); EMS: Environmental Management Systems; FDI: Foreign Direct Investment; ISO: International Standardisation Organisation; LDCs: Less Developed Countries; MNEs: Multinational Enterprises; SOEs: State Owned Enterprises.

**Source:** Presentation by F. E. N. Hegenberg (Aachen University, Germany, December 16<sup>th</sup>, 1999).

## Appendix 2: Glossary of terms and expressions

**alloy:** A substance with metallic properties composed of two or more chemical elements of which at least one is a metal.

**alumina:** Aluminium oxide produced from *bauxite* ore. It is a white powdery material that looks like granulated sugar. Alumina is smelted and refined to produce aluminium metal.

**aluminium / aluminium metal:** Aluminium metal is produced through the reduction of the alumina in electrolytic cells.

**Amazon region** (in Brazil): also referred as the 'Greater Amazon'; it covers an area which includes the states of Amazonas, Amapá, Acre, Pará, Rondônia, Roraima, Tocantins, Mato Grosso, and Maranhão, covering an area of approximately 5 million square kilometres.

**base metals:** e.g. copper, lead, tin, zinc.

**bauxite:** Aluminium hydroxide (the basic ore containing aluminium). The ore occurs in various forms and usually contains various mixtures of aluminosilicates, iron oxides and other impurities. Bauxite is used to produce *alumina*, which in its turn is used to produce *aluminium metal*.

**Brazilian Government:** includes three levels of government: Federal, state, and local (or municipalities).

**brazing:** Joining metals by flowing a thin layer of molten non-ferrous filler metal into the space between them.

**casting:** The process of forming molten metal into a particular shape by pouring it into a mold and letting it harden.

**Central Government of Brazil:** The Presidency, Ministries, Treasury, Central Bank and Social Security.

**C.I.P.:** 'Carbon In Pulp' technology (used in gold processing).

**classification of metals:** Metals are commonly grouped as follows: (1) Iron (iron ores); (2) Iron alloys (chromite, cobalt, manganese, molybdenum, nickel, vanadium), (3) Base metals (copper, lead, tin, zinc), (4) Light Metals (aluminium, magnesium,



titanium), (5) Precious metals (gold, silver, platinum), and (6) Rare metals (beryllium, radium, uranium).

**cold mill:** The equipment on which a metal is rolled into sheet or foil by passing it through pairs of rollers under pressure. In cold rolling, the incoming metal is normally at room temperature.

**cut-off grade:** The cut-off grade is the lowest grade, or metal content, of the rock leaving the mine that can be treated as ore rather than waste. Cut-off grade is the ore grade which can support exploitation and which is in the boundary of being uneconomic (this is a function of several factors, e.g.: mineral prices, operating costs, technology in use).

**engineered product:** A metal fabricated product that has been mechanically altered to create special properties for specific purposes; forgings and extrusions are examples of engineered products.

**extractive industries:** Industries that derive their principal raw materials from the earth, e.g. mining companies.

**extrusion:** The process of shaping material by forcing it to flow through a shaped opening in a die.

**fabricate:** To work a material into a finished state by machining, forming or joining.

**flat-rolled products:** Metal plate, sheet or foil products made by passing ingot through pairs of rolls. By moving the rolls closer together and passing the ingot between them, the thickness is reduced and the length is increased.

**foil** (e.g. aluminium foil): A flat-rolled product, rectangular in cross section, of thickness from 0.006" to 0.00025".

**foreign direct investment (FDI):** Direct 'risk' investment; often involves foreign control of the production process and marketing strategy, the use of brand names, marks and patents, and also the use of new (relative to local) technologies which are either embodied in equipment or as knowledge of techniques and processes.

**forging:** A metal part worked to pre-determined shape by one or more processes such as hammering, pressing or rolling.

**garimpo / garimpeiro:** Name given to the 'informal mining

/ miner' in Brazil. This comprises work done outside of the 'organised mining sector' (by officially registered companies). 'Garimpo' refers to the place (the locality); 'garimpeiro' refers to the person working in this locality. 'Garimpeiros' are usually migrant workers and they may also be termed as being 'artisan miners', 'small scale miners', 'informal miners' or 'panners'.

**greenhouse gas emissions:** Gases emitted from both natural and man-made sources such as carbon-dioxide, methane and water vapour that absorb and re-radiate some of the sun's infrared energy.

**hedging:** Covering or protecting against price instabilities. In the commodities sectors of the economy one important agent with significant influence and power for metal pricing (for determining metal price formation) and for 'regulating' the functioning of several metal traders and metal exchanges world-wide is the London Metal Exchange (LME). The LME is a 'price maker' for several metal commodities and great part of the international commercial transactions are based on its prices and specifications.

**ingot:** A cast form suitable for re-melting or fabricating. An ingot may take many forms: some may be 15 meters long and weigh 15 tons, others are notched or specially shaped for stacking and handling.

**London Metal Exchange (LME):** The international trading body that aims to facilitate (or control ?) the world-wide open market buying and selling of metals.

**metric ton (mt):** A unit of mass and weight equal to 1,000 kilograms.

**mill products:** Metal that has been fabricated into an intermediate form before being made into a finished product. The most common metal fabricating processes are rolling, extruding, forging and casting (e.g. aluminium sheet, a mill product, is used to make beverage cans, a finished product).

**mineral deposit:** Regarded as being any individualised mass of mineral or fossil substance, either occurring above or below the surface, with economic value.

**mineral exploration:** The performing of work necessary to define a mineral deposit, its evaluation and the determination of its economic feasibility.

**PET:** Polyethylene terephthalate: a plastic commonly used to make bottles for beverages.

**pig-iron:** Iron in "pigs" or rough bars; the crude iron produced in the blast furnace and cast into "pigs" which are used for making steel, cast-iron or wrought-iron. Composition varies according to the ores used, the smelting practice and the intended usage. Principal impurities are carbon, silicon, manganese, sulphur and phosphorus.

**plate** (e.g. aluminium or steel plate): A flat-rolled product, rectangular in cross section, of thickness not less than 0.250".

**portfolio investment:** Portfolio investment is often dealt with as mostly short-term flows, responsive to international differences in interest rates and exchange rates (arbitrage), and highly sensitive to domestic regulations and tax structure. In Brazil the Central Bank considers as portfolio investment: (a) foreign capital invested in depository receipts and (b) foreign capital invested in securities issued by residents and traded in the domestic financial market. This distinction allows for a separate analysis of both types of foreign investment ['portfolio' and 'FDI'] (Baumann, 1998: 7). Acronyms used: Portfolio Investment Flows-PIF and Portfolio Direct Investment-PDI [see also entry for 'foreign direct investment'].

'Portfolio' indicates the promotion of businesses in a range of investments and assets. The main reason for promoting a varied portfolio of financial securities is to achieve the maximum possible return on investment (looking for favourable levels of interests and/or dividends, and capital gains, from holding the selected securities). 'Portfolio investment' implies the collection of financial securities such as shares and bonds by investors. Typically investors would want to hold a number of different financial securities to spread their risk, and would seek a "mix" of financial securities: (a) some offering high short-term dividend payments, (b) other offering long-term capital appreciation as their market prices rise, (c) other offering medium-term rewards. Additionally, investors may plan to hold various types of financial securities which have a particular maturity structure so that they can achieve a predetermined pattern of cash flows. The attractiveness is that the risk attached to a portfolio is usually less than the weighted average risk of each individual investment.

**precious metals:** e.g. gold, platinum, silver.

**reserve:** A reserve represent that portion of the resource that has been more precisely measured and which is, or might be, available for production over a specified time period (P. Crowson, in *Mining Journal*, February 19, 1999, p. 5). [see also the entry for 'resource'].

**resource:** A resource is simply the identified or probable physical presence of minerals in the Earth, which may or may not be exploitable economically with presently available technology (P. Crowson, in: *Mining Journal*, February 19, 1999, p. 5). It is said that "resources must be continuously reassessed in the light of new geological knowledge, of progress in science and technology, and of shifts in economic and political conditions" (USGS, in P. Crowson op cit). "In short, it is necessary to assess both the physical characteristics of resources, the social and political feasibility of mining them, and the potential profitability of extracting and marketing them. None of these attributes can be precisely measured, or is fixed for all time, except when a mineral deposit has been fully mined out" (Crowson, 1999). [cf. with 'reserve'].

**services sectors** (of the economy): These include electricity, telecommunications, railways, consultancy companies, etc.

**sheet** (e.g. aluminium or steel sheet): A metallurgical rolled product, flat or coiled, rectangular in cross section, with thickness less than 0.250" but not less than 0.006".

**smelt:** To fuse or melt ore in order to extract or refine the metal it contains.

**supply-chain:** In the mining context, the *supply-chain* concept indicates "all the capabilities to plan, source, process and distribute goods, services and end-products" (*Mining Journal*, March 26, 1999, p. 224). The good management of supply-chains potentially enables companies to reduce total mining costs. In essence, the supply-chain concept promotes the idea and the need for Supply-Chain Management (SCM), and this implies the search for the most effective co-ordination of supply flows.

**terms of trade:** The amount of exports required to buy a given quantity of imports.

**tri-pé / "triplet"**: Concept of the 'triple alliance' between multinationals, the State and the local (national) private capital (Evans, 1979 studied the Brazilian case and considers the inter-relationships between these 'partners' in working the Brazilian economy - a framework for analysing foreign capital, State capital, and private local capital). The editors of the Brazilian journal *Exame* (see for example the 1999 edition of "Melhores & Maiores") also use the term "tri-pé" for indicating the percentage of capital in hands of each of these main participants [Brazilian State; foreign players; private national capital].

**world-class mineral deposit**: Defined as those deposits possessing a large tonnage and amenable to being mined over a long life at low cost, and with the capability of maintaining superior profitability, even during the bottom of the business cycle. [see 'world-class mineral operation].

**world-class mineral operations (or projects, ventures)**: Defined as those operations (or projects, ventures) possessing superior quality, profitability and capability as a whole, i.e. considering the 'deposit', the 'industrial plant', the 'business' as a whole (not just parts of it). [see 'world-class mineral deposit'].

## Appendix 3: Acronyms / abbreviations

**AAC:** Anglo American Corporation of South Africa.

**Aachen Institute of Mining Technology:** <http://sfb525.rwth-aachen.de/sfb525> (Germany).

**ABAL:** Associação Brasileira do Alumínio / Brazilian Association for Aluminium.

**ABB:** Asea Brown Boveri [ <http://www.abb.com> ].

**ABDIB:** Associação Brasileira para o Desenvolvimento da Indústria de Base / Brazilian Association for the Development of Basic Industries.

**ABIFA:** Associação Brasileira de Fundição / Brazilian Association of Smelting & Foundry.

**ABIMAQ:** Associação Brasileira da Indústrias de Máquinas e Equipamentos / Brazilian Association of Equipment and Machinery Industries. [<http://www.abimaq.org.br> ].

**ABM:** Associação Brasileira de Metalurgia e Materiais /Brazilian Association of Metallurgy and Materials.[<http://www.abmbrasil.com.br> ].

**ABNT:** Associação Brasileira de Normas Técnicas / Brazilian Association of Technical Norms & Standards (founder member of the ISO).

**AC:** Acre (one member of the federation of the 26 Brazilian states).

**ACESITA:** Cia. Aços Especiais Itabira (metallurgy company).

**AÇOMINAS:** Aço Minas Gerais (metallurgy company).

**ADIMB:** Agência para o Desenvolvimento da Indústria Mineral Brasileira / Agency for the Development of the Brazilian Mining Industry (created by the DNPM).

**ADRs:** American Depository Receipts (see also IDR).

**AEB:** Associação de Comércio Exterior do Brasil / Brazilian Foreign Commerce Association.

**AEIR:** Adicional Estadual de Imposto de Renda / Additional

Brazilian state Income tax.

**AEWC:** Airborne Early Warning and Control system.

**Agenda 21** (see also **UNCED**): The Agenda 21 was developed at the United Nations Conference of Environment and Development [1992 Rio de Janeiro Conference, ECO-92 or the "Earth Summit"].

**AGID:** Association of Geoscientists for International Development [<http://agid.igc.usp.br>].

**AISI:** American Iron and Steel Institute [<http://www.steel.org>].

**AIR:** Adicional de Imposto de Renda / Brazilian Addition to the Income Tax.

**AL:** Alagoas (one member of the federation of the 26 Brazilian states).

**ALBRAS:** Albras Alumínio do Brasil S.A. [CVRD + Japanese consortium; started operations in 1985].

**ALCA:** Área Livre de Comércio das Américas / Free Trade Area of the Americas [ same as FTAA ].

**ALCAN:** Aluminium of Canada.

**ALCOA:** Aluminum Company of America [ [www.alcoa.com](http://www.alcoa.com) and [www.alcoa.com.br](http://www.alcoa.com.br) ]

**ALSTOM:** <http://www.alstom.com>

**ALUMAR:** Alumínio do Maranhão S.A.: A mining & metallurgy consortium agreed in 1984 originally developed by ALCOA and BILLITON with the Brazilian Government in the PGC region (also included a plant for aluminium production in São Luís, Maranhão state).

**Aluminium Net:** [www.aluminium.net/](http://www.aluminium.net/)

**The Aluminum Association, Inc.:** [ [www.aluminum.org](http://www.aluminum.org) ].

**ALUNORTE:** Alumina do Norte do Brasil S.A. (Pará state). Alumina plant owned by a consortium led by CVRD (48.7%) with MRN (24.6%), Nippon Amazon Aluminium Co. (12.2%), CBA (5.7%) and other minor shareholders (8.8%). Alunorte started in October 1995.

**Alussuisse:** <http://www.usnet.ch/sodeval/alussuisse.html>

**AM:** Amazonas (a member of the federation of the 26 Brazilian states).

**AMB:** Anuário Mineral Brasileiro / Brazilian Mineral Yearbook (published by DNPM).

**AMEX:** American Stock Exchange [<http://www.amex.com>].

**AMIRA:** Australian Minerals Industry Research Association.

**AMM:** American Metal Market [<http://www.amm.com/prices>].

**AMP:** Autran Mineração e Participação. [AMP together with Rio Tinto Plc operates the Morro do Ouro mine in Brazil].

**ANC:** American National Can (a subsidiary of PECHINEY).

**Andersen Consulting:** Global management consultancy [[www.ac.com](http://www.ac.com)].

**AngloGold:** [www.anglogold.com.za](http://www.anglogold.com.za)

**ANM:** Agência Nacional da Mineração / Brazilian Agency for Mining.

**ANORO:** Associação Nacional do Ouro e Câmbio / Brazilian Gold and Exchange Association.

**AP:** Amapá (a member of the federation of the 26 Brazilian states).

**Arthur Andersen:** [www.ArthurAndersen.com](http://www.ArthurAndersen.com) (mining accountants).

**ASX:** Australian Stock Exchange [<http://www.asx.com.au>].

**Atlas Copco:** <http://www.atlascopco.com>

**BA:** Bahia state in Brazil (a member of the federation of the 26 Brazilian states).

**Banco do Brasil (or BB):** <http://www.bancobrasil.com.br> (Bank of Brazil).

**BB:** Banco do Brazil / Bank of Brazil.

**BBCB:** Boletim do Banco Central do Brasil / Brazilian Central Bank Bulletin (see BCB).

**BCB / Banco Central do Brasil:** Brazilian Central Bank [<http://www.bcb.gov.br>].

**BGS:** British Geological Survey.



**BHP:** Broken Hill Proprietary Minerals (Australia largest resource group). [<http://www.bhp.com/minerals/min.htm>].

**BILLITON:** UK-based international mining and metals group.

**BMF:** Bolsa Mercantil e de Futuros / Brazilian Futures Exchange. [<http://www.bmf.com.br>].

**BNB:** Banco do Nordeste do Brasil / Bank of North-eastern Brazil.

**BNDES:** Banco Nacional de Desenvolvimento Econômico e Social / Brazilian National Economic and Social Development Bank. [<http://www.bndes.gov.br>].

**BOVESPA:** One of Brazilian main economic indicators, produced by Banespa Bank. [<http://www.bovespa.com.br> ].

**Brasil Mineral:** [www.brasilmineral.com.br](http://www.brasilmineral.com.br) [Journal].

**BRASPETRO:** Petrobras Internacional (subsidiary of PETROBRAS created in the early 1970s).

**Brazilian institutions** (and other links): <http://www.ipea.gov.br/ipeaol.html> [IPEA - Outros Links].

**Brazilian states:** Brazil is organised as a Federal system composed of 26 states and one Federal District (DF, Brasília). The states are (in alphabetical order of their acronyms): AC, AL, AM, AP, BA, CE, ES, GO, MA, MG, MS, MT, PA, PB, PE, PI, PR, RJ, RN, RO, RR, RS, SC, SE, SP, and TO.

**Bruntland Report** (or **WCED**): World Commission on Environment and Development. [The Bruntland Report; aproved by UNO in 1987 ].

**BWI:** Bretton Woods Institutions (i.e. IMF, WB, UN, GATT/WTO).

**CADE:** Conselho Administrativo de Defesa Econômica / Brazilian Government Anti-Monopoly Watchdog.

**CAE:** Comissão de Atividades Econômicas / Economic Affairs Committee.

**CAEMI:** Companhia Auxiliar das Empresas de Mineração / Rio de Janeiro Private-Sector Holding Mining Company CAEMI.

**CAPES:** Fundação Coordenação de Pessoal de Nível Superior / Brazilian Federal Agency for Education.

**CAPRE:** Coordenadoria de Atividades de Processamentos

Eletrônicos / Brazilian Commission for the Coordination of Electronic Processing Activities and IT.

**Case Corp** (Mining Equipment): <http://www.casecorp.com>

**Cat** (Mining Equipment): [www.cat.com](http://www.cat.com)

**CBA**: Companhia Brasileira de Alumínio [Brazilian Aluminium Company].

**CBMM**: Companhia Brasileira de Metalurgia e Mineração.[Brazilian Mining and Metallurgy Company].

**CBMNF**: Companhia Brasileira de Metais Não-Ferrosos / Brazilian Non-Ferrous Metals Company.

**CBOT**: Chicago Board of Trade [<http://www.cbot.com/menu.htm>].

**CBPM**: Companhia Baiana de Pesquisa Mineral / Bahia state Mining Enterprise.

**CDM/RN**: Rio Grande do Norte state Mining Enterprise.

**CDRM/PB**: Paraíba state Mining Enterprise.

**CE**: Ceará (a member of the federation of the 26 Brazilian states).

**CEBRAP**: Brazilian centre of Analysis and Planning.

**CEF**: Caixa Econômica Federal / Brazilian CEF Federal Bank.

**CEMIG**: Minas Gerais state Electric & Gas Utilities (integrated generator and distributor).

**CENPES**: Petrobras Research Centre (PETROBRAS).

**CEPAL**: Comissão Econômica Para a América Latina / Economic Commission for Latin America and the Caribbean (also known as ECLAC).

**CEPED**: Centro de Pesquisas e Desenvolvimento / Centre for Research and Development (Bahia state).

**CET**: Common External Tariff (see MERCOSUR).

**CETEC**: Centro Tecnológico de Minas Gerais / Technological Centre of Minas Gerais state.

**CETEM**: Centro de Tecnologia Mineral / Brazilian Centre for Mineral Technology. [<http://www.cetem.gov.br> ].

**CFEM**: Compensação Financeira pela Exploração de Recursos

Minerais / Financial Contribution for the Exploitation of Mineral Resources in Brazil ("financial compensation tax").

**CFIUS:** Committee on Foreign Investment in the United States.

**CGT:** Comando Geral dos Trabalhadores / Brazilian Workers Central Command.

**CIESIN:** Consortium for International Earth Science Information Network [<http://www.ciesin.org/IC/wbank/sid-home.html> (Social Indicators of Development)][<http://www.ciesin.org/IC/wbank/tde-home.html> (Trends in Developing Economies)].

**CIF:** Cost, Insurance and Freight.

**CIMMP:** Canadian Institute of Mining, Metallurgy and Petroleum.

**CIP:** Carriage and Insurance Paid (means that the supplier pays for the freight for the transportation of goods to a designated destination, plus cargo insurance against the risk of loss or damage during transportation).

**C.I.P.:** Carbon In Pulp hydro-metallurgical mineral extraction technology.

**CIPEC:** "Conseil International des Pays Exportateurs de Cuivre".

**CIPGC:** Conselho Interministerial do Programa Grande Carajás / Interministerial Council for the Big Carajás Programme (created in 1980).

**CIS:** Community of Independent States (some of the main countries of the ex-USSR).

**CMR:** Rondônia state Mining Enterprise.

**CMSA:** Chamber of Mines of South Africa [<http://www.bullion.org.za>].

**CNI:** Confederação Nacional da Indústria / Brazilian National Confederation of Industries.

**CNPq:** Conselho Nacional de Desenvolvimento Científico e Tecnológico / Brazilian National Research Council.

**CNRF:** Canadian Natural Resources Fund [<http://www.fundlib.com/newsletters>].

**CODELCO:** Corporacion Nacional del Cobre de Chile / Chilean State-Owned Mining Corporation.[<http://www.codelcochile.com>].

**CODESAIMA:** Roraima state Mining Enterprise.

**COFINS / FINSOCIAL:** Contribuição para Financiamento da Seguridade Social / Social Security Contribution (Fund for Social Investment).

**Colorado School of Mines:** [www.mines.edu](http://www.mines.edu)

**COMEX:** New York Exchange [<http://www.nymex.com/chartsdata>].

**CONAMA:** Conselho Nacional do Meio Ambiente / National Council for the Environment (1989 resolution).

**CONFAZ:** Conselho Nacional de Política Fazendária / Brazilian Council for Taxation Policy.

**Constituição / Brazilian Constitution:** <http://www.stf.com.br>

**COPOM:** Comissão de Política Monetária / Monetary Policy Committee.

**COPPE:** Coordenação dos Programas de Pós-Graduação em Engenharia / The Co-ordinatory Body of Post-Graduate Research in Engineering from UFRJ.

**COREMI:** Consejo de Recursos Minerales / Mexican Council for Mineral Resources.

**COSIGUA:** Companhia Siderúrgica Guanabara (metallurgy company).

**COSIPA:** Companhia Siderúrgica Paulista (metallurgy company).

**CPMF:** Contribuição Provisória sobre Movimentação Financeira / Contribution over Financial Activities [provides revenues for the Government; part of the Fiscal Adjustment Programme in Brazil for Fiscal Reform (see SRF)].

**CPRM:** Companhia de Pesquisa de Recursos Minerais / Brazilian Company for Mineral Resources Research [created 1969; transformed into Serviço Geológico do Brasil / Brazilian National Geological Survey in 1994 (28th of December) [<http://www.cprm.gov.br>]].

**CRA:** Australian resource group (merged with RTZ from UK to form 'Rio Tinto PLC').

**CREA:** Conselho Regional de Engenharia, Arquitetura e Agronomia

/ Brazilian Engineering Council.[Rio de Janeiro: <http://www.crearj.com.br> ].

**CRM/RS:** Rio Grande do Sul state Mining Enterprise.

**CRU:** CRU International [<http://www.cru-int.com/cruint/>].

**CSLL:** Contribuição Social sobre o Lucro Líquido / Brazilian Net Income Social tax.

**CSOC:** Contribuição Social / Brazilian Social Contribution tax.

**CSN:** Companhia Siderúrgica Nacional (CSN is Latin America's largest integrated steel maker). [<http://www.csn.com.br> ].

**CST:** Companhia Siderúrgica Tubarão (metallurgy company).

**CUT:** Central Única dos Trabalhadores / Brazilian Workers Central Unit (created 1983).

**CVM:** Comissão de Valores Mobiliários / Brazilian equivalent to the 'Security & Exchange Commission-SEC' [<http://www.cvm.gov.br>].

**CVRD:** Companhia Vale do Rio Doce [<http://www.cvrd.com.br>].

**Datamine:** <http://www.datamine.co.uk>

**DeBeers:** <http://www.debeers.co.za>

**DECEX:** Departamento de Comércio Exterior / Department of Commerce (under MICT).

**deg:** diamonds & gemstones (precious stones).

**DEM / DNPM:** Departamento de Economia Mineral do DNPM / Mineral Economics Department.

**DF:** Distrito Federal / Brazilian Federal District, Brasília.

**DHN-MM:** Diretoria de Hidrografia e Navegação, Ministério da Marinha / Shipping and Hydrographical Directory of the Brazilian Ministry of Navy.

**DIPEM:** Divisão de Planejamento e Economia Mineral / Planning and Mining Division.(part of DNPM).

**DNPM:** Departamento Nacional da Produção Mineral / Brazilian National Department for Mining. (<http://www.dnpm.br>)

**DOCEGEO:** Rio Doce Geologia / The geological exploration company

owned by CVRD (CVRD 's subsidiary for mineral exploration).

**DOCENAVE:** Vale Rio Doce Naveg. S.A. / CVRD Subsidiary for Bulk Transport.

**DTI:** UK Department of Trade and Industry [<http://www.dti.gov.uk>].

**EA:** Environmental Auditing.

**Earth Sciences Resources:** <http://www.vl-es.geo.ucalgary.ca/VL/html/es-resources.html> (The World-Wide Web Virtual Library: Earth Sciences Resources).

**EBM:** Canadian Echo Bay Mines.

**EC:** European Community (see also EU).

**ECHO BAY Mines:** [www.echobay.com](http://www.echobay.com)

**ECLAC:** see CEPAL.

**The Economist:** <http://www.economist.com/>

**EEC:** European Economic Community.

**EEM or EEMs:** Entidades Estaduais de Mineração / Brazilian state (local) Mining Enterprises (same as "SEM").

**EFTA:** European Free Trade Area.

**EIA:** Environmental Impact Assessment (reports).

**ELETROBRAS:** Centrais Elétricas Brasileiras S.A. / Holding company for the Brazilian electricity industry (with operations in power generation and distribution).

**ELETRONORTE:** Centrais Elétricas do Norte do Brasil S.A. / North of Brazil Electricity.

**EMS:** Environmental Management Systems.

**en:** 'energy minerlas' (e.g. oil and gas).

**EOI:** Export-Oriented Industrialisation [ cf. with ISI].

**EPM:** Environmental Planning and Management [some EPM 'tools' are: EIA, RA, EA, EMS, LCA, ISO].

**EPZs:** Export-Processing Zones.

**ERICSSON:** [www.ericsson.se](http://www.ericsson.se) / [www.ericsson.com](http://www.ericsson.com)

**Ernst & Young:** Global consulting, tax, assurance company [[www.ey.com](http://www.ey.com) ].

**ERPS:** Enterprise Resource Planning Systems (involves, among other issues, dealing with 'Supply-Chain Management' - SCM, and also the management and use of 'Information Technology' - IT).

**ES:** Espírito Santo (a member of the federation of the 26 Brazilian states).

**EU:** European Union (see also EC).

**Euromonitor International:** [www.euromonitor.com](http://www.euromonitor.com)

**EVA:** Economic Value Added (a management concept / tool).

**FBP:** Full Business Potential (a management concept / tool).

**FCA:** Free Carrier (Means that a certain company 'a' pays the freight for the transport of goods from a designated place).

**FDI:** Foreign Direct Investment.

**FEF:** Fundo de Estabilização Fiscal / Brazilian Fiscal Stabilisation Fund. (substitute for the FSE created in 1994).

**FENAME:** Fundação Nacional de Material Escolar / Brazilian Teaching Foundation.

**FERTECO:** Ferteeco Mineração S.A. (iron ore producer in Brazil).

**FGV:** Fundação Getulio Vargas / Rio de Janeiro Getulio Vargas Foundation. [<http://www.fgv.br/conjuntura.htm>].

**FIELD:** Foundation for International Environmental Law and Development [ [www.field.org.uk](http://www.field.org.uk) ].

**FIEMG:** Federação das Indústrias do Estado de Minas Gerais / Minas Gerais state Federation of Industries [ [www.fiemg.com.br](http://www.fiemg.com.br) ].

**FIESP:** Federação das Indústrias do Estado de São Paulo / São Paulo Federation of Industries.

**FINAM:** Fundo de Investimento da Amazônia / Investment Fund for the Amazon region.

**FINEP:** Financiadora de Estudos e Projetos / Brazilian Financing Agency for Studies and Projects. [<http://www.finep.gov.br>].

**FINOR:** Fundo de Investimento do Nordeste / Investment Fund for the North-east of Brazil.

**FISENGE:** Federação Interestadual de Sindicatos de Engenheiros / Engineering Syndicate Federation.

**FISMD:** First International Symposium on Mining and Development (Campinas-SP, Brazil, July 10-13, 1995; organised by UNICAMP).

**FOB:** Free On Board (Means that a certain producing company pays for the freight for the transportation of goods from a designated port of shipment).

**FT:** Financial Times [<http://www.ft.com/>].

**FT/USA:** Financial Times (USA) [<http://www.usa.ft.com/>].

**FTAA:** Free Trade Area of the Americas [ also ALCA ].

**G-7:** The Group of 7 powerful countries (USA, Japan, Germany, France, Italy, Britain and Canada).

**GAIC:** General Agreement on International Corporations.

**GAII:** General Agreement on International Investment.

**GANA:** Grupo de Apoio à Normatização Ambiental / Brazilian Environmental Standardisation Group. (part of ABNT, financed by the national industrial sector; GANA is responsible to advance issues such as the ISO 14000).

**GAT/CECD:** Grupo de Assessoramento Técnico / Comissão Externa da Câmara dos Deputados (The Technical Advisory Group of the External Commission of the Chamber of Deputies).

**GAT-COPPE:** GAT/CECD and COPPE joint work.

**GATT:** General Agreement on Tariffs and Trade.

**GDP:** Gross Domestic Product.

**GEIXS:** Geological Electronic Information eXchange System [<http://www.eurogeosurveys.org>].

**GETF:** Global Environment & Technology Foundation [[www.getf.org](http://www.getf.org)].

**GFMS:** London-based Gold Fields Mineral Services.

**GNP:** Gross National Product.

**GO:** Goiás state in Brazil (a member of the federation of the 26 Brazilian states).

**Gold:** <http://www.gold.org>



**Gold Fields Ltd.:** [www.goldfields.co.za](http://www.goldfields.co.za)

**GSC:** Geological Survey of Canada [<http://www.emr.ca/gsc>].

**GSJ:** Geological Survey of Japan [<http://www.aist.go.jp/GSJ>].

**GSSA:** Geological Survey of South Africa [<http://www.geoscience.org.za>].

**GSWA:** Geological Survey of Western Australia [<http://www.dme.wa.gov.au/qswa>].

**HCP:** Historical Commodities Prices [<http://www.ebay.com/invest/data>].

**HDI:** Human Development Index.

**Historical Commodity Prices:** <http://www.ebay.com/invest/data>

**IADB:** Inter-American Development Bank.

**IAS:** International Accounting Standards (see also IASC).

**IASC:** International Accounting Standards Committee (see also IAS).

**IBAMA:** Instituto Brasileiro do Meio Ambiente e dos Recursos Naturais Renováveis /

Brazilian Environment Institute. [<http://www.ibama.gov.br>].

**IBASE:** Instituto Brasileiro de Análises Sociais e Econômicas / Brazilian Institute for Social and Economic Analysis.

**IBGE:** Instituto Brasileiro de Geografia e Estatística / Brazilian Institute for Geography and Statistics. [<http://www.ibge.gov.br> / <http://www.ibge.org> ].

**IBICT:** Instituto Brasileiro de Informação em Ciência e Tecnologia /Brazilian Science & Technology Information Institute

**IBRAM:** Instituto Brasileiro de Mineração / Brazilian Institute for Mining (founded 1976).

**IBRD:** International Bank for Reconstruction and Development (**WORLD BANK** ).

**IBRE:** Instituto Brasileiro de Economia / Brazilian Economics Institute. Branch of FGV. Controls the 'Centro de Estudos de Preços' that develop and research economic indicators such as: IGP, INCC,

INPC, IPA, IPC, IPCA and others. [ <http://www.fgv.br/fgv/ibre> ].

**IBP:** Instituto Brasileiro do Petróleo / Brazilian Petroleum Institute[ [www.ibp.org.br](http://www.ibp.org.br) ].

**IBS:** Instituto Brasileiro de Siderurgia / Brazilian Steel Institute.

**ICATU:** Banco Icatu S.A. / Icatu Bank [ <http://www.icatu.com> ].

**ICC:** International Chamber of Commerce (better known as ICCWBO).

**ICCWBO:** International Chamber of Commerce & World Business Organisation (see also WBO) [ <http://www.iccwbo.org> ].

**ICI:** Internal Consumption Industrialisation.

**ICME:** International Council on Metals and the Environment.

**ICMS:** Imposto sobre Circulação de Mercadorias e sobre Prestação de Serviços / Merchandise and Services value added tax.

**ICSG:** International Copper Study Group [ [www.icsg.org](http://www.icsg.org) ].

**IDB:** Inter-American Development Bank.

**IDL:** International Division of Labour.

**IDR:** International Depository Receipts (see also ADR).

**IE:** Imposto sobre a Exportação / Brazilian Exportation tax.

**IFC:** International Finance Corporation.

**IGM:** Instituto Geológico e Mineiro (Portugal) / Portuguese Mining and Geological Institute.[ [www.igm.pt](http://www.igm.pt) ].

**IGP:** Índice Geral de Preços / General Price Index (indicator by FGV).

**II:** Imposto sobre a Importação / Brazilian Importation tax.

**IIMD:** International Institute for Management Development [ [www.imd.ch/](http://www.imd.ch/) ].

**IIO:** International Investment Organisation.

**IISI:** International Iron and Steel Institute.

**ILFAFA:** Instituto Latino Americano del Fierro y el Acero / Latin American Iron & Steel Institute.

**ILAS:** Institute of Latin American Studies (University of London).

**ILL:** Imposto sobre Lucro Líquido / Brazilian Tax on Net Profits.

**ILO:** International Labour Organisation.

**IMF:** International Monetary Fund.

**IMM:** London based Institution of Mining and Metallurgy.

**INCC:** Índice Nacional de Custo da Construção / Brazilian Index for Construction Cost.

**INDI:** Instituto de Desenvolvimento Industrial de Minas Gerais / Minas Gerais state Industrial Development Institute.

**Infomine:** [www.infomine.com](http://www.infomine.com) [mining information web-site].

**INPA:** Instituto Nacional de Pesquisas da Amazônia / Brazilian Institute for Amazonian Research.

**INPC:** Índice Nacional de Preços ao Consumidor / Brazilian Consumer Price Index. (indicator by IBGE).

**INPE:** Instituto Nacional de Pesquisas Espaciais / Brazilian Space Research Centre. [<http://www.inpe.br>].

**IOF:** Imposto de Operações Financeiras (crédito, câmbio, seguro) / Brazilian Financial Operations Tax.

**IPA:** Índice de Preços por Atacado / Wholesale Price Index (indicator by FGV).

**IPC:** Índice de Preços ao Consumidor / Consumer Price Index (indicator produced by FIPE).

**IPCA:** Índice de Preços ao Consumidor Amplo / Brazilian 'Extended' Consumer Price Index.

**IPE:** International Political Economy.

**IPEA:** Instituto de Pesquisa Econômica Aplicada / Brazilian Institute for Applied Economic Research. [<http://www.ipea.gov.br>].

**IPI:** Imposto sobre Produtos Industrializados / Taxation over Industrialised Products in Brazil.

**IPT:** Instituto de Pesquisas Tecnológicas do Estado de São Paulo / São Paulo state Technology Institute. [<http://www.ipt.br>].

**IR:** Imposto sobre a Renda e Proventos (de qualquer natureza) / Revenue Tax.

**IRPF:** Imposto de Renda Pessoa Física / Revenue Tax for Individuals.

**IRPJ:** Imposto de Renda Pessoa Jurídica / Revenue Tax for Organisations.

**ISI:** Import Substitution Industrialisation / Import-Substituting Industrialisation.

**ISO:** International Standards Organization / International Organization for Standardization.

[<http://www.iso.ch> ; [www.tc207.org/home](http://www.tc207.org/home) ; [www.iso14000.com](http://www.iso14000.com)].

**ISS:** Iron and Steel Society [ [www.steel.org](http://www.steel.org) ].

**I.S.S.:** Imposto Sobre Serviços / Brazilian Services taxation.

**IT:** Information Technology.

**ITAMARATY:** Brazilian Embassy Coordinatory Body [see <http://www.demon.co.uk/Itamaraty>].

**ITR:** Imposto Territorial Rural / Brazilian Rural Territorial Tax.

**IUM:** Imposto Único sobre Minerais / Minerals tax.

**Jacobina Min.:** Jacobina Mineração (gold producer in Brazil).

**JCs:** Junior Companies.

**JVs:** Joint-Ventures.

**JVEs:** Joint-Venture Enterprises.

**Krupp:** <http://www.krupp.com>

**LABCSD:** Latin American Business Council for Sustainable Development, Mexico.

**LAFTA:** Latin America Free Trade Area.

**LAIA:** Latin America Integration Association.

**LATAG:** Latin American Trade Advisory Group [<http://www.latag.com>].

**LCA:** Life Cycle Assessment.

**LDC / LDCs:** Less Developed Country(ies).

**LIBOR:** London Interbank Offered Rate.

**LME:** London Metal Exchange [<http://www.lme.co.uk/stat>].

**LTNs:** Letras do Tesouro Nacional / Brazilian Treasury Securities.

**MA:** Maranhão (a member of the federation of the 26 Brazilian states).

**M&A:** Mergers and Acquisitions.

**MBR:** Minerações Brasileiras Reunidas (mining company partly owned by CAEMI).

**MCT:** Ministério da Ciência e Tecnologia / Brazilian Ministry of Science & Technology. [<http://www.mct.gov.br>].

**MEG:** Nova Scotia-based Metals Economic Group.

**MERCOSUR (or MERCOSUL):** 'Common Market of the South' between Argentina, Brazil, Paraguay and Uruguay (planned and organised since 1986; the document for the 'customs union' (*duane*) between the four countries was signed in Buenos Aires on the 5th of August 1994, creating a Common External Tariff (CET) and the protection of imports from non-member countries; launched in January 1995).

**MERN:** Mining and Environment Research Network.

**Merrill Lynch:** Global consultancy group [[www.ml.com](http://www.ml.com)].

**met:** 'metallic minerals' (e.g. iron-ore, gold).

**METAGO:** Metais de Goiás / Goiás state Mining Enterprise.

**Metal Bulletin:** <http://www.metbul.com/metbul/mblindx.html>].

**Metallica Resources Inc.:** [www.metal-res.com](http://www.metal-res.com)

**METAMIG:** Metais de Minas Gerais / Minas Gerais state Mining Enterprise.

**MG:** Minas Gerais state in Brazil (one member of the federation of the 26 Brazilian states).[ <http://www.minasmundo.com.br> ].

**MICT:** Ministério da Indústria, do Comércio e do Turismo / Brazilian Ministry for Industry, Commerce and Tourism.[<http://www.mict.gov.br> ].

**Mineral Information Institute:** [www.mii.org](http://www.mii.org)

**Minerals Council of Australia:** [[www.minerals.org.au](http://www.minerals.org.au) ].

**MINF:** Ministério da Fazenda / Ministry of Finance in Brazil [<http://www.fazenda.gov.br>].

**Mining@Chile:** [<http://www.atamericas.com/pages/mining.html>].

**Mining and Metallurgical Society of America:** [www.MMSA.net](http://www.MMSA.net)

**Mining Journal:** <http://www.mining-journal.com>

**Min-Met Australia:** <http://www.minmet.com.au/>

**MINP:** Ministério do Planejamento / Brazilian Planning Ministry.

(also known as SEPLAN) [<http://www.seplan.gov.br>].

**MinPE:** Minérios de Pernambuco / Pernambuco state Mining Enterprise.

**MITI:** Ministry of International Trade and Industry (from Japan).

**Mitsubishi Corp.:** <http://www.mmjp.or.jp/mcfutures/trade-e.html>

**MJ:** London-based *Mining Journal* [ <http://www.mining-journal.com> ].

**MMA:** Ministério do Meio Ambiente / Brazilian Ministry of the Environment.

[<http://www.mma.gov.br>].

**MME:** Ministério das Minas e Energia / Brazilian Ministry of Mines and Energy.

**MMIJ:** The Mining and Materials Processing Institute of Japan.

**MMV:** Mineração Morro Velho (gold producer in Brazil / operated by AAC of South Africa).

**MNCs:** see MNEs.

**MNEs:** Multinational Enterprises; also known as Multinational Corporations (MNCs), Transnational Corporations (TNCs), Transnational Enterprises (TNEs). The terms are used interchangeably.

**MP:** Medida Provisória / "Provisional Measure" taken by the Brazilian government.

**MRE:** Ministério das Relações Exteriores / Brazilian Foreign Relations Ministry. [<http://www.mre.gov.br>].

**MRN:** Mineração Rio do Norte (mining company).

**MS:** Mato Grosso do Sul (a member of the federation of the 26 Brazilian states).

**MSE:** Montreal Stock Exchange [<http://www.me.org>].

**MSE Ltda.:** Mineração Santa Elina Ind. Com. Ltda. (gold producer in Brazil).

**MSG:** Mineração Serra Grande (gold producer in Brazil) -[an association between MMV and TVX Gold Inc.].

**MT:** Mato Grosso (a member of the federation of the 26 Brazilian states).

**MTB:** Ministério do Trabalho / Brazilian Ministry for Work [<http://www.mtb.gov.br>].

**NAAC:** Nippon Aluminium Amazon Company (a consortium composed of 33 Japanese enterprises).

**NAFTA:** North American Free Trade Agreement (between USA, Canada and Mexico).

**NALCO:** Nippon Amazon Aluminium Co.

**NATO:** North Atlantic Treaty Organisation.

**NCM:** Novo Código de Mineração / New Mining Code for Brazil (created 1967).

**Newmont Mining Corp.:** <http://www.newmont.com/>

**New York Times:** <http://www.nytimes.com/>

**Newspapers in Brazil:** <http://www.bovespa.com.br/jornais.htm>  
(link for main newspapers).

**NFI:** New Forms of Investment.

**NICs:** Newly Industrialised Countries (also known as 'emerging markets').

**NIDL:** New International Division of Labour.

**NIEO:** New International Economic Order.

**Nippon Steel:** <http://www.nsc.co.jp>

**NIS:** Newly Independent States (old Soviet Union or ex-USSR, renamed and politically changed).

**n-met:** 'non-metallic minerals' (e.g. limestone, crushed stones).

**NRCAN:** Natural Resources Canada [ <http://www.nrcan.gc.ca/mms/> ].

**NRI:** Natural Resources International [ <http://www.nrinternational.co.uk> ].

**NWM:** Nat West Markets (National Westminster Bank Plc).

**OECD:** Organisation of Economic Cooperation and Development.

**OPEC:** Organisation for Petroleum Exporting Countries [ <http://www.opec.org> ].

**Outokumpu Technology Inc.:** [www.outokumpu.com](http://www.outokumpu.com) (from Finland).

**PA:** Pará state in Brazil (one member of the federation of the 26 Brazilian states).

**PAEG:** Programa de Ação Econômica Governamental / Brazilian Program of Government Economic Action.

**PB:** Paraíba (a member of the federation of the 26 Brazilian states).

**PBQP:** Programa Brasileiro de Qualidade e Produtividade / Brazilian Quality and Productivity Programme.

**PDAC:** Prospectors and Developers Association of Canada.

**PDTI:** Programa de Desenvolvimento Tecnológico e Industrial / Brazilian Industrial Technological Development Programme.

**PE:** Pernambuco (a member of the federation of the 26 Brazilian states).

**Pechiney SA:** <http://www.pechiney.fr/som.html>

**PETROBRAS:** Petróleo Brasileiro S.A. / Integrated Brazilian oil and energy resources company created in 1953 under the Vargas government (active in all stages of the industry - from exploration to refining and distribution). [ [www.petrobras.com.br/](http://www.petrobras.com.br/) ].

**PETROS:** Fundação Petrobras de Seguridade Social / Pension Fund from PETROBRAS.

**PGBC:** Projeto Geofísico Brasil-Canada / Brazil-Canada AeroGeophysical Project (1975).



**PGC:** Programa Grande Carajás (a large mining programme in the state of Pará in the Amazon region)[see also CIPGC].

**PI:** Piauí (a member of the federation of the 26 Brazilian states).

**PIF:** Portfolio Investment Flows.

**PIS-PASEP:** Programa de Inserção e Integração Social / Programme for Social Insertion and Integration tax (One of the taxes from the SRF).

**PLC:** Public Limited Companies.

**PMB:** Produção Mineral Brasileira / Brazilian Mineral Production.

**PMD-I:** Primeiro Plano Mestre Decenal para a Mineração / Brazilian Mining Plan (period 1965-74).

**PMD-II:** Segundo Plano Mestre Decenal para Aproveitamento dos Recursos Minerais Brasileiros / 2nd Master Plan for the Utilisation of the Brazilian Mineral Resources (elaborated in 1980 for the period 1981-1990).

**PND:** Programa Nacional de Desestatização / Brazilian Privatisation Programme (started 1991).

**PND-I:** Primeiro Plano Nacional de Desenvolvimento / Brazilian First Plan for Development (1972).

**PND-II:** Segundo Plano Nacional de Desenvolvimento / Brazilian Second Plan for Development (1975). [PND-II largely promoted ISI].

**PND-III:** Terceiro Plano Nacional de Desenvolvimento / Brazilian Third Plan for Development (promoted in 1979).

**PNDNR-I:** Primeiro Plano Nacional de Desenvolvimento da Nova República / 1st National Plan for Development of the New Republic (started 1985 with President Sarney).

**PNMA:** Política Nacional do Meio Ambiente / Nacional Policy for the Environment (1981).

**PNUMA:** Programa das Nações Unidas para o Meio Ambiente, Comitê Brasileiro. [United Nations Programme for the Environment, Brazilian Committee].

**PPDSM:** Plano Plurianual para o Desenvolvimento do Setor Mineral / Plurianual Plan for the Development of the Mining Industry in

Brazil (Published in 1994 by DNPM; elaborated for the 1994-2010 period).

**PR:** Paraná (a member of the federation of the 26 Brazilian states).

**PREVI:** Caixa de Previdência dos Funcionários do Banco do Brasil / Pension Fund of 'Banco do Brasil' (see 'Banco do Brasil').

**PSAs:** Production-Sharing Agreements.

**PwC:** PricewaterhouseCoopers; international accounting and management consultancy group (released the *Financial Reporting in the Mining Industry for the 21st Century* in March 1999; this is part of a project working towards IASC and IAS objectives - i.e. pursuing the drive for comparability in financial reporting, and harmonisation, at the international level). [[www.pwcglobal.com](http://www.pwcglobal.com)].

**QAL:** Queensland Alumina Limited (located in Australia, is the world's largest alumina refinery).

**R\$:** Real (plural 'Reais'); the Brazilian currency since 1994.

**RA:** Risk Assessment.

**RADAM:** Brazilian Radar Imagery & Mapping Project (initiated in 1971).

**RAYTHEON:** [www.raytheon.com](http://www.raytheon.com) and [www.raytheon.com/rac](http://www.raytheon.com/rac)

**R&D:** Research and Development.

**REDMIN:** Red de Informacion de la Minería / Mining Information Network (in Spanish). [<http://redmin.conicyt.cl:8080/inicio.html>].

**REMAC:** Reconhecimento Global da Margem Continental Brasileira / Reconnaissance of the Brazilian Continental Margin [A project developed during the 1970s by Petrobras, DNPM, CPRM, DHN-MM and CNPq].

**Reynolds Metals:** <http://www.rmc.com>

**Rio Tinto PLC:** UK-Australian mining corporation (resulted from merging RTZ and CRA). [[www.riotinto.com](http://www.riotinto.com)].

**RJ:** Rio de Janeiro state in Brazil (a member of the federation of the 26 Brazilian states).

**RMG:** Raw Materials Group, Sweden.

**RN:** Rio Grande do Norte (a member of the federation of the 26

Brazilian states).

**RO:** Rondônia (a member of the federation of the 26 Brazilian states).

**Rockwell Automation:** <http://www.automation.rockwell.com>

**Roskill:** Roskill International; London-based information services [ <http://www.roskill.co.uk>].

**Royal Gold Inc.:** [www.royalgold.com](http://www.royalgold.com)

**RPM:** Rio Paracatu Mineração S.A. (gold producer in Brazil).

**RR:** Roraima (a member of the federation of the 26 Brazilian states).

**RS:** Rio Grande do Sul (a member of the federation of the 26 Brazilian states).

**RSG:** Resource Service Group; Australia [ <http://www.rsg.com.au>].

**RTZ:** Now merged with CRA from Australia and called 'Rio Tinto Plc'.

**SAE:** Secretaria de Assuntos Estratégicos / Brazilian Strategy Agency. [ <http://www.cepesc.gov.br>].

**SAMARCO:** Samarco Mineração S.A. (iron ore & pellets producer in Brazil). [ [www.samarco.com.br](http://www.samarco.com.br) ].

**SAMB:** South African Minerals Bureau [ <http://www.gov.za/mineral>].

**SAMITRI:** S.A. Mineração Trindade (iron ore & pellets producer in Brazil).

**SBG:** Sociedade Brasileira de Geologia / Geological Brazilian Society.

**SBM:** São Bento Mineração S.A. (gold producer in Brazil)

[an association of AMIRA Trading and BILLITON which together form the São Bento Gold - 'SBGold'].

**SC:** Santa Catarina (a member of the federation of the 26 Brazilian states).

**SCM:** Supply-Chain Management (see ERPS).

**SE:** Sergipe (a member of the federation of the 26 Brazilian states).

**SEBRAE:** Agência Empresarial para Desenvolvimento de Pequenos Negócios / Agency for the Development of Small Businesses in

Brazil.

**SEC:** Security Exchange Commission [<http://www.sec.gov>].

**SECEX:** Secretaria de Comércio Exterior do Brasil / Brazilian Foreign Commerce Agency.

**SEM or SEMs:** Sistemas Estaduais de Mineração / Brazilian state System of Mining Enterprises. Includes: METAMIG, METAGO, CBPM, CRM/RS, CDM/RN, CDRM/PB, MinPE, CMR, CODESAIMA. [see "EEM" or "EEMs"].

**SENADO:** Senado Federal / Brazilian Federal Senate [<http://www.senado.gov.br>].

**SENGE:** Sindicato dos Engenheiros / Brazilian Engineering Labour Union. (see also FISENGE).

**SEPLAN:** see MINP.

**SHELL:** Shell International Ltd. [[www.shell.com/](http://www.shell.com/) ].

**SIEMENS:** Siemens Corporation [ [www.usa.siemens.com](http://www.usa.siemens.com) / [www.siemens.de](http://www.siemens.de) / [www.siemens.com](http://www.siemens.com) ].

**SISTEL:** Fundação Telebras Seguridade Social / TELEBRAS Pension Fund.

**SIVAM:** Sistema de Vigilância da Amazônia / Surveillance System for the Amazon.

**SMA:** Steel Manufacturers Association (North America's Largest Steel Trade Group) [<http://www.steelnet.org/sma/assoc.html>].

**SME:** Society for Mining, Metallurgy and Exploration Inc.: [www.smenet.org](http://www.smenet.org)

**SMEs:** Small & Medium Enterprises.

**SMM:** Secretaria de Minas e Metalurgia / Secretary of Mines and Metallurgy (part of MME).

**SMME:** Society of Mining, Metallurgy and Exploration Inc. [<http://www.smenet.org>].

**SNI:** Serviço Nacional de Inteligência / Brazilian National Intelligence Service.

**SOBRATEMA:** Sociedade Brasileira de Tecnologia para Equipamentos e Manutenção / Brazilian Society for Equipment and Maintenance

Technology. [ <http://www.sobratema.org.br> ].

**Society of Economic Geologists:** [www.segweb.org](http://www.segweb.org)

**SOEs:** State-Owned Enterprises.

**SP:** São Paulo state in Brazil (a member of the federation of the 26 Brazilian states).

**SRF:** Secretaria da Receita Federal / Brazilian Federal Tax Agency (administers taxes such as: Import & Export taxes, IPI, IR [IRPF and IRPJ], IOF, ITR, CPMF, COFINS, PIS-PASEP, etc.).

**SRG:** Stock Research Group [ <http://www.stockgroup.com/> ].

**SRP:** Stephen Rose & Partners Limited (works closely with 'UCI-Unibanco' and 'UBB Capital Markets').

**SSE:** Stockholm Stock Exchange [ <http://www.xsse.se/eng/index.html> ].

**S&T:** Science and Technology.

**SteelNet:** <http://www.steelnet.org>

**Stocks and Commodity:** <http://www.onr.com/stocks.html>

**SUDAM:** Superintendência para o Desenvolvimento da Amazônia / Superintendency for the Development of the Amazonian region in Brazil (established 1966).

**SUDENE:** Superintendência para o Desenvolvimento do Nordeste / Superintendency for the Development of the Northeast of Brazil.

**Svedala Industries Inc.:** [www.svedala.com](http://www.svedala.com)

**TELEBRAS:** Telecomunicações Brasileiras S.A. / Holding company for the operating Brazilian-State telephone utilities and the long distance telecommunication provider set up in 1972 (is a provider for regional telecom companies, such as TELESP, TELERJ, TELEMIG, etc.).

**TELEMIG:** Minas Gerais state Telecoms.

**TELERJ:** Rio de Janeiro state Telecoms.

**TELESP:** São Paulo state Telecoms.

**TNCs:** see MNEs.

**TNEs:** see MNEs.

**TO:** Tocantins state in Brazil (a member of the federation of the 26 Brazilian states).

**TREVISAN:** <http://www.trevisan.com.br> (economic information on Brazil).

**“Triad”:** USA, the European Union and Japan.

**TRIMS:** Trade Related Investment Measures.

**TRIPS:** Trade Related Intellectual Property Rights.

**TSE:** Toronto Stock Exchange.

**UBB:** UBB Capital Markets Limited (part of the UNIBANCO group).

**UCI Unibanco:** Unibanco Consultoria de Investimentos (part of the UNIBANCO group).

**U.F.:** Unidades da Federação / Brazilian “units” (= states) of the Federation. e.g. BA, MG, RJ, SP, etc. (see ‘Brazilian states’).

**UFRJ:** Universidade Federal do Rio de Janeiro / The Federal University of Rio de Janeiro.

**UK:** United Kingdom (England + Northern Ireland + Scotland + Wales).

**UN:** United Nations Organisation (same as UNO).

**UNCED:** United Nations Conference of Environment and Development [1992 Rio de Janeiro Conference, ECO-92 or the “Earth Summit”]; see also ‘Agenda 21’.

**UNCHE:** United Nations Conference on Human Environment / 1972 Stockholm Conference.

**UNCTAD:** United Nations Centre for Trade and Development.

**UNCTC:** United Nations Centre on Transnational Corporations.

**UNDP:** United Nations Development Program.

**UNEP:** United Nations Environment Programme (see PNUMA).

**UNESCO:** United Nations Educational, Scientific and Cultural Organisation.

**UNICAMP:** Universidade Estadual de Campinas / State University of Campinas (Brazil). [<http://www.ige.unicamp.br>].

**UNIDO:** United Nations Industrial Development Organisation

[<http://www.unido.org>].

**UNO:** United Nations Organisation (same as UN).

**UNU:** United Nations University [<http://www.unu.edu/>]; UNU/  
**WIDER:** World Institute for Development Economics Research of  
the United Nations University.

**USBM:** U.S. Bureau of Mines.

**USGS:** U.S. Geological Survey [[http://minerals.er.usgs.gov/  
minerals/pubs/stats](http://minerals.er.usgs.gov/minerals/pubs/stats)].

**USIMINAS:** Usinas Siderúrgicas de Minas Gerais S.A.  
[[www.usiminas.com.br](http://www.usiminas.com.br)].

**USP:** Universidade de São Paulo / University of São Paulo.

**USSR:** Union of Socialist Soviet Republics.

**VALESUL:** Valesul Alumínio S.A. [Started as JV between CVRD,  
SHELL and REYNOLDS]. (approved by the Brazilian government  
in December 1976; started operations 1982).

**VCET:** Verification-Certification of Environmental Technologies  
(see GETF).

**VILLARES:** Aços Villares S.A.

**VOLVO:** Swedish diversified (cars, trucks, equipment, etc.) auto-  
industry manufacturer. [[www.volvo.com](http://www.volvo.com) / [www.volvo.se](http://www.volvo.se)].

**VPM:** Valor da Produção Mineral / Value of Mineral Production.

**VSE:** Vancouver Stock Exchange [<http://www.vse.com/>].

**Wall Street Journal:** <http://www.wsj.com>

**WB:** World Bank [[http://www.worldbank.org/html/dec/data/  
home.html](http://www.worldbank.org/html/dec/data/home.html)]; see IBRD.

**WBCSD:** World Business Council for Sustainable Development,  
Geneve - Switzerland. [<http://www.wbcds.ch>].

**WBO:** The World Business Organisation (see also ICCWBO).  
[<http://www.iccwbo.org>].

**WCED:** World Commission on Environment and Development /  
The Bruntland Report (approved by UNO in 1987).

**WDM:** World Development Movement [ <http://>

[www.oneworld.org/wdm/](http://www.oneworld.org/wdm/) ].

**WGC:** World Gold Council [<http://www.gold.org>].

**WIDER:** World Institute for Development Economics Research [<http://www.wider.unu.edu/wider.htm>].

**WMC:** Western Mining Corporation (from Australia). [WMC Exploration Inc. [www.wmc.com.au](http://www.wmc.com.au) ].

**World Steel:** <http://www.worldsteel.org>

**WRI:** World Resources Institute [ [www.wri.org/wri/](http://www.wri.org/wri/) ].

**WSO:** Wall Street On-Line [<http://www.wso.com/wso>].

**WTO** (or OMC): World Trade Organisation.



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