

# Companhia Vale do Rio Doce and the Carajas iron ore project

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The *Companhia Vale do Rio Doce* (CVRD) is engaged mainly in the mining and the transporting of iron ore. The Brazilian government holds a controlling interest in the corporation.

The chief purpose of this paper is to explain why CVRD was induced to set up the Carajas Iron Ore Project (Carajas Project) in a poorly developed part of the country, involving an expenditure of approximately 3 600 MUSD.

## 1. The part played by CVRD in the national and foreign mineral industry

CVRD and *Petroleo Brasileiro SA* (Petrobras) are the major mining concerns in Brazil. Petrobras is also a government controlled organization and it is engaged in the production, refining and distribution of petroleum and petroleum products.

CVRD is the chief iron ore mining company in the country and its share in the supply of overseas iron ore markets is the largest. In addition to mining iron ore, it makes iron ore pellets and is also engaged in the manganese, titanium, bauxite and gold mining industries.

Largely due to the efforts of CVRD, Brazil has transformed a 2% share of the world iron market into a present 13% share, second only to the Soviet Union.

In 1986, Brazil produced 129.9 Mt of iron ore, of which 89.4 Mt were exported. CVRD's share of this production was 55%, while its share of ore exports was 58%.

In 1986, CVRD shipped 51.7 Mt of iron ore and pellets out of the country, and received 881.8 MUSD in exchange. If CVRD's pellet producing associates are also taken into account, the respective figures are 60 Mt and 1 069.9 MUSD, respectively. Iron ore and pellet sales to the domestic market accounted for a further 25.2 Mt. After adding revenue from the sale of other goods and from rail and harbour services provided, the net operating revenue of the Com-

pany rose to 1 585 MUSD. Export breakdown was as follows:

- 48% to the Far East (Japan, South Korea, Indonesia, the Philippines, the People's Republic of China, Taiwan and Malaysia)
- 42% to Europe (West Germany, United Kingdom, France, Italy, Belgium, Spain, Austria, Czechoslovakia, East Germany, Hungary, Yugoslavia, Poland, Rumania, and Luxembourg)
- 8% to the Americas (United States, Canada, Mexico, Trinidad-Tobago and Argentina)
- 2% to the Middle East (Saudi Arabia, Qatar, Iraq, Turkey, Egypt, and others).

Brazil is to be regarded as a nation of great mineral wealth even though it has not yet managed to become self-sufficient in petroleum. In spite of the level to which the Brazilian ore business has risen, the part it plays in the overall development of the nation still falls far short of that which Brazilian potential reserves have to offer. The production of minerals represents a mere 4% of the Gross National Product.

In spite of the drive to raise exports of mineral goods, exports are still less than imports, this is largely due to the costs of importing petroleum.

Furthermore, valuable minerals existing in any sizeable quantity in Brazil are few. This means that both the domestic economy and trade with other nations are vulnerable.

In this perspective, iron ore plays a prominent role, and Brazilian iron ore reserves are the largest in the world. The output of iron ore is only 26% of all ore output, but value-wise it accounts for 86% of earnings from the export of primary mineral wealth.

In Brazil, companies engaged in the mining industry are wholly or partly

government-owned, as well as locally or foreign-owned private concerns. Generally speaking, mining can be freely practiced except in the case of petroleum, the exploitation of which is a government monopoly.

## 2. A brief description of how CVRD was founded and its present organization

CVRD was founded in the middle of World War II by federal government action. It was one of the results of the contracts entered into in May 1942 by Brazil, the United States and the United Kingdom. These contracts are known as the Washington Agreements. In exchange for permission to set up military bases and for the supply of raw materials and the help thus provided to the Allies in their struggle against the axis powers, Brazil was to be afforded the support of these nations in intensifying its industrial development. Thus, in addition to receiving the equipment and the financing required to set up an important iron and steel mill — the Volta Redonda Iron and Steel Mill — Brazil was able to organize what is today the Companhia Vale do Rio Doce. To this end the following steps were agreed upon:

- Brazil would take over the Estrada de Ferro Vitoria-Minas, which belonged to Companhia Brasileira de Mineracao e Siderurgia S.A., in order to modernize it and raise its haulage capacity.
- With American financial support it would complete and develop the existing ore handling wharf at Vitoria, the capital of the State of Espirito Santo, owned by Companhia de Mineracao e Siderurgia S.A.
- It would receive, free of charge, from the United Kingdom, the property and ore deposits belonging to Itabira Iron Ore Co., in the State of Minas Gerais.

- It would organize a government corporation with private shareholders to mine, haul, market and ship the iron ore out of Itabira.

The corporation was brought into being on June 1, 1942, and there were three Brazilians at the head of it, one of them its President, and two Americans. This setup held good up to 1949, whereafter it was run solely by Brazilians. After some difficult years and some vacillating throughout the rest of the war and the slump that came after it, the company managed to find its feet and by the end of the 1940s it had started upon its way up, its exports increasing from a humble 0.5 Mt of iron ore in 1949 to today's 50 Mt (in 1986). It should be mentioned that it was only after 10 years that CVRD managed to reach the 1.5 Mt export target set at the outset.

The overall growth of CVRD can be briefly summed up in the following ten-year periods:

*1940s:* organized, following upon Washington Agreement.

*1950s:* Company under local control, and consolidated, exports rise and fresh markets gained in Europe, output rises to 3.3 Mt/y.

*1960s:* Company expands, transportation system improved and Tubarao harbour built, opening up way to Japanese market, exports reach 16.1 Mt/y.

*1970s:* Diversification of products, non-ferrous minerals included, particularly aluminium, plus timber and wood pulp.

At this stage, pelletizing plants run by companies associated with Japanese, Italian and Spanish interests start up. Total exports rise to 47.7 Mt/y.

*1980s:* Further expansion along with geographic spread, upon setting up of Carajas Iron Ore Project, output reaches 51.7 Mt/y in 1986.

At present CVRD is managed by a Board of Directors and an Executive Board. Both are chaired by the appointee

of the President of the Republic. Other executive bodies are the 28 Divisions (Superintendencias). As required under the Articles of Association of the Company at least 2/3 of the 10 Executive Directors must have held key jobs within the Company.

CVRD is a government corporation with private shareholders. It comes under the Ministry of Mines and Energy. The government is the major shareholder, holding at least 51% of the common shares. There are about 60 000 shareholders. CVRD shares are traded on the main Stock Exchanges in the country and heavy business is done in such stock.

From the beginning CVRD's main line of business has been iron ore, and it has always striven to meet high production targets and to trade efficiently. Its present-day status as the largest iron ore exporting company in the world bears obvious witness thereto.

Nowadays, whether directly or through its subsidiaries and associates, CVRD has expanded into other sectors, such as iron ore pellets, manganese ore, gold, titanium concentrate, railway transportation, forestry, wood-pulp and aluminium.

Table 1 shows the major subsidiaries and companies associated to CVRD. Annual net income is about 2.5 GUSD and the group employs around 35 000 people.

It should be mentioned that the Company has always shown concern for the economic and social development of those living in the areas in which it is active. CVRD acts as if it were a branch of the Brazilian government, using profits earned through the working of iron ore for the development of the country as a whole.

## 3. Why CVRD was induced to set up the Carajas project

Formerly CVRD's iron ore business operated according to an integrated system,

nowadays known as the South System. It consists of the mines that make up the Iron Quadrilateral in the State of Minas Gerais, plus the 782 km long Vitoria-Minas railway and the Tubarao harbour at Vitoria in the State of Espirito Santo. The operational capacity of this system is 75 Mt/y.

In 1967 geologists working for United States Steel Corporation in the south of the State of Para, discovered what is today known as the Mineral Province of Carajas, an area of about 4 000 square km, standing 650 meters above sea level. The chief mineral in the area is iron and known potential deposits amount to 18 Gt.

US Steel joined CVRD in 1970 to carry on with the studies that it had embarked upon right after the discovery, with a view to exploring the deposits found. The association lasted up to 1977 when, after having entered into an arrangement with its partner, CVRD bought the shares that US Steel held in the concern. The amount paid to US Steel was calculated in accordance with the shareholders agreement.

CVRD thus became the owner of vast top quality iron reserves, but these would require a heavy outlay of funds before they could be worked. CVRD decided for the time being to concentrate on feasibility studies.

An assessment of the state of affairs of the Company revealed the following major facts.

*(a) Prospects as regards the South System:*

The Company wanted to cut down on the rate of working deposits lying in the State of Minas Gerais so as to eke out production, thereby maintaining activity within its area of influence.

— CVRD had to be ready to supply iron ore to the burgeoning local iron ore and steel works mostly lying in the south of the country.

Iron ore quality was dropping as mining had to go deeper.

*(b) Prospects for the working of Carajas deposits:*

Enormous quantity of top quality iron ore (hematite of 66.1% Fe natural content had been found), predominantly fine grade (sinter feed and natural pellet), that did not require concentrating.

Beneficiation would consist merely of processing to bring down to specified particle size.

Market surveys undertaken by CVRD served to show that the overseas market could absorb further quantities of ore, particularly of the Carajas kind.

**Table 1**  
**CVRD's major subsidiaries and associated companies**

Activity/ Major shareholders	Company	Country
<i>Shipping</i> CVRD	Vale do Rio Doce Navegacao S.A — Docenave	Brazil
CVRD	Nevegacao Rio Doce Ltd — Nrd	Brazil
CVRD	Seamar Shipping Corporation — Seamar	Liberia
<i>Forestry</i> CVRD	Florestas Rio Doce S.A — Frdsa	Brazil
<i>Pulp</i> CVRD/Japan Brazil p.p.r.d.	Celulose Nipo-Brasileira S.A — Cenibra	Brazil
<i>Alumina</i> CVRD	Valenorte Aluminio Ltda — Valenorte	Brazil
<i>Aluminium</i> CVRD/Nippon Amazon	Aluminio Brasileiro S.A — Albras	Brazil
CVRD/Shell Brazil	Valesul Aluminio S.A — Valesul	Brazil
<i>Bauxite</i> CVRD/Alcan/cba (Brazil)	Mineracao Rio Do Norte S.A — Mm	Brazil
<i>Steel</i> CVRD/Kawasaki (Japan)	California Steel Industries, Inc.	USA
<i>Iron ore pellets</i> CVRD/Finsider (Italy)	Companhia Italo-Brasileira De Pelotizacao-Itabrasco	Brazil
CVRD/Ensidesa (Spain)	Companhia hispano-Brasileira de Pelotizacao-Hispanobras	Brazil
CVRD/Nissho-Iwai/several Japanese steel mills	Companhia nipo-Brasileira de Pelotizacao-Nibrasco	Brazil
<i>Iron ore</i> CVRD/Kawasaki (Japan)	Minas Da Serra Geral S.A — Msg	Brazil
<i>Manganese ore</i> CVRD/Metamat (Brazil)	Urucum Mineracao S.A. — Urucum	Brazil
Geological research CVRD	Rio Doce Geologia e Mineracao S.A. — Docegeo	Brazil
<i>Port terminal</i> CVRD/Aracruz(Brazil)	Terminal Especializado de Barra do Riacho S.A. — Portocel	Brazil

**Table 2**  
**Estimated funds requirements of the**  
**Carajas project for the output of 35**  
**Mt/y**

	MUSD	%
<b>1. Areas</b>		
Mine	515 176	14.22
Railway	1 745.723	48.20
Harbour	213 482	5.89
Townsites	160 189	4.42
<b>Sub-total</b>	<b>2 634.570</b>	<b>72.73</b>
<b>2. Other outlay</b>		
Engineering		
Services	133 884	3.70
Project		
Management	464 749	12.83
Pre-operational		
Costs	31 941	0.88
<b>Sub-total</b>	<b>630 574</b>	<b>17.41</b>
<b>3. Contingencies</b>		
	357 318	9.86
<b>Grand total</b>	<b>3 622 462</b>	<b>100.00</b>

The configuration of the deposit would enable open pit working to take place, access would therefore be easy and mining cheap.

An 890 km long railway line would have to be built linking Carajas to Ponta da Madeira in the State of Maranhao in order to haul the ore to the coast. No tunnels would have to be drilled. Only 11.3 km of bridges and viaducts would have to be raised when laying the line. The alternative of a mixed rail and waterway system was examined but was not found suitable.

A deep water harbour had to be built, at Sao Luis, in the State of Maranhao. This harbour, known as Ponta da Madeira, was suitable for the loading of vessels up to 280 Kt and could be used the whole year round.

This harbour was better than Tubarao, for it was closer to Europe and North and Central America, and only slightly further away from Japan.

The deposits lay in the Amazon region, a region covered in dense vegetation and very poorly inhabited. All forms of infrastructure were sadly lacking. At the beginning of the construction of the Tucuri hydroelectric power station the Belem-Brasilia highway was difficult to travel and the road link from Maraba to Belem was in a bad state.

CVRD would have to make heavy infrastructure investments for the project. At the mine site a large town would have to be built as well as approach ways. Along the railway line various smaller towns would have to be set up.

Nobody in Brazil had any previous experience in setting up large projects in the Amazon region, therefore feasibility studies would have to allow for further costs. This was called the "Amazon factor".

Geological research carried out in the Carajas area revealed the existence of a mineral province. In addition to iron ore CVRD also found:

- Copper, a potential of over 1.2 Gt of ore, at a content of 0.85%, plus 4 g of gold for every tonne of ore.
- Manganese, a known potential of 80Mt and a content of over 40%.
- Nickel, 47 Mt measured, with a content of 1.5% of Ni, other deposits point to a potential of over 100 Mt.
- Tin, 100 Mt of cassiterite concentrate, at an Sn content of 66 to 70%.
- Gold, not yet researched, but it is estimated that there are 100 t of gold in the area.
- Aluminium, 40 Mt of bauxite, with silica content exceptionally low.

To set up an integrated railway, mine and harbour system would not represent any technological or operational risk, in

view of the considerable experience that CVRD had gained in the South System.

In order to decide whether or not to initiate the project, CVRD reviewed the advantages of having two Integrated Production Systems to call upon, totally independent from each other. Such a state of affairs might help to strengthen even more CVRD's position as a reliable supplier of raw material.

Another important point which the company took into account was the favourable impact which the Project would have upon that part of the country. It has always been CVRD's policy to help accelerate economic and social development in whatever area it may be operating in. Like the Vitoria-Minas railway, the Carajas railway would also haul other kinds of goods. Since the area was lacking in transport this would benefit the local economy.

The first feasibility studies were for a 50 Mt/y capacity project. Since a few billion dollars worth of funds were called for, CVRD tried to work out lower cost alternatives.

A project on the scale of 35 Mt/y to be worked up to in three consecutive stages, rising from 15 to 25 and finally to 35 Mt/y was regarded as economically feasible, allowance having been made for later extensions.

Estimated funds needed for such rated output of 35 Mt/y were as show in Table 2.

Then the raising of funds for the Project had to be dealt with. The timing was bad, for the world was still feeling the effects of the second oil crisis. Moreover, interest rates were also high due to inflation.

CVRD decided to enter into arrangements with its clients in Japan and Western Europe in order to obtain help from them in raising part of the funds needed. Buyers of iron ore stood to gain from any setting up of a good quality source of raw material. CVRD concluded these arrangements successfully and was able to put together a package for the funding

**Table 3.**  
**Carajas project: local and foreign loans (MUSD)**  
**Foreign loans**

<i>A. International Community</i>	
World Bank	235
Morgan Guaranty (Co-financing)	100
Morgan Guaranty	30
USA export credits	42
	407
<i>B. Japanese package</i>	
Syndicated yen loan	166
Yen bonds	18
Japanese export credits	10
Nippon Carajas Iron Ore Co.	180
Eximbank-Japan	36
	410
<i>C. European package</i>	
ECSC —European Coal and Steel Community	257
KFW — Kreditanstalt für Wiederaufbau	73
European export credits	2
	332
<b>Total of foreign loans</b>	<b>1 149</b>
<b>Local loans</b>	
BNDES-Banco Nacional de Desenvolvimento Economico e Social	568
Finame (BNDES Agency)	136
Banco da Amazonia	13
Leasing	10
<b>Total of local loans</b>	<b>727</b>

\*A Japanese company incorporated by several Japanese steel mills.

keting aspects of the Carajas Project had been settled and that it could be put into effect at no great risk.

#### 4. Present state of the Carajas Project

Construction which had commenced in June 1978, was speeded up from September 1981, and was completed without any serious problems having been encountered. In February of 1985 the first stage of the Project was inaugurated, that is, the 15 Mt/y stage.

The second 25 Mt/y, stage was arrived at in 1987. The third stage should be reached in 1988, which means that output will have risen to 35 Mt/y.

The Project has led to direct employment for about 6 000 people, most of them from the area itself. CVRD organized training programmes for workers. These were held at the principal centres of the region. The Company has not found it difficult to recruit personnel. Those engaged have met the requirements of the Company satisfactorily.

It should also be pointed out that ever since the schematic design stage of the Project, CVRD has paid attention to the effects that the Project might have upon the environment. The Company is aware of its responsibility and has taken steps towards environmental control. Efforts are made to study and preserve existing flora and fauna, to prevent the pollution of the rivers in the mining neighbourhoods, to control the quality of the air in the harbour area and to avoid pollution of the sea.

Special mention must be made of the programme worked out by CVRD to help the Brazilian Indian communities living in the region. CVRD has allotted 13 MUSD for this programme which carries out land surveys, provides health care and educational assistance and supports agricultural projects.

Today there are signs of development within the region due to the Carajas Project. Several other projects are being

set up along the Carajas railway. These are predominately iron and steel working projects (pig iron and ferroalloys), but there are also crop and livestock projects as well as forestry ventures.

The electrical power supplied by the Tucuruí hydroelectric power station, together with the use of rail transport will lead to the setting up of other industries at a later stage. These will make use of the raw material available in this vast and extremely wealthy region of the eastern Amazon.

In implementing the Carajas Project, CVRD dealt with its biggest challenge ever, and laid the foundations of its own future. There is no doubt that CVRD plays a vital role in the development of a very important area of the Brazilian territory.