

Vale: How to improve its competitive advantage to export Iron Ore via the Brazilian Maritime Terminal of Ponta da Madeira, through the enhancement of its infrastructures and processes?



Picture: Aerial view of the Maritime Terminal of Ponta da Madeira. Vale 2015 ¹.

**Bachelor Project submitted for the Bachelor of Science HES in Business Administration
with a Major in International Management**

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Declaration

This Bachelor Project is submitted as part of the final examination requirements of the Geneva School of Business Administration, for obtaining the Bachelor of Science HES-SO in Business Administration, with major in International Management.

The student accepts the terms of the confidentiality agreement if one has been signed. The use of any conclusions or recommendations made in the Bachelor Project, with no prejudice to their value, engages neither the responsibility of the author, nor the adviser to the Bachelor Project, nor the jury members nor the HEG.

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Geneva, Aug 14th, 2015

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Executive Summary

This project aims to understand and propose improvements about the competitive advantage to export Iron Ore via the Vale's Maritime Terminal Ponta da Madeiral (PDM) in the northeast of Brazil, through the enhancement of its infrastructures and processes. This is one of the world's largest ports operated by Vale SA and accounts for 10% of the world's Iron Ore cargo movements. Vale is one of the largest mining companies and one of the largest publicly traded companies in the world with market capitalization of around US\$ 100 billion. It is the world's largest producer of Iron Ore and pellets, key raw materials for steelmaking ².

Over the last 70 years, it produced more than 5 billion metric tons of Iron Ore ³. In fact, Vale is doing some multibillionaire projects to increase its Iron Ore output export through the PDM port. China is the major Iron Ore market driver, because it consumes more than 60% of the market share. In 2014, because of China's slowdown economy, the Iron Ore prices declined around 50% of its value. The last day of 2014, the Iron Ore price was US\$ 68.80 ton ⁴. Vale break-even costs in 2015 lies between USD\$ 37/ton and US\$ 41/Ton ⁵.

Therefore, Vale needs to get competitive advantage to overcome its major's competitors, BHP (Anglo-Australian) and Rio Tinto (British-Australian) which have lower break-even (US\$ 31/Ton or 32/Ton CFR), so it can offer Iron Ore at a better price ⁶. We interviewed and collected data from reliable sources such as Vale Management and Operations teams in Brazil and Brazilian Maritime Government authorities. We analyzed the main issues in the PDM Port related to the export of Iron Ore, and proposed recommendations to the enhancement of its infrastructures and processes, so Vale Management can use it for decision-making.

In our findings, we realized that the port had ships cracking at least twice in the port, which affected its operations during this non-operating time. Moreover, Vale multibillionaire projects will increase its Iron Ore output that will choke the port capacity to export Iron Ore since it does not have yet appropriate infrastructure for this increase in supply. In addition, in our research we perceived that the port has issues with locals because of the port enhancement projects. We recommended the use of a Cargo Plan to avoid ships cracking, the construction of another Pier and 11 stockyards, the creation of Communities Councils to deal with locals involved in Vale projects. Last, we believe that the port could use its existent infrastructure to diversify its exports, increasing its agriculture commodities exports, since Iron Ore is not a renewable commodity.

Methodology

This project methodology will include 3 phases.

Phase I, Context (Introduction, Chapters 1, 2 and 3). We provided a brief introduction of this research in order to furnish an overview of this work. We provided a literature review about the Iron Ore market in Chapter 1, describing the market in a macroeconomic and microeconomic view. Moreover, we made a brief presentation of Vale in Chapter 2, the Brazilian giant mining company. In addition, we explained the Brazilian Ports System in Chapter 3. The data for this phase was collected from Iron Ore specialists and specialized websites, top Vale Management and Operations teams in Brazil and Brazilian ports government authorities, through interviews and their websites.

Phase II, Analysis (Chapters 4). This phase consists of the study of the infrastructure and processes of the Maritime Terminal of Ponta da Madeira. We studied its concept, Iron Ore logistics infrastructure and processes of the Port of Ponta da Madeira known officially as Maritime Terminal of Ponta da Madeira in the Brazilian state of Maranhão, through official port agent's officers (management level) and top Vale Operations port team interviews. Moreover, we will briefly present the world's dry bulk port benchmark for the Iron Ore market that can help us to enhance the Maritime Terminal of Ponta da Madeira efficiency.

Phase III, Conclusion, Recommendations and Limitations. Based on the analysis of the Phases I and II, we spotted in the Conclusion the main issues on the port which slows down Vale and propose Recommendations for Vale management team decision makers based on our research. Last, we will explain in the Limitations, the main issues we had in our research and propose improvements.

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Glossary

- **Backwardation:** A situation in which the spot or cash price of a commodity is higher than the forward price.
- **Bunker Fuel:** It is a derivative of crude oil. It is the gunk that is leftover after refineries have processed all the more valuable fuels from the crude source. It is thick and heavy and must be heated before it can be used in an engine.
- **CAGR:** The compound annual growth rate (CAGR) is a useful measure of growth over multiple time periods. It can be thought of as the growth rate that gets you from the initial investment value to the ending investment value if you assume that the investment has been compounding over the time period. Source: investing Answers.
- **CAPEX (Capital Expenditure):** These are funds used by a company to acquire or upgrade physical assets such as properties, industrial buildings or equipments.
- **CFR:** The seller delivers the goods on board the vessel. The risk of loss or damage of the goods pass on board of the vessel. The Seller pays the costs to the port of destination. (Incoterms® 2010)
- **Commodities:** Means merchandises like minerals (Iron Ore, Oil, gold), agricultures (soybeans, cattle, coffee), financials (foreign currencies, governments bonds) and environmental (Carbon credits) that are produced in large scale and traded worldwide. Commodities are traded in financial markets having its prices set globally by the international Market.
- **Contango:** A situation where the futures price (or forward price) of a commodity is higher than the expected spot price.
- **DWT:** Deadweight Tonnage refers to the carrying capacity of a vessel. Deadweight tonnage is calculated by taking the weight of a vessel not loaded with cargo and subtracting that figure from the weight of the loaded vessel.
- **FOB (Free On Board):** This Incoterms means that the seller delivers the goods on board the vessel nominated by the buyer at the named port of shipment. The risk pass when the goods are on board the vessel. (Incoterms® 2010)
- **Granulated:** Material between 0.6 and 5 centimeters in diameter that can be fed directly into the blast furnace.
- **Incoterms:** The Incoterms rules explain a set of trade terms reflecting business-to-business practice in contract for the sale of goods.

- **Iron Ore Swap Contract:** An Iron Ore Swap Contract is a cash-settled derivative, between a seller and a buyer of Iron Ore at a fixed price for a set amount of time that provides price certainty for both the buyer and the seller.
- **Pellet-feed:** Iron Ore powder that passes through the agglomeration process to be converted into pellets.
- **Pellets:** Pellets are small balls of Iron Ore used in the production of steel. It is made with technology that uses the powder that is generated during the ore extraction process, once considered waste. Source: Vale Website.
- **Sinter-feed:** Finer particles than the granulated ones, up to 0.6 centimeters in diameter.
- **Spot price:** commodities contract terms agreed now but delivery and payment will occur at a future date.
- **SOLAS regulation VII/7:** It identifies Dangerous goods in solid form in bulk through classification as dangerous goods by the International Maritime Dangerous Goods Code. For environmentally hazardous dry bulk materials, the classification is either: ENVIRONMENTALLY HAZARDOUS SUBSTANCE – SOLID N.O.S or "MARINE POLLUTANT" subsidiary risk (where material has other hazards). Source: International Maritime organization.
- **T/h:** Ton per hour (means the speed).
- **Vetting Inspection:** This is the process by which a charterer determines whether a vessel is suitable to be chartered, based on the information available to it. Ports, terminals, insurers and other maritime industry operators also vet ships to identify and manage risks (answers.com).

Abbreviations

- **Brazilian States:** AP (Amapá), ES (Espírito Santo), MA (Maranhão), MG (Minas Gerais), PA (Pará) and RJ (Rio de Janeiro).
- **BT:** Billion Metric Tons
- **COGS:** Cost of Goods Sold
- **CO2:** Carbon dioxide (CO₂) is the chief greenhouse gas that results from human activities and causes global warming and climate change.
- **MT:** Million Metric Tons
- **NOx:** Nitrogen dioxide is an irritant gas, which at high concentrations causes inflammation of the airways.
- **Sox:** Refers to all sulphur oxides, which is a colourless gas with a pungent, irritating odour and taste that can harm crops, trees, textiles, building materials, animals, and person's respiratory system.
- **PDM:** Ponta da Madeira Port (known officially as Maritime Terminal of Ponta da Madeira)
- **TUP:** Private Use Terminal (From the Portuguese: Terminal de Uso privado)
- **US\$:** American Dollar Currency

INTRODUCTION

The aim of this study is to identify the main issues that can jeopardize the competitive advantage of the Maritime Terminal of Ponta da Madeira (PDM) to export Iron Ore. This is a private port in the northeast of Brazil, which belongs to Vale SA and therefore is responsible for the port operations and enhancements needed. The port accounts for one-tenth of the world's Iron Ore cargo movements. It exports the world's best Iron Ore quality.

We analyzed its infrastructures and process in order to propose recommendations so it can enhance its competitiveness compared to its main competitors in Australia. This study was made with the support from senior PDM operations team and high Vale Iron Ore executives as well as senior maritime authorities in Brazil.

This study researched not only the port physical facilities and its access issues but also the method it operates to load/export Iron Ore, since load/unload is usually a major issue in the ports. Moreover, the study analyzed the port layout and configuration in order to understand of possible measures to be taken to expand or diversify its operations and products handled since Iron Ore unlike steel, is not a renewable resource.

This port is well known for its excellent dredging capacity to operate large ships, being one of the few ports to operate the large dry bulk ships, which helps Vale to get competitive advantage to export large quantities of Iron to its consumers in Europe and far Asia.

The study searched for possible issues that may exist between the port and its main stakeholders, the local communities living in the port neighborhood and the locals from where is extracted the Iron Ore handled in the port. Moreover, it also searched for possible hazards and port capacity.

In addition, we produced three chapters of Literature Review in order to give to the reader a basic understanding of the importance of the Iron Ore market in Chapter 1, the Brazilian company Vale SA in Chapter 2 and how the Brazilian port system work in Chapter 3.

In our research, we found answers for the main stakeholder issues. On top of it, there were some serious problems in how the port operate its loading process, which caused damages in the past and affected the port productivity. Furthermore, there is a mandatory enhancement to the port facilities due to a large project of expansion of the Iron Ore supply. Additionally, we found a solution to diversify its activities, which can possibly help to drive the Iron Ore market price up and therefore increase the company profitability.

CHAPTER 1: IRON ORE



Source: Vale ⁷

1.1 Characteristics

The Eiffel Tower, skyscrapers, aircraft carriers, oil tankers, all these megastructures has one thing in common: Iron Ore in its structures, the key raw material to make Steel. Roughly, 98% of the global Iron Ore production is employed to produce steel ⁸. Steel is broadly used in construction and other applications because of its high tensile strengths and low cost.

Iron Ore and Steel together are the second largest commodity bloc by value after crude oil. These linked markets produce every year not less than 800 MT of Iron Ore and 1.1 BT of Steel ⁹, actually in 2014, global Iron Ore production was 2'201 MT and crude steel was 1'662 MT.

Figure 1: Most of the Iron Ore mined



Source: Rock Tumbling Hobby ¹⁰

Hematite and Magnetite are the most common rocks where Iron is found, having Hematite 70 percent Iron and magnetite 72 percent Iron of it. These are considered "high-grade" Iron Ores, since each has a high concentration of Iron. The PDM port exports high-grade Iron Ore coming from Vale mines. There are other types of rocks found with a lower grade or smaller concentration of Iron such as taconite, which has only up to 30 % and considered as waste for a long time but since high-grade decreases with consumption, it becomes an option ¹¹.

Although Iron is dark and silver gray, its colors vary when it found in other rocks in mineral, being blue, yellow, pink, gray or black, and because of this characteristic it is used to color consumer products like plastics, paints, and cosmetic products as eye shadow ¹². Iron Ore contributes to the environment, since Steel is on top among the most recycled materials or 60% of it becomes new steel ¹³.

1.2 Quality Specifications

Iron Ore is qualified by where it is produced and by how much ferrous it has, which is indicated by percentage. High grade are the Iron Ore, which has more than 60% of Iron and the Low grade that contain between 25% and 30% of Iron.

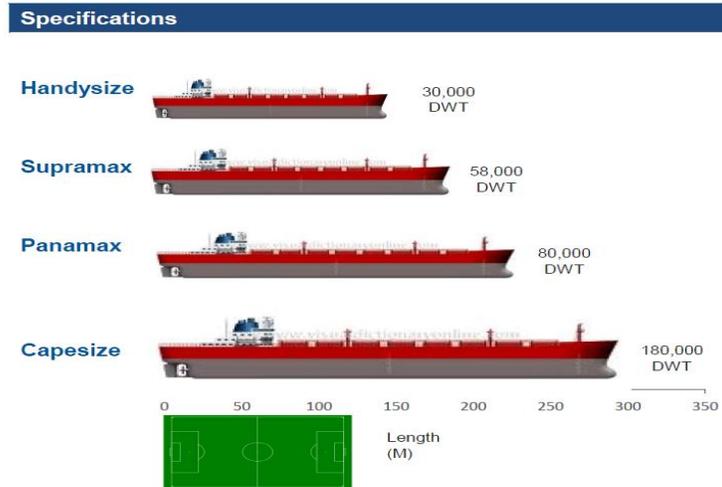
The low grade requires additional processing called beneficiation to improve the ore concentration and remove impurities, what increases costs of production. Crushing, milling, gravity or heavy media separation, screening, and silica froth flotation are some of techniques applied ¹⁴. In this process, the Fe content is improved to a maximum possible extent. The highest can be 70% i.e. purest form. As high, the concentration of Iron better is the quality. Typically, Iron Ore with 62% or higher are those with better quality.

1.3 Freight: Bulk Carriers

Bulk Carriers are vessels made to carry bulk solids such as cereals, coal, ore and cement. These vessels are more than a third of the world's merchant fleet ¹⁵. There are "Major Bulks" or the biggest group, designed to carry Iron Ore and Coal and "Minor Bulks" designed to transport steel products, forest products, bauxite or alumina cement, and fertilizers ¹⁶.

Ship classes: According to volume, trade routes, ports limitations, a variety of classes of vessels can be applied carrying dry bulk cargos.

Figure 2: Bulk Carrier Fleet types



Source: BUNGE. Mr. Alex SASS Presentation on Dry Bulk Freight at Commodity Trading Major 2015 in HEG ¹⁷.

- The Handysize are small-sized ships with a capacity ranging between 15,000 and 35,000 DWT. It is used because of its versatility and maneuverability.
- The Supramax are ships with capacity between 50,000 and 60,000 DWT. These ships offer cargo loading and unloading flexibility with onboard cranes ¹⁸.
- The Panamax are ships with capacity between 60,000 and 79,999 DWT. They are used to carry coal, iron ore, grains, and to a lesser extent, minor bulks. These ships are capable of passing through the Panama Canal, which makes them more versatile than larger ships in terms of access to different trade routes ¹⁹.
- Capesize are large-sized bulk carriers and tankers above 150,000 DWT. They are too big to pass through the Suez Canal or the Panama Canal. These ships are routinely used to carry coal, iron ore and commodity raw materials, that is why they are often called as bulk carriers instead of tankers ²⁰.
- There are the Very Large Ore Carriers (VLOC) carriers with capacity above 200,000 DWT. These ships are made to exploit economies of scale on long-haul Iron Ore routes ²¹.

Around 30% of total dry bulk shipments are Iron Ore. In 2013, 2 BT of Iron Ore were produced, being 1.2 BT of seaborne or US\$ 170 Billion worth roughly ²². Along with coking coal, it is one of the main two ingredients employed to produce pig iron, which is used to produce steel.

1.4 The Iron Ore Industry

The global Iron Ore industry is very competitive. The key points affecting competition are price, quality and range of products offered, reliability, operating costs and shipping costs ²³. The year 2014 was very tough for this industry due to the slowdown of the 70% seaborne consumer, China. The reduction of the Chinese economy speed led to a more than 50% drop in the Iron Ore prices, being the lowest level in 10 years ²⁴.

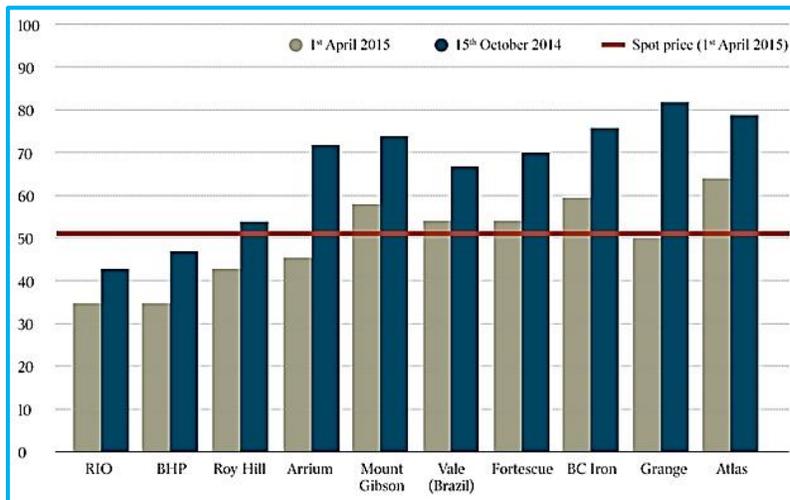
The big players are taking advantage of economy of scale to squeeze small competitors and gain market share. Efficiency in reducing costs is crucial to survive in an environment, which already led some small players to bankruptcy filings.

On December 2013, Iron Ore price was US \$135/Ton, and on April 2015 was US\$ 51/Ton (Dry Metric Ton) or a 62% fall ²⁵. The Deutsche Bank even forecasted a dark scenario where prices could hit US\$ 40/ Ton before it begins to recover. Figure 4 shows the Australia's main Iron Ore producers and Vale breakeven cost.

Competitive rivalry: High

BHP, Rio and Vale are amongst the world's largest companies with strong liquidity that could pose a threat to any rival company. There are smaller players like Fortescue that are better located to China like the other Australian competitors. However, Vale has a better product with higher Iron Ore content that is better for China for processing steel. Location and Quality plays a role in the competitive rivalry, since both can represent a cost reduction for consumers, notably China.

Figure 3: Break-even cost position of major Iron Ore producers (US\$/ Dry Ton, 62%)



Source: UBS Australia. Retrieved from The Australian Business Review ²⁶.

Supplier power: Low

Labor and Energy are the major suppliers of the Iron Ore industry and do not exert a too much power on it compared to the other industries. However, Labor Unions can be an issue for them in case of strike.

Threat of substitutes: Low

Although Aluminum, the most found mineral on earth, being a substitute at certain places instead of steel, it is not a threat to steel because of the robustness of the Steel. Since Iron Ore is key for the production of Steel, it might last for a long period except a new technology shows up.

Buyer power: High

Although Buyers are dispersed and did not have much power on prices in the past, recently due to oversupply, the scenario changed and Chinese steel makers are exerting pressure on Iron Ore producers.

Barriers to entry: High

The Iron Ore industry is characterized for big numbers in CAPEX, meaning high investments, such as long railroads, trains, huge trucks, buildings, vehicles, heavy earthmoving equipment, ports, expertise and legal permissions as barriers, meaning those who want to adventure in this must have high leverage ²⁷.

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1.5 Key Market Drivers

The Iron Ore industry has three countries who are major drivers in this market, notably Australia and Brazil on the Supply side and China, holding more than 60% of the market share on the Demand side. The recent more than 50% drop in the Iron Ore prices let the Iron Ore market to a backwardation price curve, and added a new driver in the market, India, which can help the market prices to come back to a contango prices curve for the benefit of the producers. Global Iron Ore production in 2014 was 2'201 MT and Imports accounted 1'404 MT in the same period. Chinese alone imported 930 MT last year ²⁸.

There are many countries capable to exploit Iron Ore but their percentage fine content and costs to produce are not profitable, having Brazil and Australia the lowest cost to produce and great quality material unlike China, which has the highest reserves but not good product quality (See Appendix 1).

SUPPLY SIDE

Figure 4: Countries that export Iron Ore. Total Country Trade: US\$ 126 Billion



Source: The Observatory of Economic Complexity ²⁹.

Australia

Iron Ore accounts for 21% of Australia's total exports and around 4% of its GDP ³⁰. Australia earned US\$ 75 billion in Iron Ore exports in 2014, having employed more than sixty thousand Australian employees in the Iron Ore industry. It is the second largest Iron Ore producer after China and it is the largest exporter accounting to 30% of global production ³¹. The country produced 660 MT of Iron Ore in 2014 accounting to roughly 20% of global Iron Ore output, an 8.4% increase compared to 2013 ³² (See Appendix 2).

Australia has 35 BT of Iron Ore reserves being 17 BT of Iron what makes it to have the largest Iron Ore reserves. Its main reserves or 95% of it are concentrated in Western Australia at Pibara region where its main companies Rio Tinto, BHP and Fortescue are located ³³.

Brazil

Brazil exported 320 MT of Iron Ore in 2014 or 0.95% growth compared to the previous year. It is the second largest Iron Ore producer but the first in terms of Iron Ore content and host the largest Iron Ore company producer, Vale SA ³⁴. The country has the Iron Ore content quality its main advantage over the other countries as product differentiation, having High Iron content and low silica ³⁵ (See Appendix 3).

DEMAND SIDE

Figure 5: Countries that import Iron Ore. Total Country Trade: US\$ 129 Billion



Source: The Observatory of Economic Complexity ³⁶.

China

China drives the Iron Ore demand, accounting for more than 60% of seaborne in 2013. Due to slowdown of its economy where it had more than 14% GDP growth in 2007 ³⁷ to 7,4% GDP growth in 2014 (7,7% in 2013) ³⁸, and is forecasted by specialists to slow even further in the coming years. In China, real estate, infrastructure, and machinery, account for more than 80% of total steel demand. These sectors have no good prospects for the coming years, particularly real estate and infrastructure (See Appendix 4).

India

In 2010, India had 8 BT of Iron Ore reserves, being one of the world's largest reserves. (Source: IBM). In 2013 its production decreased by 19,5% (136 MT) compared to 2012 (169 MT). The peak production was 2010 when it reached 207 MT (See Appendix 5).

India can be a substitute for a former voracious China Iron Ore consumer. According to the India steel ministry, the government mining company National Mineral Development Corp will increase output to more than 75 MT/ year by the 2018-2019 until it produce 100 MT/ year by 2020-2021, which is the goal. The ultimate goal is to produce 500 MT/ Year of Iron Ore so it can produce 300 MT/Year of steel by 2025 ³⁹.

1.6 Key Market Players

“...I’m very conscious of the fact that Rio and BHP are Australia’s biggest corporate taxpayers... I want them to continue making a lot of profits here in Australia.”

Tony Abbott MP - Prime Minister of Australia ⁴⁰

A situation in which a particular market is controlled by a small group of firms is called Oligopoly, what indeed may be the case of the Iron Ore industry, where three companies control the market, although there are many players. Rio Tinto, BHP and VALE, known as "The Big Three", which mined 44% of the total Iron Ore production last year, or 1,929 MT. Vale, the world's number one producer, mined 320 MT last year. Rio Tinto and BHP Billiton mined 295 MT and 225 MT respectively. These companies have the Supply Power to decide whether the Iron ore price will go on a Contango or Backwardation situation.

Rio Tinto

A British-Australian multinational metals and mining corporation with headquarters in London, United Kingdom. It is the second largest Iron Ore miner and has the lowest production cost in the industry or US\$ 19.5/ Ton.

Despite the market volatility in Iron Ore, the company managed to increase Net Earnings by incredible 78% to US\$ 6.5 billion compared to a year ago (US\$ 3.6 Billion). Company's management adheres to the economy of scales strategy of lower prices and higher volumes, which allows them to gain market share from small producers ⁴¹.

Vale

The Brazilian giant mining company is one of the largest logistics operators in Brazil and the world largest Iron Ore producer. Likewise, Vale is adapting to tough times in the Iron Ore market. It is equally using of its strong CAPEX to do economies of scales to smashes small producers. Although its production output increased in 2014 (332.4 MT) compared to 2013 (310.7 MT), its Net Income in 2014 was US\$ 353 Million or a 13% drop compared to 2013 (US\$ 406 Million) which is understandable due to the constant drop in the Iron Ore prices its main product. Iron Ore in 2014 accounted to 51.4% of its operating revenues (US\$ 37.5 Million) (Source: Annual Report 2014) ⁴².

Vale had an adjusted EBITDA of US\$ 13.353 billion in 2014, a 40.8% drop from the US\$ 22.560 billion achieved in 2013, mainly due to lower commodity prices which negatively impacted adjusted EBITDA by US\$ 10.580 billion in 2014. COGS amounted to US\$ 25.064 billion in 2014, an increase of US\$ 819 million compared to the US\$ 24.245 billion in 2013, what could be a result of higher volumes as the company argue ⁴³. Besides Iron Ore, other major business segments include base metals (21.8%), fertilizers (6.7%) and other minerals (18%) ⁴⁴.

BHP

Anglo-Australian mining, metals and petroleum company headquartered in Melbourne, Australia. One of the world's largest producers of major commodities, including aluminium, coal, copper, Iron Ore, manganese, nickel, silver and uranium, and have substantial interests in oil and gas. For 2015, BHP will continue with its strategy for Iron Ore on producing at the lowest possible cost with Western Australia Iron Ore unit costs now below US\$ 20/Ton. Total Iron Ore production for the nine months ended March 2015 increased by 17 % to a record 172 MT. Production for the 2015 financial year is now expected to be 230 MT, 2% higher than prior guidance. Western Australia Iron Ore (WAIO) production increased by 16% to a record 188 MT (100% basis) underpinned by continued improvements in integrated supply chain ⁴⁵ (See Appendix 6).

1.7 Global Demand

Although Iron Ore prices were for long months in backwardation, a recent switch to contango suggest that the market is gaining a new breath. The demand for Iron Ore and Steel will keep going globally and China is expected to consume 1 BT/Year by 2030 ⁴⁶.

China and India large populations constant growing will demand high quality Iron Ore to make Steel to create infrastructure to respond to their needs. The rest of Asia is also continuing to urbanize and industrialize, and will emerge as fast growing regions, meaning demand for steel, and thus Iron Ore, will continue for the next decades and urbanization and industrialization will drive it ⁴⁷ (See Appendix 7).

1.8 The Iron Ore production in Brazil

Brazil produces Iron Ore in open mines ⁴⁸. It has 13,6% of the 170 BT world's Iron Ore reserves. The country Iron Ore fine is the best with a 49% Fe Iron content average. The main Brazilian states Iron Ore reserves holders are: MG (72,5% of its reserves and Iron Ore fine 46,3% Fe content average), MT (13,1% Brazilian reserves and 55,3% Fe content average) and PA (10,7% Brazilian reserves and 64,8% Fe content average, a very good Iron Ore quality) where Vale has its main projects.

In 2013, the Brazilian Iron Ore production was 386, 3 MT with 63,6% Fe content average. It was a 3,6% decrease related to the previous year due to the weather conditions in the regions North and Southeast and due to delay in the environmental permission to exploit new section in some mines from Vale, which made impossible to operate in its full capacity. The production value was US\$ 18,7 Billion worth or 14,3% increase compared to the previous year, corresponding to 59,3% of the Brazilian mineral production value.

This was the production in 2013 by states: MG (68,8%), PA (27,3%), MS (2,0%) and AP (1,6%). The main companies producers were: VALE S/A (MG, MS e PA), Samarco Mineração S/A (50,0% VALE) (MG), Companhia Siderúrgica Nacional-CSN (MG), Mineração Usiminas (MG), Itaminas Comércio de Minérios (MG), MMX Sudeste Mineração (MG) and Anglo Ferrous Amapá Mineração (AP) which together accounted for 89,9% of the production ⁴⁹.

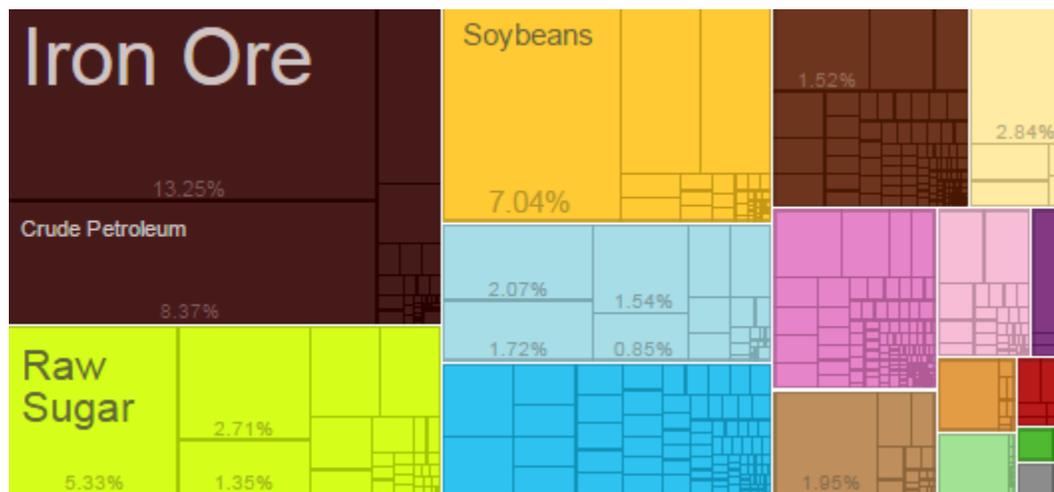
1.9 The Weight of Iron Ore for the Brazilian Trade Balance

In the last years, the results of the Brazilian Trade balance only worsened. In 2011, there was a surplus of US\$ 30 Billion, but in 2012, this figure decreased to US\$ 19 Billion. In 2013, Brazil had a modest surplus, but in 2014, it was not possible, having a more than US\$ 4 Billion deficit because of the drop in the commodities prices, which Brazil is highly dependent on its commodities. The mining industry accounted for 1.1% of GDP and approximately 1% of employment in 2013, but when we talk about the Trade Balance its significance is much more important ⁵⁰ (See Appendix 8).

Although Mining was the second main Brazilian segment exported in 2014 accounting to 12,6% or US\$ 28,4 Billion of the Brazilian Trade Balance and Soybeans & products was the first accounting 14% or US\$ 31.4 Billion, these positions change often based on their prices. Iron Ore is the main product Brazil exports accounting to 13.25% of its exports, and the main product moved in its ports in 2013, being 7,4 times bigger than Soybeans ⁵¹ and Vale has roughly 80% share in the Brazilian Iron Ore exports ⁵².

Despite the fact that Brazil has exported 15 MT more of Iron Ore in 2014, the world's price dropped more than 50% what contributed to the drop of the Trade Balance and the loss position in the country export rank. If the Iron Ore prices applied in 2014 were the same as 2013, Brazil would have a US\$ 8 Billion surplus ⁵³.

Figure 6: Products exported by Brazil. Total Country Trade: US\$ 247 Billion



Source: The Observatory of Economic Complexity ⁵⁴.

CHAPTER 2: VALE, BRAZIL'S MINING GIANT

MISSION: *To transform natural resources into prosperity and sustainable development.*

VISION: *To be the number one global natural resources company in creating long term value, through excellence and passion for people and the planet.* ⁵⁵

2.1 History

In the seventy decade, Vale became one of the largest mining company, position that holds until these days. On May 6, 1997, when Vale produced 114 MT of Iron Ore, had US\$ 350 Million as Net Income, 11 thousand employees and was US\$ 10,5 Billion worth, it was privatized by a group which acquired 41, 7% shares for US\$ 3,338 Billion, investment returned after one year for them. In 2003, Vale was US\$ 100 Billion worth, meaning its sale was below its real Market value ⁵⁶. In 2014, Vale had US\$ 657 Million as Net Income, 76,5 thousand employees and was US\$ 40,5 Billion worth. It has the wonderful city of Rio de Janeiro as its headquarter ⁵⁷.

In 2007, it spent \$19.4 billion on Inco, a Canadian nickel producer ⁵⁸ and in the same year “Vale do Rio Doce” changed its logo and name to “Vale SA” as a positioning strategy answering to international market.

Figure 7: Vale's Logo Before and After



Before



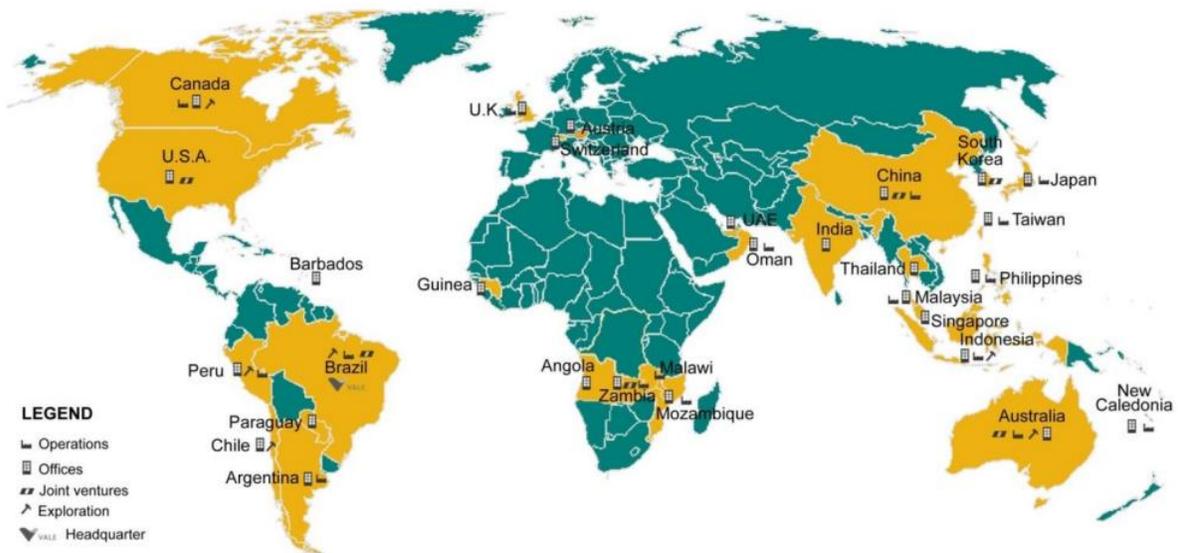
After

Source: B9 website ⁵⁹

In 70 years of operations, Vale produced 5 BT of Iron Ore, this is equivalent to 375.000 Eiffel Towers ⁶⁰. The Brazilian government holds direct and indirect shares and is the main shareholder with its 12% golden (preferential) shares what gives veto powers over changing Vale's headquarters location and corporate purposes ⁶¹.

2.2 Vale Today

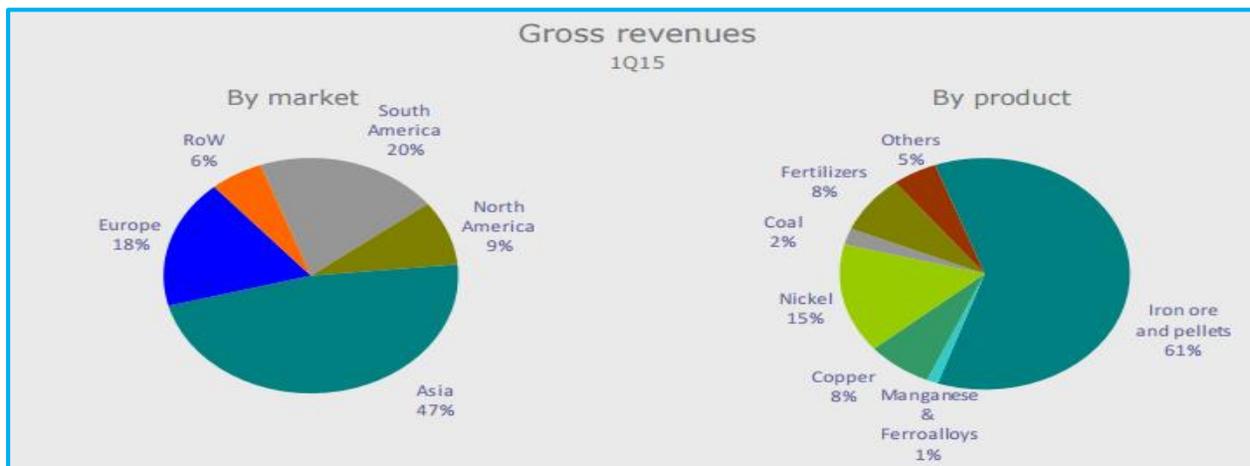
Figure 8: Vale Global Presence



Source: Vale ⁶²

Nowadays, besides Iron Ore, Vale produces and sells pellets, manganese, alloys, gold, nickel, copper, kaolin, bauxite, alumina, aluminum, and potash ⁶³. It is one of the three largest mining company along with BHP and Rio Tinto and it is present in the five continents and has in Rio de Janeiro its headquarters. It is not only the largest Iron Ore producer but also the largest nickel producer. Essentially it is a logistic company since it depends of its logistics efficiency to compete against its main competitors (BHP and Rio Tinto) since they are closer to the main market, Asia, notably China. Vale has 10,000 kilometers (6,200 miles) of railroad tracks, this is or more than the distance between Geneva and Rio de Janeiro according to Google Maps (9,141 km) and uses the world's biggest ore carriers and ships. Moreover, it has eleven ports (See Appendix 9) and a large fleet of ships ⁶⁴.

Figure 9: Vale Gross Revenues by market and product



Source: Vale ⁶⁵

Vale has in Asia (47%) its main market. The drop in the Iron Ore prices and the world's economies slowdown as a whole let Vale to have bad performance compared to the previous years, which is understandable since it is a market trend. However, while BHP managed to decrease its COGS by 0,25% between 2013 and 2014, and Rio Tinto improved its COGS decreasing by 6,08% on the same period, Vale went on the opposite way and increased its COGS by 12,52% on the same period. Apparently, it suggests that Vale is not doing its homework to reduce costs in order to get competitive advantage over its Australian competitors.

Although Vale managed to increase its Net Income by incredible 729,5% between 2013 and 2014, what could be a reduction in income tax from US\$ 15,2 Billion to US\$ 2,6 Billion, but in terms of absolute value (US\$ 954 Million) its bottom line was modest compared to BHP (US\$ 13,8 Billion) and Rio Tinto (US\$ 6,5 Billion).

2.3 Vale Economies of Scale Strategy

In the commodities industry, a decrease in demand suggest the market to decrease supply, which helps partially since prices goes higher in this scenario and can benefit producers. However, the mining industry apparently skipped this basic economics lesson, since they are oversupplying the Iron Ore market with Iron Ore production records. The aim of their strategy is to gain market share, smashing small Iron Ore suppliers. Vale is not different, since it is increasing its production over the years despite the slowdown economic growth of China where its GDP growth is expected to slow to 6.8% and 6.3% in 2015 and 2016 respectively, from 7.4% in 2014.

In the period between 2013 and 2014 it increased its production by 7% roughly, while the Iron Ore prices decreased by more than 50%. The negative aspect of its strategy is that it is not selling its 7% increase in production volume since Iron Ore shipments increased modest 3% in 2014 ⁶⁶.

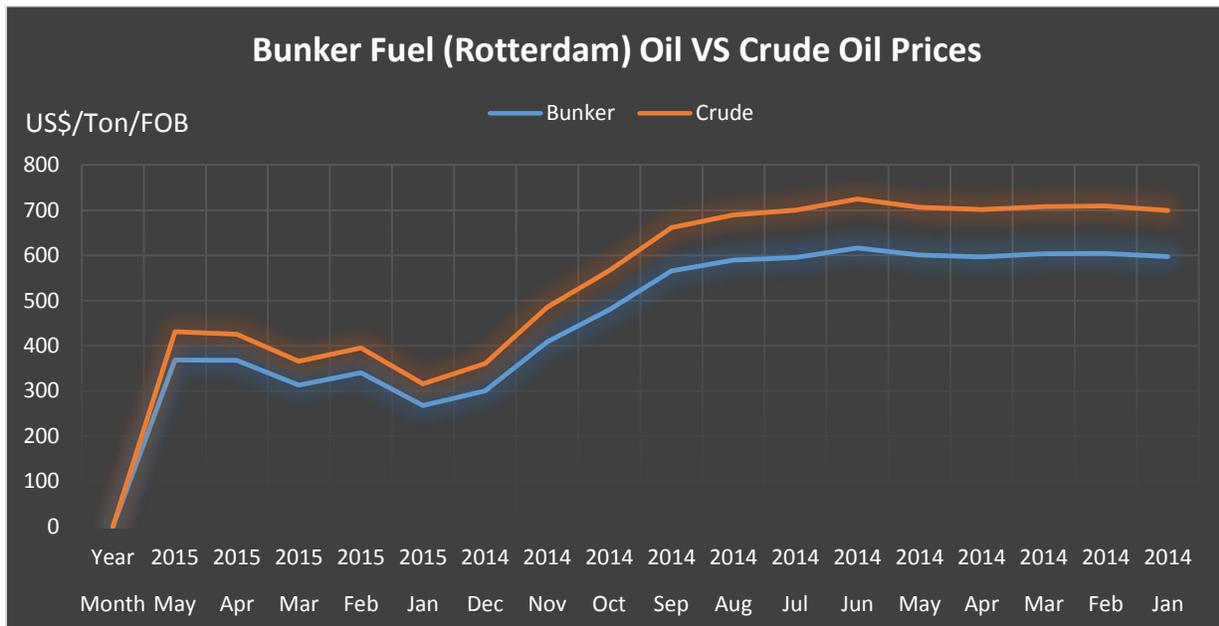
2.4 The Bunker Fuel Cost for Vale

Compared to its Australian competitors, Vale has a large disadvantage, which is its geographic location since China is closer to Australia compared to Brazil. This geographical situation places Vale upper on the Iron Ore cost curve compared to its main competitors and requires strong logistics efficiency.

Vale's Iron Ore exports is seaborne, and for a ship, the fuel can represent between 50% and 70% of the total costs of owning and operating a ship ⁶⁷. The recent drop in the oil prices on the last six months brought some relief for Vale because bunker fuel, a derivative of crude oil, is used to power the ships engines. Last year used to be US\$ 21/Ton to carry Iron Ore from Brazil to China (compared to US\$ 9–US\$ 11 from Australia to China) and now lays on US\$ 10/Ton, being a US\$ 11/Ton decrease for Vale and only US\$ 4/Ton decrease for the Australians Iron Ore producers. The freight costs difference between Vale and BHP and RIO now is only US\$ 4 to US\$ 5/Ton compared to more than US\$ 10/Ton last year ⁶⁸.

If embargo on Iran is successful lifted, Vale can benefit even more with the drop of oil prices since Iran holds 30 million barrels ⁶⁹ and is expected to throw it on the market pulling the prices to less than US\$ 40/barrel ⁷⁰.

Figure 10: High correlation between Bunker Fuel VS Oil Prices



Bunker fuel: Heavy Fuel Oil (Rotterdam) - Prices in US dollars per ton - FOB - 1% of sulfur. Crude Oil (petroleum), is a simple average of three spot prices; Dated Brent, West Texas Intermediate, and the Dubai Fateh, US Dollars per Barrel. Sources: National Institute of Statistics and Economics, and Index Mundi ⁷¹.

2.5 Valemax, the giant ship



Picture: Valemax. Vale 2015 ⁷².

Valemax is the world's largest ore carriers capable of carrying 400,000 Metric Ton each, being 2.3 times bigger than Capesize ships and its environmental friendly because it emits 35% less CO2 per ton of ore transported. Valemax helped Vale to benefit with the recent drop in the Oil prices reducing its transportation costs of moving Iron Ore from Brazil to China, enhancing competitiveness against its Australian counterparties ⁷³. In 25 years of operations Valemax helped to reduce: 21,000,000 MT of CO2, 520,000 MT of NOx, 350, 000 MT of Sox, Environmental risk: (avoiding around 250 Capesizes calling at Brazilian and Chinese ports).

Vale: How to improve its competitive advantage to export Iron Ore via the Brazilian Maritime Terminal of Ponta da Madeira, through the enhancement of its infrastructure and processes?

TAVARES, Erisvelton

Specifications: 400,000 DWT, 30m depth of hull, 23m loaded draft, 65m breadth, 362 length (Valemax standing on its bow would be 38 meters taller than the Eiffel Tower), 15 knots speed, 95 MT/Day Fuel oil consumption ⁷⁴.

Figure 11: Valemax Routes to Asia



Source: Vale ⁷⁵

Valemax ships dock at ten ports, plus two floating Vale stations in the Philippines. It takes 15 days to reach Europe, its closest destination and 35 days from the Maritime Terminal of Ponta da Madeira to reach its longest and main destinations in Asia ⁷⁶ while the Australians competitors take 15 days to reach Asia.

2.6 Operating Systems

Vale operates four systems in Brazil where it produces and distributes Iron Ore: Northeast, Southeast, South and Southwest. The Northeast and the Southeast systems are totally connected, being mines, railroads and ports. Altogether, makes 22 Iron Ore mines and 11 pelletizing plants. The Northeast System is the main production system vale operates in volume and growth expectation. It links the Carajás mine to the Maritime Terminal of Ponta da Madeira through the Carajás Railroad (See Appendix 10). The Northeast System is composed of:

Figure 12: Vale, The Northeast System



Source: Vale ⁷⁷

Vale: How to improve its competitive advantage to export Iron Ore via the Brazilian Maritime Terminal of Ponta da Madeira, through the enhancement of its infrastructure and processes?

TAVARES, Erisvelton

2.7 The Carajas Mine

The Carajás open pit operations mine owned by Vale is the largest Iron Ore mine with 7.2 BT, located in the state of Pará, in North region of Brazil. In 2013, Vale produced 104.88 MT of Iron Ore in this mine, a 1.8% decrease compared to the previous year ⁷⁸. The Iron content is the world's highest quality having 67% pure Iron Ore or Fe near the surface that reduces COGS with beneficiation, comparing with BHP and Rio Tinto Pilbara operations where Iron Ore is produced with 62%–63% Fe content ⁷⁹.

Carajás Serra Sul S11D is a US\$ 19,67 Billion licensed project of expansion of Carajás that is on ongoing process and will generate 2'600 jobs on operating phase and 30'000 jobs on peak of the construction and US\$ 44,59 Billion in logistics infrastructure ⁸⁰. It has It has 2.78 BT of Iron Ore reserves ⁸¹. This project will increase the mine capacity to 90 MT/ Year by 2017 and to 230 MT/ Year to 2019 ⁸². The Iron Ore cost per Ton (FOB), for producing from the S11D deposit is expected to be US\$ 15/Ton ⁸³. (See Appendix 11).

2.8 The Carajás Railroad - EFC

The engineering studies to build the Carajás railroad dates to 1974 and after 8 years the first 15 Km were set, starting officially on February 28, 1985. The railroad that connects the largest open mine in the world has 892 Km extension, 36 crossing yards and 62 bridges. It connects the mine with the Maritime Terminal of Ponta da Madeira. The railroad not only transports 120 MT of Iron Ore but also 350,000 people living in remote areas of Brazil.

According to Vale, this railroad has over 16,000 cars and 276 engines (the train has 3,450 m length and one driver), being 35 compositions circulating on the tracks simultaneously, including one with 330 cars and measuring 3.3 kilometers in length, being among the world's longest train in regular operation.

The Carajás Railroad has lots of technology such as simulators and will have once doubled, Track Switch Devices (TSD), which allow trains to cross from one track to another without speed restrictions, what makes it the most efficient railroad in Brazil, according to the Logistics and Supply Chain Institute published in 2012. It has 40 Km/h as average speed, thanks to its 73% straight line route and only 27% curves what can reduce speed. There are plans to double track 559 Km of tracks, connecting 54 maneuvering yards making it even more efficient ⁸⁴.

2.9 The Port of Tubarão

Figure 13: The Port of Tubarão



Source: Vale 2015 ⁸⁵.

The Porto of Tubarão or Maritime Terminal of Tubarão (TUP), one of the benchmarks for Vale along with the Ponta da Madeira Port, started its operations on April 1, 1966. It was drew to receive large ships smaller than capesize what was unusual for the ports since that time supramax were the largest vessels. According to the University of São Paulo (USP), the Port of Tubarão was “The most Efficient Dry Bulk Loading Port” in 2009 compared to other nine dry bulk ports. The port is 35% more efficient than the Australian and Norwegian dry bulk ports ⁸⁶. The Port of Tubarão is one of the main ports Vale has along with the port of Ponta da Madeira. According to Vale, this port handles roughly 100 MT/ Year of Iron Ore, but in 2014 it handled 109.808.864, being that 92,4% was Iron Ore ⁸⁷.

It is located on the north margin of Vitória Bay, in the city of Vitória, Estate of Espírito Santo close to the public Port of Vitória in the Brazilian state of Espírito Santo, this port covers 18 square kilometers, connected through motorway and railway systems and consists of four maritime terminals: Iron Ore, Praia Mole, Diverse Products and Bulk Liquids. The port handles Iron Ore and pellets, coal, grains, fertilizers and bulk liquids ⁸⁸. The port enjoys of tropical weather, humid (80%-90%) and saline and has its rain season starting on October to April.

Operational Restriction to the Ships:

- Deadweight 405.000 MT
- Maximum Length 365 meters
- Maximum Breadth 66 meters
- Maximum Depth: 22,30 plus tide, limited to 23 meters

The port has 3 mining docks

- South Dock 1 with 390m and 1 Berth with 14,5m
- North Dock 1 with 390m and 1 Berth with 15,2m
- Dock 2 with 400m with 1 Berth with 20m length

Moreover, it has a grain dock, called Dock 3 with 300m length and 1 Berth with 14,7 and 1 dock for general cargo and fertilizers called Dock 4 with 240m length and 1 Berth with 11,35m ⁸⁹.

CHAPTER 3: THE BRAZILIAN PORTS SYSTEM OUTLOOK

“The history of the nations is written with the work from their children’s, the richness of their soil and with the movements of their ports”. (Sérgio Matte)⁹⁰

3.1 Brazilian Ports

Brazil has 8’511 Km of seashore, in its 8’514.876 Km² of area ⁹¹, which gives to it a natural and close relation with the ocean. In fact, in 2012, the Brazilian Foreign Trade was US\$ 466 Billion worth, moving 688 MT of cargo and 80% (or US\$ 371 Billion) of it was made via maritime and 90% was export cargo ⁹².

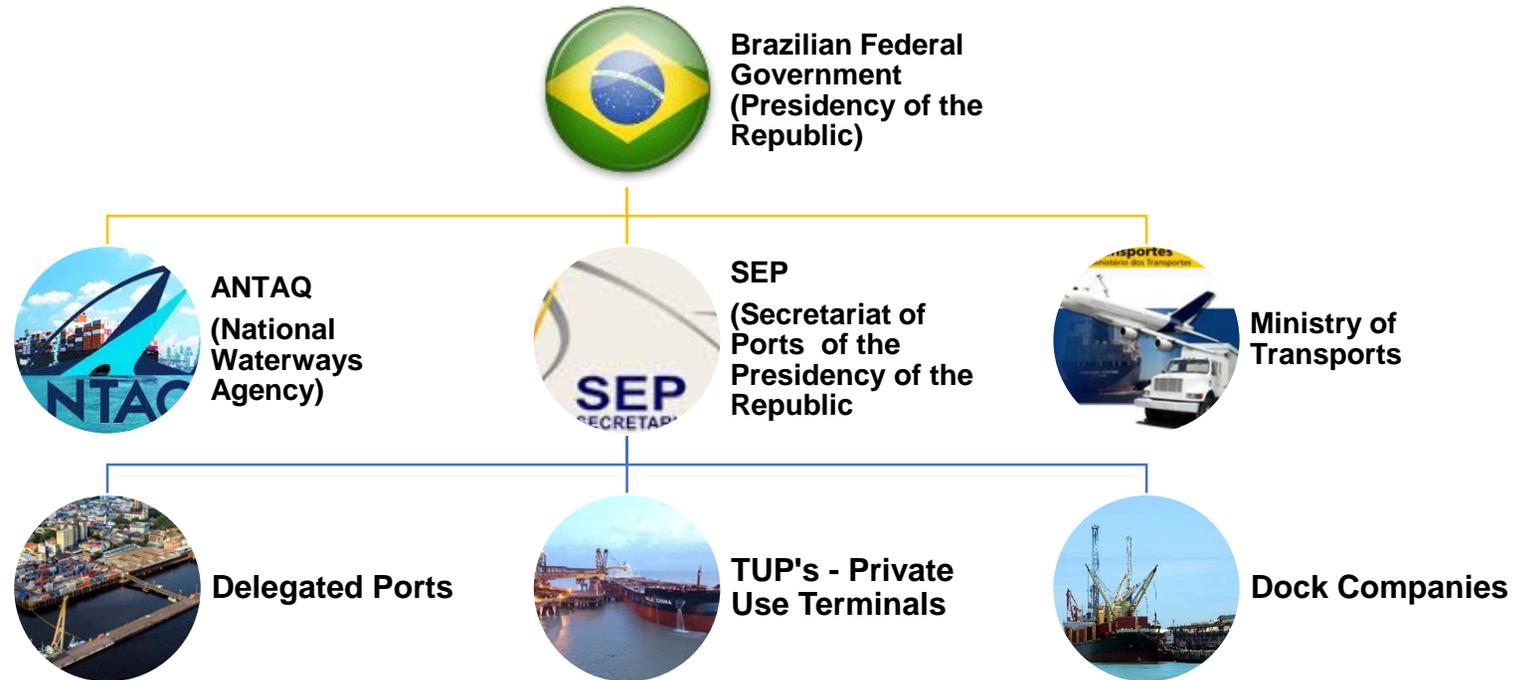
The Brazilian Ports System is “The Land Lord type”, existent in the majority of the countries. It is defined as the infrastructure belongs to the Brazilian government, which gives power to exploit by the private sector. There are two types of ports in Brazil: The Public Ports and the Private Use Terminals (TUP from the Portuguese). In the case of the TUP’s, it is given 25 years authorization to exploit by the ANTAQ (maritime authority).

Although Brazil is very competitive in producing commodities ranked number one in many commodities such as coffee and cattle, its logistics is far from ideal and the situation at its ports are not different. Therefore the ports are more than important to Brazil growth in order to export its commodities, it is essential. The main issues Brazil has with its ports are poor dredging in the ships access, roads ports access, trains and trucks bottlenecks and bad governance ⁹³.

According to ANTAQ, Brazil handles close to 1 BT of cargos every year in its ports and Iron Ore is the main product ⁹⁴. The Brazilian ports system is composed of 34 Public Ports (Waterways and Maritime) and 128 TUP’s. The system as a whole allowed for the movement of 904 MT (solid bulk, liquid bulk and general cargo) in 2012, compared to 886 MT moved in in 2011 ⁹⁵.

3.2 Ports Hierarchy Structure

Figure 14: Brazilian Ports Structure



Source: ANTAQ ⁹⁶

Key Government Agencies:

- **SEP - Secretariat of Ports:** The Presidency of the Republic of Brazil through the Presidency Secretariat for Ports, here as SEP, is in charge of the Maritime Ports (being 34 Ports under its responsibility) and its policies, programs, concessions to private ports and projects.
- **Ministry of Transports:** It is responsible for the Waterways Ports (Rivers and lakes).
- **ANTAQ:** This is a regulatory agency linked to the SEP and Ministry of transports. It aims to Implement, regulate, and supervise the activities and services in the waterways and maritime ports in order to preserve the society's interest.

Ports administrators under concessions:

Docks Companies: These are shared private and public companies that have the Federal Government as the largest shareholder, meaning the Brazilian government has decision power on it. These docs control 18 maritime ports and are seven of them: Dock Company of Ceará State, Dock Company of Pará State, Dock Company of Rio Grande do Norte State, Dock Company of Bahia State, Dock Company of Espírito Santo State, Dock Company of Rio de Janeiro State, Dock Company of São Paulo State.

- **Delegated Ports:** There are 16 of the 34 ports under responsibility of SEP that are delegated and authorized to be operated by the state and city governments (See Appendix 12).

3.3 Private Use Terminals (TUPs)

The TUP's are private owned lands close to the ports operated under government authorization. It is a private terminal inside of a public port but belonging to private companies for their use to store and move cargos. These terminals accounted for 65% of Brazil's cargo handling in 2012. There are 128 Private Use Terminals (TUPs) authorized to operate in Brazil ⁹⁷ (See Appendix 13).

3.4 Brazilian Ports PESTEL Analysis ⁽⁹⁸⁾

Political: The heads of the Brazilian ministries, including SEP and Ministry of Transports are chose or negotiated politically by the Brazilian President and political parties, and it is based on politics and not technical skills what compromise the efficiency of the ports due to the corruption risk. The two ministries are disputed by the politics because of the high flow of investments it has.

Recently Brazil had corruption scandals involving politicians and suppliers of its largest company, the oil giant producer Petrobras. These suppliers are authorized by the justice to participate in the investments of public ports what can led to possible increase in final costs of the ports and its access because of corruption, losing the opportunity to invest effectively in the country's infrastructure and enhance competitiveness ⁹⁹.

Economical: Although the World Bank states that Brazil had a boom decade between 2003-2013 when more than 26 million people were lifted out of poverty, the recent indicators are not that impressive. In fact, Brazilian GDP decreased by only 0,1% growth what says that its economy did not grow and is stagnated ¹⁰⁰.

For 2015, the economic indicators are pessimist. On Jan 9, 2015, the GDP growth was estimated to be 0.40% from 0.50% the previous week and inflation was expected to be 6.60% from 6.56% previously. Moreover, Financial agencies Standard & Poor's and Moody's Investors Service downgraded Brazil's credit rating what can scary those investors more conservatory ¹⁰¹.

In this scenario is difficult to expect high investments in its logistics to enhance its ports and their access. However, Brazil stated it will invest US\$ 11,5 Billion in 2015 only in Ports through private investments (concessions) and its reserves. Brazil also will give 63 new authorizations to build TUP's ¹⁰².

Social: Strikes are very common in Brazil from the truck drivers, operational workers and government's agencies in the ports. In January 2015, at least ten ports under responsibility of the dock companies had strikes for a period of six hours. They complain about privatizations in the ports what can led to layoffs because the government is looking for investments from the private sector ¹⁰³. Brazilian work law permits the arrangement of disputes between shipping organizations and Labor Unions. ¹⁰⁴.

Moreover, the Brazilian ports not only copes with the richness that it produces in its soil, but also neighborhood poverty, prostitution, sexual diseases outbreak and smuggling and drug dealers. In addition, the ports produce (solid/liquid) waste and the risks of chemicals hazards are constant. It is important to point out that the ports usually are very important for the local economies being the main revenue generator what creates hundreds of jobs ¹⁰⁵.

Technological: The last year's lack of investments in the ports led it to a fragile situation in its installations being in decline. This lack of investments caused a reduced in the number of ships docking and required the shipping ports to accept passenger cruisers to compensate its losses. According to IPEA (Institute of Applied Economics Research), Brazil needs to do 265 infrastructure projects and invest US\$ 13,1 Billion in construction, extension and renewal of ports. This includes its access such as roads, railroads, dredging and modernization of equipment's.

The need does not mean that something will be done. In the last decade, only US\$ 2,6 Billion was invested in 34 Ports which responds to 76,7% of the country foreign trade or roughly 0,6% of the GDP. Perhaps the biggest issue in the ports in terms of infrastructure are the deepness of the ports ship access, not adequate for the new ships being building, like Valemax for example ¹⁰⁶.

Environmental: According to a top executive from Vale in China and Brazil in special interview to this Bachelor Project (See Appendix 22), one of the major issues Vale has to keep expanding are the ports licenses that takes a long time for approval. The main conformities to be requested are: Operation License, Dredging License, Environmental Management Units, Individual Emergency Plans, Solid Waste Management Plan, environmental Audit, Risk Management Program, Emergency Control Plan, Environmental Risk Program and Environmental Controlling and Monitoring Program ¹⁰⁷.

The SEP (Secretariat of Ports) develops sustainable programs to minimize the impacts that Ports have on the cities where they are located ¹⁰⁸. This department requires some mandatory steps to lease an area inside a statutory port or to obtain a license to construct a Private Use Terminal (TUP) that are:

- Submit a Project Draft to the environmental authority. This includes contact data, size of the construction, localization of the installations, technical details, liquid effluents, solid waste and atmospheric emissions, among others.
- After that, the environmental authority will issue the Term of Reference in order to conduct the environmental impact study.

- When the study is evaluated positively, the Previous License, which is valid for five years, is conceded.
- In addition, it needs to apply for the Installation License in order to begin construction. To do so, the applicant must present the Execution Project, a Basic Environmental Program and an Environmental Management Program. If successful applied, the authorities grant a six-year license.
- Finally, once the construction work is concluded, must apply for ten years Operation License.

Legal: Those who work in international logistics in Brazil know very well how bureaucratic is the Brazilian Port System. The excess in bureaucracy to do the customs clearance creates a bottleneck and makes the Brazilian products less competitive. There are many government agencies such as Ministry of Defense, Brazilian Health Surveillance Agency, Federal Revenue Department, and Ministry of Agriculture. Each Agency will issue a mandatory document and check the shipments physically. Brazil do not have only one system linked to provide all information's but the exporter/Importer must provide data and fill different forms to each of the agencies/departments ¹⁰⁹.

Moreover, the bureaucracy in the ports led to payment of demurrages because of the time that the ship last in the ports, what increases the costs to produce in Brazil and lose competitiveness compared to other countries. According to specialists, today is impossible to avoid demurrage in Brazil ¹¹⁰.

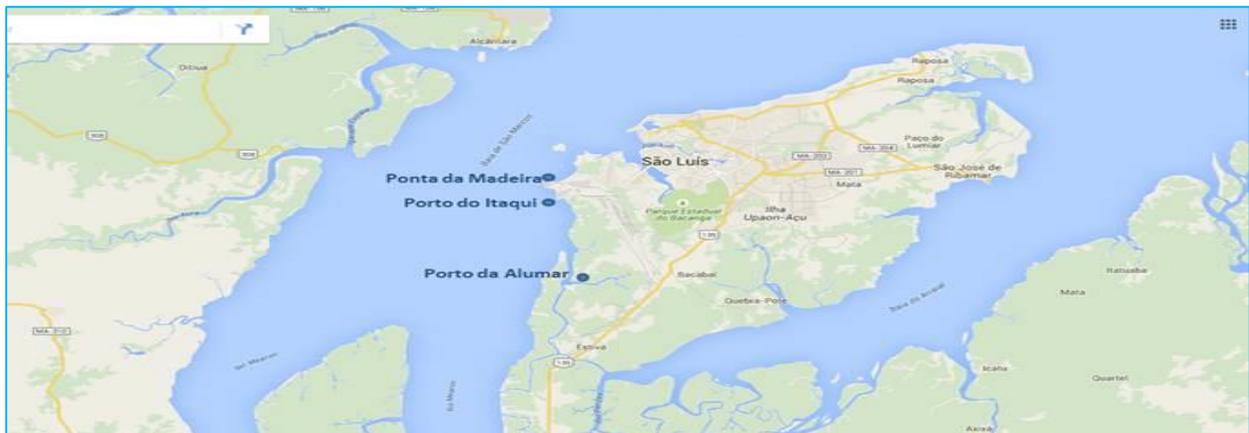
Demurrage and Customs Clearance responds to 18,56% and 17,84% of the costs respectively for those companies who operate in the Brazilian ports. The ports costs grew by 27, 26% between 2009 and 2012 according to the Brazilian Institute Tax Planning. In 2012 these costs were US\$ 9.55 Billion, a 27,1% increase compared to 2009 (US\$ 7,51 Billion) and this costs hit US\$ 4,86 Billion in the first semester of 2013 ¹¹¹.

CHAPTER 4: VALE'S MARITIME TERMINAL OF PONTA DA MADEIRA

4.1 The Complex of Itaqui

In order to understand the Maritime Terminal of Ponta da Madeira (here as PDM), we need first figure out where it is located.

Figure 15: Ports Location of the Complex of Itaqui in the São Marcos Bay



Source: Bachelor Thesis Interview by email with Mrs. Luciana Ferreira Kuzolitz, New Business Manager – Port of Itaqui. Sent on Jul 9, 2015 ¹¹².

The Brazilian state of Maranhão located in the Northeast of Brazil is a strategic place for Vale. Iron Ore produced in Carajás Mine and carried through the Carajás Railroad is shipped to the main markets in Europe and Asia from its private port called Maritime Terminal of Ponta da Madeira (from the Portuguese: Terminal Marítimo da Ponta da Madeira or PDM). The company's private terminal is located in the Complex Port of Itaqui in São Luís city, on the east bank of São Marcos Bay. The Complex is made of:

- Port of Itaqui (Public Port belonging to the Brazilian State Government);
- The Maritime Terminal Alumar (TUP) belonging to the Alumar Consortium (Alcoa, Rio Tinto, Alcan e BHP Billiton companies, where ships docs in a 252m dock length);
- The Maritime Terminal of Ponta da Madeira - PDM (TUP) which belongs to Vale SA;

It is the busiest cargo complex port in Brazil, having handled 107 MT of Iron Ore in 2013 and had 10,7 MT storage capacity in the same year (See Appendix 14) ¹¹³.

4.2 The Port of Itaqui

The Port of Itaqui started its operations on Jul 4, 1974. It is located in São Marcos Bay and serves to the states of Maranhão, Tocantins and norths of the states of Goiás and Mato Grosso, being that the two last benefit of the port infrastructure because they are large producers of cattle and soybeans respectively. It has 1.616 m of docks length with different depths: 9m and 21,5m, distributes in six berths called berths 101, 102, 103, 104, 105, 106.

Figure 16: Overview of the Port of Itaqui with its berths and dimensions



Source: PDZ. Porto do Itaqui ¹¹⁴

The port handles around 15 MT/ Year of cargo: 52% solid grains (pig iron, coal, copper, soybeans, fertilizers, rice and wheat), 45% liquid grains (refined oil products) and 3% are containers ¹¹⁵. In fact, in 2014, it handled 18.028,302 MT of cargo in its installations or a 17, 89% growth compared to the previous year. Refined Oil ranked first and accounted to 43,7%, followed by Soybean with 16,9% ¹¹⁶.

4.3 The TUP Alumar Consortium

The Maritime Terminal of Alumar is located in São Marcos Bay having a 5,5 km canal access from the Port of Itaqui. It has 545 m dock length and 19,6m width and is owned by a consortium of large aluminum producers (Alcoa, Rio Tinto, Alcan e BHP Billiton) ¹¹⁷. It has two berths, 01 (320m length and 13m depth) and 02 (225m length and 13m depth). Its Terminal can dock ships up to 50 Ton (Handymax) ¹¹⁸. This TUP handled 13.678.369 MT of Cargo in 2014, 6,86% growth compared to 2013, handling mainly bauxite 66,5% and Aluminum 23,9% ¹¹⁹.

Figure 17: TUP Alumar



Source: Foto Imagem Website ¹²⁰.

4.4 The TUP Ponta da Madeira (PDM Port): History and Overview

Figure 18: Maritime Terminal of Ponta da Madeira Location



Source: Vale 2015 ¹²¹.

The Maritime Terminal of Ponta da Madeira (here as PDM Port) is located near the public Port of Itaqui. The terminal is capable of accommodating up to five ships at the same time. It is a deep-draft port, capable to dock the Valemax megaships. This port was the first to receive Valemax ships ¹²². In fact, the PDM Port is the home of one of the world's deepest draft terminals. The world's largest bulk carriers operates in this port often bound for Rotterdam, which is able to accommodate vessels of an equally deep draft ¹²³.

It exports not only Iron Ore, but also manganese ore, copper concentrate and pig iron produced by Vale, and soybeans and pig iron produced by third parties ¹²⁴ (See Appendix 15). It exports roughly 110 MT/ Year of Iron Ore ¹²⁵. The port has Iron Ore storage capacity of 10.7 MT ¹²⁶, and

has capacity to handle 130 MT/Year of Iron Ore, or 10% of the world's Iron Ore handled standing as one of the largest ports in the world ¹²⁷, being a very important logistical corridor for Vale ¹²⁸. (See Appendix 16). It exported more than 3,500,000 tons of pig iron ¹²⁹. In 2011, 13 trains with 330 wagons circulate daily to deliver Iron Ore to this port ¹³⁰.

It was built to load Iron Ore from Carajás and export to Asia. Its excellent deepness favors the operation of large vessels such as Valemax. The project of the PDM Port had the analysis of the location and the development of the port operations as its main concern. The location was taken into consideration the width and the deepness of the São Marcos Bay so it could provide conditions for large bulk carriers to dock and a canal to have at least two ships to operate on both ways. In addition, it had a great visibility to operate and it is out of the storms route and could operate almost the whole year without the waves influence. The port started its operations on Jan 6, 1986, when 11,6 MT of Iron Ore was loaded ¹³¹. (See Appendix 17).

4.5 Port Information

The Port had 4 piers, Pier I, Pier II, Pier III and Pier IV, but the Pier II used for loading pig iron, soybean, corn and other commodities was give back to the Port of Itaqui since it was a leasehold contract. Now PDM Port has 3 piers that load only Iron Ore ¹³².

Figure 19: PDM Piers Location



* Pier IV was under construction. Source: INCHCAPE SHIPPING SERVICES ¹³³

Figure 20: PDM Pier I



Source: Vale ¹³⁴

Receives ships up to 420.000 DWT and has 590 m berth extension with a 23 m depth. Loads Iron Ore at a 16.000 T/h loading rate.

Figure 21: PDM Pier III (North and South Berths)



Source: Vale ¹³⁵

Receives ships up to 200.000 DWT Berth South and 180.000 Berth North. It has 655 m berth extension with a 21 m depth. Loads Iron Ore and manganese at 8.000 T/h loading rate.

Figure 22: PDM Pier IV South



Source: Vale ¹³⁶

Receives ships up to 450.000 DWT and has 1.600 m berth extension with a 25 m depth. Loads Iron Ore at a 16.000 T/h loading rate

Table 1: PDM Port Piers Comparative Table:

		Pier I	Pier II	Pier III	Pier IV
01	Length Overall	480 m Max	280 m Max	480 m Max	480 m Max
02	Beam	70 m Max	50 m Max	50 m Max	50 m Max
03	Max. Draft	23 m Max	18 m Max	21 m Max	25 m Max
04	Max Air Draft	22,4 m Max	18 m Max	22, 4 Max	23 m Max
05	DWT	420 MT Max	155 MT Max	200 MT/ Max	450 MT Max
06	Loading Rate	16. 000 T/h	8.000 T/h	8.000 T/h	16.000 T/h

Source: INCHCAPE SHIPPING SERVICES ¹³⁷. * Pier II no longer belongs to Vale since it was a leasehold contract.

The port has 3.05 days as approximate laytime ¹³⁸ and port congestion is a problem with Ponta da Madeira suffering from the biggest delays of up to two weeks ¹³⁹.

4.6 The Iron Ore Production and Loading Process at PDM

Figure 23: PDM Port Logistics and Operation Process



Source: VALE ¹⁴⁰. Bachelor Thesis Interview with PDM Operation Team

- 1 Unloading:** The port operates 6 wagon dumpers. Each dumper can unload at 8.000 T/h speed. Handling 2 wagons (105 Ton each) at the same time. After that, the ore flows through a conveyer belt up to the forklifts in the storage yard.

2

Stacking: The Stockyard is made by 3 forklifts with 16.000 T/h capacity and 1 with 8.000 T/h capacity, plus 4 stacker-reclaimer with 8.000 T/h capacity each.

3

Stockyard: The stockyard is made by 11 yards having 8,8 MT of storage capacity.

4

Recovery: In this process, the ore is collected from the yards and send through the conveyer belts to the ships.

5

Loading: The vessel is loaded through the conveyer belt and the terminals stands out to accommodate Valemax ships ¹⁴¹.

For a complete reference of the Iron Ore process in the Northeast System, please refer to Appendix 18 .

4.7 Future Projects

Two large ongoing projects will enhance the Northeast System:

- S11D: Extension of the Carajás Mine, it is a US\$ 19 Billion project, which will throw 90 MT/Year of Iron Ore into the market. Expected to be ready by 2016 and will increase Iron Ore output from 109 MT to 230 MT per year. This project contains Iron Ore reserves at 66.7 % grade, higher than the 62 % benchmark grade and the 61.5 % grade coming from Australia ¹⁴². Please refer to Appendix 19.
- CLN S11D: This is a project to support the extension of the Carajás Mine and involves a 570 km of railway double-tracking and a 101 Km construction of railroad extension in southeast of the state of Para. It's US\$ 1,2 Billion worth. So far, this is only 13% complete and expected to be ready by 2018, what can jeopardize the flow of Iron Ore from S11D in 2016 ¹⁴³. See Appendix 20.

4.8 Sustainable Aspects

Table 2: PDM Port Environmental and Social Impacts Aspects Table:

N°	Issues	Impact	Severity of the issue		
			High	Medium	Low
1	Community Employment	Positive			X
2	Noise Pollution	Negative	X		
3	Integration to local communities	Negative	X		
4	Increased HIV/AIDS prevalence	Negative		X	
5	Impacts on health	Negative	X		
6	Impacts on wildlife	Negative	X		
7	Impacts on local economy	Negative		X	
8	Increased violence	Negative	X		
9	Loss of marine habitat	Negative	X		
10	Improvement of ports operations	Positive			X

Positive: means Vale is doing well. Negative: the other way round. Source: Adopted from Port of Dar es Salaam – Tanzania ¹⁴⁴

Vale boosted the employment in the PDM Port region with thousands of jobs but such progress brought some negatives impact as a big infrastructure usually causes in its surrounding areas. In fact, the locals complain about inexistence of compensation payments since railroad damages the rivers, wildlife, agriculture production, properties (cracks due to the trains) health and education. The huge noise that the train generates causes disturbs to the students in schools as well as headaches and death of fishes and pollution of the water in the port neighborhood. Moreover, because of the increase of the population, around 200.000 people live close to the port, drugs, prostitution and violence widespread locally ¹⁴⁵.

Children's are victims on the railroads because the trains hit them and there are reports that the kids walking on the railroad are beat by the security officers. Vale invests heavily in security, more than US\$ 145 Million, but there are complains that employees are harassed to work on an intensive speed under noise and atmospheric pollution ¹⁴⁶.

In 2010, two employees passed away due to an accident in the PDM conveyer belt, but the Carajás Railroad is well known for its accidents, which increases dissatisfaction among the locals. Among the Railroad, alcohol used by the locals (they sleep on the tracks) is the main cause of the accidents.

Table 3: Carajás Railroad Accidents

Year	2006	2007	2008	2009	2010
Accidents	62	40	48	34	34
Deaths	29	9	4	12	7

Source: ANTT. Retrieved from Relatório Missão Carajás ¹⁴⁷.

4.9 PDM Operational Issues

- Incident 1: Vale Beijing: On December 2011, the ship Vale Beijing (400 DWT) from the Valemax class, one of the world's largest bulk carriers presented cracking on both side of its hull at Pier I, blocking ports operations for unexpected 2 days. It prevented 750 MT of Iron Ore to be loaded or USD 47'250.000 as damages today (Iron Ore spot any origin at US\$ 63/Ton for Jun 2015) and not taking into consideration the fact that soybean, copper, pig iron and manganese was also blocked to ship out. She was loaded with 384, 3 MT of Iron Ore, volume enough to build up 3 Golden Gates Bridges in California, reason why the ship cracked. People accused Vale of lack of a Cargo Plan ¹⁴⁸.
- Incident 2: Trade Daring: On Nov 11, 1994, the vessel Trade daring docked at Pier I, broke in half. The incident obliged the port to stop for 2 weeks and took 35 days to remove the ship from the local and normalize operations in the port. It was speculated that lack of expertise by those who were involved in the loading and a lack of a Cargo Plan was the reasons of the problem. Other ships also presented problem to set sail from the port ¹⁴⁹.
- 230 MT of Iron Ore throw into the port by 2016 with the port current capacity of 130 MT only, to be extended by 150 MT by 2018, creating a 100 MT mismatch for 2 years and then a 80 MT gap for the consecutive years. Not taking into consideration cultural aspects about timeline where Brazil often delay its projects, which could complicate the scenario.

4.10 Worlds Benchmark: Port of Port Hedland

Figure 24: Port of Port Hedland



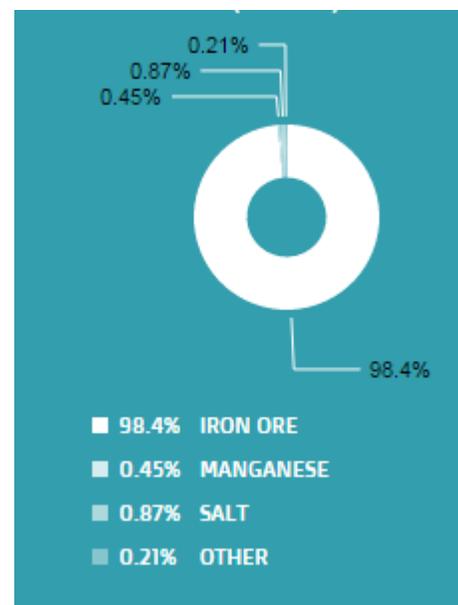
Source: Port of Port Hedland Handbook ¹⁵⁰.

The Port of the year 2012 and the World's Largest Bulk Export Port is the Australian Port of Port Headland. It handled 372,301,352 Ton of cargo between 2013-14. Port Hedland is the world's largest bulk export port (See Appendix 21).

The ports vision is to be the world's leading port, having safety, profitability, sustainability, efficiency and innovation as Mission and has Respect, Excellence and Courage as its Values. In order to agree with its Safety Mission, the port applies high Vetting inspection grades, four stars minimum rate to accept ships to dock-in.

The Port of Port Hedland has currently sixteen berths with varied depths, of which four are public berths or state owned. The other twelve berths exclusive for the Iron Ore export and accounting to 97% of the port trade output are private, being that eight are property of BHP and four from Fortescue Metal group, the world's fourth largest Iron Ore producer ¹⁵².

Figure 25: Port of Port Hedland Commodity Breakdown



Source: PILBARA PORTS ¹⁵¹

Technical info: Tidal Range: 7m; Current: 2-3 knots; Depths: 14.8m (IH), 15m -16.6m (channel)

The long-term BHP partner in Australia, the Japanese CEO company Mitsui, stated that. Due to recent drops in the Iron Ore prices (now in the US\$ 50's), their main strategy was to postpone 290 MT of Iron Ore Ton Target or US\$ 599 Million investments in the Port of Port Hedland and extract the best of its existent CAPEX ¹⁵³.

Why Port of Port Hedland is a benchmark port for dry bulk cargo?

- Over one quarter of the world's Iron Ore produced is in Western Australia, where the port is located (26% in 2012).
- Port Hedland is responsible for approximately 24% of global seaborne Iron Ore trade, expecting to grow to 27% in the next years.
- Western Australia exported 558 MT of Iron Ore in 2013 representing an economic value of US\$ 49.3 Billion.
- 4'140 vessel movements between 2012 -2013 and is expected 4800 plus movements in 2013 -2014.
- Western Australia has annual export growth average of 11% in the last 10 years to 2012-2013.
- In 2012-2013 Western Australia contributed 47% of Australia's merchandise exports ¹⁵⁴
- Iron Ore loading rate between 10.000 MT/Hr and 12.500 MT/Hr for BHP and 13.500 MT/Hr for Fortescue ¹⁵⁵.

4.11 PDM Port SWOT Analysis

Figure 26: PDM SWOT Analysis



Strength

- The port is well located and has appropriate deepness for large vessels what help Vale to diminish costs to export.
- Weather conditions can favor the port operations and improve productivity with less ships waiting to dock.
- Vale has decades of expertise and a qualified team

Opportunities

- S11D On-Shore will increase the port unloading (2 wagon dumpers with 8.000 T/h) and storage capacity (4 storage yards with 461.000 Ton each). S11D Off-Shore (the new) will increase the port capacity.
- China is too big to keep going slowing down its economy and its two digits economy recovery will be back soon, meaning more Iron Ore consumption to its mills and construction.
- Large ports already understood that diversification is also key for them. Port Hedland export more than 98% Iron Ore but its increasing in other agriculture materials though.

Threats:

- Brazil-China-Peru is building a railroad that will cross the east of the country to the coast of Peru to export to China. The construction of the Pacific-Atlantic Railroad can shorter the time to export to Asia from Carajás what could delay the progress of the port since the largest part of the Iron Ore is exported to Asia.

- The studies of the project to build up the “Port of Espadarte” in the Brazilian state of Pará can short 400 km the distance between Carajas mine and the ships to export Iron Ore. This port will be the world’s fourth largest Off-Shore port. The port will have 25 m depth and can receive Valemax ¹⁵⁶.
- There was some vessels cracking in the port what can risk the region in case of loss of materials on the ocean like fuel and the cargo itself since it is not an ocean natural material.

Weakness:

- Although Vale is improving local communities with its investments in the region, after three decades of its presence, the state of Maranhão continues to have the second-lowest ranking in the Human Development index among Brazil’s 27 states according to Brazilian Institute of Geography and Statistics what can provide a weak qualified labor supply to the port.
- Moreover, the port is weak regarding communication with the local community. Locals from the closest port location blame the port for noise with its railroad, pollution of the rivers, and resettlement of a small fishing village on the banks of the Maritime terminal of Ponta da Madeira (100 fishermen) ¹⁵⁷. In addition, they blame Vale for selling its richness and not bringing anything to the community, what can be better understood by the train wagons, which brings the ore to the port and returns to the mines empty ¹⁵⁸.
- Lack of diversification of commodities. Although the Port of Port Hedland export more than 98% Iron Ore, it has other commodities in its portfolio (See Figure 25). According to a Senior Executive from Vale Operations team at the PDM Port (See Appendix 23), the port had exclusivity to operate the Pier II, but as the contract terminated, other parties are operating it exporting soybeans, corn, pig iron and Vale still exports copper through that pier. To sum up, Vale could use that terminal to rent to third parties to export other commodities ¹⁵⁹.

CONCLUSION

The S11D project will create a great opportunity with Iron Ore at 15 US\$/Ton FOB producing it at a lower price and with the best market quality available, being in tune with its cost reductions policy, which could overcome its Australian competitors in terms of product quality and price. Despite that, it will also throw 230 MT/Year of Iron Ore by 2016 in the PDM Port that has 130 MT/Year capacity only and is doing improvements to make it capable to handle 150 MT/Year by 2018.

This will choke its port capacity and create a 100 MT/Year Iron Ore mismatch for 2 years at least and then an 80 MT/Year gap for the consecutive years. Not taking into consideration possible delays that could complicate the scenario. It could represent a US\$ 5,53 Billion loss in two years and US\$ 4,42 Billion loss later on (based on Iron ore prices at Jul 29, 2015 US\$ 55.30/Ton CFR Tianjin TSI) ¹⁶¹ at least, not taking into consideration a possible contango situation in the Iron Ore prices with China growing its GDP as it used to do.

Therefore Vale needs urgently to enhance the PDM port infrastructure even more than it is doing at the moment, requiring the construction of another Pier or Pier V and 11 stockyard of 8,8 MT of storage capacity. It could double its capacity by 2018, gaining competitive advantage with its high quality product at a low price and Valemax as an important instrument to deliver cheaper than its competition. Obviously that it requires more investments in CAPEX, but needed in order to avoid future losses since mining companies need to keep operating to reduce costs, being one of the reasons of Vale Economies of Scale Strategy.

Moreover, cracking of ships can jeopardize not only the company liquidity because of multimillionaire fines due to possible environmental damages for the nature but also it can scratch the company image among very important stakeholders who are the local communities and local governments. It is important to point out that impacts on nature are not a smaller issue than image impacts for the company since nowadays Sustainability and Social responsibility are major issues for any company.

Figure 27: Carajás mine output forecast for 2018 ¹⁶⁰



These events could represent a risk to a US\$ 19 Billion project and put Vale on target of the media, a very influential instrument in Brazil, which could put the Federal Government, an important Vale's shareholder, under pressure to make changes. This is a reason why we propose an improvement in its loading process.

Finally, the recent more than 50% drop in the Iron Ore prices let a lesson of the importance of diversification to avoid losses, since Iron Ore accounts to almost 80% of what is exported at PDM. The port could diversify its products with an opportunity available in other commodities, as we will discuss and recommend next.

RECOMMENDATIONS

The PDM Port presents three issues that could jeopardize Vale's profitability on the short run and one opportunity that can help the port to boost its profitability on the long run:

First, Communities' conflicts can jeopardize Vale's projects because of its appeal on the government, which has great influence on Vale shareholders board. In order to tackle the first issue or these unsatisfied stakeholders, we recommend the creation of Communities Councils with locals (city citizens, government agencies such as police, hospitals and NGO's) and Vale's employees as members where the issues/ challenges could be discussed and solved in a council. Vale would grant prestigious among the locals and show care for them. The Council could reunite once a month and Vale could use it not only to discuss issues but also to present to the stakeholders the measures that it is taking to countermeasure the issues raised previously.

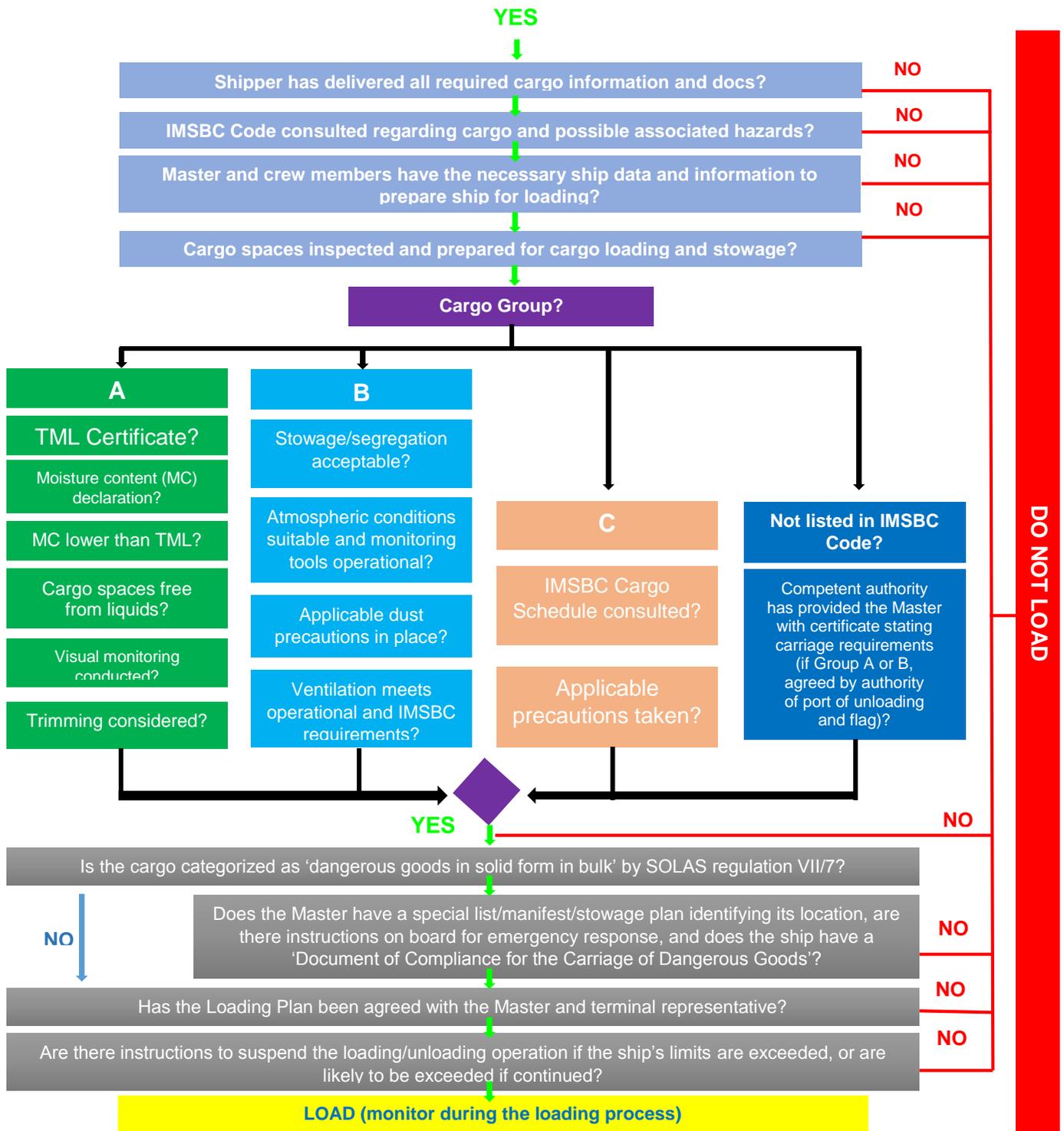
Figure 28: Communities Council Scheme



Source: Author

Secondly, cracking of ships is an issue that can not only reduce temporally the port operations as the port previously had but also attract media attention and consequently legal issues like multimillionaire fines. In order to tackle this issue we recommend the use of a loading process based on the International Maritime Solid Bulk Cargoes Code, because this is a serious hazard that must be tackled properly. We propose to the PDM Port to follow the following loading flowchart to make sure, if it is safe or not to load the cargo:

Figure 29: PDM Port Iron Ore Loading Flowchart Recommendation



IMSBC: International Maritime Solid Bulk Cargoes Code. Source: LLOYD'S REGISTER ¹⁶²

Group A – cargoes which may liquefy if shipped at a moisture content exceeding their Transportable Moisture Limit (TML).

Group B – cargoes which possess a chemical hazard which could give rise to a dangerous situation on a ship.

Group C – cargoes which are neither liable to liquefy (Group A) nor possess chemical hazards (Group B). Cargoes in this group can still be hazardous.

Third, oversupply from Carajás beyond its capacity, which could not only generate losses in its economies of scale strategy but also billionaire losses, which is definitely a problem for any shareholder. We recommend tackling this issue with the construction of the Pier V, which is not being considered at the current moment according to Vale Operations Team Interview (See Appendix 23), most likely because of the drop in the Iron Ore prices and the uncertainty of the Chinese economy.

In 2013, the costs to build up only the Pier IV was US\$ 119.2 Million ¹⁶³. If we simply apply a 6% inflation average rate that Brazil had in 2013 and 6% in 2014 and possible 8% in 2015, being a 6,6 % inflation average rate, the Pier V in today's money would estimate a cost of US\$ 131,2 Million.

Vale could try to acquire land to do so on the right side of the PDM Port so it can create another Pier format of stockyards. It will reduce the port operations stress and accommodate the future Iron Ore output from Carajás mine.

Figure 30: PDM Port Pier V future installations location



Source: Vale 2014 ¹⁶⁴. Based on Bachelor Thesis Interview with Vale Operations Team

Figure 31: Pier V 3D Vision



Source: Vale. Based on PDM Pier IV 3D Vision with two docking Berths ¹⁶⁵.

Finally, the PDM Port could enhance its productivity by the key trend word “diversification”. It is important to point out that the PDM port is not far from the Soybean hub in the center of Brazil, which is the second most important commodity for Brazil in value and has its hub not that far from Carajás Railroad. Vale could use its CAPEX structure to ship out their production (since bulk cargos are designed to transport not only ore but also grains) especially when there is a drop in the Iron Ore prices, which is the current scenario. Vale could slow down a bit its export of Iron Ore to pull up the prices and increase its other commodities export. We know mining is a non-renewable resource and Vale must be prepared for the time when the resources will be scarce, and increase the export of agriculture can be a good start.

Table 4: PDM Port Cargo movements types 2014

Cargo	Movements	2013
Iron Ore	77%	5,14%
Bauxite	6,3%	5,68%
Fuel and Oil	5,6%	12,92%
Aluminum	2,3%	16,64%
Soybean	2,1%	2,67%
Fertilizers	1%	8,16%
Manganese	1%	-16,35%
Coal	1%	56,76%
Pig Iron	1%	-20,39%

Source: ANTAQ ¹⁶⁶

On the right side of the port there are land which could be used to build up other 11 stock yards having 8,8 MT of storage capacity, or double its current capacity, creating a second pear format yards as can be seen in the bottom side of the port layout (See Figure 30). As an example, Total Capex to build up the recent pier IV and expand the port with: 2 Wagon dumpers (8.000/Th capacity), 4 Stock yards (461.000/Ton each), 5 stock yards machines (1 forklift reclaimer, 2 reclaimers and 2 reclaimer machines) is expected to cost US\$ 4.114 billion (Total capex) ¹⁶⁷.

Applying a 6,6% inflation rate, in 2015 it could cost US\$ 4.385 Billion, but we remind that losses for the gap in the port capacity is expected to be between US\$ 4,42 Billion and US\$ 5,53 Billion. Simply put, the table 4 explains the ROI that is expected to be as follows:

Table 5: PDM Port Pier V + 4 Stock Yards Return on Investment Calculation

Formula applied	(Gains – Cost) / Cost	=ROI
2 First Years	(US\$ 5,53 Billion – US\$ 4,38 Billion) / US\$ 4,38 Billion	26%
Consecutive Years	(US\$ 4,42 Billion – US\$ 4,38 Billion) / US\$ 4,38 Billion	0,9%

Where US\$ 5,53 Billion for the first two years (or US\$ 4,38 Billion for the consecutive years) is the Iron Ore price based on Iron Ore prices at Jul 29, 2015 US\$ 55.30/Ton CFR Tianjin TSI, meaning the price that Vale could gain selling the ore or possible losses in case of inertia related to these initiatives. The US\$ 4,38 Billion is the cost to build up these projects based on the recent costs used to build up the Pier IV and applying a 6,6% average inflation rate. The 26% and 0,9% ROI shows a positive rate of return of the investment. Typically a ROI greater than zero already demonstrates the viability of an investment.

Here we summarize our proposed initiatives to be taken in the PDM Port.

Table 6: Recommendations Summary

	Initiative	Begin	Duration	Overview	Expected Impacts
1	Communities Councils	2015	Permanent Process with monthly meetings	Create Communities Councils with main stakeholders (Vale employees and locals).	Improve communication with the community so Vale can carry on with its business.
2	Ships cracking	2015	Permanent Process with immediate start	Cargo Loading Plan applying International Maritime Solid Bulk Cargoes (IMSBC) Code	Provide a detailed guide to port operations so it can comply with international ports and have a straight process to avoid accidents.
3	S11D oversupply	2016	2 years and expected to finish by 2018	Construction of the Pier V on the same specifications of the Pier IV and 11 stock yards	Pier V will enhance PDM capacity to 230 MT so it will respond to the increase supply from Carajás mine. Cost
4	Diversification	2018	2 years which is the time to build up the port expansions	The PDM port could use the expansion of the port with the Pier V and the 11 stock yards to increase its diversification in its commodities portfolio	The PDM Port can be less sensitive to the volatility in the Iron Ore prices and invest in renewable commodities since Iron Ore is not a renewable material although the steel is largely recycled.

LIMITATIONS

Despite the fact that this Bachelor Project reached fully its aims, there were still unavoidable limitations, as we will discuss here.

First, because of company's privacy issues, most of the data expected to be shared was not done since the company management argued that it was not available and preferred to share most of the time Vale public information, although these information's were not easily found on the internet. Second, Vale management hesitated to be identified, which consequently limited them to share more data, perhaps afraid of the unknown results of this research or it could be shared with Vale's competitors.

Third, the PDM Port has not a substantial public online database to be exploited in order to conduct a study, which limited the author to find facilities drawings, layouts, maps, detailed cargo movements in order to provide an in-depth recommendation to the port concerning its infrastructure and processes. Last but not least, time constraints were definitely an important issue since this study had to be conducted along with other mandatory academic classes required and validation exams.

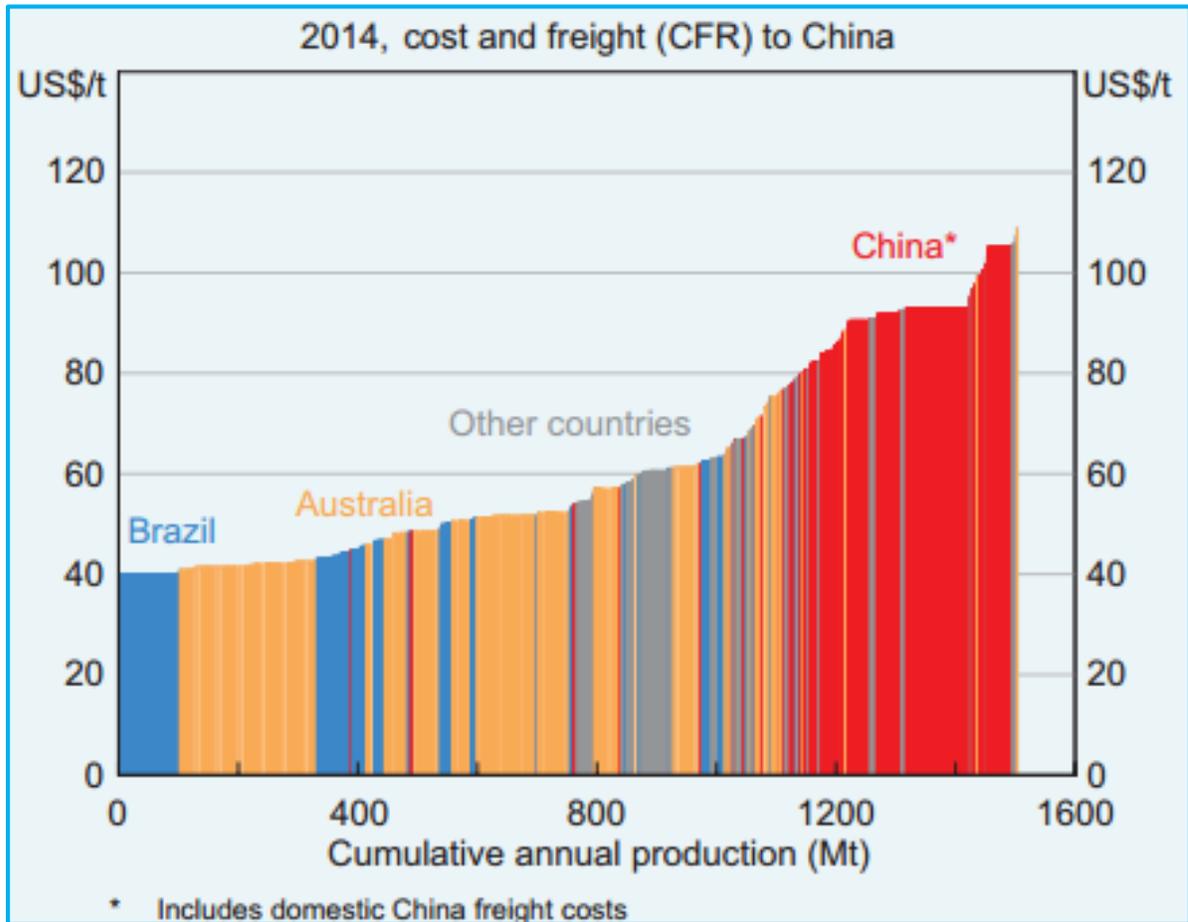
In order to provide a relevant work, we had to contact as many Vale key employees as possible so we could enhance the chances to get reliable data to be analyzed for this study. However, is not easy to contact Vale employees since there was not a specific website about the port to contact them. We decided to contact maritime authorities in Brazil, such as ANTAQ and the Brazilian Ministry of Transports in order to get contacts in Vale. Regarding the lack of data about the PDM Port, we connected public information's accessed on Vale websites, with information's provided by Vale Management and Operations and finally with ports databases from Brazilian maritime authorities.

Most of these issues regarding the company sharing private data could be minimized with a clear agreement between students and companies through the confidential agreement contract provided by HEG. Regarding the time, it could be solved with an extension of the time to start the Bachelor Project, meaning instead of having its beginning at the end of the fifth semester, it could be done in its very beginning so we could have more time to contact the companies and explain the relevance of our research for the company.

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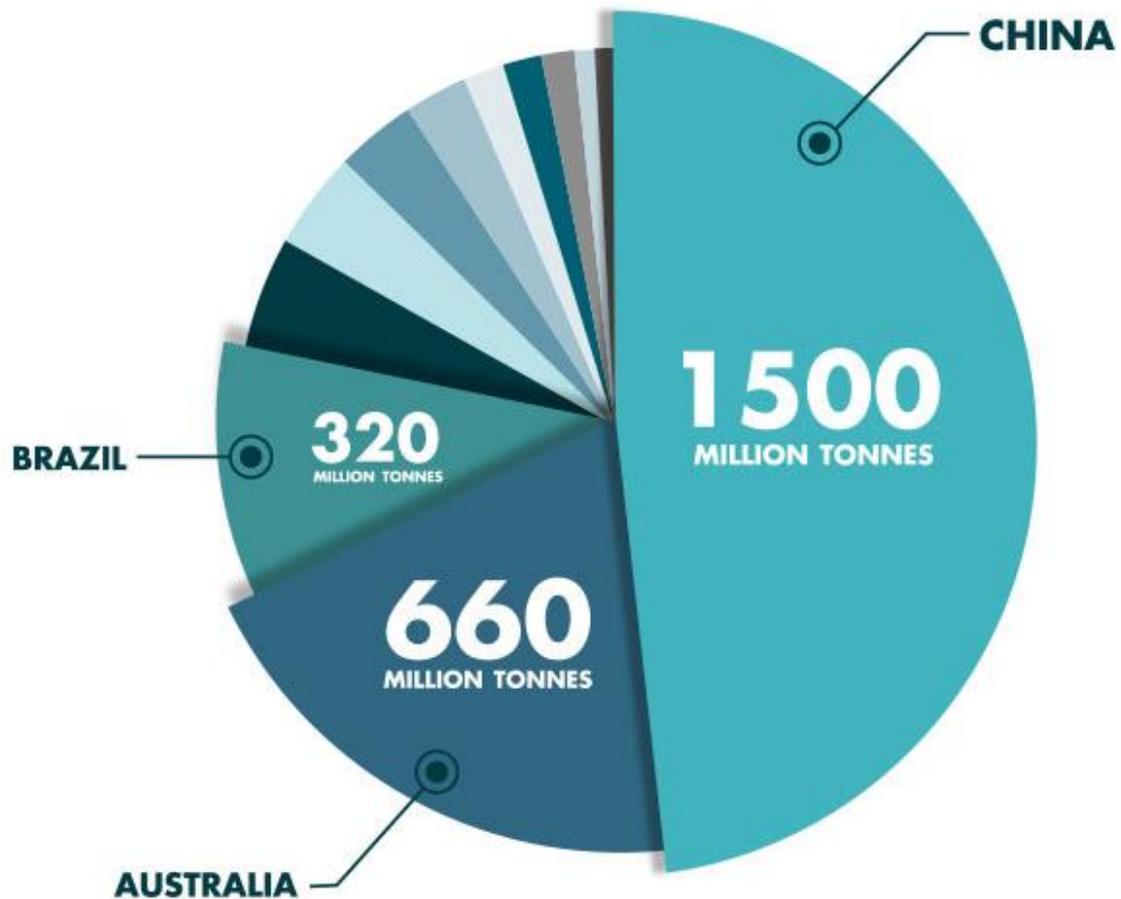
Appendix 1: Global Iron Ore Production Costs



Source: Reserve Bank of Australia.

Retrieved from: RESERVE BANK OF AUSTRALIA. Iron Ore and Coal Cost Curves. [Online]. Accessed on 23 Jun, 2015. Available on: <http://www.rba.gov.au/publications/smp/boxes/2014/aug/b.pdf>

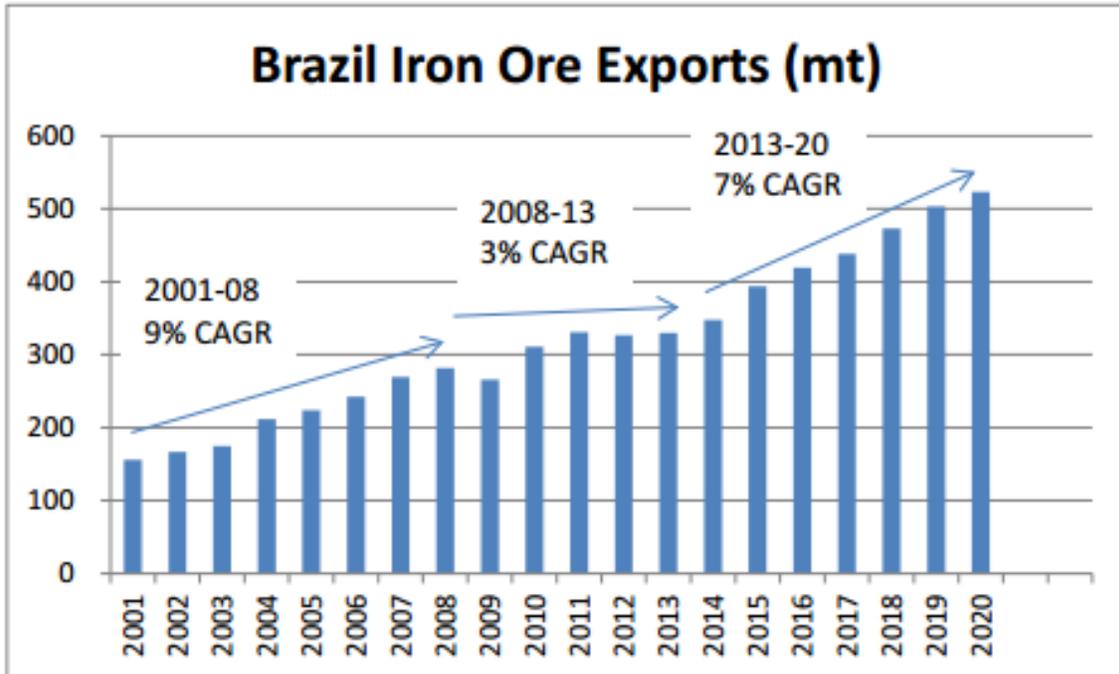
Appendix 2: The world's top 3 Iron Ore producers 2014



Source: Iron Ore Facts.

Retrieved from: IRON ORE FACTS. The World's Biggest Iron Ore Producers [Online]. Accessed on Jun 23. Available on: <http://www.ironorefacts.com/the-facts/iron-ore-global-markets/>

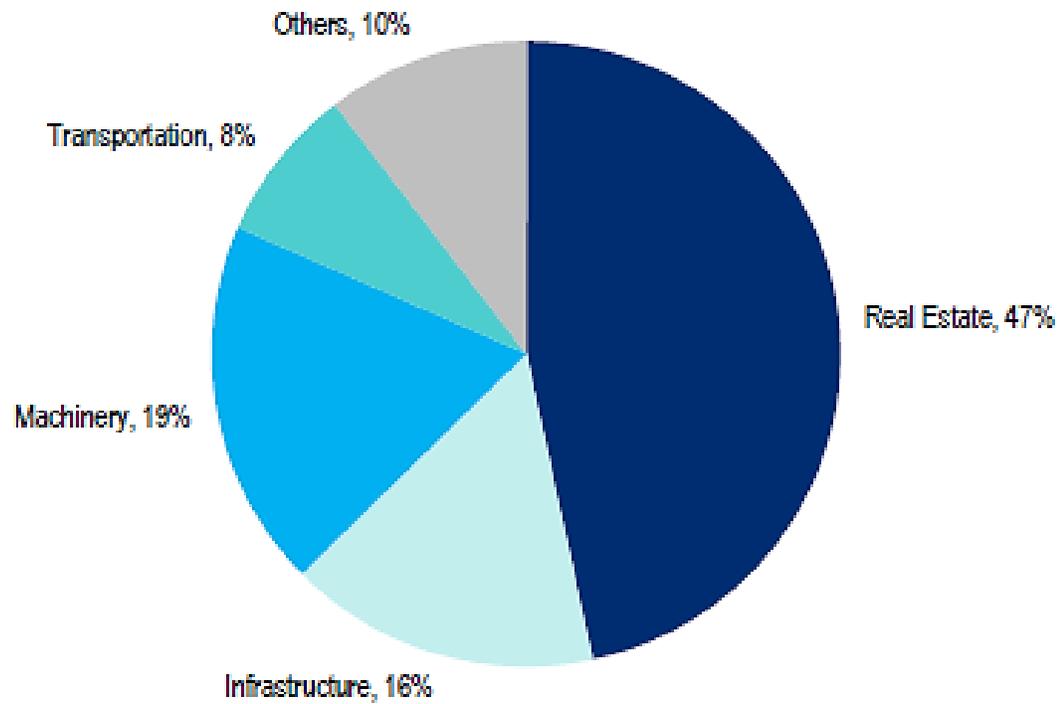
Appendix 3: Brazil Iron Ore Exports



Source: City Research

Retrieved from: CITI. Global Iron Ore [Online]. Accessed on Jun 23, 2015. Available on: http://pg.jrj.com.cn/acc/Res/CN_RES/INDUS/2014/3/3/26c848fe-8a0d-487b-b8ec-01040f96af8f.pdf

Appendix 4: Chinese Steel demand by sector 2013



Source: City Research

Retrieved from: CITI. Global Iron Ore [Online]. Accessed on Jun 23, 2015. Available on: http://pg.jrj.com.cn/acc/Res/CN_RES/INDUS/2014/3/3/26c848fe-8a0d-487b-b8ec-01040f96af8f.pdf

Appendix 5: India's Iron Ore Demand and Supply

Figure 104. India – Iron ore Demand-Supply

Year	Production	Domestic Consumption/ Requirement (e)	Imports	Exports	Share of Export with production
2010-11	207.2	107.2	1.9	97.7	47.1%
2011-12	168.6	100.6	1.0	61.7	36.6%
2012-13*	136.0	103.4	3.1	18.4	13.5%

Source: Production/Consumption - Indian Bureau of Mines, Ministry of Mines; Import/Export - MMTC, Ministry of Commerce; * Provisional; e Estimated)

Source: CITI.

Retrieved from: CITI. Global Iron Ore [Online]. Accessed on Jun 23, 2015. Available on: http://pg.jrj.com.cn/acc/Res/CN_RES/INDUS/2014/3/3/26c848fe-8a0d-487b-b8ec-01040f96af8f.pdf

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Appendix 6: Vale's Competitor's Financial Comparative

BHP (US\$ Billion)	2012	2013	2014
Revenues	70,477	65,953	67,206
COGS	14, 727	14, 471	14,435
Net Income	15,473	11,223	13,832
RIO (US\$ Billion)	2012	2013	2014
Revenues	50,942	51,171	47,664
COGS	37,534	36,104	33,910
Net Income	-3,028	3,665	6,527
Vale (US\$ Billion)	Dec 31 2012	Dec 31 2013	Dec 31, 2014
Revenues	91,269	101, 490	88, 275
COGS	49, 832	52, 511	59, 087
Net Income	9,892	115 (Million)	954(Million)

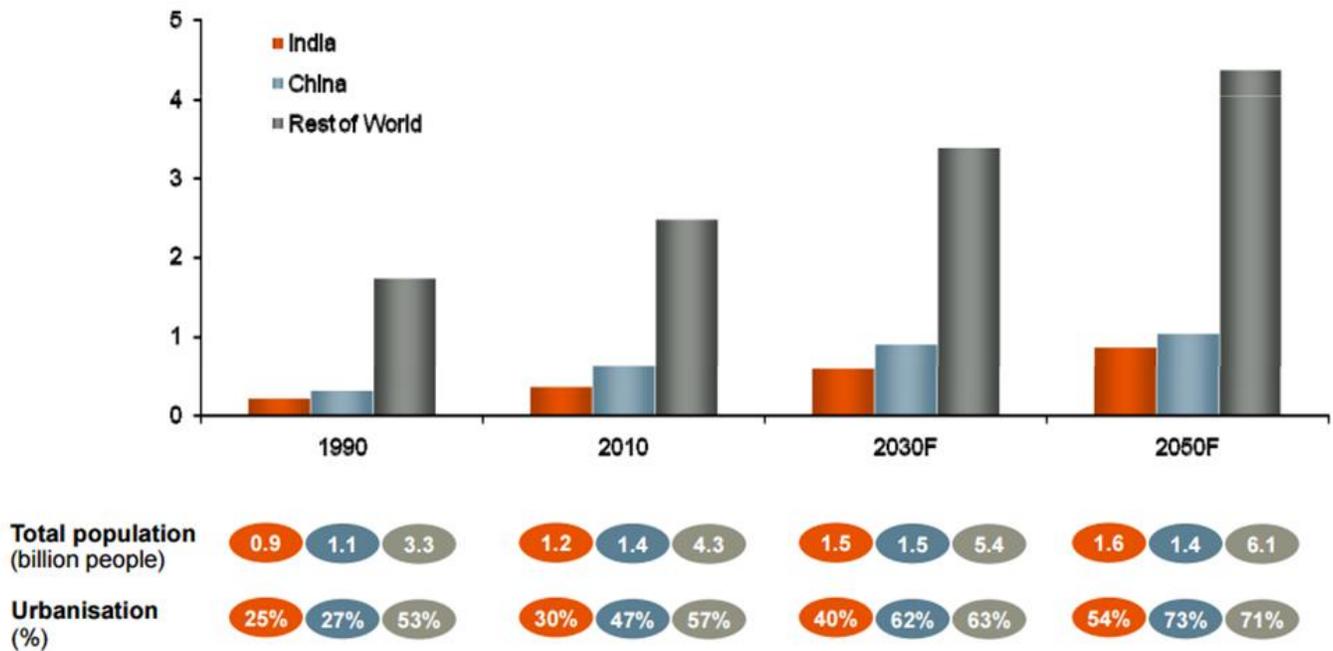
Source: Bloomberg

For BHP: Retrieved from: BLOOMBERG. BHP Billiton Limited [Online]. Accessed on Jun 25, 2015- Available on: <http://www.bloomberg.com/research/stocks/financials/financials.asp?ticker=BHP:AU>

For RIO: Retrieved from: BLOOMBERG. Rio Tinto Ltd [Online]. Accessed on Jun 25, 2015- Available on: <http://www.bloomberg.com/research/stocks/financials/financials.asp?ticker=RIO:AU>

For Vale: Retrieved from: BLOOMBERG. Vale SA [Online]. Accessed on Jun 25, 2015- Available on: <http://www.bloomberg.com/research/stocks/financials/financials.asp?ticker=VALE3:BZ>

Appendix 7: Projected urbanization of India, China and the Rest of World



Source: BHP Billiton Iron Ore

Retrieved from: BHP. BHP Billiton Iron Ore BHP Billiton Iron Ore - Growth and Outlook [Online]. Accessed on Jun 24, 2015. Available on: http://www.bhpbilliton.com/home/investors/reports/Documents/2012/120320_AJMConference.pdf

Appendix 8: Iron Ore and the Brazilian Trade Balance



Total Brazil years	2012	2013	2014
Brazilian Exports	242.578	242.033	225.100
Brazilian Imports	223.183	239.747	229.137
Brazil Trade Balance	19.394	2.286	-4.036
Iron Ore Exported	30.989	32.491	28.402

* Values expressed in Millions of US\$ FOB

Source: MDIC (Brazilian Ministry of Industry and Foreign Trade)

Retrieved from: MDIC (Brazilian Ministry of Industry and Foreign Trade). MDIC Sistema AliceWeb - Elaboração IBRAM. [Online]. Accessed on Jun 21, 2015. Available on <http://www.ibram.org.br/>

Appendix 9: Vale Ports



Port of Tubarão

 Brazil



Ponta da Madeira Terminal

 Brazil



Itaguaí Terminal

 Brazil



Guaíba Island Terminal

 Brazil



Inácio Barbosa Terminal

 Brazil



Santos Terminal

 Brazil



Port of Sohar

 Omã



Teluk Rubiah Terminal

 Malaysia



Balintang Special Port

 Indonesia



Harapan Tanjung Mangkasa

 Indonesia



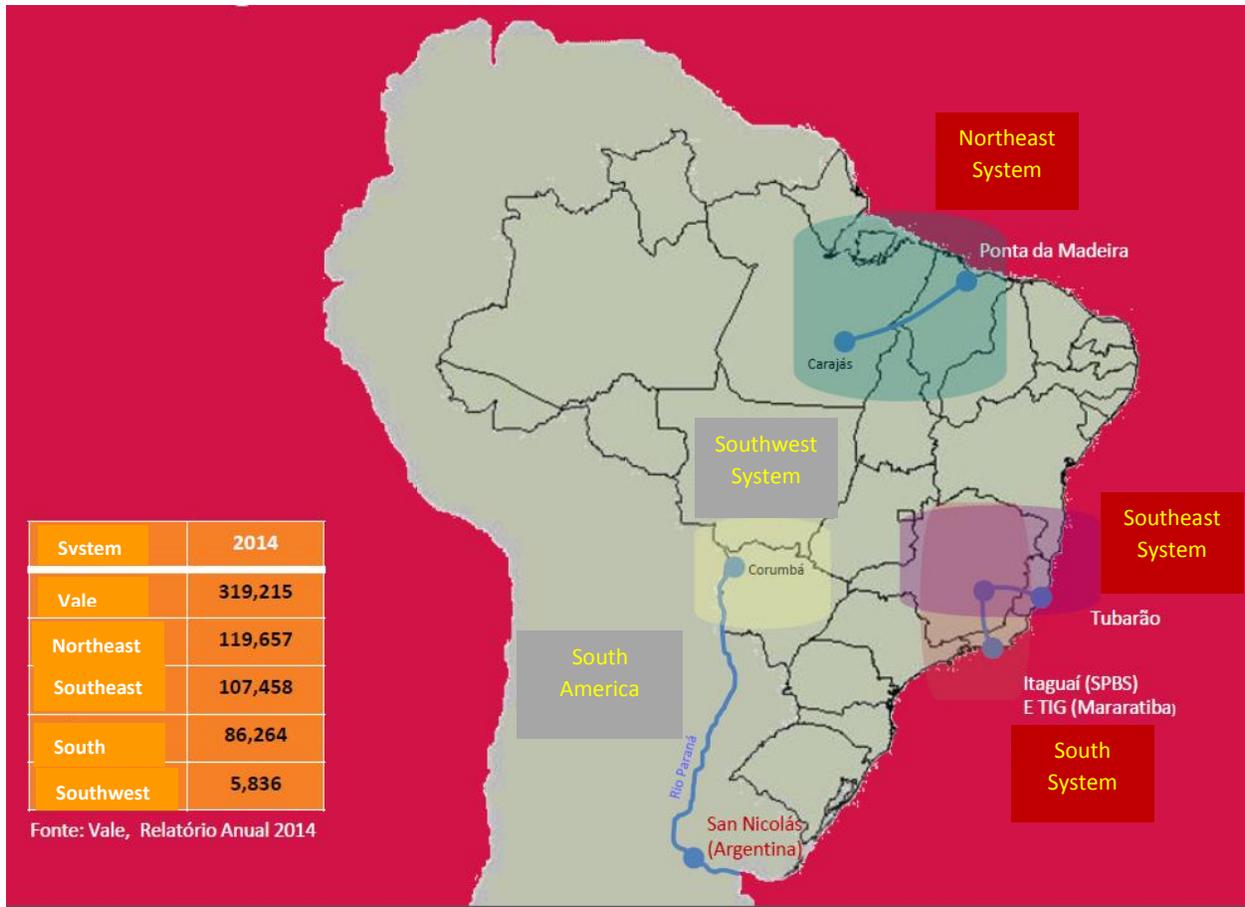
San Nicolas

 Argentina

Source: Vale

Retrieved from : VALE. Logistics. Ports and terminals [Online]. Accessed on Jul 26, 2015. Available on: <http://www.vale.com/EN/business/logistics/ports-terminals/Pages/default.aspx>

Appendix 10: Vale Iron Ore Operating Systems and Iron Ore Production in Brazil



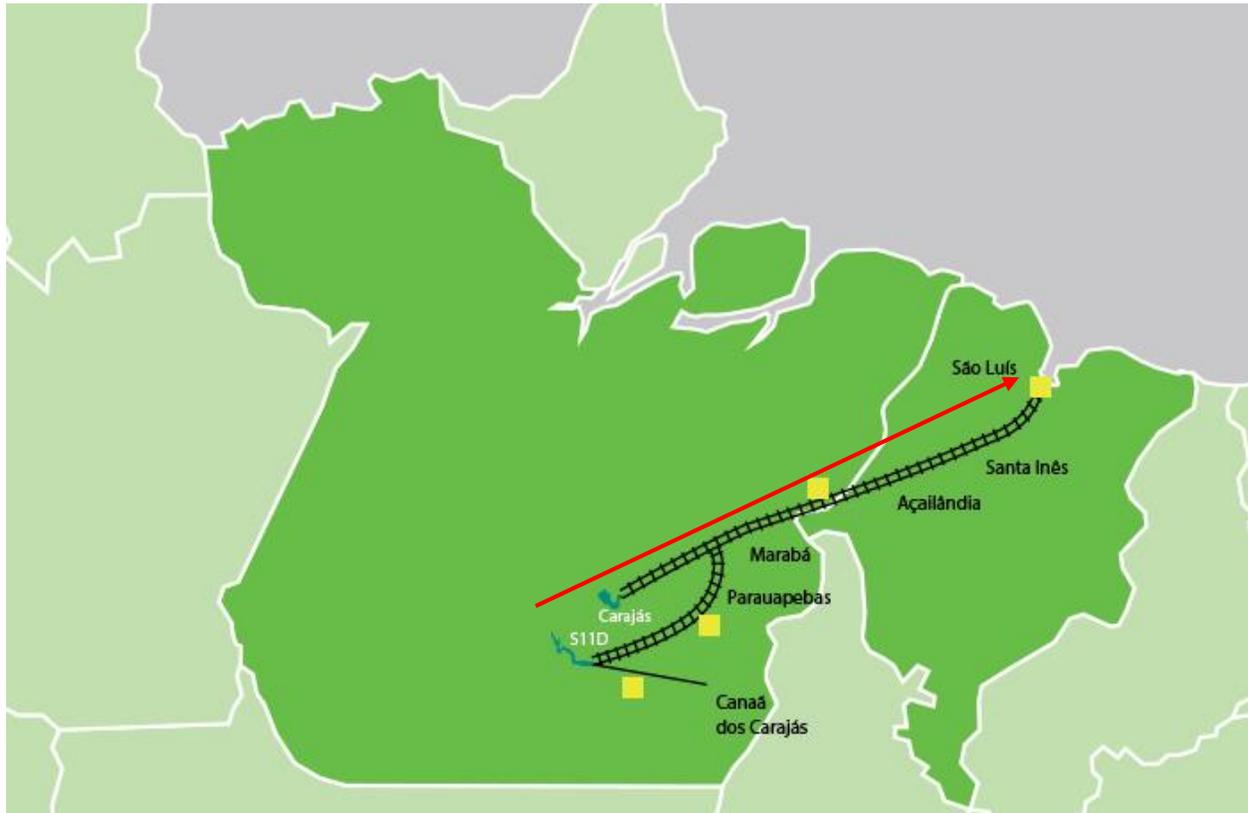
Source: Vale 2015

Retrieved from: VALE. Terminal Marítimo da Ponta da Madeira – Apresentação Institucional [PDF file]. São Luís-Brazil 2015. Bachelor Thesis Interview. Sent by email from Vale Operations Team

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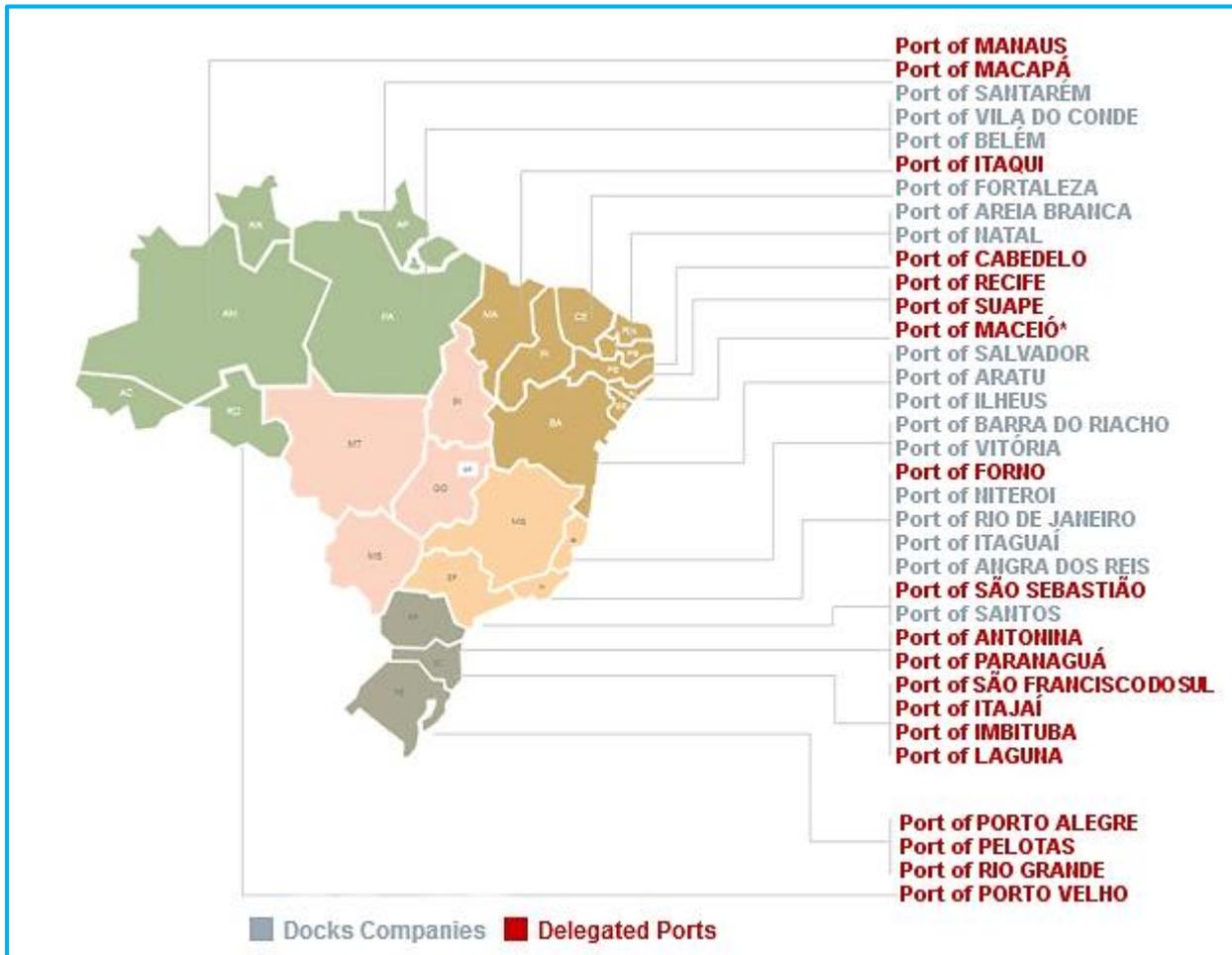
Appendix 11: Carajás S11D Iron Project



Source: Vale

Retrieved from: VALE. Initiatives [Online]. Accessed on Jul 17, 2015. Available on:
<http://www.vale.com/en/initiatives/innovation/s11d/Pages/default.aspx>

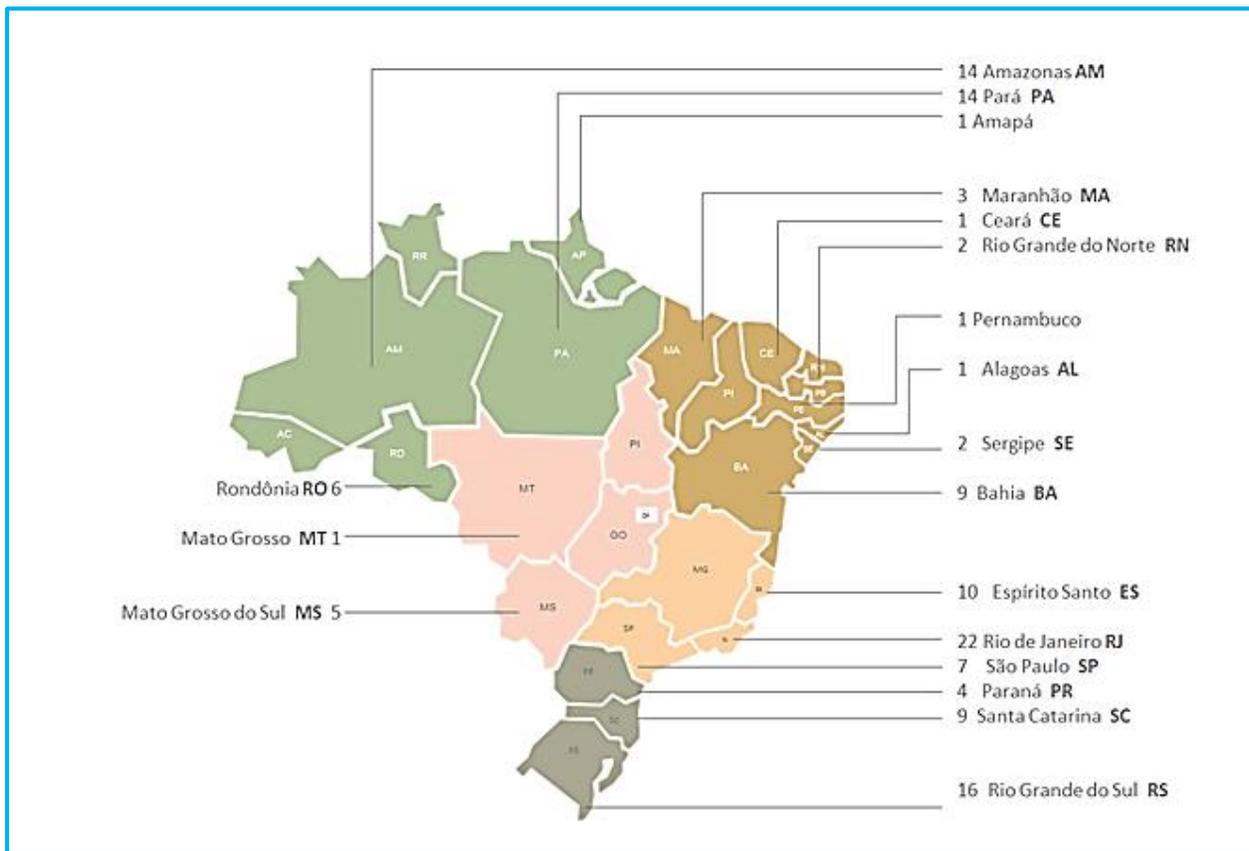
Appendix 12: Statutory ports



Source: Secretariat of Ports

Retrieved from: PORTOS DO BRASIL. The National Port System [Online]. Accessed on Jul 3, 2015. Available on: <http://english.portosdobrasil.gov.br/sections/port-systems>

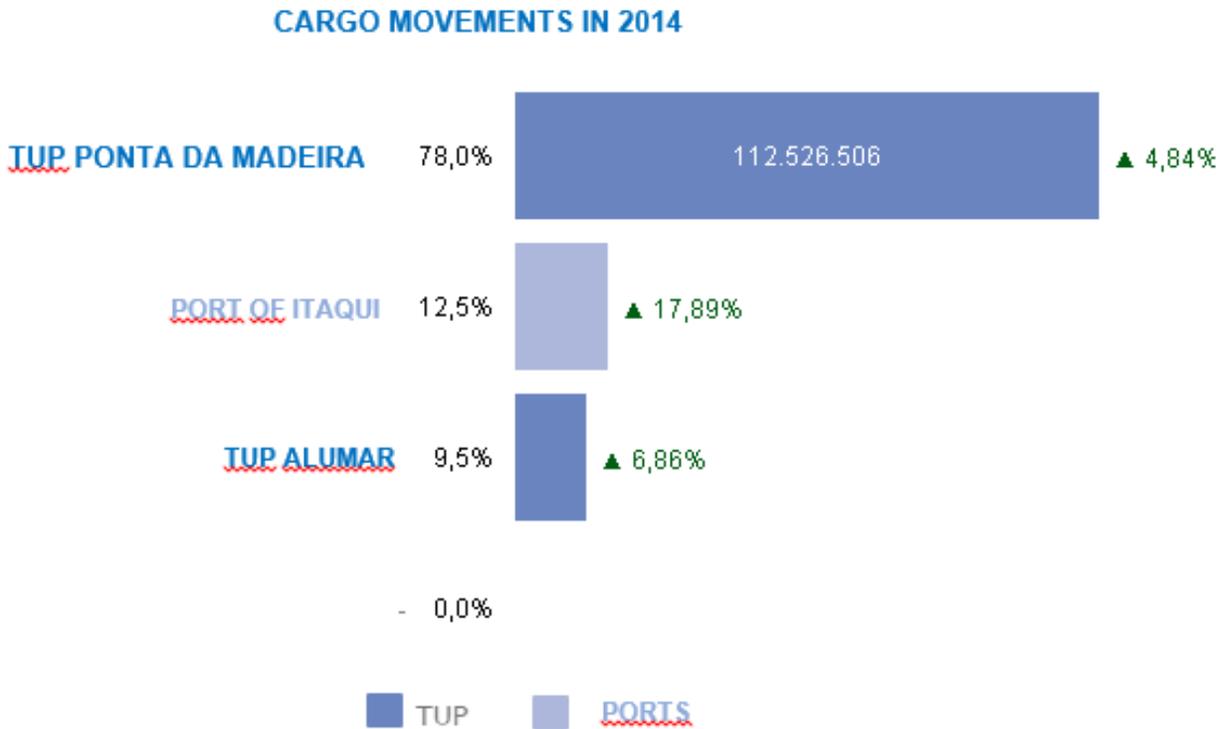
Appendix 13: Private Use Terminals (TUP's)



Source: Secretariat of Ports

Retrieved from: PORTOS DO BRASIL. The National Port System [Online]. Accessed on Jul 3, 2015. Available on: <http://english.portosdobrasil.gov.br/sections/port-systems>

Appendix 14: The Complex of Itaquí Cargo Movements in 2014



Source: ANTAQ

Retrieved from: ANTAQ. Anuario. Movimentação Portuária [Online]. Accessed on Jul 26, 2015. Available on: <http://www.antaq.gov.br/anuario/>

Appendix 15: Brazilian Seaborne Foreign Trade between 2013 and 2010 Top Cargoes in Metric Tons

Rank	EXPORTS				IMPORTS					
	Commodity	2013	2012	2011	2010	Commodity	2013	2012	2011	2010
1	Iron Ore	321,907,582	324,355,162	320,880,845	305,909,053	Containerized Cargo	38,882,055	34,260,967	35,013,293	31,836,582
2	Containerized Cargo	39,308,318	36,908,521	36,765,912	27,934,315	Fuels, Mineral oils & products	39,055,648	36,092,651	33,410,756	32,661,028
3	Soybeans	43,096,028	33,850,659	35,508,919	33,250,257	Fertilizers	23,595,898	20,777,436	20,528,606	16,181,378
4	Sugar	24,381,022	22,114,868	22,557,634	24,419,564	Coal	15,973,147	18,587,398	17,130,133	15,276,819
5	Fuels, Mineral Oils & Products	13,498,717	20,792,704	20,802,549	21,152,414	Petroleum Coke	6,755,283	5,869,589	8,591,962	6,866,364
6	Soybean meal	12,205,169	12,109,273	11,121,437	9,209,580	Wheat	6,590,106	5,535,404	5,366,825	4,915,671
7	Steel Products	7,063,555	8,703,263	10,073,539	7,150,766	SulFur, soils, lime, plaster	4,003,272	3,998,491	3,428,351	2,828,944
8	Corn	25,278,771	21,148,224	9,175,367	10,614,181	Inorganic chemical Products	2,885,791	2,673,625	2,766,182	2,572,125
9	Alumina	7,126,123	8,703,263	7,289,991	6,337,264	Caustic Soda	2,284,664	2,914,505	2,683,181	2,147,414
10	Bauxite	8,229,826	8,703,263	6,518,796	6,226,637	Steel	2,308,011	2,262,988	2,258,918	3,322,210
	SUB-TOTAL	502,095,111	497,389,200	480,694,989	452,204,031	SUB-TOTAL	142,333,875	132,973,054	131,178,207	118,608,535
	Other	30,696,665	28,042,365	34,044,979	37,389,612	Other	10,718,047	11,849,067	12,169,271	8,190,971
	T O T A L EXPORTS	532,791,776	525,431,565	514,739,968	489,593,643	T O T A L IMPORTS	153,051,922	144,822,121	143,347,478	126,799,506

Source: ANTAQ

Retrieved from: AMERICAN ASSOCIATION OF PORT AUTHORITIES. Port Industry Statistics [Online]. Accessed on Jul 5, 2015. Available on: <http://aapa.files.cms-plus.com/Statistics/Brazilian%20Seaborne%20Trade%202013%20Top%20Cargos.pdf>

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Appendix 16: Brazilian Port Rankings 2013 by Cargo Type in Metric Tons

Rank	DRY BULK		LIQUID BULK		BREAKBULK		CONTAINERIZED		TOTAL TONS	
	PORT	TONS	PORT	TONS	PORT	TONS	PORT	TONS	PORT	TONS
1	TUP CVRD Tubarão	109,693	TUP Almirante Barroso	52,808	TUP Portocel	8,585	Santos	33,777	TUP CVRD Tubarão	110,480
2	TUP Ponta da Madeira	107,328	TUP Almirante Maximiano Fonseca	25,797	TUP Praia Mole	4,734	Paranaguá	7,902	TUP Ponta Da Madeira	107,328
3	Itaguaí	53,824	TUP Madre de Deus	22,698	Santos	4,259	TUP Portonave	7,569	Santos	99,808
4	Santos	49,383	TUP Almirante Tamandaré (Ilha D'Água)	15,154	TUP Terminal Portuário TKCSA	3,351	Rio Grande	6,427	Itaguaí	58,328
5	TUP MBR	39,758	TUP Almirante Soares Dutra	14,633	São Francisco do Sul	2,797	TUP Porto Itapoá	5,646	TUP Almirante Barroso	52,808
6	Paranaguá	30,290	Santos	12,389	Rio De Janeiro	1,825	Rio de Janeiro	5,522	Paranaguá	41,912
7	TUP Ponta de Ubu	22,595	TUP São Francisco do Sul	10,360	TUP Fibria	1,606	Suape	4,482	TUP MBR	39,758
8	TUP Porto Trombetas	17,482	Suape	7,332	TUP Marítimo de Belmonte	1,048	Itaguaí	4,450	TUP Almirante Maximiano Fonseca	25,797
9	TUP Alumar	11,995	Itaqui	6,993	TUP Bertolini Belém	1,033	Itajaí	4,109	TUP Madre de Deus	22,698
10	Vila do Conde	11,348	TUP Manaus	5,297	TUP Pecém	1,003	TUP Chibatão	3,327	TUP Ponta De Ubu	22,683
11	TUP CVRD Praia Mole	9,576	Aratu	4,218	TUP J.F de Oliveira Belém	960	Salvador	3,264	Rio Grande	20,535
12	Rio Grande	9,576	Rio Grande	3,792	Paranaguá	945	VITÓRIA	2,270	TUP Porto Trombetas	17,482
13	São Francisco do Sul	9,352	Tup Guamaré	3,096	TUP Chibatão 2	814	TUP Super Terminals	2,221	Itaqui	15,292
14	Itaqui	8,077	TUP de GNL da Baía de Guanabara	3,065	TUP Ibepar Manaus	788	TUP Embraport	2,050	TUP Almirante Tamandaré (Ilha D'Água)	15,154
15	TUP Aracruz Guaíba	6,180	Paranaguá	2,775	TUP Santa Clara	779	TUP Pecém	1,701	TUP Almirante Soares Dutra	14,633
	Top 15	496,458	Top 15	190,408	Top 15	34,527	Top 15	94,719	Top 15	664,697
	Other	72,650	Other	29,523	Other	9,461	Other	3,300	Other	266,348
	Total Dry Bulk	569,107	TOTAL LIQUID BULK	219,931	TOTAL BREAKBULK	43,988	TOTAL CONTAINERIZED	98,019	TOTAL CARGO	931,045

Source: ANTAQ

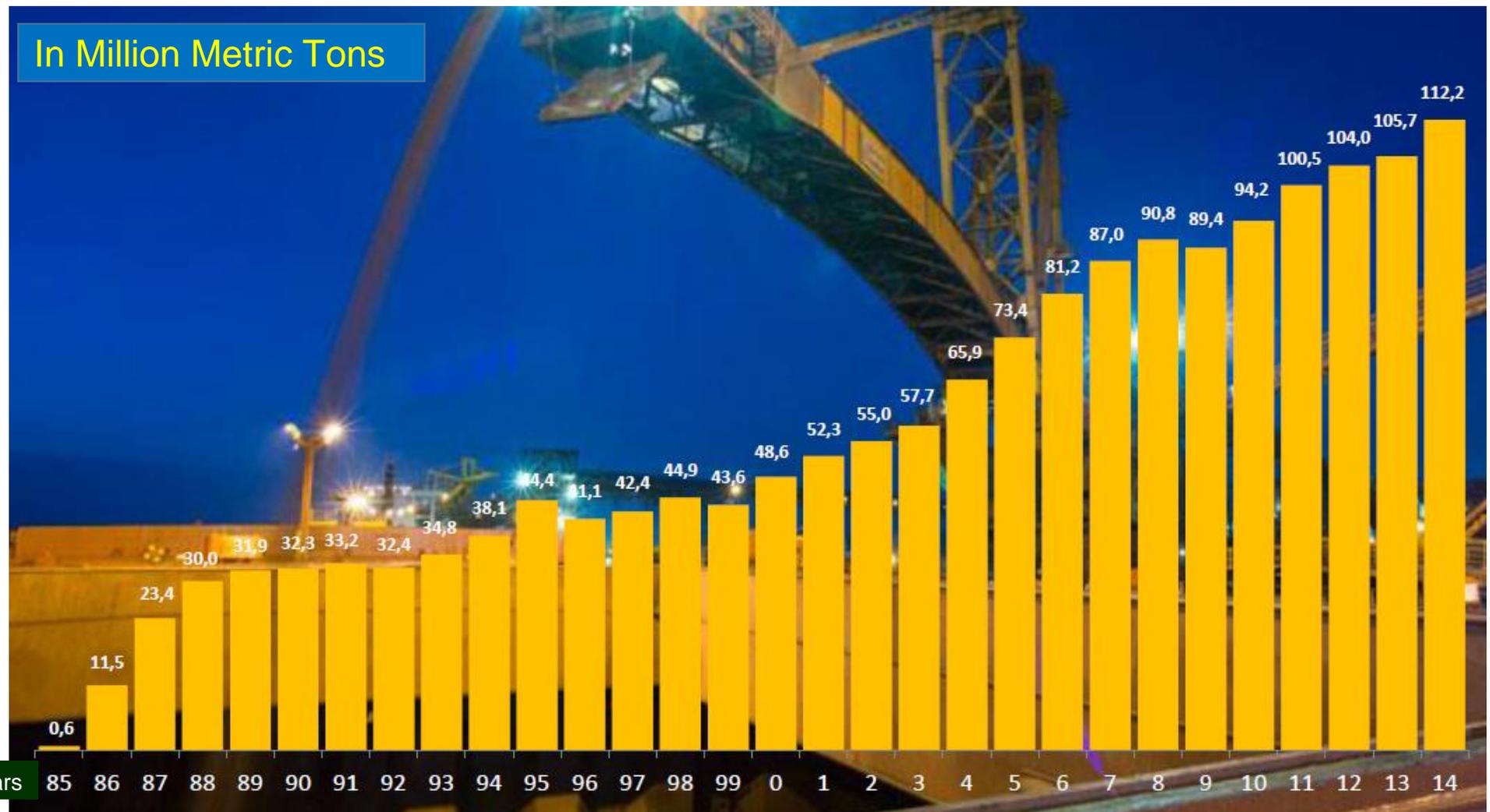
Retrieved from: AMERICAN ASSOCIATION OF PORT AUTHORITIES. Port Industry Statistics [Online]. Accessed on Jul 4, 2015. Available on:

<http://aapa.files.cms-plus.com/Statistics/Brazil%20Ports%202013%20Ranked%20by%20Cargo%20Volume.pdf>

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Appendix 17: Iron Ore loading evolution at PDM



Source: Vale 2015. Retrieved from: VALE. Terminal Marítimo da Ponta da Madeira – Apresentação Institucional [PDF file]. São Luís-Brazil 2015. Bachelor Thesis Interview. Sent by email from Vale Operations Team

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Appendix 18: Vale's Iron Ore Process in the Northeast System

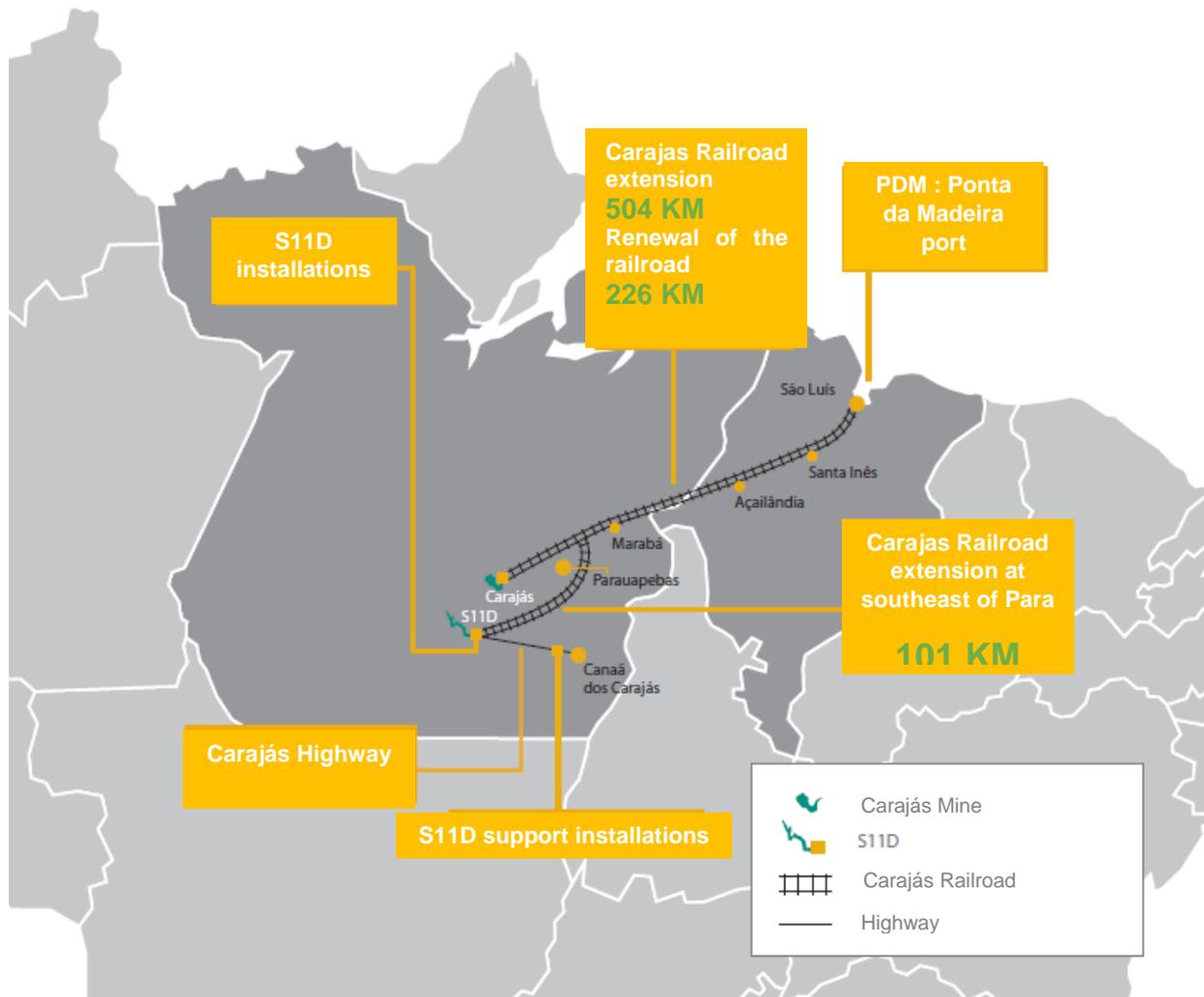


Source: Vale. Carajás Infographics [Online]. Accessed on Jul 25, 2015. Available on: <http://www.vale.com/PT/business/mining/iron-ore-pellets/Documents/carajas/index.html>

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Appendix 19: The Carajas Mine Complex



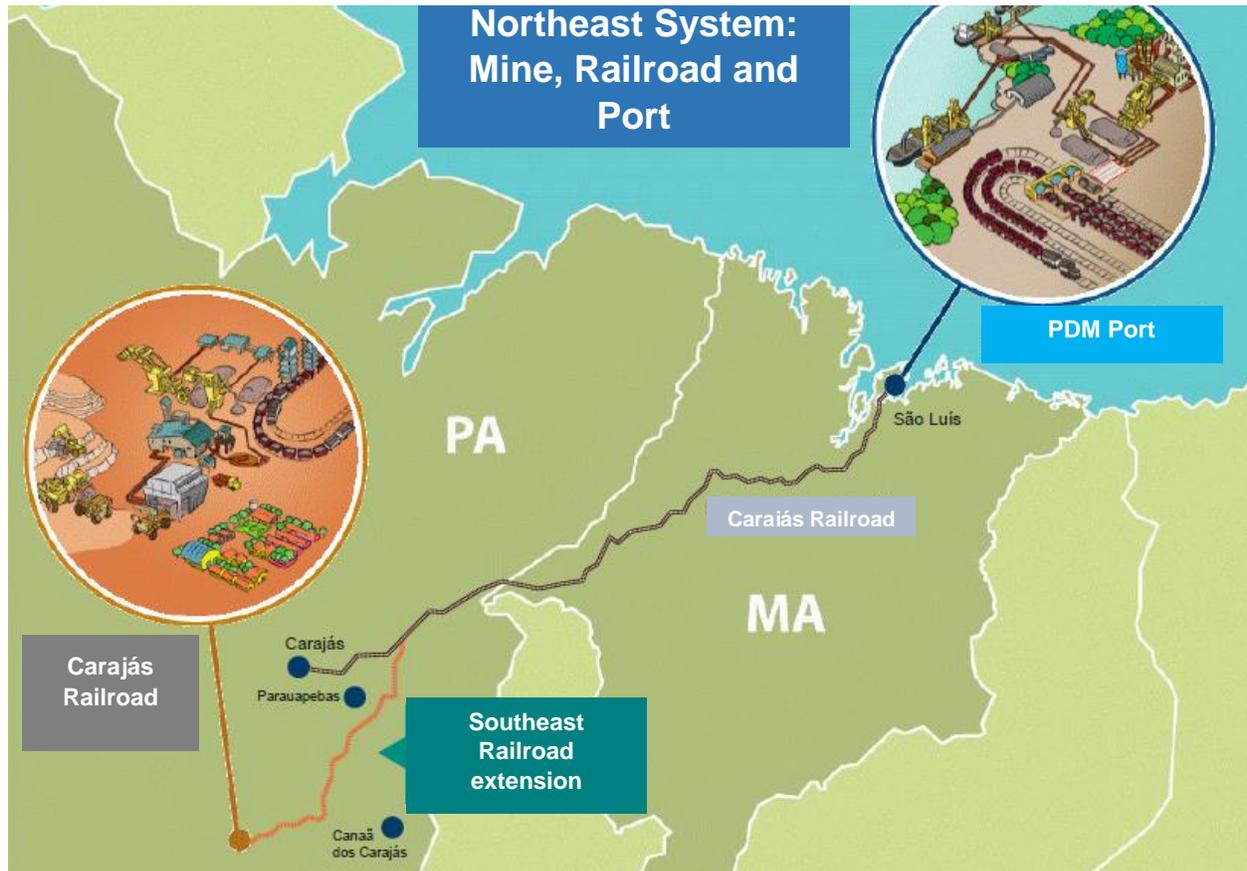
Source: Vale.

Retrieved from: VALE. Vale Projeto Carajás [PDF file]. Aug 2013. Bachelor Thesis Interview. Sent by email from Vale Operations Team

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Appendix 20: Railroad Extension-Southeast of Para



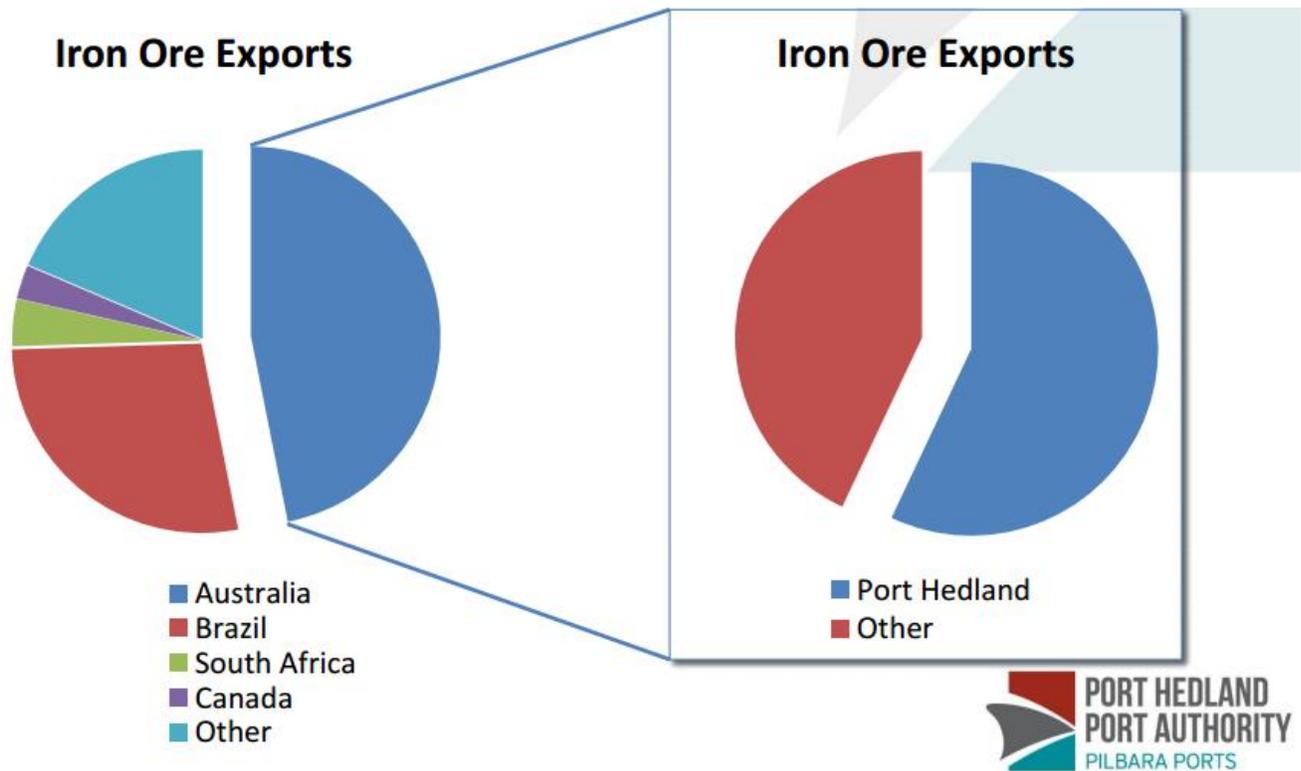
Source: Vale 2015.

Retrieved from: VALE. Terminal Marítimo da Ponta da Madeira – Apresentação Institucional [PDF file]. São Luís-Brazil 2015. Bachelor Thesis Interview. Sent by email from Vale Operations Team

Vale: How to improve its competitive advantage to export Iron Ore via the Brazilian Maritime Terminal of Ponta da Madeira, through the enhancement of its infrastructure and processes?

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Appendix 21: Port Hedland, the largest bulk export port



Source: BREE; Bloomberg; UNCTAD. Retrieved from Port Hedland Port Authority

Retrieved from: AMSA. Facilitating Growth and Optimising Operations at Port Hedland [Online]. Accessed on Jul 13, 2015. Available on: http://www.amsa.gov.au/seafarers_welfare/documents/6-pt-hedland-growth-ship-issues.pdf

Appendix 22: (1st Interview) Interview with a Top Executive from Vale in China and Brazil

Author Introduction:

This Bachelor Project is about how Vale and how to improve its competitiveness to export Iron Ore via the Brazilian Ponta da Madeira Maritime Terminal, through the enhancement of its infrastructure and processes. Vale has an excellent productivity capacity but on the last months, there was an expressive drop in the Iron Ore prices what makes Vales to struggle in its competitive with BHP and Rio Tinto. Recently you gave an interview in China where you stated the importance of Valemax?

Interviewed: Valemax

The Iron Ore market return is very low in terms of price and volume. Unlikely gold which only a small bar can make a good profit, Iron Ore price is very low, so to make profit its needed to export a huge quantity. In the case of the Iron Ore, its location is very important in terms of logistics to be competitive to deliver it to customers, in this case China, is much closer to Vale's competitors and the Iron Ore price today is US\$ 70/Ton (Price on Jan 15, 2015).

The Valemax – 400K Ton, are the largest bulk carriers. Vale made it to get competitive advantage to deliver among its main competitors (Rio Tinto and BHP), since its competitors are closer to China (Australians), the main Iron Ore consumer and one of the prices drivers. These ships have 23 meters deep and he said it has Freight USD 20/Ton; before the Valemax, the capsize ships had freight at USD 26/Ton. He also mentioned of the importance of the drop in the Oil prices for Vale since the fuel is cheaper what makes them to get competitive advantage through its large vessels, actually Vale was reported as the lowest-cost producer of iron ore this week as the downtrend in oil prices cut shipping costs.

Interviewed: Distribution Center in Malaysia

Ponta da Madeira and Tubarão ports were tailored made to receive these ships/Valemax. China had some issues to receive these ships but it will approve 10 ports to receive these ships in the future. The "Competitive Advantage" can be achieved through these large ships and through a new distribution center that Vale made in Malaysia¹⁶⁸. In this country, Vale distributes its Iron Ore shipments into smaller ships to deliver its cargo in the ports that cannot accept the large vessels and on the same time to mix the Iron Ore in order to get a better quality, because Vale produces Iron Ore with different qualities and mixing it makes a better product. Vale prefers to do it in Asia or close to its customers in order to optimize its ports handling processes.

Author: Recently Brazil had corruption scandals with Petrobras, the Brazilian oil company and its suppliers what was “the largest corruption scandal in the world”, or around 500 billion USD stolen. Does Vale has any issue with these suppliers?

Interviewed: Corruption

The point is Vale has the same Petrobras suppliers what can make its price to be higher or lose competitive advantage over its competitors. There are projects to expand Vale operations in its ports with these same suppliers what can increase Vales liabilities due to its supplier’s unfair high prices.

Author: What are the benchmarks for Iron Ore ports?

Interviewed: Benchmarks/ Logistical and key issues to explore

The loading process in the ports are pretty much the same in terms of efficiency, having the same speed. The port of Ponta da Madeira is the faster in the world to load Iron Ore, but there are some ports in China, Majishan, Dongjiakou, Fujian, which “Unload” as almost fast as Vale does with the Loading process. However, the ”Unloading” process is much more difficult compared to Loading.

Interviewed: Environmental/Legal

It is the main vale issue today because of the Brazilian bureaucracy and recent changes in its environmental laws. There are some “uncertainties” in the new Mining Code, what made the ports expansions more complicated due to these “not clear” legislations. Its tough to get the environmental licenses to operate since these ports are private or belongs to Vale and needs the Brazilian government approval to expand and once again, bureaucracy in an issue that can impacts Vale’s investments to enhance its ports.

Interviewed: Rails

There are projects to expand the Carajás railroad that connects Vale’s Carajás mine in the Brazilian state of Para to the port of Ponta da Madeira, called “North System” which is made of Mine-Rail-Port of Ponta da Madeira. Vale is making a “Double-Track rail system” in order to avoid “Wait” periods by the trains what can reduce its delivery time in its access.

Author: Could you please give me some figures about the Iron Ore ports?

Interviewed: Key Figures:

Port of Ponta da Madeira 120 MT of Iron Ore Volume per year

Port of Tubarão 110 MT of Iron Ore Volume per year

Author: What are your projects for the next 5 years?

Interviewed:

Close to the port of Ponta da Madeira, Vale is expanding the Mine of Carajás, a “Green Field”, 80 km from the existent mine, where they will connect it with the existent rail, making a Double-Track in order to avoid waste of energy to “wait” for the trains to manouvre to get pass. Through these changes it will go from the current 120 Million Ton of iron Ore Volume per year to 230 MT, what makes it the largest Vale project expansion (totally connected to the Port of Ponta da Madeira.

***The Interviewed requested privacy regarding its identification.**

Appendix 23: (2nd Interview) Interview with a Senior Executive from Vale Operations at Maritime Terminal of Ponta da Madeira (PDM)

Author Introduction:

I am doing a Bachelor Thesis in Switzerland at "Business Administration, Major in Commodities" in the prestigious University of Applied Sciences of Western Switzerland, about "Vale: How to improve its competitive advantage to export Iron Ore via the Brazilian Ponta da Madeira Maritime Terminal, through the enhancement of its infrastructure and processes?".

I had the privilege to talk with Vale Switzerland (ST-Prex) and Brazil (Rio) and would like to have the opportunity to talk with Vale Maranhão as well about the Maritime terminal of Ponta da Madeira. These informations are for academic use only. I am Brazilian and proud of Vale and what this company represents in Brazil and overseas that is why I decided to do this thesis about the Brazilian mining giant Vale.

Interviewed:

Could you please send your questions by email?

Author: Yes, indeed. Here are my questions:

Author: The history of the port? I know it started its activities in 1986 soon after the beginning of the Carajás mine activities. I would like to understand why the Maranhão state was chose instead of Para state where the mine is located.

Interviewed:

Please find as attachment two PDF's file from Vale called Chapter 6, and Chapter 7, Vale 70 years. This is part of the book "Vale-Our history" and tells us the history of Vale, including the port history and concept.

Author: Could you provide the Layout of the Maritime Terminal of Ponta da Madeira? Drawings, photos, piers and berths specifications?

Interviewed:

Find as attachment a PDF from vale Maranhão that presents the port. It is called "Vale, Institutional Presentation".

Author: How many piers and berths you have?

Interviewed:

There are 3 Piers. Pier I, Pier III and Pier IV. The Pier II was the Berth n° 105 from the Port of Itaqui, but this Pier is no longer exclusive for Vale since it was a leasehold contract and the contract is terminated.

Nowadays other parties operate in the Pier II where it exports soybeans, corn and pig iron. Vale also uses this pier to export other commodities but it is no longer linked with the Maritime terminal of Ponta da Madeira.

Author: Is there studies to build up the berth V?

Interviewed:

No Information about it.

Author: How many Iron Ore stockyards you have?

Interviewed:

There are 11 stockyards with 8,8 MT storage capacity.

Author: Is there silos to store grains to be exported by third parties?

Interviewed:

There are 5 silos and 2 warehouses to store grain from third parties. However, these commodities are exported through the Berth 105 from the Port of Itaqui (former Pier II from Vale), which is linked to the Maritime terminal of Ponta da Madeira through conveyer belt.

Author: Could you please provide me information's about the future expansion projects of the port?

Interviewed:

Check the file "Vale, Institutional Presentation" and look for "S11D project".

Author: Could you please provide me data from the Carajás mine and how the Carajás railroad operate?

Interviewed:

Check the file from Vale called V+ 70th edition, which shows step by step our business.

*** Interviewed files sent:**

- Vale Maranhão Report (This is an anual report about the achievements of the company in that state)
- “Vale, Institutional Presentation” (This is an institutional presentation about the Maritime Terminal of Ponta da Madeira).
- V+ 73 Years of excellence (This is a commemorative magazine of Vale)
- Vale. Carajás S11D Iron Project

***The Interviewed requested privacy regarding its identification.**

Appendix 24: (3rd Interview) Interview with Mr. Jorge Lúcio de Carvalho Pinto, a Journalist from ANTAQ (Brazilian Maritime Agency)

Interviewed Contact Details:

Jorge Lúcio de Carvalho Pinto
Agência Nacional de Transportes Aquaviários (ANTAQ)
Assessoria de Comunicação Social (ASC)
SEPN - Quadra 514 - Conjunto "E" - 1º andar - Edifício ANTAQ CEP-70760-545 - Brasília/DF - Tel.: (61) 2029-6521

Author Introduction:

I am doing a Bachelor Thesis in Switzerland at "Business Administration, Major in Commodities" in the prestigious University of Applied Sciences of Western Switzerland, about "Vale: How to improve its competitive advantage to export Iron Ore via the Brazilian Ponta da Madeira Maritime Terminal, through the enhancement of its infrastructure and processes?"

Author: Could you please confirm how many ports Brazil has and which are administered by ANTAQ?

Mr. Jorge Lúcio: ANTAQ has 34 public ports because it considers only those that are moving cargos currently.

Author: The ANTAQ is subordinated to the Ministry of Transports or to the Secretariat of Ports?

Mr. Jorge Lúcio: ANTAQ is linked to the Secretariat of Ports.

Author: Could you please provide me public and private data about the ports movements between 2013 and 2014?

Mr. Jorge Lúcio: You can find data in the ANTAQ website in our statistics under the section "Anuário": <http://www.antaq.gov.br/anuario/>

Author: How does the Brazilian Ports works? What are their main challenges today?

Mr. Jorge Lúcio: The Brazilian Port System is the Land Lord type, existent in most of the countries. It is defined as that system where the infrastructure belongs to the government, which is the one who gives the power to exploit by the private sector. There are two types of ports in Brazil, the Public Ports and the Private ports (from the Portuguese TUP or Maritime Terminals). The authorization given by the government (ANTAQ) to exploit the Private Ports last 25 years, but can be extended for two consecutive periods of 75 years.

Nowadays the Brazilian ports have Dredging problems because the vessels are becoming bigger to face logistics constraints. Ports accesses (road and ocean) and the fact that the ports are inside big cities make the situation worse since the trucks have to share space with the cities locals. This is the case in Santos, Rio de Janeiro, Recife, etc.

Vale: How to improve its competitive advantage to export Iron Ore via the Brazilian Maritime Terminal of Ponta da Madeira, through the enhancement of its infrastructure and processes?

TAVARES, Erisvelton

Appendix 25: (4th Interview) Interview with Mrs. Luciana Kuzolitz, New Business Manager at Port of Itaqui

Interviewed Contact Details:

Luciana Ferreira Kuzolitz

Gerente de Novos Negócios

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Author Introduction:

I am doing a Bachelor Thesis in Switzerland at "Business Administration, Major in Commodities" in the prestigious University of Applied Sciences of Western Switzerland, about "Vale: How to improve its competitive advantage to export Iron Ore via the Brazilian Ponta da Madeira Maritime Terminal, through the enhancement of its infrastructure and processes?".

Author: I would like to know the relation between the Port of Itaqui and the two TUP's (Maritime Terminals of Private Use) existents in the port of Itaqui Complex. How does it works? Could you please provide me some figures about the Port Complex cargo movements?

Mrs. Luciana Kuzolitz: The Complex of the Porto of Itaqui is composed of 3 large ports: Ponta da Madeira (belongs to Vale), Port of Itaqui (public port) and Maritime Terminal of Alumar (belongs to Consortium Alumar). You can find cargo movements in the ANTAQ website.

PS: Mrs. Luciana Kuzolitz kindly collaborated to this Bachelor Project with website links, maps and pictures about the Complex of Itaqui.

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