GOVERNO DO PARÁ

SEICOM (Secretaria de Estado de Indústria, Comércio e Mineração - State Department of Industry, Commerce and Mining)

Mining Plan of

Pará State

2014-2030

MINISTRY OF MINES AND ENERGY

Minister
Edison Lobão

Secretary of Geology, Mining and Mineral Processing
Carlos Nogueira da Costa Júnior

PARÁ STATE GOVERNMENT

Governor
Simão Jatene

Deputy Governor
Helenilson Cunha Pontes

SEDIP - Special Secretary for Economic Development and Production Incentive
David Araújo Leal

SEICOM - State Secretary for the Industry, Commerce and Mining
Maria Amélia Enriquez

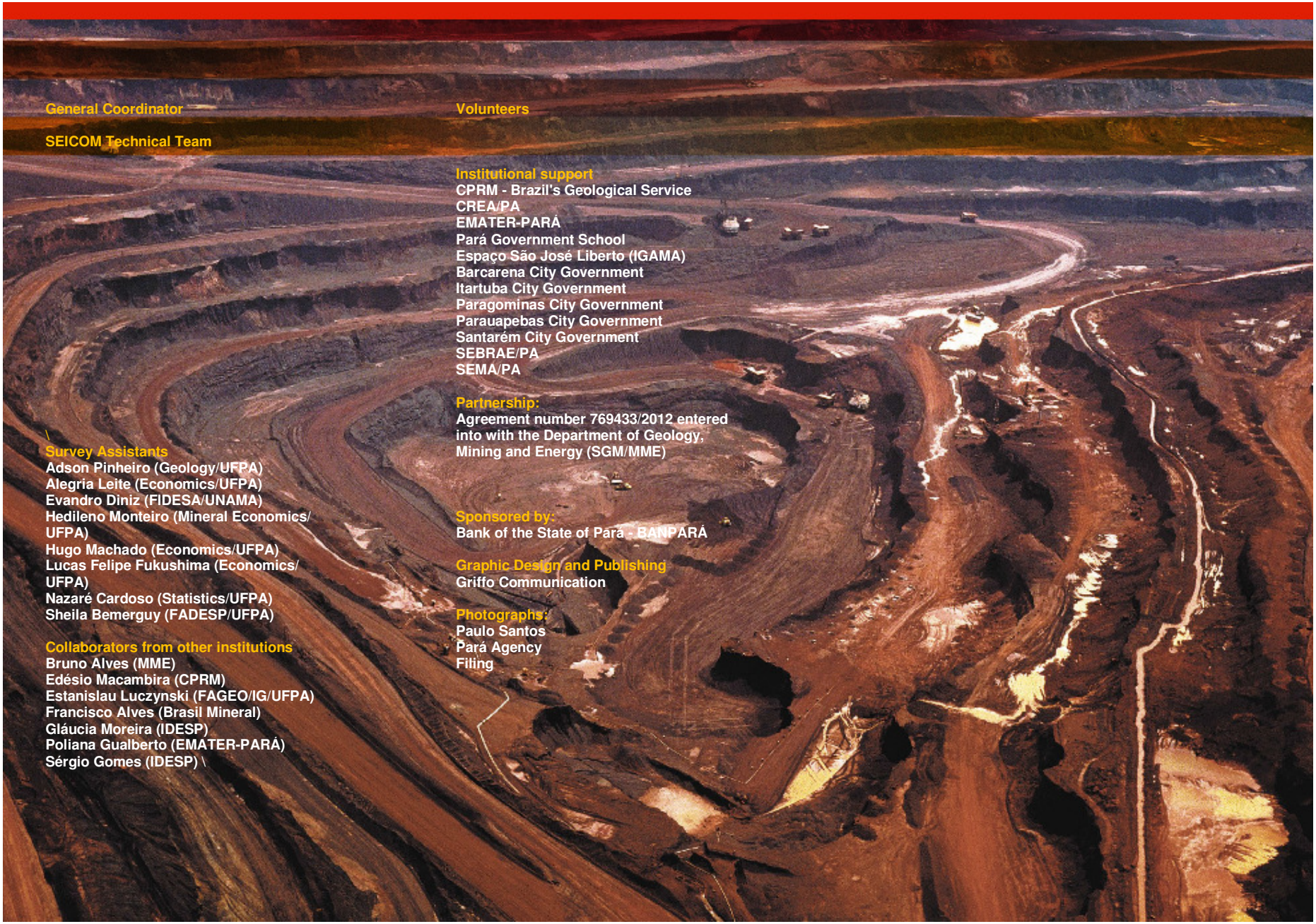
SEICOM - Special Secretary for the Industry, Commerce and Mining
Rodrigo Garcia

DIGEM/SEICOM - Director of Geology, Mining and Mineral Processing
Ambrózio Hajime Ichihara

DDI/SEICOM - Director of Industry Development
Lucélia Guedes

DICS/SEICOM - Director of Commerce and Service
Airton Lisboa

SECOP/SEICOM - Operating Department of Incentive Policies
Marília Amorim



General Coordinator

SEICOM Technical Team

Survey Assistants
Adson Pinheiro (Geology/UFPA)
Alegria Leite (Economics/UFPA)
Evandro Diniz (FIDESA/UNAMA)
Hedileno Monteiro (Mineral Economics/ UFPA)
Hugo Machado (Economics/UFPA)
Lucas Felipe Fukushima (Economics/ UFPA)
Nazaré Cardoso (Statistics/UFPA)
Sheila Bemerguy (FADESP/UFPA)

Collaborators from other institutions
Bruno Alves (MME)
Edésio Macambira (CPRM)
Estanislau Luczynski (FAGEO/IG/UFPA)
Francisco Alves (Brasil Mineral)
Gláucia Moreira (IDESP)
Poliana Gualberto (EMATER-PARÁ)
Sérgio Gomes (IDESP)

Volunteers

Institutional support
CPRM - Brazil's Geological Service
CREA/PA
EMATER-PARÁ
Pará Government School
Espaço São José Liberto (IGAMA)
Barcarena City Government
Itartuba City Government
Paragominas City Government
Parauapebas City Government
Santarém City Government
SEBRAE/PA
SEMA/PA

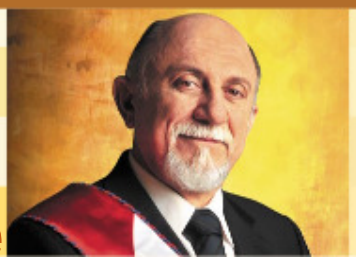
Partnership:
Agreement number 769433/2012 entered into with the Department of Geology, Mining and Energy (SGM/MME)

Sponsored by:
Bank of the State of Pará - BANPARÁ

Graphic Design and Publishing
Griffo Communication

Photographs:
Paulo Santos
Pará Agency
Filing

Message



GOVERNOR
OF PARÁ STATE
SIMÃO JATENE

As a public servant, but mainly as a son of this State, it is with great pleasure that I introduce the first Mining Plan of Pará State, covering activities until 2030.

The mining sector already accounts for more than 26% of Pará's GDP and around 90% of our exports. These exports guarantee the country the revenues that are indispensable to the balance of national accounts. However, this has occurred at the expense of the state's finances - twenty years ago, we exported around one billion dollars, and mining accounted for 16% of the state's ICMS (Sales Tax). Today, we export 13 billion dollars and this share has increased to 3 %, since the external sale of commodities is exempt from ICMS tax.

That is why it is unacceptable to allow our state to continue to be a major exporter of unprocessed minerals. Besides that, since minerals are an exhaustible resource, mining cannot avoid contributing more strongly to local governments in order to serve as a platform for new investments that will help diversify the regional supply chains and provide greater support to the state's economy in the future.

We need to convert this fantastic mineral potential into effective means of reducing the still high levels of poverty in Pará State, because I believe that the greatest wealth of this state is its people. But we must not forget that it will be just as challenging, or even more challenging, to redress the inequalities that lie at the root of most social problems we face in everyday life.

We have lived with large-scale mining for over three decades and this experience shows that, in order to add value to minerals, maximize the benefits and reduce negative externalities, the "visible hand " of public policies is needed to point to alternative paths that can be followed.

It should be remembered, as the Plan shows, that we still live with illegal and uncontrolled mining, and this has a negative impact on ecosystems and people's lives. For this type of mining, which lacks formalization and regulation, it is essential to have public policies that can convert it into a local and regional development factor, in all its dimensions.

We believe that companies in the mining sector should be leading partners in this mission, which is to develop our state without destroying it. And, for that matter, the large-scale mineral industry in the State of Pará has shown that it is possible to coexist in a healthy way with the environment, by adopting sustainable principles, which comprise to produce & preserve and to preserve & produce.

Finally, this Plan invites companies to make a pact for the construction of a State that has an abundant supply of natural wealth and which is generous in the distribution of benefits, in order to promote the development of the economy, with respect for the environment and with the distribution of the real gains to the majority of the society.

In the next 20 years, Pará will certainly have the largest mineral GDP in Brazil, and that is why we are under the obligation to transform the mineral riches into wealth for Pará, and to invert the logic of mineral exploration, which is now destined for other countries, for the vertical integration and industrialization within the State. I would say that this is the biggest challenge to be overcome, whether we are government employees or citizens of Pará State: to transform Pará's ore into wealth and wellbeing for the people of Pará!

Simão Jatene

Message

SPECIAL SECRETARY OF
ECONOMIC DEVELOPMENT AND PRODUCTION STIMULUS

DAVID ARAÚJO LEAL

On the threshold of a new perspective of development in the State of Pará, mining plays a role of great economic importance in the construction of this scenario, as we have already contributed with nearly one third of Brazil's mining GDP. Pará is a mining state and that can be measured by the significant share of mining both in the State's GDP (and exports) and the domestic and foreign markets, but this potential is still not sufficiently known by the majority of its population.

The 1960s was the decade when Pará started to become part of the history of Brazilian mining. From that time until 2013, many discoveries were made, mines were explored, positive and negative socioeconomic effects were produced and, mainly, the lives of thousands of people were changed because of the mining activity. The primary goal of mining shall be the sustained economic and social development, and that is the path that must be trodden by SEICOM (State Department for the Industry, Commerce and Mining).

It is worth noting that the Plan considers the mineral sector in all its stages, from survey and exploration to extraction, beneficiation and processing of minerals. It brings a realistic view of the present and clear guidelines about the future, based on this mineral potential. It is, therefore, a strategic tool that can be used to enforce the provisions contained in article 245 of the State Constitution, especially with respect to the internalization of positive effects generated by the exploration of the State's mineral and water resources.

Due to the current situation of our state, we can no longer allow our State to be only an exporter of mineral commodities. We must go much farther. We must take a close look at past problems, in order to advance in the present, with objective actions aimed at reducing social disparities between mining and non-mining municipalities, thereby internalizing the positive impacts for the whole region where the activities are performed.

The Government of the State of Pará intends to increase its capacity to manage all stages of the mining process. For SEDIP, this industry is way too important, so the State cannot just passively watch the unfolding of events, allowing only companies and the Federal Government to make all the decisions. Therefore, with this Plan, we believe that we can advance a lot towards the democratization of mining as a tool for the development of our state and region.

I wish you all a great job!

David Leal

Summary

Mining in Pará is undergoing a period of expansion and there is the prospect of strong growth in the coming years. Pará is the second largest mining state in Brazil. Its exports of minerals and metals, due to the excellent quality and quantity of its mines, guarantee the country the revenues that are necessary to ensure the country's macro-economic balance. In the second decade of this century, Pará will house the largest iron ore mine in the world - S11 D, which will begin extracting 90 million tons, plus 20 new implementation and expansion projects, with investments of R$ 68 billion by 2017, with the potential to create 48,000 new jobs. Between 2010 and 2030, the exports of minerals and metals will increase from 116 to 300 million tons.

	1990	2010	2030 (ESTIMATED)
GDP %	2,6	26,3	**35**
EXPORTS %	74 (US$ 1.1 billion - 38 Mt)	87 (US$ 13 billion -116 Mt)	**+ 90 (US$30 billion, 300 Mt)**
TAX %	16	extraction 3.7 processing 1.9	**extraction 1.5 processing 1.7**
JOBS %	3,6	extraction 1.5 processing 2.0	**extraction 2.8 processing 3.1**
MINES	less than 50	171	**230**
MINING MUNICIPALITIES	about 15	55	**80**

In 2012, Pará exported US$ 13 billion, while 20 years ago, it exported US$ 1.1 billion and the projection for 2030 is of at least US$ 30 billion. In 1990, less than 20 municipalities housed mines in Pará. Today, there are 55 municipalities that have mines and, for 2030, the forecast is that there will be more than 80 municipalities in the state with formal mining activities. One interesting fact is that the share in GDP, which was of 2.6% in 1990, increased to 26.3% in 2010, and it is expected to reach 35% in 2030, while the ICMS tax revenues (from mineral extraction) in this period fell from 16% to 3.7% and they are expected to be of only 1.5% in 2030, due to the tax exemptions resulting from the Kandir Law.

In addition, we shall not forget that the ore is a local exhaustible resource, which means that eventually it will run out. This is especially true for large mines that every day, with the introduction of new technologies, increase the scale of production, thereby reducing their lifespan. That demonstrates the strategic importance of first Mineral Plan of Pará State (PEM-2030), whose purpose is:

To serve as a planning tool for good management of mineral resources, based on sustainable use and on the addition of value to minerals and the territory, with the purpose of promoting competitiveness and combating poverty and inequality in Pará, through the creation of jobs and income and the multiplication of opportunities.

This intense activity resonates with spaces and dimensions that go far beyond the site of extraction, extending to the region, state, country and, mainly, the world.

GLOBAL	NATIONAL	STATE	LOCAL
• Supply to foreign industry • Competitiveness of players • Market for technologies • International Stock Exchanges	• Balance of Payments • Monetary Balance • Supply to the Industry	• TFRM (Taxa de Controle, Acompanhamento e Fiscalização das Atividades de Pesquisa, Lavra, Extração, Transporte e de Aproveitamento de Recursos Minerários = Controlling, Monitoring and Supervision Tax related to the Survey, Production, Extraction, Transportation and Beneficiation of Mineral Resources) and CFEM (Compensação Financeira pela Exploração de Recursos Minerais = Financial Compensation for Exploiting Mineral Resources) installments • Demands for Government Services • Inequalities Between Municipalities	• CFEM and other revenues from mining • Positive and negative externalities

Due to its importance, it is understood that mining can contribute more decisively towards the development of Pará State. However, this is not a natural consequence. It requires public policies to:

- Stimulate the consolidation of the mineral-based supply chains;
- Expand the number of local companies in the supply chain;
- To ensure demands and resources for strengthening and diversifying the production;
- Promote, directly or indirectly, the development of territories affected by mining activities;
- Involve mining entities in the context of the State's social and environmental responsibility;
- Leverage and properly use the mineral revenues;
- Promote greater interaction between mining activities and traditional activities of the State, in order to strengthen the local and regional capacity, thereby ensuring the productive inclusion, among others;

In order to allow the achievement of such objectives, the PEM-2030 brings a clear definition of the State's priorities, axes of operation, strategies and actions, because it has been demonstrate that there is an increase in the efficiency, efficacy and effectiveness of policies when there are clear goals to be pursued, because it is possible to avoid waste, to concentrate efforts and to ensure the synergy required for implementing the proposed initiatives.

mining, including the four classic dimensions of sustainability: environment, society, market and governance.	**QUALITY PUBLIC** GOVERNANCE	**REGIONAL DEVELOPMENT BASED ON MINING**	**ENVIRONMENT:** ENVIRONMENTAL SUSTAINABILITY
		SOCIETY: COMMITMENT TO THE FIGHT AGAINST POVERTY AND INEQUALITY	

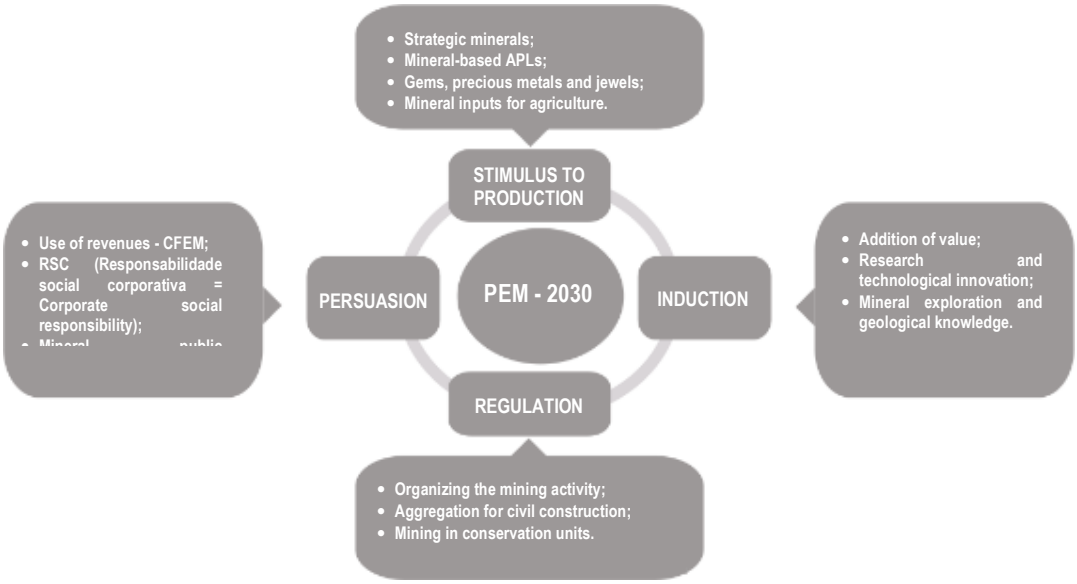
Executive Summary

PEM-2030 establishes three guidelines:

1)**Consensus**	existence of minimal understanding of complex issues;
2)**Cooperation**	intra and inter-institutional, inter-sector and intergovernmental
3)**Commitment**	to ensure the development of Pará through the exploitation of its mineral base.

PEM 2030 has been prepared by many hands, that is, by a large and diverse group of professionals and representatives of the society. And it results from a participatory process structured in 13 workshops and three consolidation seminars, attended by 1,300 representatives of 244 organizations, including government agencies (101), private sector (70), education, research and CT&I institutions (20), plus entities that represent the civil society (53). Specific studies and diagnoses are also part of the methodology of PEM-2030.

PEM 2030 indicates the strategies, actions and programs that are necessary for implementing Pará's mineral policy.



PEM-2030 will be implemented by the SEICOM team, who will appoint a Steering Committee for the Plan. The programs, projects and actions will be implemented through partnerships with various institutions, through technical cooperation agreements. The achievement of future goals will be ensured through the work of an Executive Group and a Monitoring Group. For that, it will guarantee a percentage of the CFEM resources that shall necessarily be used to implement the policies of this PEM-2030. Finally, PEM-2030 will be transformed into State Law, to be used as an instrument of the State Mining Policy, with a view to the fulfillment of the provisions of Pará State's Constitution.

PEM-2030 is addressed to:

- Public managers at all levels of government.
- Business managers.
- Segments of society affected by mining activities.
- Non-governmental organizations.
- Teachers, members of the Academia, extension workers and researchers.
- Professionals that work in mineral and social-environmental areas.
- Investors interested in learning about the business environment and opportunities resulting from mining and mineral processing.
- Opinion-makers; among others.

Executiv

PRESENTATION **16**

MINING PLAN OF PARÁ STATE 2030 ..... **19**

1. CONTEXT OF MINING IN THE STATE OF PARÁ **22**

1.1 MINERAL SURVEY 24
1.2 MINERAL RESERVES 25
1.3 MINERAL MINING - MINING INDUSTRY 26
1.4 MINERAL PROCESSING 27
1.5 MINERAL PRODUCTION 27
1.6 EXPORTS OF MINERAL GOODS 29
1.7 TAXES AND COMPENSATION GENERATED BY THE MINERAL ACTIVITY 32
1.8 MINING JOBS AND ESTABLISHMENTS 36

2. INTERFACES OF MINING IN PARÁ - BETWEEN INFORMAL MINING AND THE CHALLENGE OF CONSOLIDATING INTEGRATED PRODUCTION CHAINS **42**

2.1 INFORMAL MINING 42
2.2 MINERAL PRODUCTION CHAINS OF PARÁ 50
2.2.1 Metallic Minerals *50*
2.2.2 Non-metallic minerals *65*

3 GROWTH TRENDS IN MINING AND MINERAL TRANSFORMATION **84**

3.1 FORECAST OF NEW INVESTMENTS 84
3.1.1 Investment in Mining (Mineral Extraction Industry) *84*
3.1.2 Investments in Mining Logistics *88*
3.1.3 Investment in Mineral Transformation *89*
3.1.3.1 Scenario of investments in processing, without ALPA 92
3.1.4 New investments and employment dynamics *92*
3.2 PRODUCTION ESTIMATE 94
3.2.1 Mining *94*
3.2.1.1 Metallic minerals 94
3.2.1.2 Non-metallic minerals 98
3.2.1.3 Gold and gems (gold and precious stones) *103*
3.2.2 Mineral Processing *104*
3.2.1.1 Metallic minerals 104
3.2.1.2 Non-metallic minerals 105
3.3 LABOUR IN THE MINERAL INDUSTRY 106
3.3.1 Labor in the mining of metallic products *107*
3.3.2 Labor in the mining of non-metallic products *109*
3.3.3 Labor in mineral processing *111*
3.3.4 Job creation summary *112*

4. FUTURE CONSTRAINTS **118**

4.1 DYNAMICS OF THE WORLD ECONOMY 120
4.2 DYNAMICS OF THE NATIONAL ECONOMY 122
4.3 QUALIFICATION LEVEL OF THE MANPOWER 124
4.4 COMPETITION IN THE INTERNATIONAL MARKET 125
4.5 INFRASTRUCTURE AND LOGISTICS 125
4.6 COST OF ENERGY 129
4.7 POLICIES IN FAVOR OF THE AGGLOMERATION ECONOMIES 130
4.8 POLICY ON SCIENCE, TECHNOLOGY AND INNOVATION FOR MINING 135
4.9 NEW REGULATORY FRAMEWORK OF MINING 136

4.10. TAX AND FISCAL POLICIES 136
4.11 SOCIAL DIMENSION 138
4.12 ENVIRONMENT - SUSTAINABILITY DIMENSION 139

5.0 PLAN - GOALS, POLICIES, STRATEGIES AND ACTIONS 146

5.1 OBJECTIVES AND GUIDELINES 146
5.2 STRATEGIES AND ACTIONS 147
5.2.1 Strategy 1 - Stimulus to Mineral Production Projects 150
5.2.2 Strategy 2 - Regulation of the Activity Mineral, Projects: 151
5.2.3 Strategy 3 - Induction to Mining Activities 152
5.2.4 Strategy 4 - Persuasion to mining activities, Project: 153

6. MECHANISMS AND INSTRUMENTS OF MINERAL POLICY - SGPEM (SISTEM FOR MANAGEMENT OF THE STATE MINING POLICY) 158

Presentation

STATE SECRETARY
FOR THE INDUSTRY, COMMERCE AND MINING
MARIA AMÉLIA ENRIQUEZ

The state of Pará covers 14.6% of the national territory, is home to 4% of the Brazilian population and is the second mining state in Brazil, surpassed only by Minas Gerais. Between 1980 and 2012, foreign sales of mined metals and minerals generated revenues in the order of US$ 150 billion to the country. The mineral industry accounts for 26.3% of Pará's GDP, 23.5% of which refers to the mining industry and 2.9% to the processing industry. Although its share of direct jobs is small (around 3.3%, including 1.5% in mining and 1.8% in processing), the total number of jobs resulting from investments in mining is multiplied by four, when we consider indirect jobs, induced jobs and the jobs created in the supporting infrastructure.

That is sufficient to say that the mining sector has the potential to contribute significantly to local and regional development, thus becoming a platform of opportunities to leverage strategic actions, provided that there is minimal understanding of the sector's complex issues, through a guideline founded on the three Cs - consensus, cooperation and commitment - among players that regulate, operate and coexist with mining in this State.

Prior to 1970, the mining activity was fully regulated by the Federal Government, so the regulation in the State is somewhat recent. In the 1970s, the State was one of the strategic bases of the Radam Brazil Program. The Institute of Economic and Social Development of Pará (IDESP), which served as a support for this project, was a national and international reference in the field of geosciences in the Amazon. In the early 1980s, SEICOM (the Department of Industry, Commerce and Mining) was established through Law number 4.946, of December 18, 1980, and it started playing an important role in the structuring of Pará's Gems and Jewels Complex, whose highest expression is ESJL (Espaço São José Liberto = São José Liberto Space), in addition to actions to monitor the industrial and mining activity in the state. In the same decade, Law number 5,183, of November 30, 1984, created the State Mining Company PARÁ MINÉRIOS, which made relevant geological discoveries in the state, mainly in the field of mineral inputs for agriculture, especially limestone for soil correction. In addition, Law number 5422, of December 29, 1987, established the State Committee for Geology and Mining of Pará, giving greater relevance to the debate, through the proposition and the validation of state policies for the mining sector.

For several reasons, but mainly for the economic ones, unrelated to the decisions of the State, such as the extinction of IUM (Imposto Único sobre Mineração = Single Tax on Mining) in 1988 - which allocated 70% of the amount collected to the state mining authorities - and the promulgation, in 1997, of Supplementary Law number 87 of September 13, 1996 (Kandir Law), which exempted basic and semi processed products from the payment of ICMS tax (Sales Tax), the main tax of the State, it was not possible to maintain much of this institutionality.

However, even with the financial constraints of the State, after the recognition of the strategic role of mining in the development of Pará, SEICOM was re-established in late 2011, through State Law number 7570, of November 22, 2011, with the purpose of boosting the State's production sectors in a sustainable manner and, especially, establishing public policies for the mining sector.

In order to accomplish its mission, SEICOM began, in February 2012, a series of activities involving studies, technical reports, thematic workshops and work meetings, among others, which culminated in the preparation of the first Mining Plan of Pará, focusing on the long term - PEM - 2030.

For the preparation of PEM 2030, thirteen Thematic Workshops were held according to the methodology of the National Mining Plan[1], in addition to three Consolidation Seminars, for the integration of the proposed actions, involving public agencies, the private sector, universities, research institutes and other civil society organizations. It is important to emphasize that this was a participatory process and the seminars and workshops were attended by 1,300 people from 244 entities, including public bodies (101), the private sector (70), educational, research and ST& (Science, Technology and Innovation) institutions (20) and civil society entities (53)[2].

Thus, the mineral industry of Pará, understood as a set of activities that ranges from prospecting (mineral surveys), mining (extraction of minerals), beneficiation, mineral processing to the preparation of final products, now has an important planning tool that has guidelines, strategies and actions defined by the Government of Pará, to guide the programs needed for the development of the state, through its mineral platform.

Thus, the main objective of PEM-2030 is to serve as a planning tool for good management of mineral resources, based on the sustainable use and on the addition of value to minerals and the territory, with the purpose of promoting competitiveness and combating poverty and inequality in Pará.

PEM-2030 offers, to the public sector and the private sector, content and tools to stimulate the good mineral governance, thus creating opportunities for those who live in, work in and contribute to the development of this State. From this perspective, the implementation of the PEM will expand the opportunities for the State in terms of:

[1] National Mining Plan 2030 http://www.mme.gov.br/mme/menu/plano_de_mineracao_2030/plano_nacional_2030.html

[2] See the methodological procedure in detail in Annex V.

- Greater efficiency in the intermediation between business interests and the interests of the local community at the time of making decisions on complex issues related to mining, thereby improving the ability to understand and negotiate the conditions for the environmental licensing of large projects that are established in the region.
- Growing national and international prominence at the time of the discussion about important projects that directly affect the dynamics of the Brazilian mining sector and, therefore, the mining of Pará state.
- Greater and better control over the amounts to be collected by the State in the form of compensation, fees and taxes and other shares of the government in the exploration and use of minerals through an effective program aimed at controlling and monitoring the mining activities, thereby allowing the fulfillment of the provisions of Article 17, clause XI of the Constitution of the Pará State.
- Expansion of knowledge about the mineral wealth of Pará's territory, the possibilities of inducing new investments and, consequently, multiplying the income resulting therefrom.
- Clear state policy to add the mining sector to the development strategies of the State, considering the various classes of minerals.

Finally, this first State Mining Plan, PEM-2030, aims to multiply these opportunities and convert them into real gains for the development of Pará, in addition to being a tool that will enable the inclusion of the mineral sector in state policies, whether they are aimed at economic growth, such as the ones designed for the social-productive inclusion, or for the promotion of sustainability, to help overcome two great historical problems of Pará, which are poverty and social and territorial inequalities.

Maria Amélia Enriquez

MINING PLAN OF THE PARÁ STATE - 2030

Purpose

To serve as a planning tool for good management of mineral resources, based on sustainable use and on the addition of value to minerals and the territory, with the purpose of promoting competitiveness and combating poverty and inequality in Pará.

Principles

- Creation of jobs, generation of income and multiplication of opportunities;
- Development respecting the limits of the environment;
- Management and governance with transparency;
- Involvement and political-institutional coordination.

Specific Objectives

- Stimulate the consolidation of the mineral-based supply chains;
- Expand the number of local suppliers;
- Promote, directly or indirectly, the development of territories affected by mining activities;
- Leverage and properly use the mineral revenues;
- Involve mining entities in the context of the State's social and environmental responsibilities;
- To ensure demands and resources for strengthening and diversifying the production; and
- Promote greater interaction between mining activities and traditional activities, in order to strengthen the State's capacity, thereby ensuring the productive inclusion, among others.

Actions

- To develop and strengthen the areas of Management, Development and Supervision of mining activities within the State;
- To encourage the academic and research development in the fields of mining and their interfaces with the development;
- To carry out joint actions with other agencies and municipalities in direct mining activities, and the development with social inclusion;
- To influence the establishment of mechanisms of transparency and social control over the income generated from mining in the State.

1

CHAPTER

Context of Mining in the State of Pará

1. CONTEXT OF MINING IN THE STATE OF PARÁ

Although the mining activity is part of the historical formation of Pará, formal and large-scale mining began to be important only in the State in the 1960s.

The events that have marked the recent journey of mining in Pará, from 1950 to 2000, are systematized in Table 1. It shows the main characteristic of the period, the role of mining in the global scenario, as well as the key national policies for the development of Amazonia and those that influenced mining in Pará, besides describing the major mining events in this period in Para.

In the 1960s, based on surveys of multinational groups and the institutional system created by the Federal Government, among which it is worth highlighting the following ones: Mineral Code (1967), Company of Mineral Resources Research (CPRM) in 1969, First Decennial Master Plan (1964) and Executive Group of the Mining Industry (GEIMI). It is also worth highlighting the national policies for the integration of Amazon, such as: Operation Amazon, Tax Incentive Policy, operation of the Agency for the Development of Amazonia (SUDAM) and the Bank of Amazonia (BASA), among others (Table 1).

TABLE 1 - HISTORY OF MINING IN PARÁ STATE

EVENTS	Until the 1950s	1960s	1970s	1980s	1990s	2000s
Main characteristic of the period	Speculative (international private capital)	Expansion of Mineral Discoveries (international private capital)	Exploration (national state capital)	Growth (national state capital)	Diversification (national private capital)	Expansion (international private capital)
Mining in the Global Economy	High rates of growth in demand and prices of materials.	Minerals become strategic and the prices reach their peak.	Energy crisis. Recomposition of the global matrix. Shock in the commodities market.	Restructuring in the global market of minerals. Oversupply; reduction in the intensity of use of materials. Drop in prices and loss of "strategic" status of the ores.	Stability in the drop of metal prices, reduction in investments, increase in interests for noble metals. Prevalence of a short-term view.	"Super cycle of minerals" Rise of China as a major consumer of commodities and exporter of manufactured goods. Rise of emerging economies (BRICS). The sub-prime crisis. European crisis.
National policies that influenced Mining in Pará	International agreements.	New Mining Code in 1967. Concept of national company. 1964-1 Decennial Master Plan. 1969-Creation of CPRM and creation of GEIMI.	RADAM Brazil Project. II PDA allocates 15.4% of its budget to mining.	The 1988 Constitution scares foreign capital away, changes the concept of national company, eliminates OLUME and introduces new tax on mining (ICMS and CFEM).	1995 - revision of the constitution with respect to the concept of "national company". 1996 - complete revision of the Mining Code (Law 9.314/96)	Multiyear Plan - The issue of the environment becomes relevant. PAC - increase in demand. 2008 - initial discussions about the change in the mineral regulatory framework.
Policies for the development of the Amazon	To integrate the Amazon with the rest of the country, Juscelino Kubistchek initiated the Belém-Brasília Project (Highway BR-010).	The Amazon Operation. Creation of a system of tax incentives for the Amazon (SUDAM and BASA). Paving of the Belém-Brasília Highway	POLAMAZ0NIA (IDESP - 1975)	Grand Carajás Program - income tax exemption for 10 years; reduction in II (import tax) and IPI (tax on industrialized goods), recommendation for exemption from ICMS tax.	Brazil in Action - resumption of infrastructure projects. Avança Brasil (Let's Advance, Brazil) Program.	Expansion of specially protected areas (MMA)
Main Events of Mining in Pará	1958 - Nilçon Pinheiro discovers gold in Tapajos; Predominantly, prospectors were the ones that were looking for minerals.	Strengthened research: 1960 - Bauxite (ALCAN) manganese (USSteel) 1967 - Iron (Carajás) and manganese (USSteel) 1969 - titanium (CODIM) 1970 - Bauxite (RTZ)	Over 15 new reserves discovered. 1976 - CADAM starts operating. 1979- MRN starts operating.	1985 - CVRD starts operating (iron and manganese) - Paraupebas; Sta Lucrécia (bauxite)- Almeirim; ALBRAS (Al) - Barcarena 1988 - COSIPAR (pig iron) - Marabá. CCM (Tucuruí) Simara (pig iron), Marabá.	1991 - CVRD-gold-Parauapebas 1995-Alunorte (alumina) - Barcarena 1997 - Pará Pigmentos CVRD/ Cadam - kaolin - Ipixuna - 1997-RCC-kaolin Ipixuna do Pará	2003 - Bauxite in Paragominas (Vale-Hydro) 2004 - Cement in Itaituba (CBE) 2004 - Copper in Canaã dos Carajás (Sossego/ Vale) 2005 - Bauxite in Juruti (Alcoa) 2007 - Gold in Itaituba (Serabi)

Source: SEICOM, 2013.

IMAGE 1 - BEGINNING OF THE BABYLON OF SERRA PELADA (1980). Photography by: BRENO AUGUSTO DOS SANTOS

In the 1970s, state-owned enterprises were the ones that made the main oilfield discoveries that today are in the exploration stage and, since then, there has been an increase in the demand for and the prices of mineral assets, which are now considered to be "strategic".

The 1980s, in turn, were marked by a deep process of financial weakening of the Nation State, with the abrupt decline in investments and, in some cases, the dismantling of important mineral management organizations. This had a great impact on the mineral policy model implemented in Pará, which was geared almost exclusively to exports, and with the primary purpose of raising foreign capital for the payment of the country's public debts. An icon of that is the Great Carajás Program (or CMP in Portuguese), originally proposed to be the basis of an integrated regional development, but which was reduced to the iron ore project, the one that had the greatest power to raise foreign capital in the short term. This source was therefore marked by the detachment of the Federal Government's interests from the interests of Pará State and, therefore, from those of the local society, whose repercussions are felt strongly today.

It should be noted that, in this decade, the discovery of gold in the district of Serra Pelada, a municipality of Marabá at that time, put the state of Pará and Brazil in the national and international media. A "great human anthill" was formed in Serra Pelada in the early 1980s (Figure 1), in the search for gold. The heyday of mining occurred between 1982 and 1986 and it brought wealth for a few, but misery for many. In this context, the mining properties in the area belonged to former state company Cia Vale do Rio Doce (CVRD) and they were purchased by the Federal Government, and the amount paid was calculated based on unexplored mineral reserves. In the comings and goings of the interruption of its exploration, the gold mining was and still is the subject of greed by those who believe that there is a lot of gold to be explored, as well as other high value minerals such as silver, palladium and platinum, which are associated with gold.

The closure of the mine of Serra Pelada, in 1992, did not stop the interests of independent groups of miners and cooperatives; the dream of the search for gold remains unchanged, despite the lives and interests that were buried in the large cava of Serra Pelada.

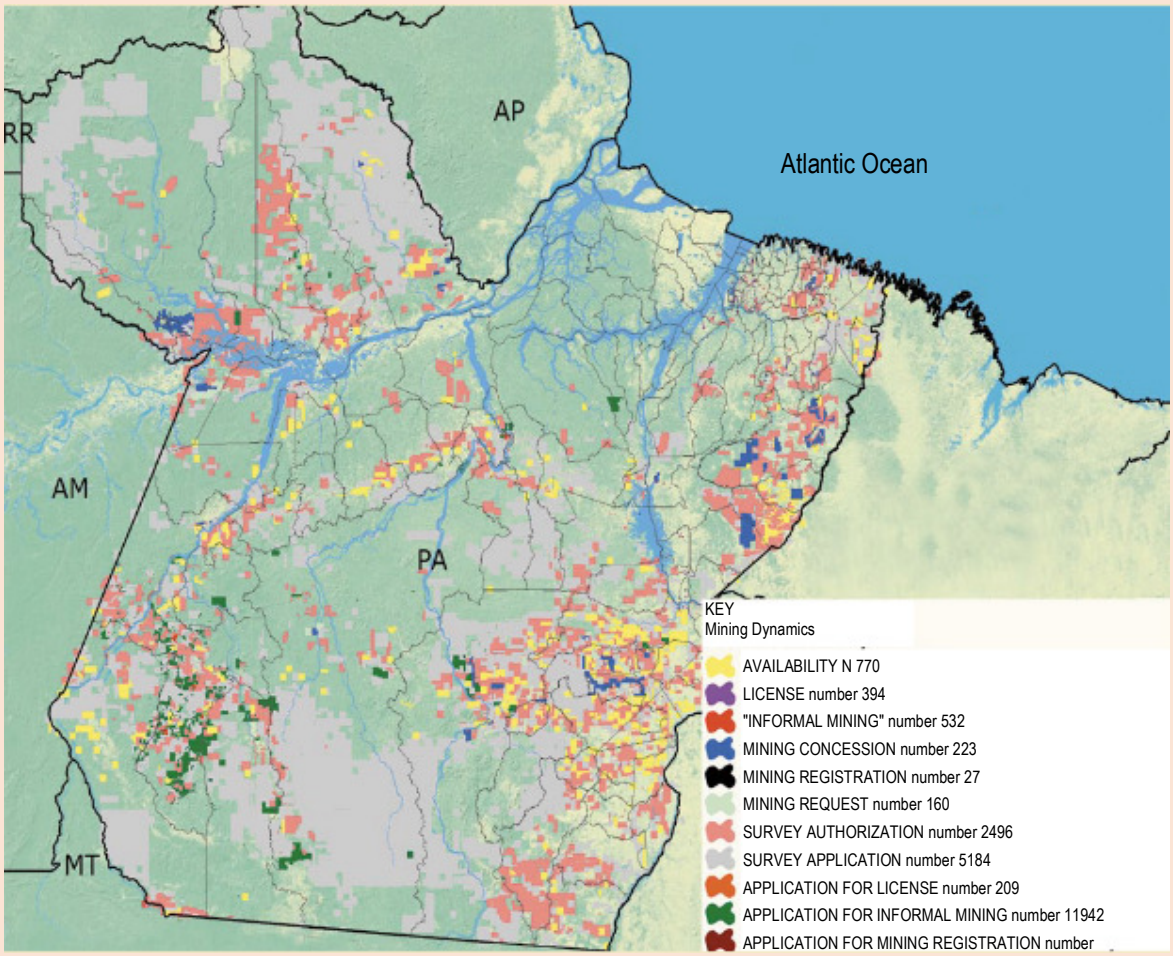
The 1990s represented a deepening of the use of the mining model as a means of raising foreign currency for the Federal Government, which culminated in the Kandir Law. However, this has promoted profound distortion in the tax revenues of Pará, as it will be further described in item 1.6. However, the mineral production of the state was diversified with the start of the production of important projects - gold, kaolin, alumina, besides the successive expansions in the iron project, with the CVRD company (or Vale, as it is now called) as the frontrunner.

The 2000s, after nearly two decades of low mineral prices, were characterized by what was called "the super cycle of *commodities* [3] *" with* a substantial increase in mineral prices, as a result of the increase in global demand led primarily by China. At the end of the decade, the crisis of *subprime,* succeeded by the European crisis, caused strong oscillations. However, the market's fundamentals are still favorable to the growth of mineral consumption, although at a level that is lower than the one seen in this decade, as it will be better discussed further in section 4.1.

3 Erten, Bilge and Ocampo, José Antônio. Super Cycles of Commodity Prices Since the Mid-Nineteenth Century. World Development Vol. 44, pages 14-30, 2013.

The mineral processes that existed until December 2012 are shown on Map 01.

MAP 1 - DYNAMICS OF MINING IN PARÁ



Source: SEICOM, 2013.

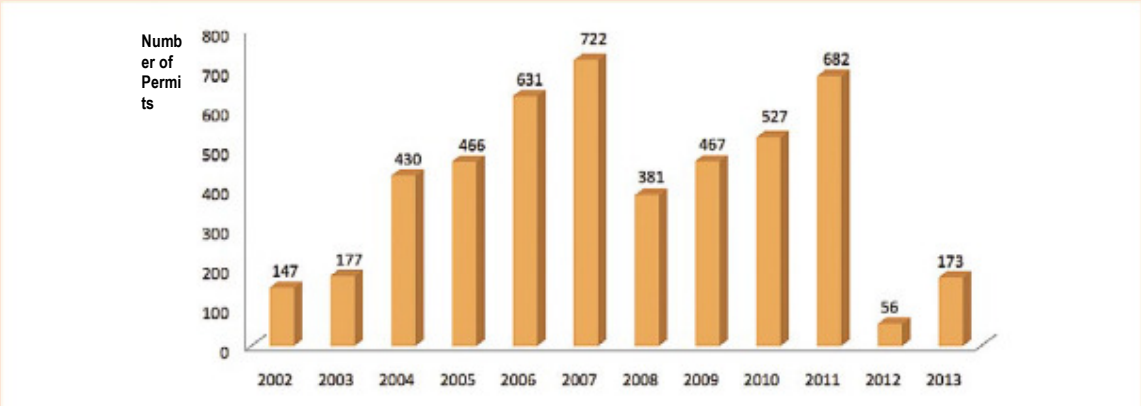
It is worth noting the Survey Applications that make up most of the proceedings that are a strong interest in Pará's mining areas, although such proceedings do not guarantee the right of access to the underground. It should also be noted that the mining activity, to a greater or lesser extent and in different forms, is present in all regions of the state.

1.1 MINERAL SURVEY

As a prerequisite for mining, mineral survey is essential to generate new mines. A retrospective of the last 10 years shows a trend towards an increase in the publications of Survey Permits[4], but with major interruptions, sometimes caused by the international economic crisis and sometimes by government decisions (Chart 1).

4 See Glossary.

CHART 1 - PROGRESS OF THE NUMBER OF SURVEY PERMITS IN THE STATE OF PARÁ (2002-2013)



Source: http://www.dnpm.gov.br/conteudo.asp?IdSecao=156&IdPagina=204.

Thus, the sharp fall in 2012 is due primarily to the decision of the MME to suspend the granting of mining titles, until the New Regulatory Framework of Mining is approved by Congress [5] . However, when compared to the performance of other states, it appears that Pará was one of the states that has given the smallest amount of this type of title. In 2012, Minas Gerais issued 1728, São Paulo 1088 and Bahia 1026[6].

Out of all Permits issued by the DNPM by 2012, 917 are meant for gold, 197 for minerals used in agriculture, 139 for mineral used directly in construction, among others. As for the applicants, among the largest single economic groups, it is worth highlighting VALE, with 238 cases, and Votorantim with 48 (DNPM, Mining Registry, 2013).

1.2 MINERAL RESERVES

The mineral reserves of the main metals (aluminum, copper, nickel and gold) in Pará are undergoing significant growth, with the exception of iron and manganese, which had no major mergers (Table 1). In the case of aluminum, the reserves of Pará do not consider the revaluation of the reserves of Votorantim Metais, in the municipality of Rondon, Pará State, in the order of 1.5 billion tons. With respect to the reserves of copper and nickel, the expectation is that, based on the various Final Research Report submitted as of 2009, there will be a significant increase, as well as in the gold reserves, through the recovery of investments attracted by the current price of US$ 1.300/oz.

TABLE 1 - SUMMARY OF MINERAL RESERVES OF PARÁ STATE, 2009.

SUBSTANCE	PARÁ	BRAZIL	WORLD
Aluminum *	3.25	74%	11%
Copper (contained) (millions of t)	26.465.617.00	89%	3%
Iron*	16.50	21%	3%
Manganese (millions of t)	0.07	29%	1%
Nickel (contained) (millions of t)	4.13	33%	3%
Gold (contained) (t)	2.232	33%	3%

* Billions of tons
Source: DNPM - Mineral Yearbook (2010) and Mineral Summary (2011)

Brazil and the world followed the growth of metallic mineral reserves, largely concentrated in the same countries:

5 Link of PL number 5.807/2013 http://www.camara.gov.br/proposícoesWeb/fíchadetramítacao?ídProposícao=581696

3 6 http://www.dnpm.gov.br/mostra_arquívo.asp?IDBancoArquívoArquívo=7448

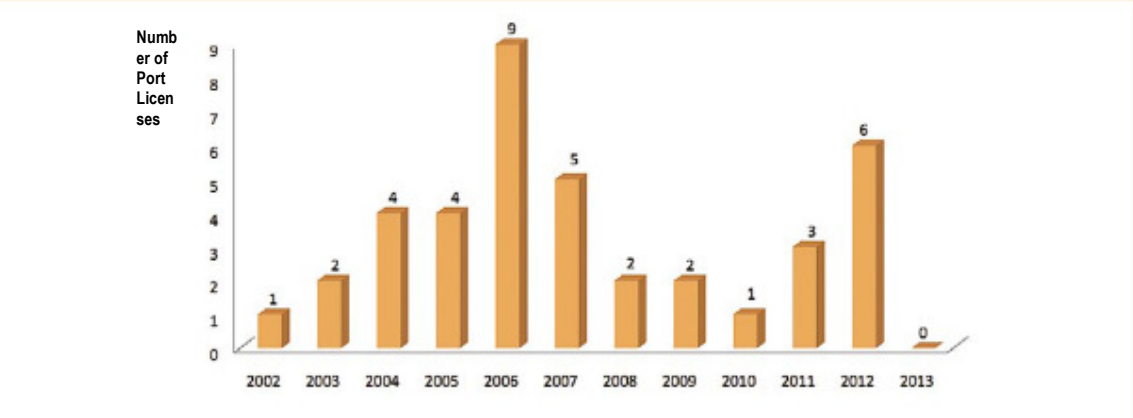
- Nickel - the reserves are concentrated in Australia, New Caledonia, Brazil and Russia, while the production is concentrated in Russia, Indonesia, Philippines, Canada, Australia, New Caledonia and Brazil;
- Aluminum - reserves in Guinea, Australia, Jamaica, Brazil and China, while the production is concentrated in Australia, China, Brazil, Guinea and Jamaica. China's output led to a decrease in market prices;
- Copper - the reserves are concentrated in South America, mainly in Chile, Peru and Brazil, but with China and Australia occupying an intermediate position, while production is mainly concentrated in Chile, USA, Peru, Australia and Brazil;
- Iron - with reserves in Ukraine, Russia, China, Australia, while the production goes almost in the opposite direction: China, Australia, India, Brazil and Russia;
- Manganese - reserves are concentrated in Ukraine, South Africa, Australia, Brazil and China, while production goes almost in the opposite direction: Brazil, South Africa, Australia, China and Gabon;
- Gold - the reserves are concentrated in Australia, South Africa, Russia, Chile and the USA, while the production is concentrated in China, Australia, USA, South Africa and Russia.

1.3 MINERAL MINING - MINING INDUSTRY

There is an intense oscillatory movement in the Mining Concessions [7] that has to do with the process of development of the mine, which also involves environmental licensing. In the 2002-2013 period, MME / DNPM issued 39 mining concessions in Pará, aimed at about 30 different minerals, with emphasis on: bauxite, limestone, mineral used directly in construction, mineral water, cassiterite, gold, silicon, quartz, kaolin, copper, iron ore, among others.

In terms of stock, out of the 224 Concessions that were granted in Pará, from 1955 to 2013, the companies that individually stood out the most were Votorantim with 28 Licenses (metallurgical bauxite and limestone for cement) and Vale with 19 titles (manganese, copper , iron, gold, cassiterite, nickel, aluminum and sand).

CHART 2 - INCREASE IN THE NUMBER OF MINING CONCESSIONS IN THE STATE OF PARÁ (2002-2013)



Source: DNPM (Mineral Yearbook, Various).

In addition to the Concessions, the mining of minerals can be carried out through other mineral systems, such as Licensing, normally used for minerals directly applied in construction, and the PLG (Permissão de Lavra Garimpeira = "Informal Mining" Reserve Area). In the first case, by 2013, Pará had registered 416 cases and, in the second case (PLG), 548, although the demand for the latter is 20 times higher.

7 See the glossary.

1.4 MINERAL PROCESSING

The processing of minerals began in the 1980s with the production of aluminum and, since then, there has been significant diversification of such processing (Table 2).

TABLE 2 - PRODUCTS OF PARÁ'S MINERAL PROCESSING INDUSTRY.

MINERAL GOOD	PRODUCTS OF THE PROCESSING INDUSTRY EXPORTED BY PARÁ
Sand	Tempered safety glasses [8] and mirrors.
Clays	Ceramic tiles, bricks for construction, sinks, washbasins, sanitary wares and porcelain articles.
Bauxite metallurgical	Calcined alumina, aluminum, aluminum oxides, wires, cables, and household articles
Limestone	Ordinary Portland cement, other concrete articles, prefabricated building elements, concrete blocks etc...
Copper	Cathodes of refined copper, copper-tin alloys (bronze), copper wires
Iron	Cast iron, nickel iron, tinned steel, "non-malleable cast iron" tubes, forged steel/iron bars, ferromanganese, ferrosilicon, non-alloy galvanized steel/iron wires, alloy steel balls.
Nickel	Not-alloyed nickel bars, nickel alloys, in crude form, nickel tubes
Gold	Gold bars, jewelry.
Rocks Ornamental	Worked slate, simply cut or sawn granite, with a flat or smooth surface and marble
Silicon	Metal silicon, ferrosilicon-manganese
Tantalum	Other products that use tantalum

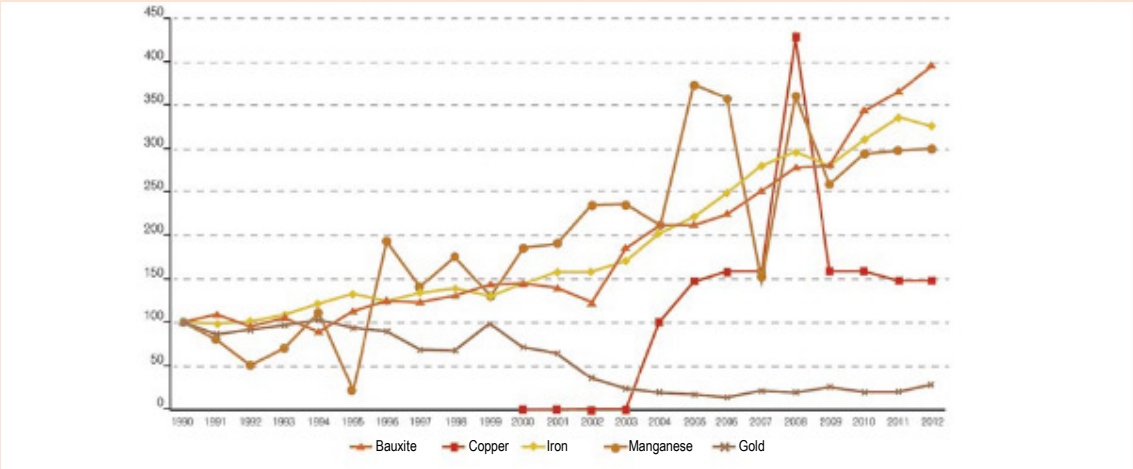
Source: SEICOM/DDI, 2013.

In 2012, the State had around 658 companies that transform metallic and non-metallic minerals into various products such as: aluminum, alumina, cement, iron, silicon metal and iron and aluminum rods, cables etc.

1.5 MINERAL PRODUCTION

Since the beginning of large-scale mining in Pará territory, there has been an increase in the scale of production of mineral commodities. Between 1990-2012, the mining of bauxite increased from 8 to 31 million tons, iron from 32 to 107 million, kaolin from 86 in 1996 to 2.187 million in 2012 and copper from 207 in 2004 to 406000 in 2012 (Chart 3).

CHART 3 - EVOLUTION OF MINERAL PRODUCTION IN PARÁ, 1990-2012 (1990 = 100)



Source: Prepared by SEN/SEICOM, based on data from DNPM/MME.

8 Product manufactured in Pará after the import of the glass plate.

In terms of value, the expansion also increases. Between 1996 and 2010, the value of production of iron multiplied by 12, going from US$ 1 to US$ 12.7 billion, of bauxite by three, from US$ 600 to US$ 1.6 billion, just like the others, as shown in Table 2.

TABLE 2 - CONSTANT VALUE (BASE YEAR = 2010) of PARÁ'S MINERAL PRODUCTION - 1996/2010 *.

YEAR	BAUXITE	KAOLIN	IRON COPPER	MANGANESE	GOLD	OTHERS	TOTAL
1996	578,817	91,244	1,055,545	111,624	812,404	154,425	2,804,059
1997	540,104	137,091	1,205,178	105,105	517,434	44,098	2,549,010
1998	644,392	185,695	1,252,247	104,709	560,711	45,428	2,793,182
1999	890,301	298,958	1,594,231	107,757	233,631	36,859	3,161,737
2000	846,612	378,050	1,743,882	202,188	225,361	35,019	3,431,112
2001	987,316	473,278	2,164,552	172,122	243,847	50,744	4,091,859
2002	906,813	565,087	2,516,507	184,887	299,480	33,501	4,506,743
2003	1,194,225	795,586	2,949,996	228,586	206,496	46,030	5,420,919
2004	1,424,740	825,359	646,680 3,879,739	389,129	163,733	51,543	7,380,923
2005	1,165,574	655,947	951,166 4,654,613	430,786	143,023	46,900	8,048,009
2006	1,198,317	679,990	1,488,668 5,450,615	159,798	126,113	49,267	9,152,768
2007	1,407,175	675,123	1,496,680 5,600,513	266,262	160,742	50,062	9,656,557
2008	1,390,146	681,274	1,466,245 7,659,443	1,185,348	176,814	47,930	12,607,200
2009	1,349,182	575,919	1,166,720 8,181,165	453,800	269,687	55,252	12,051,725
2010	1,617,553	520,126	1,435,141 12,663,756	641,850	283,139	57,143	17,218,708

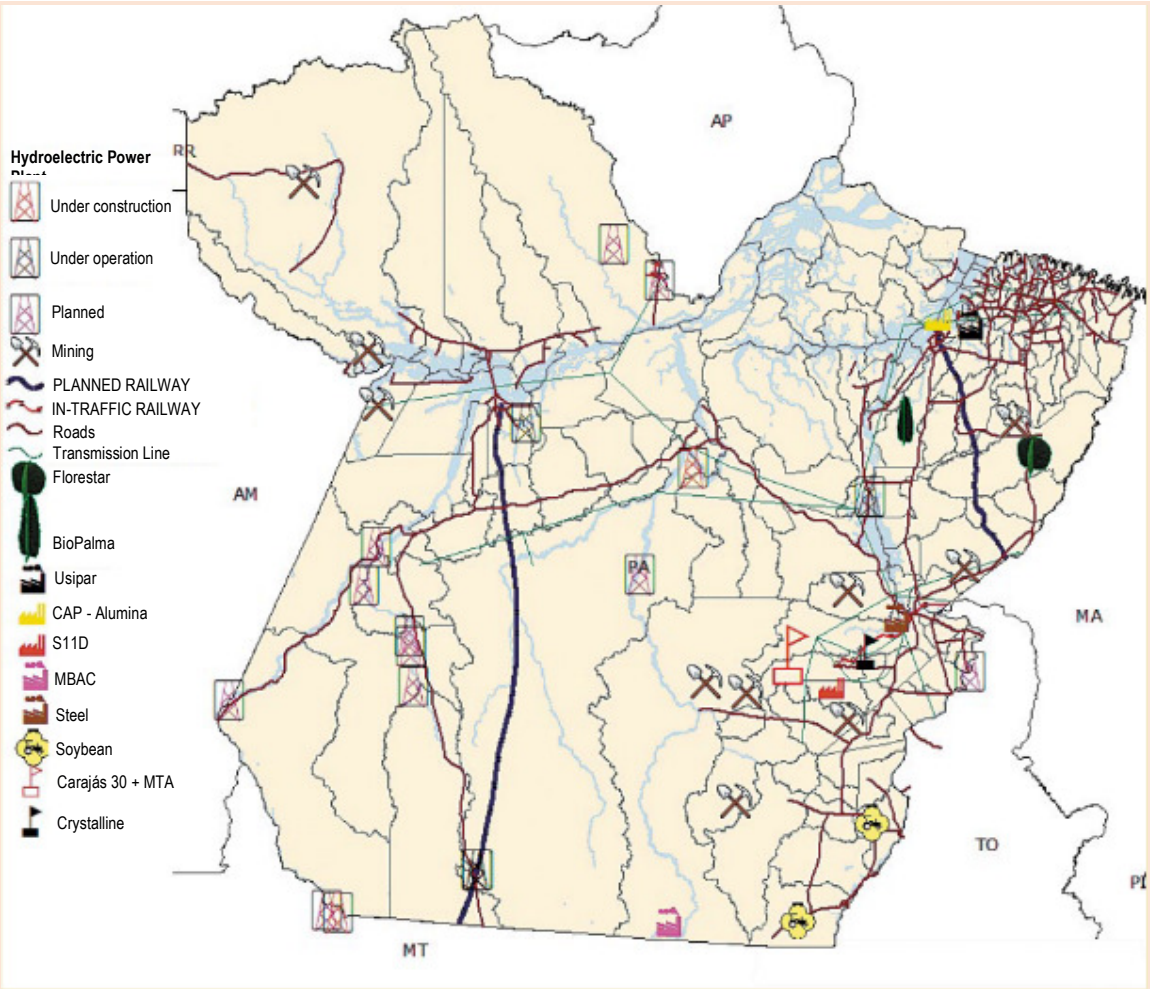
Source: MDIC/SECEX - Companies/DNPM - * In 1000 (Base Year = 2010).

Although the intention of exploring vast areas in Pará territory is a strong tendency, mineral production is still concentrated in a few substances, few companies and few cities, but this concentration was much higher in the recent past. Taking as an indicator of the collection of CFEM tax, which demonstrates the existence of formal mining in the municipality, it turns out that, in 2004 [9] , Mining was present in 32 municipalities; in 2012, it increased to 55. In 2004, 17 substances were formalized (five metallic and 12 non-metallic), whereas in 2012 this number increased to 22 (seven metallic and 15 nonmetallic).

The spatial distribution of the main minerals projects, both in the South, Southeast and West regions of the state, coupled with large infrastructure, logistics and agriculture projects (Map 2) shows that the activity is of increasing importance, either because of the supply of agricultural mining inputs, aggregates and metals to major projects, or for the historical role in bringing money to the country.

9 Initial year of the series on collection of the CFEM tax, published by DNPM.

MAP 2 - MAJOR PROJECTS IN PARÁ



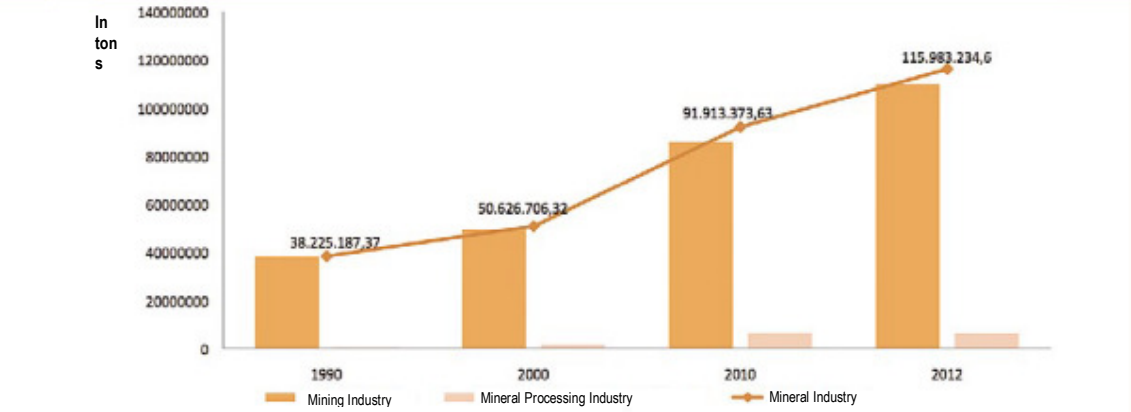
Source: SEICOM, 2013.

The increasing numbers of mining in Pará draw our attention to four important aspects:
1) whether state of Pará has appropriate institutions to deal with this reality;
2) what has to be done in order for the State to take advantage of this growth to develop?;
3) what can happen with these trends, in this environment of uncertainty with respect to the new regulatory framework of mining that is being discussion in Congress; 4) which compensatory measures may be created to counteract, in fact, the negative effects of Law Kandir on the economy of the state of Pará?

1.6 EXPORTS OF MINERAL GOODS

Whether seen from the perspective of volume, or of value, the evolution of mineral exports in Pará is impressive. Out of everything that is mined, 80%, on average, is taken to foreign markets. Throughout the 2000s, this percentage ranged between 85% and 92%. In proportional terms, the mining industry accounts for 70% of the State's exports and the mineral processing industry accounts for 17%. In three decades, the volume of exports of minerals and metals of Pará was multiplied by three, from 38.2 million tons in 1990 to 116 million in 2012. The products of the manufacturing industry, with a negligible share in the 1990s, showed significant growth, although such growth was still residual in the 2000s, according to Chart 4.

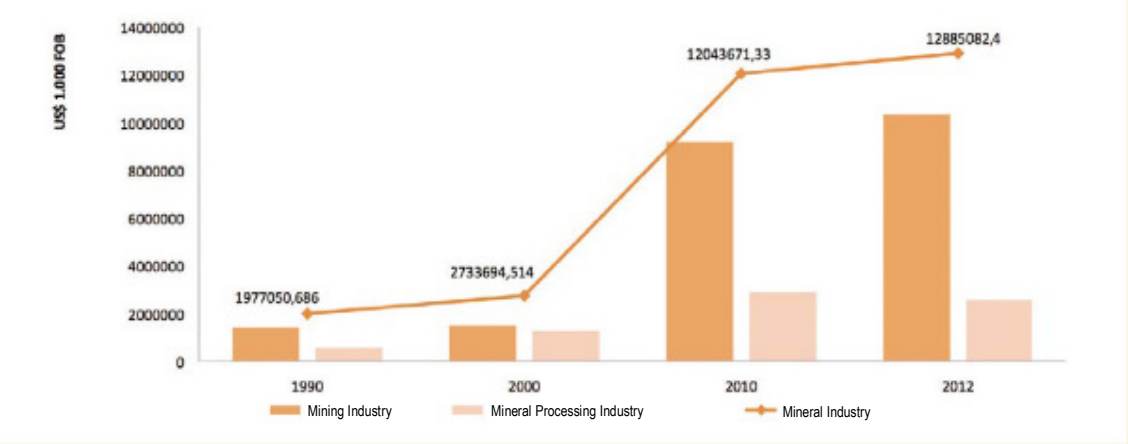
CHART 4 - VOLUME OF EXPORTS OF GOODS FROM THE MINING-METALLURGICAL INDUSTRY IN THE STATE OF PARÁ FROM 1989 TO 2012.



Source: MDIC (Alice system) developed by SEICOM.

With regard to FOB dollar values, in the three decades, the value **was multiplied by six,** from approximately US$ 2 billion in 1990 to US$$ 13 billion in 2012 (Chart 5), which shows strong appreciation of the terms of trade in the period of analysis. The mining industry, because of its scale of production is the one that shows the most significant value, going from US$ 1.4 billion in 1990 to US$ 10.3 billion in 2012, while the processing industry went from US$ 600 million to US$ 2.6 billion.

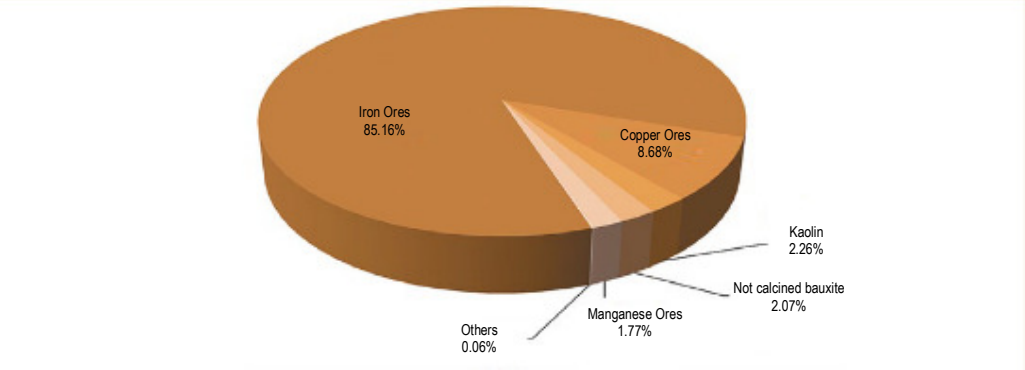
CHART 5 - VALUE OF EXPORTS OF GOODS FROM THE MINING-METALLURGICAL INDUSTRY IN THE STATE OF PARÁ FROM 1989 TO 2012.



Source: MDIC (Alice system) developed by SEICOM.

The profile of mining exports of Pará State resembles what occurs at the national level, with the predominance of iron ore. While in the country, as a whole, this percentage is 80%, in Pará, it is equivalent to 85% (Chart 6). In 1990, this share was 70% and it reached 60% in 2004. This growth is explained by the increase in prices, because in 1990, the ton was worth US$ 13.50, reaching a level of US$ 180 in 2012. Except for iron ore, the remaining 15% are concentrated in six substances, with the predominance of metal minerals: copper, kaolin, bauxite, manganese, tin and nickel.

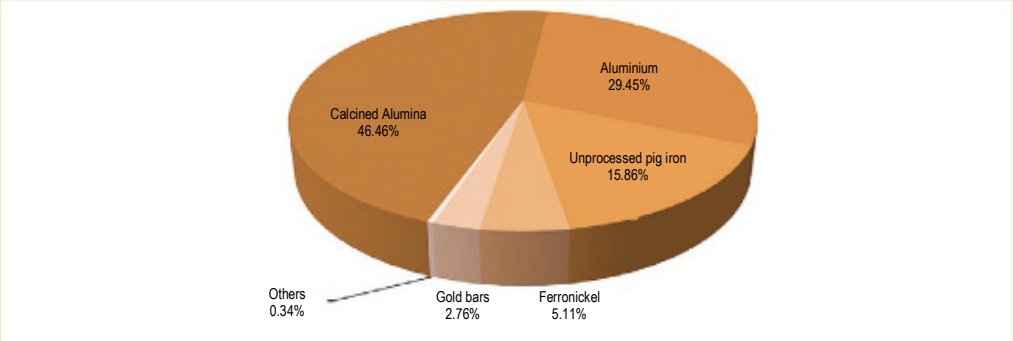
CHART 6 - EXPORTS OF THE MINERAL MINING INDUSTRY, PARÁ - 2012.



Source: MDIC (Alice system) developed by SEICOM.

In the case of the processing industry, the products in the aluminum chain stand out, especially alumina and aluminum, accounting for 77% of what is exported by the industry, as shown in Chart 7.

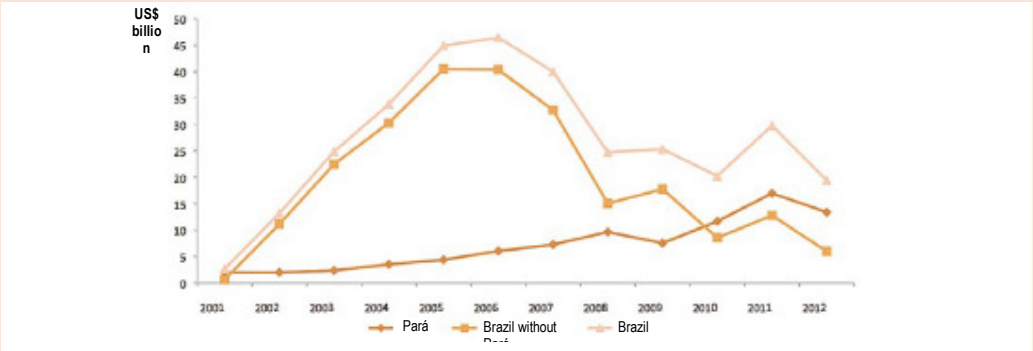
CHART 7 - EXPORTS OF THE MINERAL PROCESSING INDUSTRY, PARÁ - 2012.



Source: MDIC (Alice system) developed by SEICOM.

Pará accounts for 6% of national exports and generates the second largest trade surplus in Brazil (Chart 8). In 2012, the State's contribution to exports of minerals and metals was 32%.

CHART 8 - EVOLUTION OF THE TRADE BALANCE (US$ Billion), 2001-2012.



Source: MDIC (Alice system) developed by SEICOM.

This mineral-exporting model is costly to the state of Pará, because of socioeconomic and territorial burden that is represents and the absence of the tax bonus, as shown in the previous analysis.

1.7 TAXES AND COMPENSATION GENERATED BY THE MINERAL ACTIVITY

Most of the tax on mining is federal tax, with the highest concentration in the mining and processing stages, but also with ample opportunities for deductions and exemptions, if the project is located in the Amazon, such as the reduction in income tax (IRPJ) and if the project is directed to exports, exemption of Social Integration Program (PIS) charges and the Contribution to Social Security Financing (COFINS) plus Value Added Tax on Goods and Services (ICMS), levied by the States.

The taxes and compensations generated by mining that benefit the States more strongly are ICMS and the financial compensation for the Exploitation of Mineral Resources (CFEM), in addition to income tax (IRPJ), because of the transfers to the States' Participation Fund (FPE).

A broad overview of the tax incentives and taxes on the mining activity in its different stages is shown in Table 3.

TABLE 3 - DESCRIPTION OF TAXES AND INCENTIVES BY LEVELS OF GOVERNMENT AND THE ADDITION OF VALUE IN THE MINERAL INDUSTRY

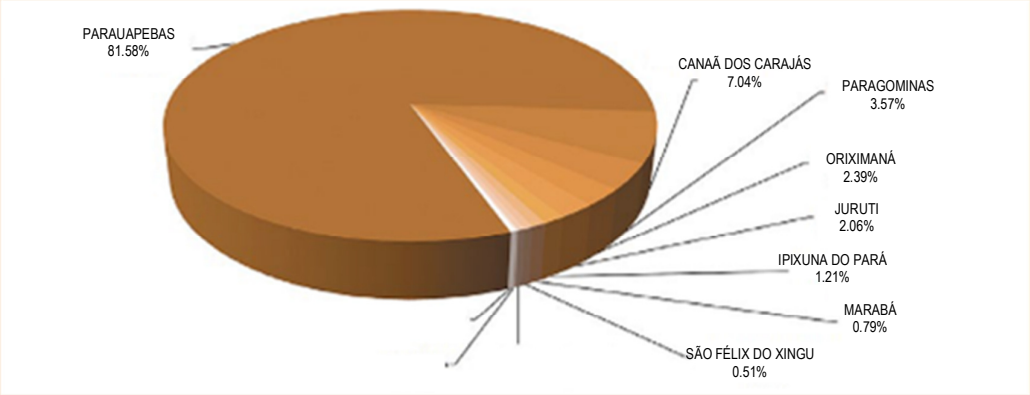
CHARGES/ INCENTIVES		VALUE ADDITION STEPS OF THE PRODUCTION CHAIN		
		EXPLORATION (MINERAL SURVEY)	MINING AND BENEFICIATION	TRANSFORMATION
FEDERAL	ENCARGOS	TAH (TAXA Anual por Hectare = Annual Rate per Hectare) - R$ 2.02 year/hectare (2013), changing to R$ 3.06 year/hectare at the time of renewal (DNPM is responsible for the collection). Labor charges: Social Security - 20%, on average, from the employer, plus additional charges, such as 8% of FGTS, 6% of transportation vouchers, food vouchers, 2.70% of vacation pay and 8% of the 13th salary	Income tax: taxable income (15% + 10% on the amount above 20%) CSLL (Social contribution) tax: 12% of the net profit PIS: 0.65% of the revenues or 1.65% of the value added COFINS tax - 7.6% of the value added CFEM* - 0.2% to 3% of the net sales (+ 1% for the landowner when it is not the company)* IOF-gold: 1% of the sale price, as a financial asset. ROYALTY: 15% of the remittance to the other country.	IPI-cement 0%. IDI COA Income tax 1-Steel Dvo IPI (industrialized products tax)-fertilizers/ 0% IPI-Bricks/roof tiles :8%
	INCENTIVOS	DEPRECIATION: it can be computed as a cost or a charge. AMORTIZATION: expenditure on prospecting, calculation of the volume of mines, mine development, expansion, cost of restructuring, costs during the construction period and pre-operation of mine. EXHAUST: mining depletion can be computed as a cost.	Income Tax (Exemption or reduction of 50% or 70% depending on the year of installation). Destination of sales (export) PIS - total exemption COFINS - total exemption	Dido + reduction or exemption of IPI. PDTI: Programa de Desenvolvimento Tecnológico Industrial (Industrial Technological Development Program) Law number 8661/93, revoked by law number 11.196/2005 (Asset Law) Decree No. 3.000/99 regulates the IRRF
ESTADUAL	ENC.	Environmental Licensing Fee	ICMS tax: 17% for domestic operations and 12% for interstate operations. Exempt for exports. TRFM fee: 0.5 Al UPF of R$ 2.5697 in 2014. Ordinance ("Portaria") 165/2013. Environmental Compensation / Environmental Permits (conditions)	ICMS tax
	INC.		ICMS - Kandir Law exempted commodities and semi-finished products ICMS-gold/Precious stones: presumed credit, reduced to 1%; limestone / gypsum: exemption for domestic transactions; 60% reduction in the basis of calculation in interstate operations. ICMS-kaolin: deferral in internal transfer operations; quartz and coal: deferred to the time at which the output of metallic silicon. Bauxite-alumina-aluminum: deferral in the territory. 2% for interstate operations. Financial incentives in the form of loan that corresponds to 75% of the ICMS generated and actually paid (Law 5943/96, Decree 1318/96). TFRM: exemption for aggregates and reduction for the category of goods	State Incentive Policy: reduction of the calculation basis or deferral of ICMS

TABLE 3 - DESCRIPTION OF TAXES AND INCENTIVES BY LEVELS OF GOVERNMENT AND THE ADDITION OF VALUE IN THE MINERAL INDUSTRY				
CHARGES / INCENTIVES		VALUE ADDITION STEPS OF THE PRODUCTION CHAIN		
		EXPLORATION (MINERAL SURVEY)	MINING AND BENEFICIATION	TRANSFORMATION
MUNICIPAL	ENC.	Municipal licensing rate	IPTU (property tax) ISSQN ITBI	IPTU (property tax) ISSQN ITBI Municipal licenses
	INC.	Exemption and / or reduction of ISSQN	Exemptions and / or reduction of ISSQN and property tax (IPTU)	of projects

The way mining is structured in Pará, by, on one hand, large-scale projects for export and, on the other, by small companies with high level of informality - informal prospecting and mining of direct use in construction - prevents this activity from contributing, in due proportion, to the public finances of the State. In terms of ICMS tax, the mining industry contributed with only 2.6% of the total collected by Pará (SEFA, 2012). There is a discrepancy between this percentage and the weight in terms of GDP (23.5%) and exports (70%). It is noteworthy that before the Kandir Law, in 1990, mining accounted for 16% of the total ICMS tax revenues in the State [10] . During the effectiveness of the Kandir Law, from 1996 to 2012, it is estimated that Pará refrained from collecting around R$ 15 billion and, since mineral production is increasing, these losses increase every year.

Between 2004 and 2012, CFEM [11] collected by Pará went from R$ 73 to R$ 524 million, which accounts for 27% of the country's tax revenues. This total was distributed to 55 municipalities, and only one (Parauapebas) of such municipalities accounts for 81.5% of the total collected (Chart 9 and Map 3).

CHART 9 – MUNICIPALITIES THAT ACCOUNT FOR MOST OF THE CFEM REVENUES, IN PARÁ – 2012.



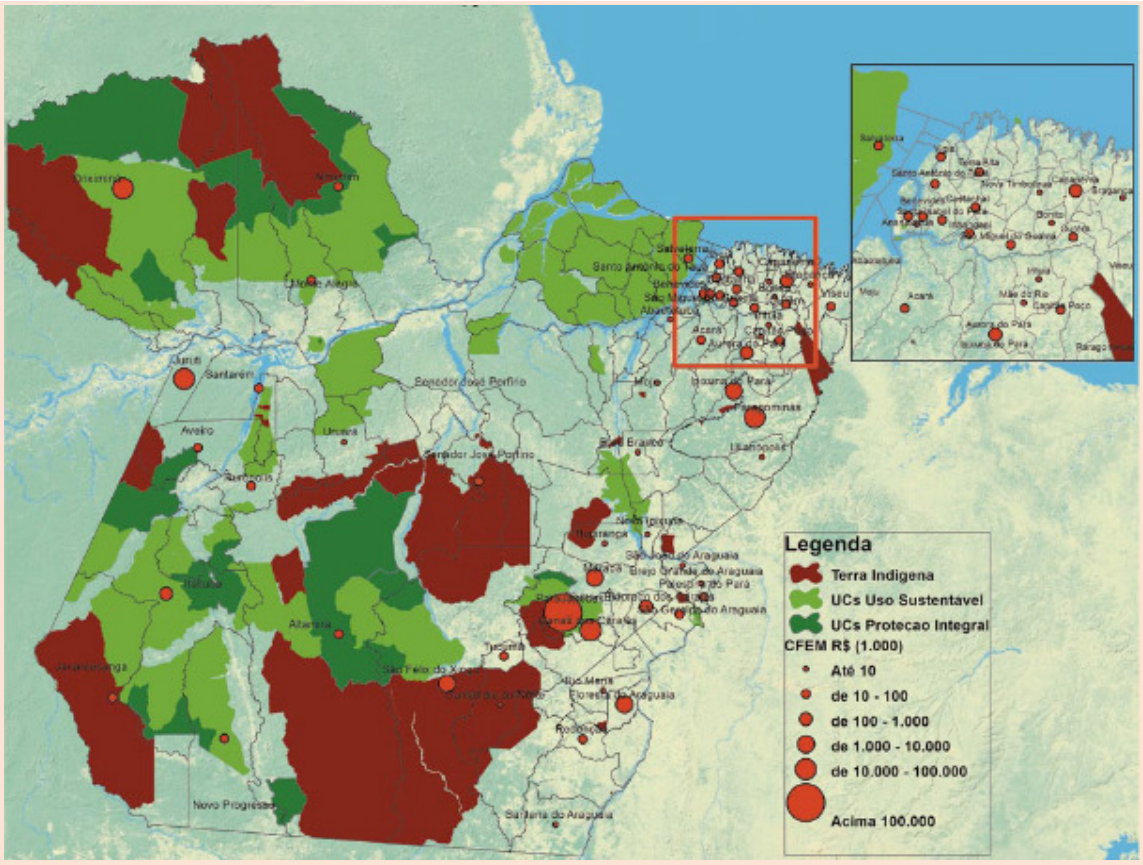
Source: Prepared by SEICOM based on data of DNPM.

Canaã dos Carajás is in second place in terms of CFEM collection due to copper mining; but after 2016, it will certainly be in first place in Brazil in terms of CFEM tax revenues, because mine S11 D, belonging to Vale, already began producing 90 million tons (see BOX D S11) and, if a ton of iron stays at the US$ 100 price level and the rate of CFEM tax is 4% of the gross revenue, this amount may reach US$ 500 million, only with respect to the quota related to the municipality.

10 Silva, 1994.

11CFEM has four levels of rates ranging from 0.2% to 3% and they are imposed on the "net income", which, on average, is equivalent to 1.5% of the value of mineral production that is generated in Pará. Of the amount collected, 65% goes to the producing municipality, 23% to the State and 12% to the Federal Government.

MAP 3 - COLLECTION OF CFEM BY MUNICIPALITY, IN PARÁ, 2012.



Source: Prepared by SEICOM based on data of DNPM.

The current model of CFEM, whose proposed reform is under discussion in Congress, is considered by experts as one that has the lowest rate of collection in the world [12] . Additionally, the concentrated distribution creates strong distortions in terms of distributive justice, exacerbating inequalities between municipalities, especially those surrounding the large mines. This is because, besides benefiting from most of the CFEM tax, the mining municipality receives other financial benefits such as Tax on Services of Any Nature (ISSQN) and the transfers of quota-share of ICMS, among others due to the direct investment of companies.

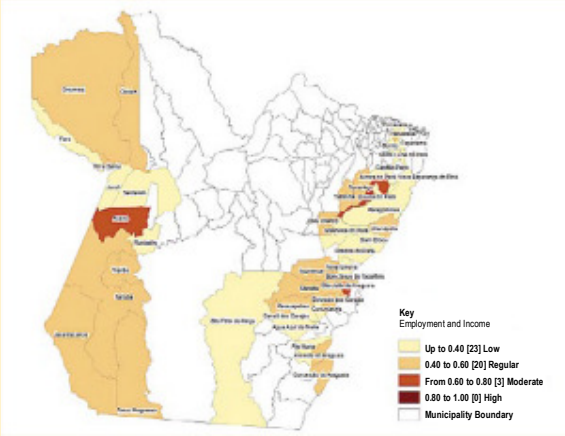
Meanwhile, the price of property and the cost of services go up a lot in the mining municipality and poor people have difficulty staying there. Then there is a strong tendency to migrate to nearby towns that, in turn, end up absorbing the surplus population of the "rich neighbor". The surrounding municipalities, in turn, find it difficult to keep skilled human capital and companies, since the opportunities occur in the "rich neighbor". Thus, the surroundings sees the productive factors moving to the mining municipality, where there are more chances and more money. This fact exacerbates inequality between municipalities, which collides with the big goal of the State to reduce inequality at all levels, including territorial level.

Maps 04 and 05 illustrate the gap between mining and non-mining cities, specifically in the West and South of the State, with respect to the rate of employment and income, estimated by FIRJAN [13] . As an example, note that in 2000, the towns of Obidos and Oriximiná were virtually at the same level of employment and income and, a decade later, in 2010, the mining city moved to a higher level and the neighboring town dropped to a lower level.

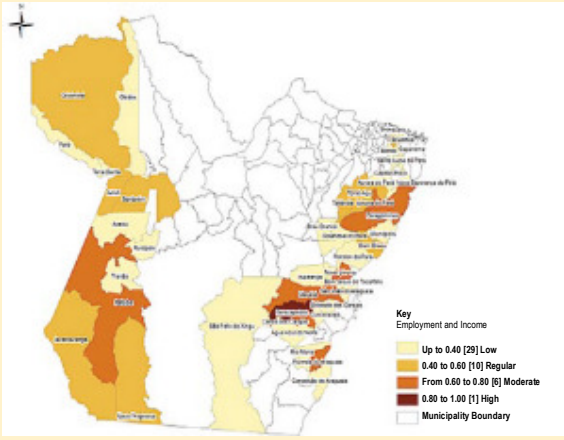
12 Enriquez (2013).

13 FIRJAN - Federation of Industries of the State of Rio de Janeiro.

MAP 4 - MINING MUNICIPALITIES OF PARÁ - FIRJAN SUB-INDEX OF EMPLOYMENT AND INCOME, 2000.



MAP 5 - MINING MUNICIPALITIES OF PARÁ - FIRJAN SUB-INDEX OF EMPLOYMENT AND INCOME, 2010.

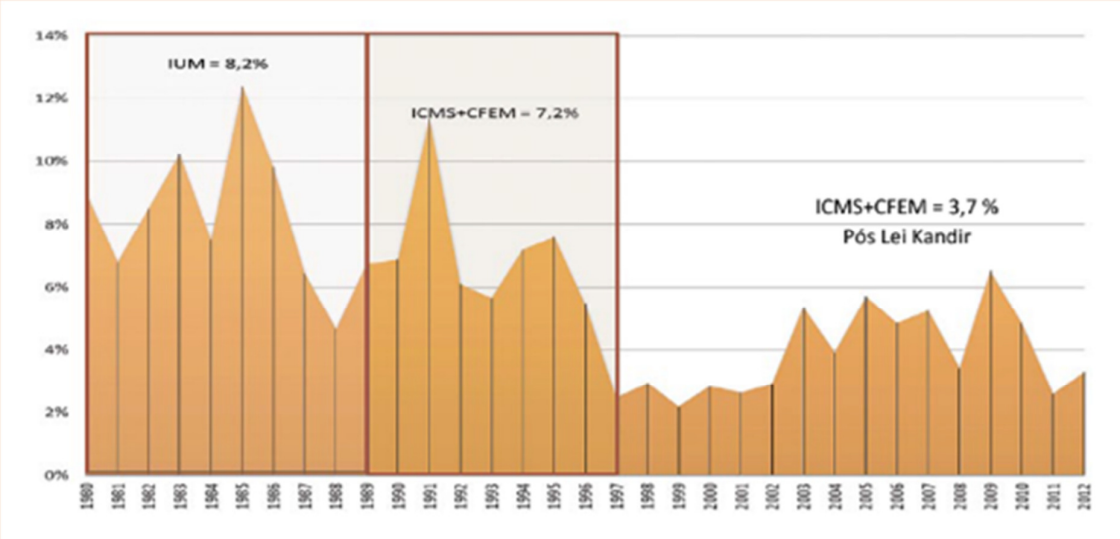


Source: Prepared by SEICOM based on data of IFDM/FIRJAN

Considering the importance and scale of mining activity in Pará, one can expect those benefits to be expanded to a radius of coverage that goes beyond the mining front. The failure to provide that means wasting an opportunity to convert mining into an authentic platform to leverage regional development.

From a historical perspective, we realize that, over four decades, the mining-related government charges, in terms of percentage of the value of exports, has suffered significant decline. In the 1980s, when the only charge levied on mining was the Single Tax on Minerals (IUM), on average, this proportion was 8.2%. In the 1990s, the IUM was extinguished and minerals joined the ICMS tax base, in addition to the introduction of CFEM - the proportion dropped to 7.2%. In the late 1990s, and every year in the 2000s, this proportion fell sharply to 3.7%, i.e. less than half of what it was during the IUM (Chart 10).

CHART 10 - GOVERNMENT CHARGES OF MINING IN PROPORTION TO THE EXPORTED VALUE IN PARÁ, (1980-2012).



Source: Prepared by SEICOM based on data of Annex I

It seems very odd, especially for people that are unaware of the structure of Pará's public finances, to see how such a state rich in natural resources is at the same time, so poor in its social indicators, with 31% of its population living below the poverty line. It should be clear that, historically, countries and regions developed through their mineral base relied heavily on tax instruments.

In summary, considering that almost all mineral production is exported in a crude or semi-processed manner, i.e. without consideration of the positive multiplier effects, upstream and downstream, offered by the manufacturing industry in terms of employment, acquisition of goods and services, technological demands etc., it appears that the national tax model, when preventing Pará from deriving benefits from its most thriving industry, wastes a great opportunity to reduce regional disparities.
To use mining as a development platform requires actions to change the tax code both to allow better sharing of mineral revenues, and primarily to induce productive diversification and add value by converting a richness that will not last forever and is volatile into assets that are sustainable.

1.8 MINING JOBS AND ESTABLISHMENTS

The demand of formal mining for labor is limited, because of the very nature of mining, which is capital intensive, but also because of the high quality of the mines, allowing greater output per unit of labor employed (ENRIQUEZ, 2007).

When we consider the formal employment, the mining industry of Pará accounts for only 1.5% of the total percentage, which is 2.0% of the manufacturing industry. In the Amazon region, these percentages are 0.7% and 2.3%, respectively (Table 3). This shows the mining "vocation", par excellence, of Pará, because when we consider the national average, we see that the industrial "vocation" stands out by absorbing the greater mass of labor - almost 17%.

TABLE 3 - PARÁ, AMAZON, BRAZIL - MANPOWER FORMALLY EMPLOYED IN SELECTED ACTIVITIES, 2011.

STATE	INDUSTRY MINING (A)	(A)/(C)	MINERAL PROCESSING INDUSTRY (B)[1]	(B)/(C)	(A) + (B)	TOTAL OF THE LABOR EMPLOYED (C)	(A)+(B)/(C)
Pará	15,483	1.49%	20,742	2.00%	36,225	1,037,089	3.5%
Amazon Region*	27,760	0.70%	92,082	2.33%	119,842	3,947,399	3.0%
Brazil	231,389	0.50%	7,726,509	16.68%	7,957,898	46,310,631	17.2%

(*) Made up of seven states of the North Region plus Maranhão and Mato Grosso.
Source: MTE/RAIS.

The mining phase is known to use few people and the processing step is known to create more jobs that pay better and are more stable and allow more reallocation in cases of crisis, among other advantages.

Indeed, there is great contrast when considering the ratio of jobs in mining and mineral processing. From the data in Table 3, it appears that, while, in the national average, employment in each mining step corresponds to 33.4, the stage of processing, in the Amazon Region average, this ratio is 3.3 and in the State Pará it is only 1.3.

ESTABLISHMENTS

According to MTE / RAIS 2011, Pará has 144 establishments in the mining industry, employing 15,500 workers. Micro and small businesses (MSBs) account for the majority of such establishments (89%). However, the large establishments (large companies) are the ones that employ most workers (83%), although they account for only 4% of the total, according to Chart 11.

These indicators, again, show the mineral model of the state that has, on one side, few companies producing on a large scale and, on the other, the MSBs that, even though they are the majority, do not appear as strong absorbers of labor. A probable hypothesis is the high level of informality of these companies.

CHART 11 - DISTRIBUTION (%) OF THE MINING INDUSTRY BY SIZE, PARÁ - 2011.

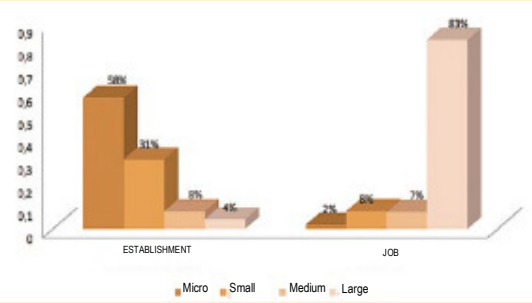
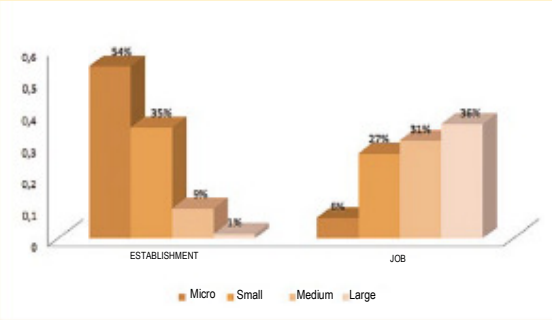


CHART 12 - DISTRIBUTION (%) OF THE TRANSFORMATION INDUSTRY BY SIZE, PARÁ - 2011.



Source: MTE/RAIS.

In the segment of mineral transformation, Pará has 658 establishments employing around 19 thousand workers. The micro and small establishments also account for the majority (89%) of establishments, (MTE / RAIS, 2011). However, unlike the mining segment, in the transformation industry, micro, small and medium establishments are the ones that employ most of the workforce (64%).

This asymmetry between the mining industry and the transformation industry is indicative of the challenges the State faces to move forward in the denser stages of the production chains of its mineral assets. The indicators show that the majority of establishments in the manufacturing industry are medium-sized and small, but this concentration is much higher for the industry of nonmetallic minerals. Large establishments are geared primarily to the steel manufacturing step and there is a great niche for micro and small enterprises in the production of metal as shown in Chart 13.

CHART 13 - ESTABLISHMENT OF THE MINERAL TRANSFORMATION INDUSTRY IN THE STATE OF PARÁ, 2011.

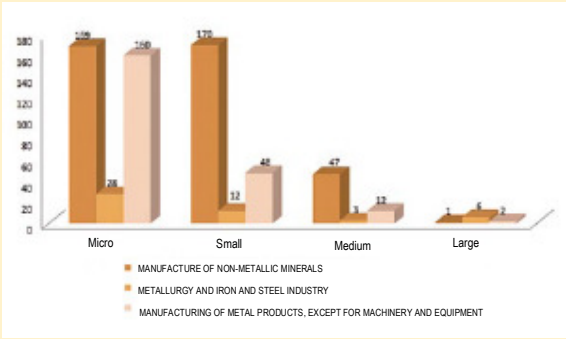
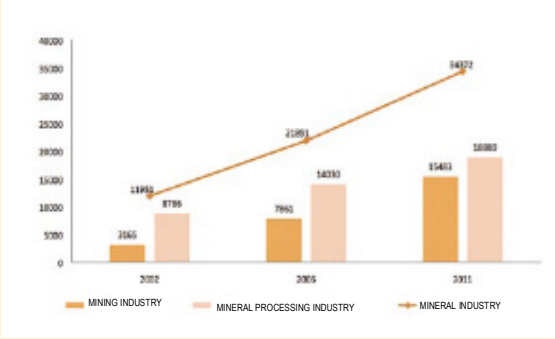


CHART 14 - EVOLUTION OF EMPLOYMENT IN THE MINING AND MINERAL TRANSFORMATION INDUSTRY IN THE STATE OF PARÁ, 2002-2011.



Source: Prepared by SEICOM based on MTE/RAIS

In just a decade, employment in the mining industry was multiplied by three. The transformation industry grew at an average annual rate of 8%, while mining at a rate of 17% (Chart 14). However, in absolute terms, the mineral transformation industry is the one that employs most people in this State.

This shows that, on the one hand, companies took advantage of the rising tide of prices to boost production, especially iron ore, as we have seen. In addition, it shows that the export oriented production base rests on primary goods, i.e. without adding value, with the postponement of major mineral transformation projects, such as ALPA, for example, that could change the state's production traits (BOX of ALPA).

In the profile of Pará's export basket, it is possible to notice a throwback to the 1990s, when 72% of exports were composed of basic or semi-manufactured products. In 2012, this proportion increased to 80%. Manufactured products, which accounted for 12% in 2010, started to account for 9% in 2012. (Charts 15, 16, 17 and 18).

CHART 15 - PROFILE OF PARÁ'S EXPORT BASE, 1990.

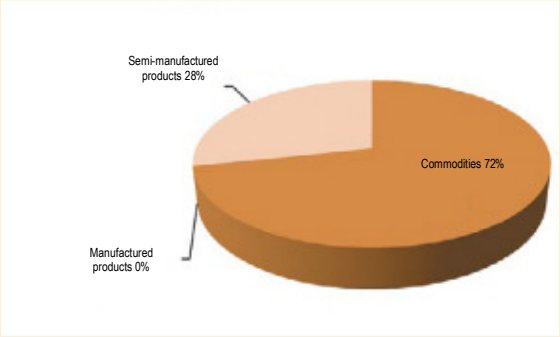


CHART 16 - PROFILE OF PARÁ'S EXPORT BASE, 2000.

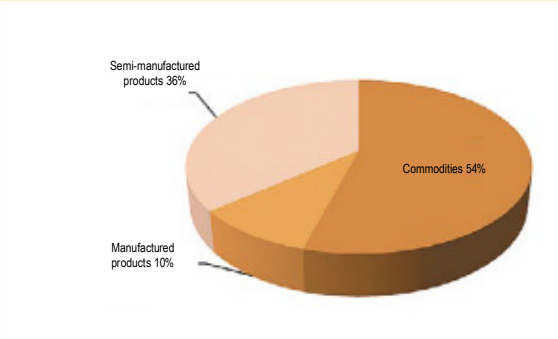


CHART 17 - PROFILE OF PARÁ'S EXPORT BASE, 2010.

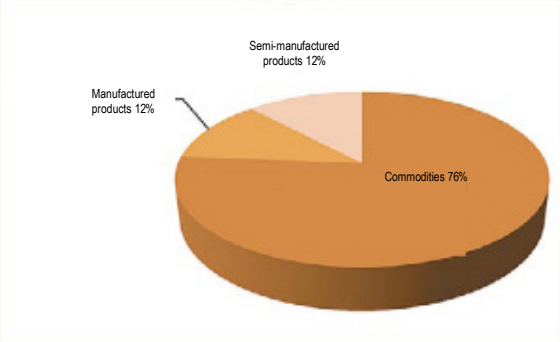
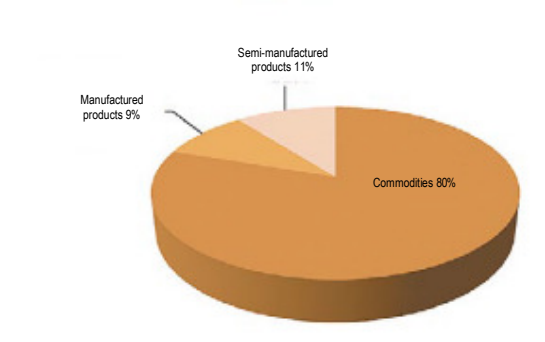


CHART 18 - PROFILE OF PARÁ'S EXPORT BASE, 2012.



Source: SEICOM, 2013

The profile strongly based on the export of *commodities* has strong implications and it is one of the great challenges of PEM-2030, for the addition of value to the mineral production chains, as shown in item 2.2.

2

CHAPTER

Interfaces of **Mining** in **Pará**

2. INTERFACES OF MINING IN PARÁ - BETWEEN INFORMAL MINING AND THE CHALLENGE OF CONSOLIDATING INTEGRATED PRODUCTION CHAINS

2.1 INFORMAL MINING

The mining activity has been part of the history and culture of the state of Pará for almost a century. As a mining activity that initially required little technology and was present in all regions of the state.

The "informal mining" activities, which have become, with rare exceptions, a complex system of informal semi-mechanized mining, involve larger equipment such as modern dredges, bulldozers and facilities for gold ore beneficiation. Thus, the mining activity that was carried out with the aid of rudimentary equipment, which characterized the "traditional" mining activity, which used a "pair of machines", "smoking snake ", "lontona" and others, began to employ more sophisticated machinery, which do mechanical or hydraulic dismantling, "shafts" and even systems of underground galleries.

Four types of informal mining prevail in Pará:

1) stripping with the use of jet-nozzle (Image 2)
2) in shafts (Image 3)
2) with bulldozers (PCs) (Image 4)
4) with dredges in river beds (Image 5).

The mining activity occurs most often in areas that are hard to reach and usually in an irregular way, without technical guidance, which leads to profound environmental impacts on the natural and social environment. According to the State Department of Environment (SEMA), soil erosion and pollution of rivers by improper use of mercury are the most significant impacts. Among the social problems, it is possible to highlight the illegality and poor working conditions that contribute to other social problems such as alcoholism, drugs and prostitution.

There are mines in almost the entire State. By October 2013, DNPM registered around 12 thousand PLGs (ANP, October 2013). However, only 4% of this demand has been converted into formal activity, since the DNPM granted only 548 PLG titles from 1992 to 2013. One of the reasons for this low rate of formality is the difficulty in obtaining the environmental permit, or the fact that the activity is being carried out in prohibited areas (conservation units, indigenous reserves, maroon areas or others), or a number of challenges inherent in the activity [14] .

Map 06 shows that most of the applications for PLGs are in or near Conservation Units (UCs) and Indigenous Lands (Tis), where the regularization of the mining activity is done by IBAMA, which is the licensing authority.

IMAGE 2 - OUTDOORS INFORMAL MINING (USE OF JET NOZZLES).

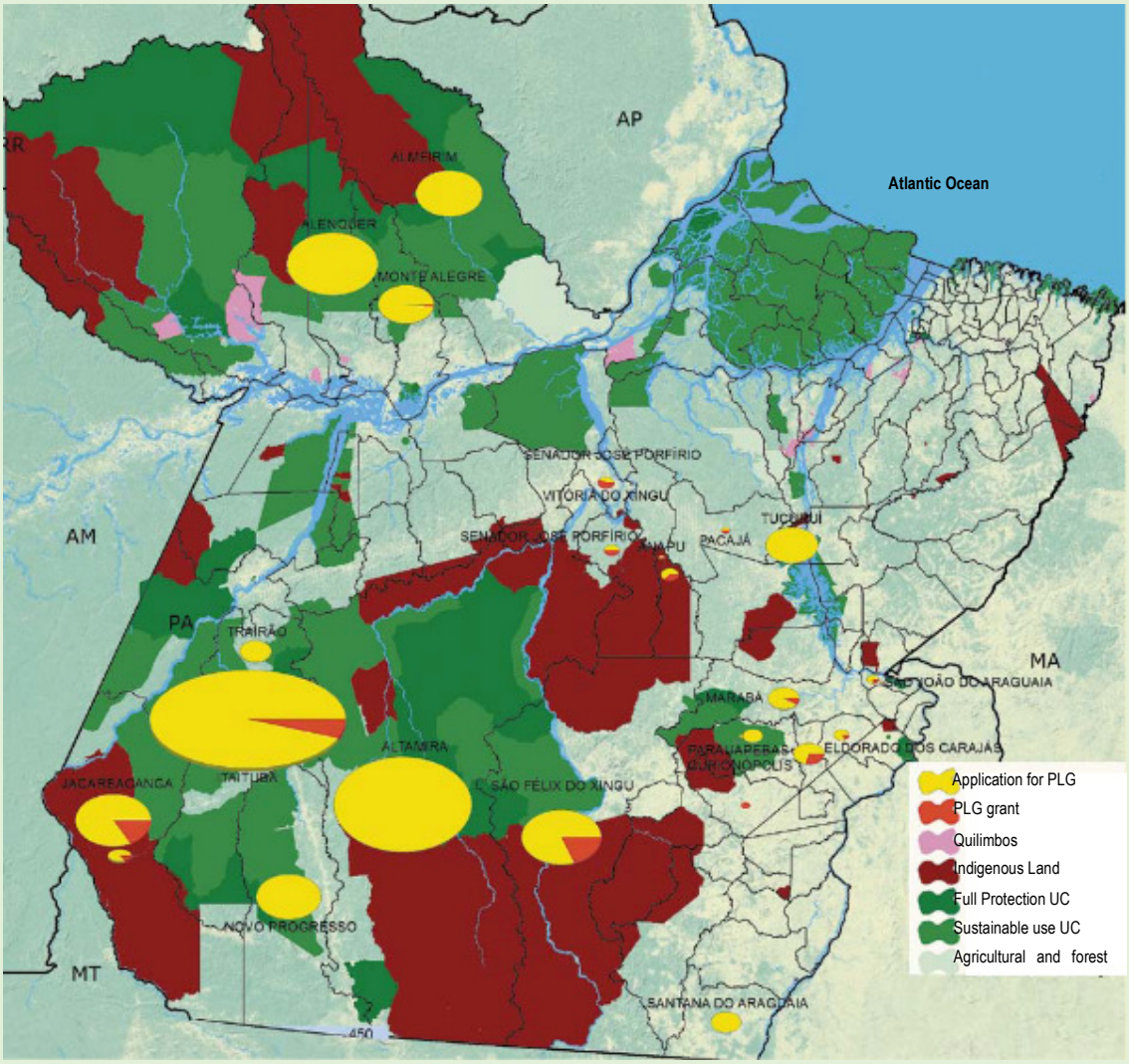
IMAGE 3 - INFORMAL MINING IN SHAFTS

IMAGE 4 - INFORMAL MINING, MECHANIZED WITH PC.

IMAGE 5 - INFORMAL MINING WITH DREDGE IN THE RIVERBED.

14For regularization of the informal mining activity, miners have great difficulty in meeting the requirements of the environmental licensing process, be it in areas over which the federal government has jurisdiction, where the license must be issued by IBAMA, be it in state areas, where the license must be issued by SEMA, or in areas smaller than 50 ha, where the license is granted by the Municipal Environment Offices accredited by SEMA. For an extensive discussion on the problems of informal mining, see the Report of the 3rd Workship of PEM 2030 (available for download at http.//seicom.pa.gov.br/dowriload/pmep2030/RELAT%C3%93RIO%203%C2%AA%200FICI- NA%20-%20ATIVIDADES%20G ARIMPEIRA.pdf

MAP 6 - MUNICIPALITIES WITH PLG, PLG APPLICATION, UCs and TI.



Source: SEICOM, 2013.

Formal PLGs are distributed in 15 municipalities, with Itaituba (Table 4) in first place, since it has 85% of the granted titles, followed by São Félix do Xingu (5%), Jacareacanga (4%), Curionópolis (1%) and the other 11 municipalities (5%). Gold stands out, but there are PLGs for gems, especially diamond, cassiterite and even copper.

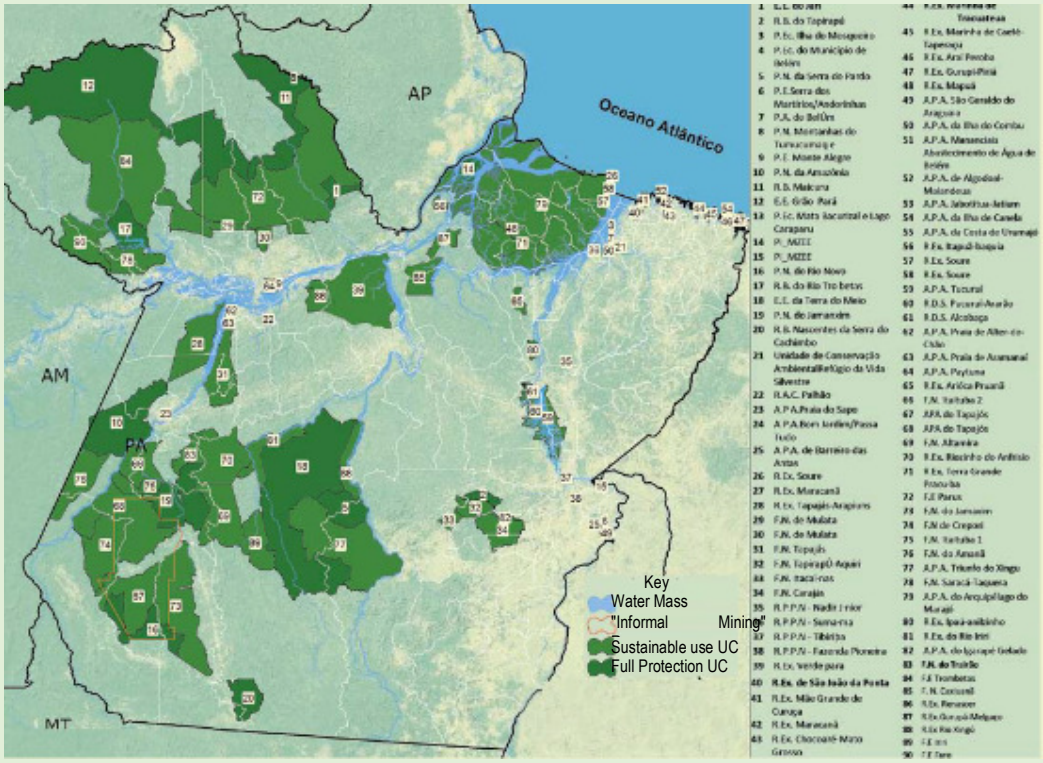
TABLE 4 - PERMITS FOR INFORMAL MINING BY MUNICIPALITY IN PARÁ, 2013.			
MUNICIPALITY	**Number of PLGs granted**	**SUBSTANCE**	**Application for PLG**
ITAITUBA	467	Gold (466) / Copper (1)	9,729
SÃO FÉLIX DO XINGU	29	Cassiterite (24)/ Copper (5)	129
JACAREACANGA	23	Gold	121
CURIONÓPOLIS	07	Gold (3)/Copper (4)	17
ALTAMIRA	04	Gold	474
VITÓRIA DO XINGU	04	Gold (2) / Diamond (2)	03
SENADOR JOSÉ PORFÍRIO	03	Gold (1)/Diamond (2)	03
ANAPÚ	03	Gold (1)/Diamond (2)	05
MARABÁ	02	Amethyst	23
ÁGUA AZUL DO NORTE	02	Gold	0
MONTE ALEGRE	01	Diamond	77
PACAJÁ	01	Gold	01
ELDORADO DOS CARAJÁS	01	Quartz	05
SÃO JOÃO DO ARAGUAIA	01	Quartz	03
ALENQUER	0	-	207
ALMEIRIM	0	-	112
NOVO PROGRESSO	0	-	106
TUCURUÍ	0	-	68
TRAIRÃO	0	-	25
SANTANA DO ARAGUAIA	0	-	23
PARAUAPEBAS	0	-	10
OTHER CITIES	0	-	906
TOTAL	**548**		**12,047**

Source: DNPM - Prepared by SEICOM, 2013.

According to data available, the main star of mining in Pará is the Tapajos region, whose discovery of gold happened in 1956. Three decades later, informal mining was legitimized with the creation of "the Tapajós gold mining reserve" (Ministerial Decree number 882/1983), which ensured free access to the pre-existing "informal mining" occupation. Two decades later, in 2006, the creation of a mosaic of UCs (Unidades de Conservação = Conservation Units) with National Parks, National Forests, Environmental Preservation Areas and Mining Reserves, left hundreds of miners in the illegality and, in a way, created a conflicting situation that has been insufficiently treated up to this time.

According to the Chico Mendes Institute for Biodiversity Conservation (ICMBio), the UCs that allow mining are FLONA (Floresta Nacional or National Forest) Saracá-Taquera, FLONA of Amana, FLONA of Crepori, FLONA of Jamaxim and APA (Área de Proteção Permanente or Permanente Protection Area) of Tapajós, all of which have already prepared their Management Plans. However, there are six UCs that have not prepared their plans (FLONA Altamira, FLONA Itaituba I, FLONA Itaituba II, APA Tapajós, PARNA (Parque Nacional = National Park) of the Amazon and PARNA of Rio Novo), which is an obstacle to the legalization of these mining areas.

MAP 7 - ESPECIALLY RESERVED AREAS IN PARÁ.



Source: SEICOM, 2013.

Socioeconomic aspects of mining

The Federal Constitution of 1988 made significant changes to the legal framework of mining, by establishing that the state was also responsible for "fostering the organization of the mining activity in cooperatives, taking into account the protection of the environment and the economic and social protection of the informal miner"(Article 174, paragraph 3). In this sense, the miners began to organize in Pará, in the 1980s, and, since then, 33 cooperatives, four associations, two unions and one institute have already been identified in 15 municipalities of Pará (Table 5). Thus, it is estimated that the mining activity in Pará involves around 100,000 people from different backgrounds.

It is seen that the highest density of social organizations is concentrated in the municipality of Curionópolis, certainly because of Serra Pelada[15]. It is important to note that the number of members of COOMIGASP comprises members of other cooperatives, since the miners are simultaneously involved in all cooperatives of Curionópolis.

According to article 174 of the 1988 Federal Constitution, the mining activity is legally supported, through laws number 7.805/1989, which created PLG number 11.685/2008 and instituted the "Informal Miner's Statute". However, law number 7.805/1989, in its article 10, paragraph 1, establishes the concept of mining-able ore as:

> Paragraph 1 - The following mineral are considered mining-able: gold, diamonds, cassiterite, columbite, tantalite and wolframite, in the alluvial, colluvial and alluvial forms; the scheelite, other gems, rutile, quartz, beryl, muscovite, spodumene, lepidolite, feldspar, mica and others, in types of occurrences that may indicated, at the discretion of the National Department Mineral Production - DNPM.

15Extinct since 1992, the former mining activity of Serra Pelada was formed in the early 1980s, from a large human anthill that peaked between the 1982 and 1986. The mining rights of the area that belonged to the former state company Cia Vale do Rio Doce (CVRD), today called VALE, were purchased by the Federal Government by the reserve value. The Federal Government transferred such rights, since 1990, to the Cooperative of Informal Miners of Serra Pelada (COOMIGASP), which, in turn, signed a contract with company Colossus Minerais to mine the remaining gold.

TABLE 5 - SOCIAL ORGANIZATIONS OF INFORMAL MINING IN PARÁ, 2013.			
CORPORATE NAME	**ACRONYM**	**MUNICIPALITY**	**Number**
Coop. de Mineração do Estado do Pará Ltda.	COMEPA	Santarém	ND
Coop. dos Garimpeiros do Sul do Pará Ltda.	COOGASUPA	Redenção	ND
Coop. dos Produtores de Ouro da Margem do Rio V. Rural	COPOMARVE	Santa Maria das Barreiras	ND
Coop. Mista dos Garimpeiros do Carrapato	COMEC		20
Coop. de Mineração dos Garimpeiros da Liberdade Arara	COMIGLA	São Félixdo Xingu	20
Coop. dos Garimpeiros e Mineradores da Taboca e do Mun. de São Felixdo Xingu	COOGATA		ND
Coop. Mineradora dos Garimpeiros de Ariquemes Ltda.	COOMIGA		321
Coop. de Mineração dos Garimpeiros de São Félixdo Xingu	COOMIX		16
Coop. dos Garimpeiros do Estado de Rondônia	COOGER		30
Coop. Mista de Garimpeiros de Serra Pelada	COOMIGASP	Curionópolis	44,450
Coop. dos Garimpeiros dos Minérios de Serra Pelada	COOMISPE		3,600
Coop. Mista de Mineração dos Garimpeiros Mineradores Proprietários de Catas de Serra Pelada	COOMPRO		9,691
Coop. Mista dos Produtores, Agricultores e Garimpeiros de Curionópolis	COOMPAG		5,300
Coop. Agromineral dos Garimpeiros do Serrado	COPERSERRADO		3,880
Coop. dos Produtores de Minérios de Curionópolis	COOPEMIC		20
Coop. Agro Mineral e Comercial dos Garimpeiros e Moradores de Serra Pelada	COOPERGASP		22
Coop. Mista do Garimpo da Cutia	COOMIC		400
Coop. Mista de Exp. Min. Agrop. e Colonizadora de Patrocínio	COOPA	Itaituba	42
Coop. de Extração Mineral do Vale do Tapajós	COOPEMVAT		21
Coop. dos Garimpeiros da Amazónia	COOGAM		560
Coop. dos Garimpeiros Mineradores e Produtores de Ouro do Tapajós	COOPOURO		40
Coop. Mista de Desenvolvimento do Creporizão	COMIDEC		48
Coop. de Extração Mineral do Agua Branca	COEMIABRA		ND
Coop. Mista Agro Mineral do Rio Sereno	COOMASE	Marabá	862
Coop. dos Garimpeiros do Xingu	COOXIN	Altamira	20
Coop. dos Garimpeiros E Mineradores do Brasil	COOGAMIBRA		32
Coop. dos Garimpeiros Mista de Alenquer Ltda.	COOGARMA	Alenquer	ND
Coop. dos Garimpeiros do Município de Cachoeira do Piriá	COOMINÉRIO	Cachoeira do Piriá	30
Coop. de Desenvolv. Mineral dos Garimpeiros de Serra Pelada	COOPERSERRA	Parauapebas	11,800
Coop. dos Garimpeiros do Galo, Ressaca, Ouro Verde, Itatá e Ilha da Fazenda	COOGROVIF	Senador José Porfírio	545
Coop. de Pequenos Mineradores de Ouro e Pedras Preciosas de Alta Floresta	COOPERALFA	Jacareacanga	ND
Coop. Mista de Exploração Mineral e Extração Vegetal	COOPERMINÉRIOS	Novo Progresso	49
Coop. de Desenvolvimento da Atividade Mineral de Canaã dos Carajás	MINERCOOP	Canaã dos Carajás	ND
TOTAL OF COOPERATIVES	**33**		**81,819**
Associação de Desenvolvimento Local Integrado e Sustentável de Parauapebas	ADLISP	Parauapebas	40
Associação dos Mineradores de Ouro do Tapajós	AMOT	Itaituba	2,000
Associação dos Garimpeiros Trabalhadores da Taboca e Região	AGATTAR	São Félixdo Xingu	26
Associação de Assistência e Defesa dos Garimpeiros de Serra Pelada	ADEGASP	Curionópolis	1,500
Instituto Socioambiental dos Garimpeiros do Brasil	ISGB		1,500
Sindicato dos Garimpeiros e Trabalhadores de Mineração de Curionópolis e Serra Pelada	SINGASP		38,000
Sindicato dos Garimpeiros de Novo Progresso	SIGANP	Novo Progresso	420
TOTAL OF ASSOCIATIONS AND UNIONS	7		**43,486**

ND: Not available. Source: OCB/PA, adapted with research of DIGEM/SEICOM.

According to DNPM, the PLG allows mining in a area that is no more than 50 ha in size. In order to mine beyond these limits and environments, it is necessary to change the regime to a Mining Concession. For many experts, the secondary deposits (alluvium/colluvium/elluvium) of gold in Pará are practically exhausted, and because of that, the miners have turned to the primary rocks, using mechanized mining techniques, in total disregard to what the law determines.

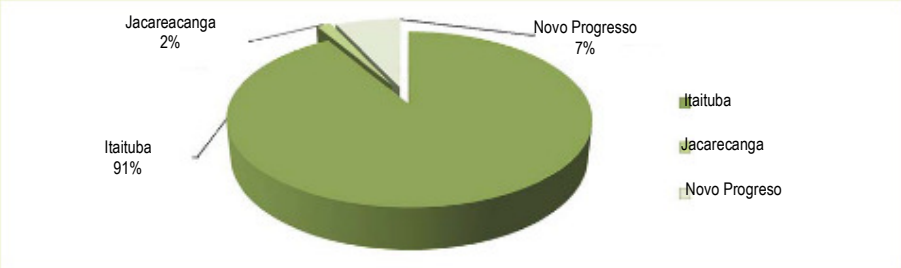
Pará's municipalities that have the mining activity as the basis of the local economy, as in the case of Itaituba, Cachoeira do Piriá, Jacareacanga and others, use gold as a medium of exchange for almost all transactions, that is why it is so difficult to know the real dimension of this economy. In municipalities that have informal mining activities, the Distributors of Securities (DTVM) are the ones that buy and sell the gold coming from the mines. According to the Board of Planning and Collection (DIPAR/DNPM) and the Tax Authority (Receita Federal), there are 21 DTVMs operating in Pará (2012).

According to these agencies, in 2012, the production of gold in Pará was 5.85 tons, 2.1 t of which (36%) was produced by mining companies and 3.8 t (64%) came from the informal mining activity.

The formal production comes from several small businesses, especially Reinarda Mineração Ltda., in the municipality of Floresta do Araguaia (PA), while the informal mining production of gold is located in the municipalities of Senador José Porfirio, Novo Progresso and Itaituba.

Itaituba is the leading gold producer in the state, with 3,441 in 2012, representing 60% of the total production of Pará and 91% of the production from the informal mining activity, as shown in Chart 19. The municipality of Novo Progresso reported a production of 263.3 kg of gold in 2012, followed by Jacareacanga, with a production of 58 kg (information obtained in ANP).

CHART 19 - DISTRIBUTION OF THE PRODUCTION OF INFORMAL GOLD MINING BY MUNICIPALITY IN PARÁ - 2012.



Source: SEICOM, 2013.

It is important to note that the municipality of Novo Progresso has no official PLG. Thus, the output reported is due to the sale of gold from informal mines in its surroundings, through the DTVMs located in the municipality. This suggests evidence of "evasion" of gold, or the existence of mining points that have not been formally identified yet. According to a representative of a DTVM, it is estimated that gold sold through distributors in the city of Itaituba corresponds to only 37.5% of the local production.

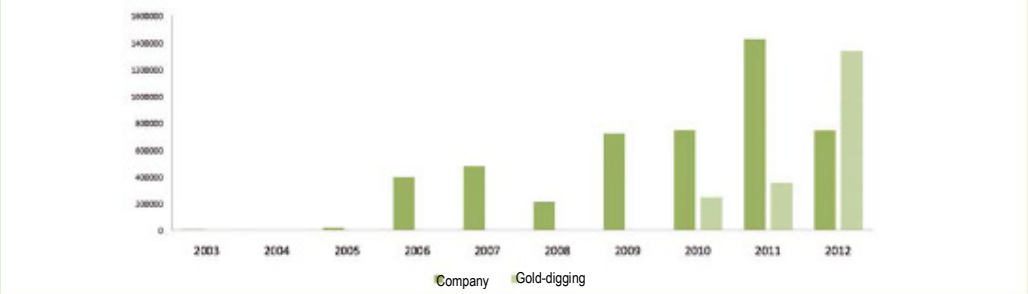
In fact, according to Chart 20, which records the payment of CFEM of gold, it is possible to note the following:

I. Trend of increase in the revenues from payment of gold CFEM [16], both by the companies and the DTVMs. From R$ 5,000.00 in 2003, it increased to R$ 2.1 million in 2012.
II. The CFEM amount paid by the DTVMs surpasses the amount paid by the companies from 2012 onwards. While companies have paid R$ 743,000, the DTVMs paid R$ 1.4 million
III. There is no record of payment of CFEM by the DTVMs in a large part of the series

16CFEM is not paid directly by the miner, but rather by the first purchaser. It corresponds to 1% of the net revenues (gross sales revenues minus taxes, insurance and freight)

presented, from 2003 to 2013. Payment data only begin to appear after 2010.

CHART 20 - PAYMENT OF CFEM GOLD (2003 TO 2012).



Source: DNPM - Prepared by SEICOM.

There is no doubt that this situation is a reflection of the sharp increases in gold prices in the 2000s, as well as the change in rates of CFEM on informal gold mining[17].

Chart 21 presents a series of quotations of prices since 1975. We observe that, despite fluctuations in the late 1970s, prices remained low during the following two decades, varying between US$ 250 and US$ 400 an ounce. This behavior began to reverse after the 2000s, when prices reached their peak in 2011, with the value of around US$ 1,800. However, since 2012, there has been a drop in prices, which have hovered around US$ 1,300, but at a level still well above the past decades.

CHART 21 - QUOTATIONS OF GOLD PRICES (US$/troy ounce), 1975 to 2012.

Source: www.kitco.com.

Informality and dispersion hinder the lawful marketing of gold to the foreign market. Therefore, out of the gold mined and registered in the State in 2012, 77%, on average, was sold in the domestic market, while 1.37 ton (23%) was exported. The export is done by companies, while domestic marketing is mostly arising out of the mines (ANP).

At present, informal mining has been increasingly mechanized, which increases its potential impact and the social-environmental conflicts, so there is a yearning that this activity shall be become a small mining activity with a smaller impact and greater environmental and socioeconomic control. However, this hardly happen without systematic public policies.

In this sense, SEICOM stimulates spatial planning for small-scale mining, but it understands that this is a process that requires caution and attention because of all the existing legal and organizational apparatus, in order to avoid overlapping of actions that can make the system increasingly complex and time consuming. It is also important to emphasize that the planning actions must be integrated with the participation of regulatory institutions, both from the mining sector and from environmental agencies [18] , at different levels, as well as government agencies, universities, private companies and civil society in general, to stimulate the synergy that can potentiate the actions, such as business interactions that are expected to occur between the mines and the Gem and Jewel Complexes of Pará.

17Article 17 of Law number 12,087, of November 11, 2009, which became effective as of January 1, 2010, reduced the rate from 1% to 0.2% for the original purchaser of mineable minerals extracted under the PLG scheme. It should be noted that notifications of CFEM debit collection, in the order of R$ 50 million, relating to taxable events between 01/1991 and 12/1999 have been filed by the Director General of DNPM, based on the report of the Attorney General of DNPM number 58/2010-SC.

18 Buoyed by the Tapajós Work Group (GT-TAPAJOS) the State Office for the Environment (SEMA) carried out a series of actions that resulted in the publication of Normative Instruction number 006/2013, which establishes new procedures for environmental licensing of the mining activity, to minimize the environmental impacts of this activity.

2.2 MINERAL PRODUCTION CHAINS OF PARÁ

The possibilities of promoting regional development through the integration of economic activities throughout the mineral supply chains are broad. Hence the importance of presenting an integrated view around existing or potential production chains, rather than a simple isolated analysis of minerals.

Mineral vertical integration generates a wide range of business opportunities, promotes the deployment and proliferation of business ventures and boosts the regional economy. The vertical and horizontal integration of the chains induces the addition of value to the mineral production and the greater inflow of financial circulation and distribution of wealth and resources in the region in which the activities are carried out. Concomitantly, the vertical integration between the production structure and its supplier networks represents a significant opportunity for the development of micro and small local and regional firms, also contributing to the increase in the circulation of wealth and quality of life.

2.2.1 Metallic Minerals

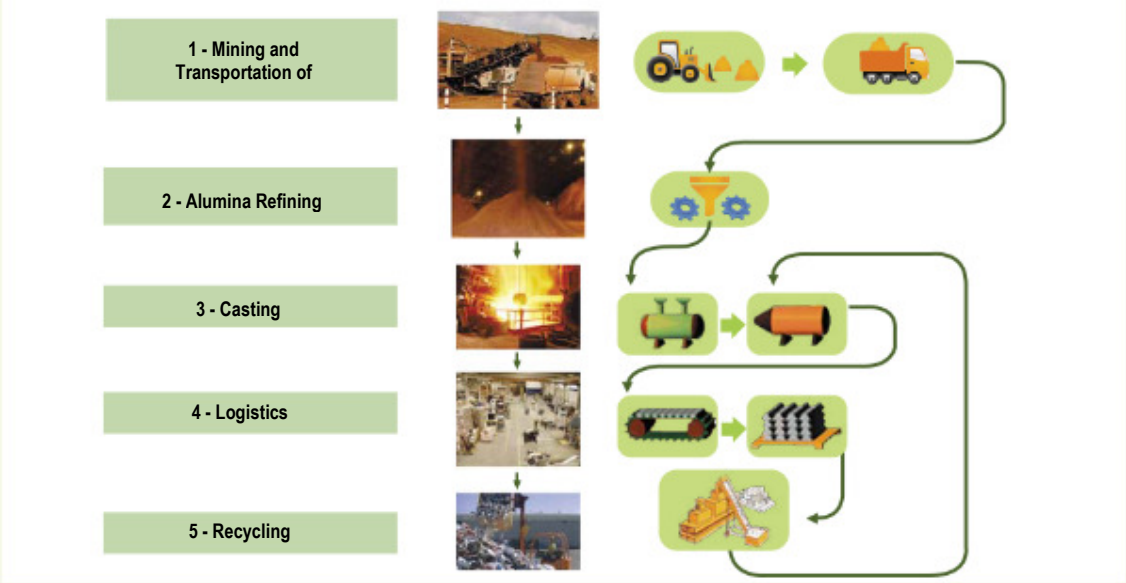
I - Aluminum

Bauxite is the raw material for aluminum. And it is also used in the industries of chemicals (aluminum sulfate), abrasives and cement (high alumina). It is a rock formed by hydrated aluminum minerals that occur in large deposits. Pará has a total reserve of 3.24 billion tons, which represents 74% of the national reserves of metallurgical bauxite and 11% of the international reserves (DNPM, Mineral Contents Mineral Yearbook, 2009 data)

The Aluminum Production Chain

The production process begins with the extraction and processing of bauxite, which goes to the plants of production of alumina (aluminum oxide), and then to *smelters* , a stage in which the alumina is subjected to the electrolytic reduction process and the aluminum metal is produced by removing oxygen (Figure 1).

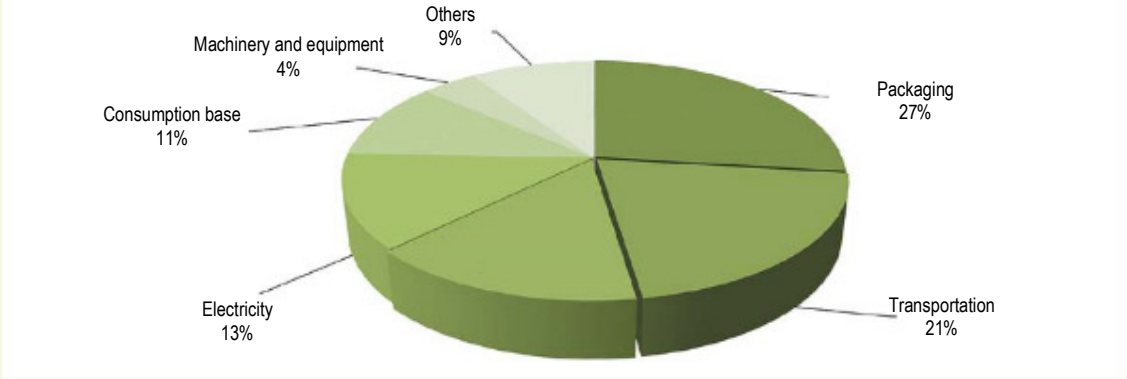
FIGURE 1 - VALUE CHAIN OF THE ALUMINIUM INDUSTRY.



Source: SEICOM, 2013.

The ingots of metallic aluminum, in turn, are sent to the metals industry (4th cycle), where they are transformed into intermediate goods by means of rolling, extrusion, casting and drawing. Each of these processes generates different raw materials for different industry segments, such as plates and sheets (produced by laminating), extruded (metal profiles produced by extrusion). The sectors of packaging, transport and construction are the ones that consume most aluminum in Brazil, 63% of the total in 2011 (Chart 22).

CHART 22 - THE INDUSTRY'S CONSUMPTION OF ALUMINIUM IN BRAZIL IN 2011.



Source: ABAL.

The integration of the production chain of the aluminum industry occurs mainly through the production of rolled and extruded products that serve the packaging, transportation equipment and construction industries. They are producers of inputs for other industries, such as food (packaging), cargo and passenger transportation, infrastructure projects and real estate for public, corporate and residential use (construction).

Integration of the production chain in the state of Pará

In Pará, the aluminum chain is the most advanced in the process of vertical integration, with operations ranging from the first (bauxite mining) up to the fifth cycle (production of packaging and utensils). It is spread over various regions of the state, including companies that conduct activities directly linked to the production of raw materials and metal products, and organizations involved in a wide range of related sectors, referring to the supply of goods and services for core industries (Map 8).

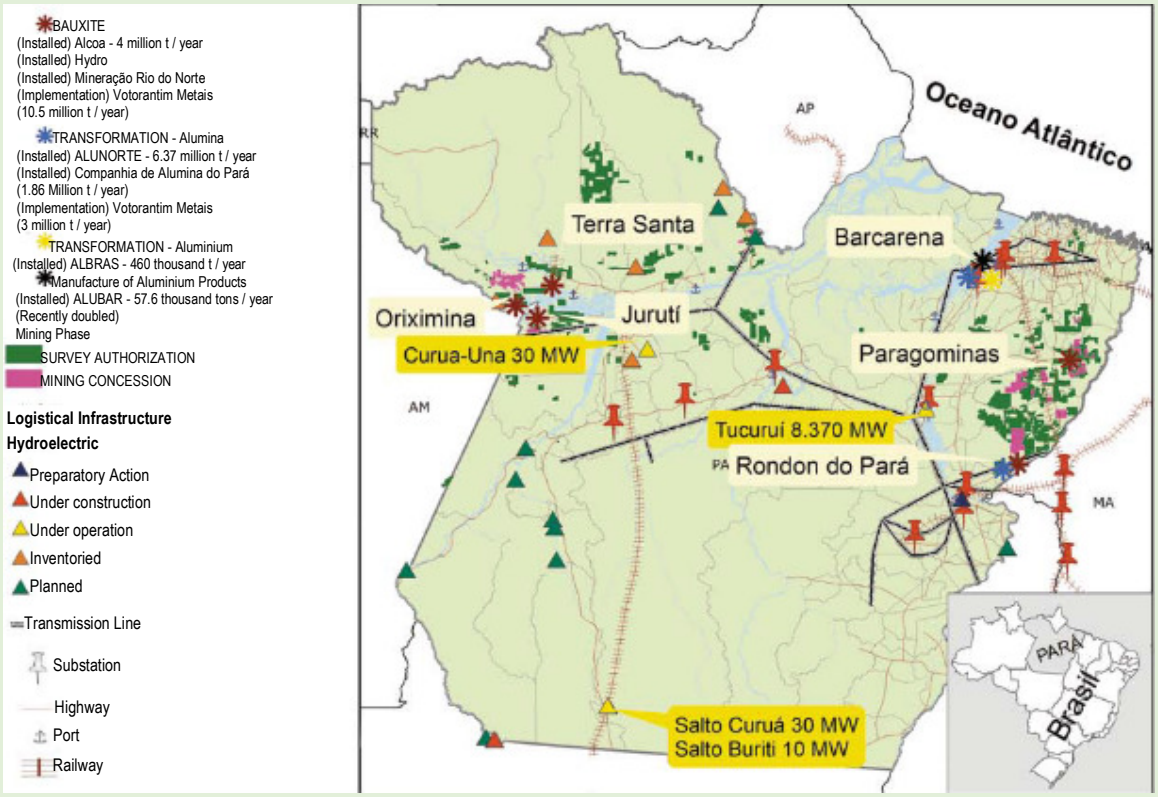
First cycle:

There are mines in the municipalities of Oriximiná and Terra Santa (MRN), Juruti (ALCOA) and Paragominas (Hydro). The bauxite extracted from MRN and Hydro goes to the alumina plant of Hydro/ALUNORTE in the city of Barcarena. Part of the output is sent to the neighbor aluminum *smelter* of Alumínio do Brasil S/A (ALBRAS), a company also controlled by the metallurgical conglomerate NorskHydro, a global leader in the aluminum industry. The metallurgical park of Barcarena has a logistics infrastructure that guarantees the network of road transport, made up of federal and state highways; electricity aplenty provided by the Tucuruí Hydroelectric Plant; and port terminal Vila do Conde. Rondon do Pará will house an integrated complex for the production of bauxite and alumina, where mining and processing of minerals will occur at the same site.

Second cycle: Production of Alumina

Alumina is industrialized by Hydro / Alunorte. 70% of its production is exported and 30% transformed into primary aluminum in Barcarena and São Luís (MA). In Barcarena, there is one plant under construction, Companhia de Alumina do Pará (CAP). In the case of future installations of Rondon do Pará, the transformation of alumina will be taken to the next deposit.

MAP 8 - SPATIAL DISTRIBUTION OF THE ALUMINUM PRODUCTION CHAIN IN PARA.



Source: SEICOM, 2013.

Third cycle: Production of metallic aluminum

It occurs in Barcarena in ALBRAS factory. Since it is an electro-intensive process, the installation of this complex required the construction of Tucuruí HPP.

Fourth cycle: Production of processed aluminum

The main company is ALUBAR, manufacturer of rebar and cables using liquid aluminum supplied by ALBRAS, whose facilities are close to those of the company. It is also important to highlight PISA, the city of Belém, and ALUPAN, in the municipality of Castanhal / PA, makers of household goods, which also use as raw material aluminum metal supplied by ALBRAS. Another important group is the REXAM PLC group, maker of packaging for beverages. This company uses, as raw material, aluminum foil from the Minas Gerais state, since there is no production of aluminum rolled products in Pará territory.

Aluminum production in 2012 was 475 thousand tons, 7% (32 000 t) of which was destined for the local market. Out of the portion absorbed locally, 95% was allocated to ALUBAR, and the remaining 5% to other industries (Annual Report 2012, ALBRAS).

Exports of the aluminum production chain in the state of Pará in 2012.

Pará is an important *Trader* of primary products of the first three cycles of this chain, that is, lower value-added goods in the international market.

In the case of bauxite, the U.S. is the main importer that, along with Canada, purchased 71% of such mineral in 2012. A decade ago, these countries accounted for 59% (Table 4).

TABLE 4 - DESTINATION OF EXPORTS OF PARÁ'S BAUXITE, 2000 AND 2012.								
COUNTRY	2000				2012			
	US$	%	TON	US$/T	US$	%	TON	US$/T
UNITED STATES	20,163,828	22.23	912,830	22.09	91,995,110	42.99	2,838,673	32.41
CANADA	33,389,915	36.81	1,467,288	22.76	59,860,403	27.97	1,852,990	32.30
IRELAND	3,521,976	3.88	163,870	21.49	49,922,731	23.33	1,562,469	31.95
CHINA					8,793,903	4.11	267,043	32.93
GERMANY					3,440,415	1.61	108,900	31.59
ARGENTINA	572,492	0.63	15,344	37.31		0.00		
GREECE	7,468,025	8.23	324,455	23.02		0.00		
UKRAINE	11,726,517	12.93	519,537	22.57		0.00		
VIRGIN ISLANDS (AMERICAN)	13,860,506	15.28	626,991	22.11		0.00		
TOTAL	**90,703,259**	**100.00**	**4,030,315**	**22.51**	**214,012,562**	**100.00**	**6,630,075**	**32.28**

Source: MDIC.

In 2000, there were seven countries and consumers and, in 2012, only five. Unlike the higher growth of metals, bauxite prices registered a moderate growth, going from U.S. $ 22.5 to U.S. $ 32.3 / t in the period, equivalent to an average rate of 2.8% increase per annum.

As for alumina, the market has diversified from five to ten destinations; but the concentration remained in Canada and Norway (Table 5), since, in 2000, these countries accounted for 61.5% and in 2012 for 67%. Just as bauxite, the average prices of alumina rose slightly over the period, from U.S. $ 195.00 in 2000 to U.S. $ 248.00 in 2012, equivalent to an average annual rate of 1.9%.

TABLE 5 - DESTINATION OF EXPORTS OF PARÁ'S ALUMINA, 2000 AND 2012.								
COUNTRY	2000				2012			
	US$	%	TON	US$/T	US$	%	TON	US$/T
CANADA	17,446,820	11.40	88,866	196.33	446,825,759	37.65	1,803,632	247.74
NORWAY	77,274,947	50.51	397,599	194.35	349,312,233	29.43	1,408,209	248.05
UNITED ARAB EMIRATES		0.00			134,397,731	11.32	538,021	249.80
QATAR		0.00			99,872,692	8.41	401,729	248.61
UNITED STATES	18,757,843	12.26	95,818	195.77	54,427,556	4.59	217,470	250.28
ICELAND		0.00			42,480,899	3.58	180,383	235.50
ARGENTINA	22,485,974	14.70	114,716	196.01	42,383,973	3.57	175,997	240.82
FRANCE		0.00			7,625,292	0.64	30,171	252.74
EGYPT		0.00			6,311,748	0.53	26,150	241.37
GEORGIA		0.00			3,304,545	0.28	13,075	252.74
GHANA	17,015,543	11.12	87,836	193.72		0.00		
TOTAL	**152,981,127**	**100.00**	**784,834**	**194.92**	**1,186,942,428**	**100.00**	**4,794,836**	**247.55**

Source: MDIC.

As for the exports of aluminum, Japan remains the main destination, along with Switzerland, and they account for 90% of Pará's exports. Among the stages of the production chain, aluminum is the one with the highest concentration of buyers. The average prices of aluminum, despite constant increases in the cost of labor and energy, rose slightly, from U.S. $ 1,507.00 in 2000 to U.S. $ 1,974.00 in 2012 (Table 6), the equivalent to an average annual rate of 2.1%.

TABLE 6 - DESTINATION OF EXPORTS OF PARÁ'S ALUMINUM, 2000 AND 2012.								
COUNTRY	2000				2012			
	US$	%	TON	US$/T	US$	%	TON	US$/T
JAPAN	314,661,802	58.10	208,270	1,510.84	432,148,584	57.43	219,429	1,969.42
SWITZERLAND		0.00			249,507,072	33.16	125,852	1,982.54
NETHERLANDS (HOLLAND)	150,029,416	27.70	101,723	1,474.88	70,778,604	9.41	35,805	1,976.76
BELGIUM	58,649,726	10.83	37,653	1,557.64		0.00		
SOUTH KOREA	1,553,281	0.29	1,019	1,524.43		0.00		
UNITED STATES	7,121,553	1.31	4,458	1,597.64		0.00		
ITALY	9,580,424	1.77	6,281	1,525.33		0.00		
TOTAL	**541,596,202**	**100.00**	**359,403**	**1,506.93**	**752,434,260**	**100.00**	**381,087**	**1,974.44**

Source: MDIC.

In the comparison between the values and export volumes (Table 7), although metallic aluminum is the product with the highest sales value, in dollars per ton, and bauxite is the product with the lowest value, the greater volume of exports corresponds to the last product. It is also worth highlighting that 56% of the exported volume corresponds to bauxite, which equates to just 10% of revenues in export dollars.

TABLE 7 - DESTINATION OF EXPORTS OF PARÁ'S ALUMINIFEROS, 2000 AND 2012.								
PRODUCT	2000				2012			
	US$	%	TON	US$/T	US$	%	TON	US$/T
BAUXITE	90,703,259	11.55	4,030,315	22.51	214,012,562	9.94	6,630,075	32.28
ALUMINA	152,981,127	19.48	784,834	194.92	1,186,942,428	55.12	4,794,836	247.55
ALUMINUM	541,596,202	68.97	359,403	1,506.93	752,434,260	34.94	381,087	1,974.44
TOTAL	**785,280,588**	**100.00**	**5,174,552**	**151.76**	**2,153,389,250**	**100.00**	**11,805,997**	**182.40**

Source: MDIC.

In summary, exports of goods of the aluminum chain reveal two weaknesses: 1) Excessive concentration of sales to a small number of buyers (USA, Canada and Japan), which causes the region to be vulnerable because of the dependency; 2) the largest volume of exports corresponds to the lowest value-added products, which means that this chain cannot tap the full potential generated by mineral extraction, because the opportunities for generating employment and income along the production chain are appropriated by the importing countries, which internalize the remaining cycles of the supply chain.

Potentialities of the aluminum production chain in the state of Pará

The main opportunities refer to the possibilities to integrate the chain, through the establishment of industrial activities in the fourth and fifth cycles, i.e., production of processed and manufactured aluminum. First, to support the expansion of the activities of the 4th cycle, given the large investments of the federal government in the energy sector in the state of Pará Secondly, the attraction of investments to the segment of rolled and extruded products that correspond respectively to 42% and 24% of the total national production, in which there is potential link with the demands of large infrastructure works of Pará in the fields of logistics and energy. Thirdly, the effective implementation of the Export Processing Zone (EPZ) opens opportunities for attracting several other branches of the manufactured aluminum industry, focusing on the external market.

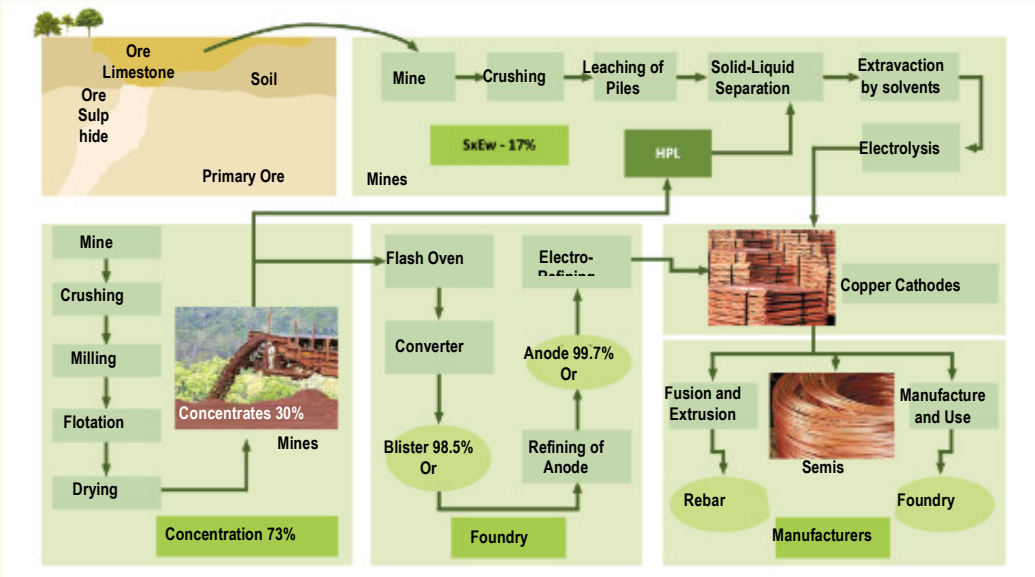
II - Copper

Copper is a relatively scarce metallic element in the earth's crust. Pará accounts for 89% of the national reserves and 3% of international reserves (DNPM, Mineral Summary, 2009 data). The main physicochemical characteristics of copper are low melting point, good ductility and malleability, resistance to oxidation and, especially, high thermal and electrical conductivity.

The Copper Production Chain

The supply chain of copper comprises, in its first cycle, ore extraction and concentration with 30% copper. In the second cycle, the concentrate is refined by pyrometallurgical or hydrometallurgical processes, which result in the production of cathodes, which can be transformed into extruded goods (wires, cables and rods) or manufactured goods (third cycle) (Figure 2)

FIGURE 2 - COPPER PRODUCTION CHAIN.



Source: SEICOM, 2013.

During 2012, the average price of Brazilian exports of copper was U.S. $ 2,144 per ton of concentrate and U.S. $ 8820 per ton of refined metal, which indicates a value ratio of 3.3 times the refined metal in relation to the concentrate.

The Copper Production Chain in Pará

Copper production in Pará is concentrated in two companies, Vale, in the town of Canaã dos Carajás, and Serabi in the city of Itaituba, which produces copper as a byproduct of gold mining. The production of Vale boils down to the first cycle, the copper concentrate, destined to the foreign market. An experimental plant for the production of cathodes, which would follow the hydrometallurgical route, was erected in the Carajás Mineral Province, but it failed to materialize. Company executives claimed operational difficulties. Thus, Pará's production remains limited to the first cycle. (Map 9)

Exports of Copper in the State of Pará in 2012

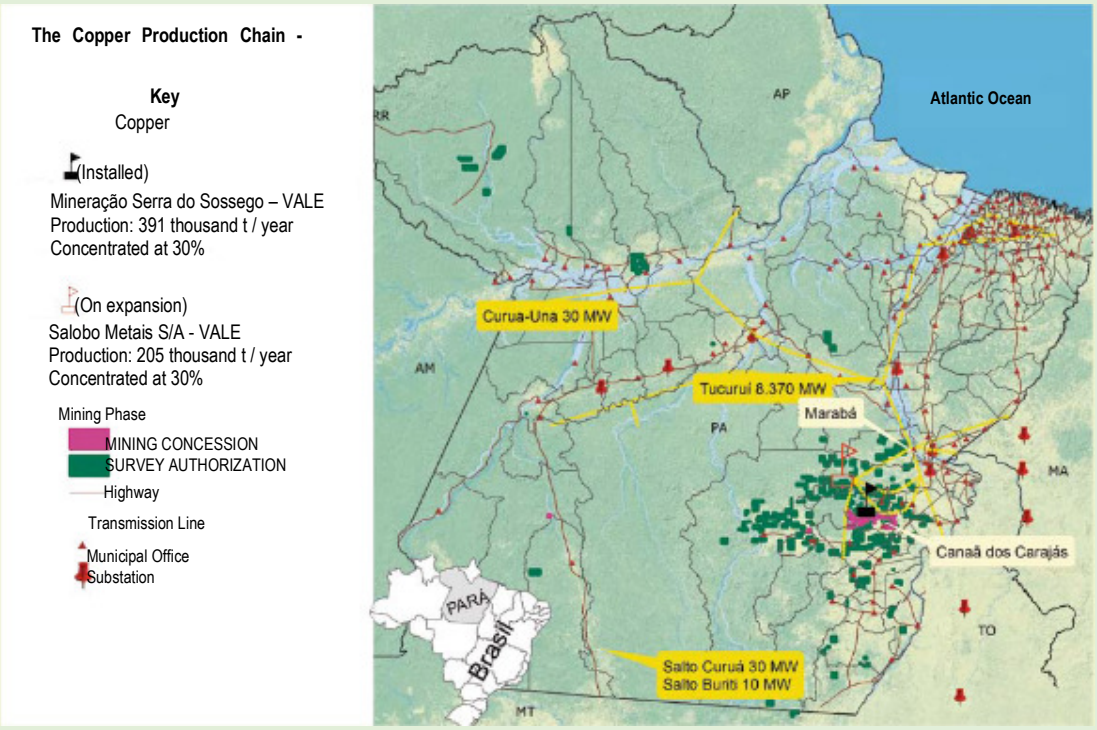
Exports of copper from Pará started in 2004, with sales to the European market. Almost a decade later, in 2012, the main market is still Europe, especially Germany, followed by Bulgaria. However, China and South Korea already account for a significant portion. Together, the four main buyers absorbed 86% of the state's exports. It is observed that the market for buyers of copper concentrate is one of the least concentrated among the chains of metallic minerals in the state (Table 8).

Potentialities of the copper production chain in the state of Pará

The main opportunity is the expansion of the local market of electrical conductors, because of government investment in the power generation sector. As a result, the Group ALUBAR, originally geared for the production of aluminum wire, is expanding to produce copper conductors.

The main problems for the integration of this chain are the costs of electricity and the need for blending concentrates to get the ideal balance for the production of cathodes.

MAP 9 - LOCATION OF COPPER RESERVES IN THE SOUTHEAST REGION OF PARA.



Source: SEICOM, 2013.

TABLE 8 - EXPORTS OF COPPER OF PARÁ STATE (IN 1000 TONS).

COUNTRY	2004				2012			
	US$	%	TON	US$/TON.	US$	%	TON	US$/TON.
GERMANY					319,173,634	35.61	140,502	2.271,67
BULGARIA					151,504,826	16.91	72,051	2.102,74
CHINA					150,108,398	16.75	73,371	2.045,89
SOUTH KOREA					138,131,193	15.41	66,074	2.090,55
SWEDEN					70,488,784	7.87	33,064	2.131,89
INDIA					66,731,260	7.45	32,747	2.037,78
HONG KONG					43,190	0.00	95	455,30
BELGIUM	196,000	100.00	40	4,900.00		0.00		
TOTAL	**196,000**	**100.00**	**40**	**4,900.00**	**896,181,285**	**100.00**	**417,904**	**2,144.47**

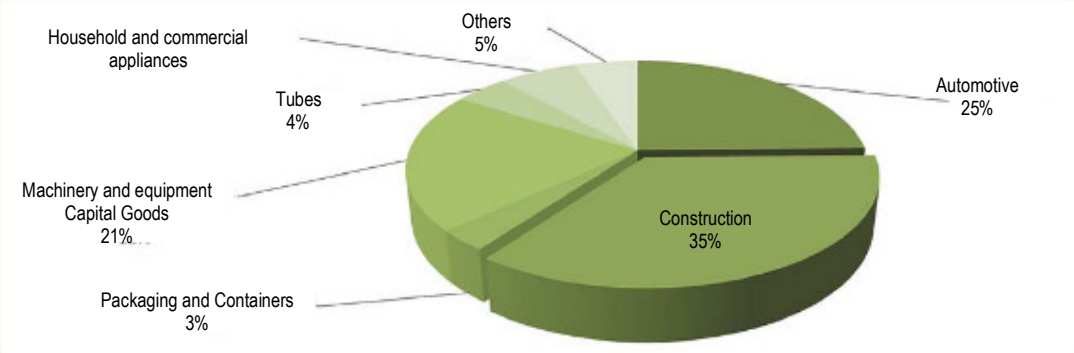
Source: MDIC (2013).

III - Iron and Steel

Among the metals, iron is the most consumed one and one of the most common of the earth's crust. Almost all the ore produced worldwide is used in the steel and iron industry and, to a lesser extent, in the cement industry. Pará holds 21% of the national reserves of iron ore and about 3% of the international reserves (DNPM, Mineral Summary, 2009 data) and has two applications for mining concession.

Steel is used primarily by the industries of construction, automotive and capital goods, including machinery and equipment, among others (Graph 23).

CHART 23 - APPARENT CONSUMPTION OF STEEL BY THE INDUSTRY IN 2012.

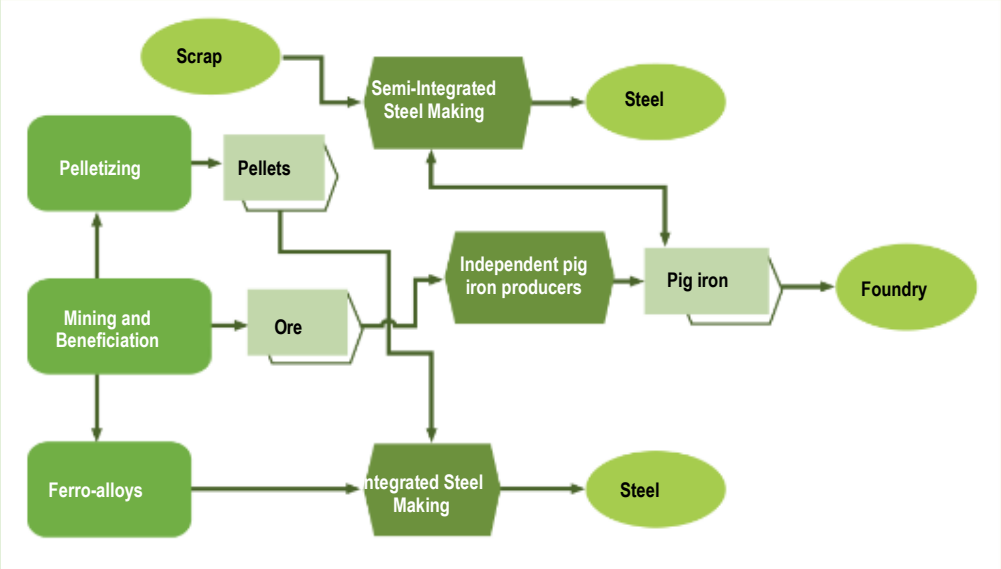


Source: SEICOM, 2013.

Production Chain of Iron and Steel

The production chain of iron ore is made up of the steps of mining and processing of ore, transformation into pig iron/ ferroalloys, steelmaking and casting (Figure 3).

FIGURE 3 - ILLUSTRATION OF THE IRON-STEEL CHAIN.



Source: SEICOM, 2013.

The first step is the mining and processing of ore. Then the processed product is sent to the production of pellets or the production of ferro-alloys. The pelletized ore is used in the production of pig iron or steel production in integrated steel industries, which is the same fate of the ferro-alloys. Pig iron is an intermediate product used in the production of steel in foundries. In addition to these processes, there are also semi-integrated steel mills that produce steel from iron scrap.

The integration of the steel production chain may represent an increase in unit prices of the order of about 1.070% in the case of long steel in relation to iron ore. Likewise, it may represent an increase in the number of jobs created, because to produce 1 ton of iron, only 0.08 workers is necessary, but to produce 1 ton of long steel, 4.5 workers are needed, and that corresponds to a difference of 5600%.

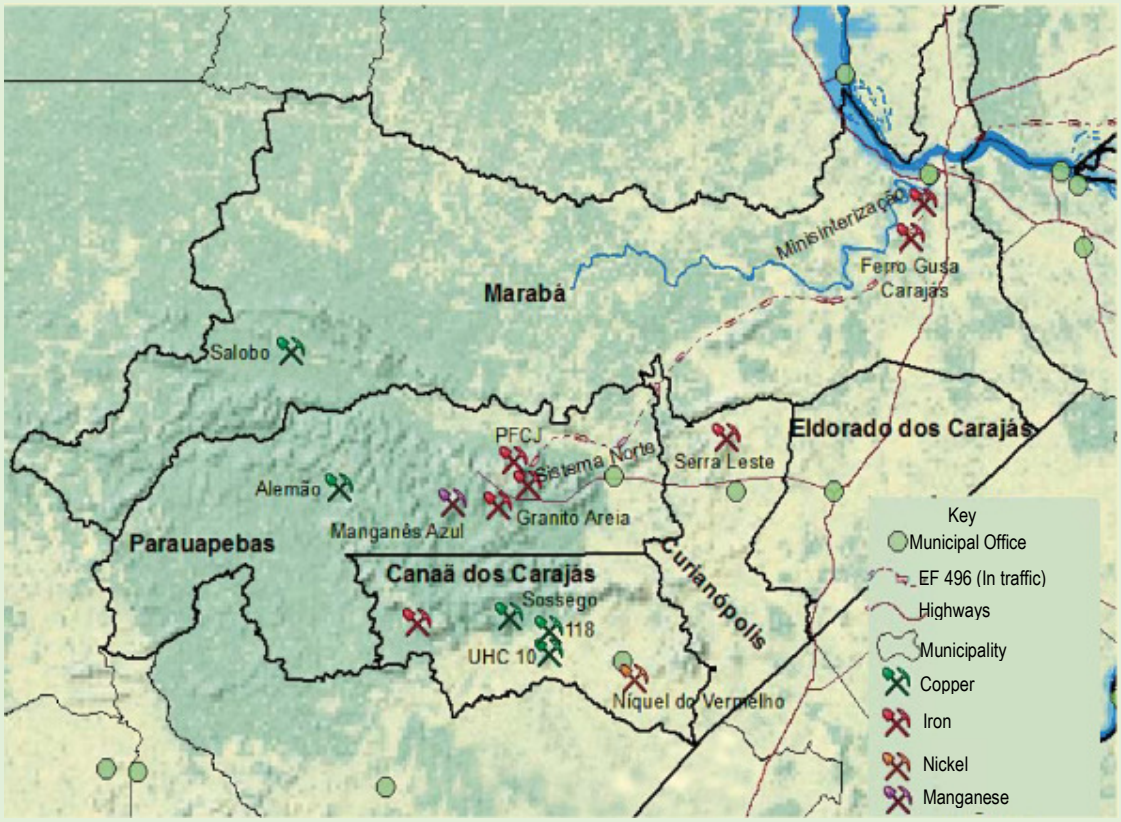
TABLE 9 - AVERAGE PRICES OF IRON AND STEEL PRODUCTS IN 2011, AND JOBS/TONS RATIO IN PARÁ.		
PRODUCT	US$/TON.	JOBS/1000 T
IRON ORE	116	0.08
PELLETS	178	-
LUMP	106	-
SINTER-FEED	114	-
PELLET-FEED	164	-
PIG IRON	494	1.5
STEEL - SEMI-FINISHED	652	-
STEEL - FLAT PRODUCTS	961	-
STEEL - LONG PRODUCTS	1,241	4.5

Source: DNPM (2012).

The Production Chain of Iron and Steel in the State of Pará

In Pará, the mining activities and steel production chain activities are concentrated in the Carajás Mineral Province. The iron comes from the Carajas mine in Parauapebas, operated by Vale. The project of Mine S11 D in the municipality of Canaã dos Carajás is also being implemented by the same company. There is also a small mining activity (1.45 Mt / year), in Floresta do Araguaia that supplies SIDEPAR, a pig iron producer. In the city of Marabá, there are pig iron production plans, owned by Ibérica and Sidepar companies and a long steel mill, which belongs to the Ceará group SINOBRAS (Box I), which uses iron scrap as raw material, and only 30% of ore from the mines of Vale, in Carajás (Map 10).

MAP 10 - SPATIAL LOCATION OF THE CARAJÁS MINES.



Source: SEICOM, 2013.

BOX I – SIDERÚRGICA NORTE BRASIL (SINOSBRAS)

The mineral vertical integration of Pará gained new momentum with the implementation, in 2008, of the first integrated Steel Mill of the Northern Region, SINOBRAS, of the Aço Cearense group, in the municipality of Maraba. With initial production of 300 tons/year of long steel, it allow the region to take a major technological leap, from a policy of integration with the local society, professional associations, educational institutions and formation of a regional supply chain, contributing to the expansion and improvement of the business environment that already existed due to the mineral industry.

The company, which is responsible for 1,410 direct jobs, is under expansion to 600,000 tons / year, with an investment of 140 million Reals (FIEPA/NETS).

The final products are bars and bar coils for reinforced concrete SI 50, wire rods, mechanical bars, steel wires SI 60, round bars SI 25, annealed and flat wire for the industry, welded mesh and trusses.

FIGURE 4 - SINOBRAS FURNACE
SOURCE: SINOBRAS

FIGURE 5 - MANAGEMENT BUILDING
SOURCE: SINOBRAS

FIGURE 6 - SI 50 RODS USED IN CONSTRUCTION.
SOURCE: SINOBRAS

FIGURE 7 - WIRE RODS, WHICH CAN BE USED ON VARIOUS PRODUCTS FOR INDUSTRIAL PURPOSES.
SOURCE: SINOBRAS

Besides the integration with **the construction chain, hardware stores and trade for the industry,** these products can be used for developing other items that can be manufactured by new industries such as lightweight structures and trusses; nails, screws, nuts, washers, springs, shafts, pins and other machine elements made from long steel rods and combinations with wire rods for the manufacture of other screens, grids and special products.

Exports of the Iron and Steel Production Chain in Pará in 2012

Out of the minerals of Pará, iron was the one that had the greatest increase in price. According to data from MDCI, between 2000 and 2012, its price went from an average of US$ 16.00 to US$ 89.00 per ton, which means an unparalleled average annual growth of 14%. The evolution of Pará exports of iron ore show that there was progressive and intense concentration of sales to the Asian market (Table 10).

TABLE 10- EXPORTS OF IRON ORE OF PARÁ STATE (IN 1000 TONS).								
COUNTRY	2000				2012			
	US$	%	TON	US$/TON.	US$	%	TON	US$/TON.
CHINA	34,565,773	5.07	2,342,715	14.75	4,561,478,072	51.85	51,881,435	87.92
JAPAN	178,465,396	26.18	11,497,185	15.52	927,623,672	10.54	10,507,431	88.28
SOUTH KOREA					688,466,319	7.83	7,741,602	88.93
GERMANY	112,696,209	16.53	6,671,363	16.89	486,612,182	5.53	5,499,154	88.49
PHILIPPINES	5,949,681	0.87	381,140	15.61	368,136,221	4.18	4,056,610	90.75
OTHERS	349,965,398	51.34	21,840,907	16.02	1,765,378,360	20.07	19,540,532	90.34
TOTAL	**681,642,457**	**100.00**	**42,733,310**	**15.95**	**8,797,694,826**	**100.00**	**99,226,764**	**88.66**

Source: MDIC (2013).

In 2000, sales were still fairly scattered, because although Japan was responsible for absorbing 26% of sales, the five main buyers accounted for 49% of the total exports. This situation changed in 2012, when 70% of the exports were directed to the Asian market (China, Japan and South Korea). It is important to note that China alone accounts for 52% of purchases of Pará's iron.

Likewise, the prices of pig iron also increased significantly, from going US$ 119.00 in 2000 to US$ 417.00 in 2012, which represents an average annual rate of 10%. Exports have been directed almost exclusively to the steel industry in North America, since in the U.S. along with Mexico absorbed 90% of sales (Table 11).

TABLE 11 - EXPORTS OF PIG IRON OF PARÁ STATE (IN 1000 TON)								
COUNTRY	2000				2012			
	US$	%	TON	US$/TON.	US$	%	TON	US$/TON.
UNITED STATES	34,128,741	100.00	286,449	119.14	336,190,466	82.97	809,420	415.35
MEXICO					29,825,475	7.36	69,893	426.73
CHINA					27,293,762	6.74	59,350	459.88
SPAIN					11,866,898	2.93	32,370	366.60
TOTAL	**34,128,741**	**100.00**	**286,449**	**119.14**	**405,176,601**	**100.00**	**971,033**	**417.26**

Source: MDIC (2013).

The comparison of the exports of the products of the steel production chain indicates that there is almost absolute predominance of iron ore (first cycle), with a very low volume of pig iron, which is the third cycle of the production chain and has an average selling price and a 'job per ton' ratio much higher than the primary product. This situation has hardly changed between 2000 and 2012, a period of intense growth in global demand for metals.

TABLE 12 - COMPARISON OF EXPORTS OF STEEL-METALLURGICAL PRODUCTS OF PARÁ.								
PRODUCT	2000				2012			
	US$	%	TON.	US$/TON.	US$	%	TON.	US$/TON.
IRON ORE	681,642,457	95.23	42,733,310	15.95	8,797,694,826	95.60	99,226,764	88,66
PIG IRON	34,128,741	4.77	286,449	119.14	405,176,601	4.40	971,033	417,26
TOTAL	**715.771.198**	**100.00**	**43,019,759**	**16.64**	**9,202,871,427**	**100.00**	**100,197,797**	**91.85**

Source: MDIC (2013).

The chain of iron has problems that are similar to those of the aluminum chain: concentration of buyers in a few countries and products of low commercial value. However, in the case of steel, the problems are exacerbated due to the fragility and lack of integration of the production chain, since the relationship between the stages of the chain is still in its infancy and there is, at present, regular supply of iron ore to reduction plants.

Potentialities of the Production Chain of Iron and Steel in the State of Pará

The sheer volume of investment planned for the region of Southeastern Pará, in the coming years, opens wide possibilities for the development of this production chain, mainly in the manufacture of materials for the construction industry. The possible consolidation of the metal mechanic complex of Marabá represents the opening of a large market for the supply of articles and metallurgical services, which will help boost the regional steel industry. For this, it is vital to be able to solve the problems of weak infrastructure and unskilled workforce, as well as the increase in the supply of energy inputs at lower cost and with reduced environmental impacts.

IV - Manganese

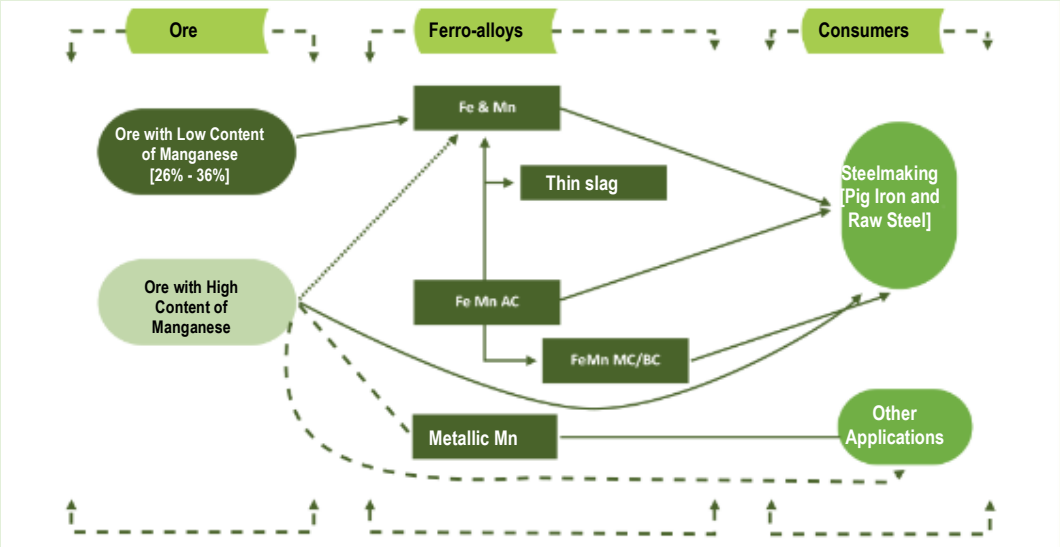
Manganese is the fourth most common metal in the world after the iron, aluminum and copper. And it is mainly used in steelmaking processes, in the composition of alloys, for allowing increased degree of hardness and toughness. This mineral is also an important raw material for the manufacture of batteries, besides being a micronutrient for fertilizers. According to DNPM 2012, Pará holds 51 million tons of mineable reserves of manganese, corresponding to 29% of the national reserves and 1% of the international reserves, and it has two active mines.

Manganese Production Chain

Much of manganese is used for manufacturing ferromanganese, alloy with 80% of this mineral; it is also used in the production of ferro-silico-manganese and alloys with copper and aluminum, due to its features of corrosion resistance and mechanical strength. Manganese and ferro-alloy are mainly used in the steel industry.

The beneficiation of manganese passes through the stages of crushing, washing and screening, resulting in three distinct products with different particle sizes. In the case of ferromanganese alloy, the ore is reduced in furnaces and mixed with iron ore and carbon. For non-ferrous alloys, the pure mineral is produced by leaching with sulfuric acid and subsequent electroplating.

FIGURE 8 - PRODUCTION CHAIN OF MANGANESE-BASED PRODUCTS.



Source: SEICOM, 2013.

Production Chain of Manganese in Pará

In Pará state, there are only mining and beneficiation of manganese ore, which is completely exported, so there is no vertical integration of this production chain in Pará's territory.

Exports of Manganese in Pará State

The exports of manganese also showed progressive concentration. China, which absorbed less than 6% of sales in 2000, now accounts for 47% of this market in 2012. France, which had a significant share of 62% in 2000, accounts for 26% in 2012, a percentage that is still significant. Together, China and France went from 67% in 2000 to 73% of total exports in 2012, another apparent case of market concentration among metallic minerals exported from Pará

TABLE 13 - EXPORTS OF MANGANESE OF PARÁ STATE (IN 1000 TONS).

PRODUCT	2000				2012			
	US$	%	TON	US$/T	US$	%	TON	US$/T.
CHINA	2,520,292	5.89	52,211	48.27	85,534,286	46.91	750,221	114.01
FRANCE	26,347,070	61.53	631,067	41.75	47,949,052	26.30	365,148	131.31
NORWAY		0.00			15,219,256	8.35	129,674	117.37
OTHERS	12,515,978	29.23	241,981	51.72	13,669,817	7.50	60,373	226.42
UKRAINE		0.00			10,758,681	5.90	83,815	128.36
VENEZUELA		0.00			9,206,929	5.05	44,119	208.68
SAUDI ARABIA	1,439,880	3.36	21,239	67.79		0.00		
TOTAL	**42,823,220**	**100.00**	**946,498**	**45.24**	**182,338,021**	**100.00**	**1,433,350**	**127.21**

Source: MDIC (2013).

The emphasis on exportation of manganese demonstrates the lack of integration of the steel-metallurgic production chain and lack of diversification of mineral based products in the state of Pará, due to the phase of stagnation experienced by the park of reduction plants (known as "pig iron producers") located in the region, since manganese is almost entirely destined to the production of steel. The resumption of the production of pig iron opens important possibilities for the integration of this chain, enabling future production of long and flat steel that can absorb some of the local production of iron ore and manganese.

Potentialities of the Manganese Production Chain

The future implementation of steel and metal-mechanic complexes in the Southeast region of the state represents a great opportunity for the vertical integration of the industry of this product in Pará's economy.

Another opportunity of great interest is the manufacture of rechargeable batteries for electric vehicles, known as LMD, which are made up of 4% lithium, 61% manganese and 35% oxygen. This product has a low production cost and its features are great power, thermal stability and considerably safer than traditional lithium batteries. It is estimated that by 2020 about 25% of the U.S. vehicle fleet will consist of electric models. There is also the possibility of mineral micronutrients oriented for the agribusiness.

V - Nickel

Nickel is widely used to protect metal parts because it is resistant to oxidation. It enables the manufacture of special steels, such as stainless, as well as the manufacture of magnets and electrical, magnetic, and expansion alloys, high permeability alloys, copper-nickel alloys and other nonferrous alloys. The main applications of this metal are ferrous and non-ferrous alloys for use in the industrial sector, coins, military equipment, transport equipment, aircraft and construction.

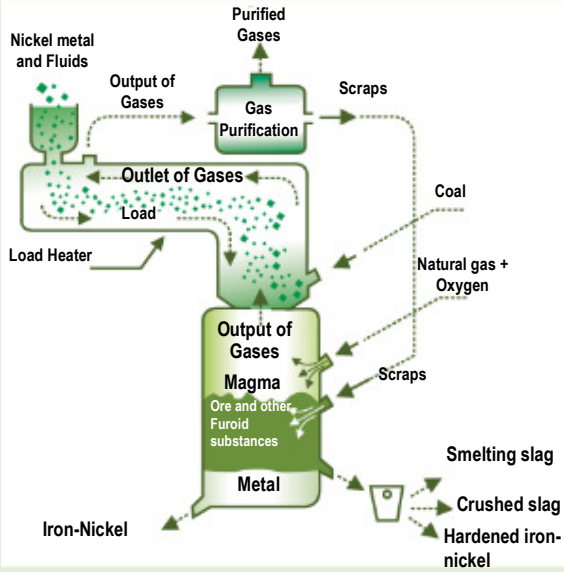
Pará's nickel reserves are around 24 million tonnes and there are two applications for mining concession, which equates to 33% of the national reserves and 3% of the global reserves (DNPM, Mineral Summary, 2009 data).

Nickel Production Chain

Ferronickel is produced by pyrometallurgical process in which the crushed ore undergoes melting in electric arc furnaces, then refining and elimination of impurities such as phosphorus and sulfur. The latter can be used for the production of *matte* [19] (Figure 9).

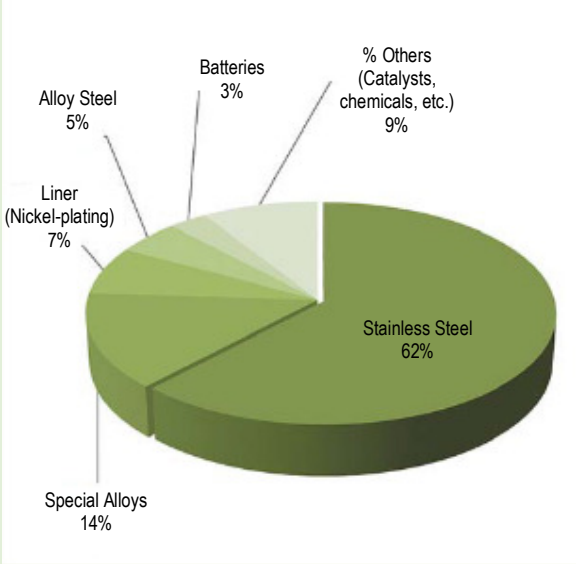
19 Matte is an intermediate product for obtaining nickel.

FIGURE 9 - PRODUCTION PROCESS OF IRON-NICKEL.



Source: Field Research - Adaptation: SEICOM, 2013

CHART 24 - GLOBAL NICKEL CONSUMPTION.



Source: VALE, 2011.

The primary use of nickel is still for stainless steel, followed by special alloys and coating, among others (Chart 24).

Looking at the average prices of the production chain, it appears that there is a ratio of 277% of value addition in the product price, after the electrolytic reduction process, i.e., the market value is nearly tripled during the vertical integration of this mineral chain. Likewise, to produce one thousand tons of iron-nickel, an average of 1.5 employees is used, and this coefficient significantly rises in the nickel electrolyte production step.

TABLE 14 - AVERAGE PRICES OF THE NICKEL PRODUCTION CHAIN IN 2011.

PRODUCT	US$/T.	JOBS THOUSAND/ T
Ferro-nickel	6,025	1.5
Electrolytic nickel	16,717	N/A

Source: DNPM (2012).

Production Chain of Nickel in Pará State

In the state of Pará, company Vale carries out operations for the production of iron-nickel in the municipality of Ourilândia, destined for exports to the foreign market.

Potential of the Nickel Production Chain in Pará. The opportunities for vertical integration are related to the development of the steel industry, in which the iron-nickel alloy is one of the inputs. There are also possibilities for the use of this alloy in the future production of stainless steel.

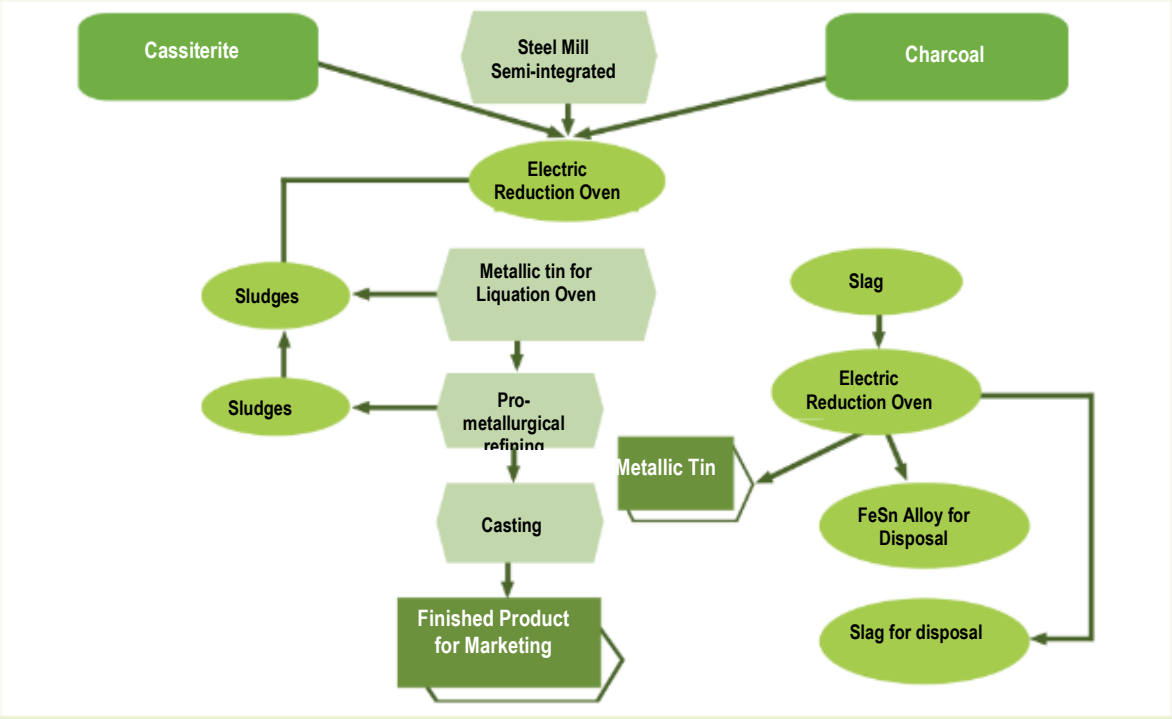
VI - Tin

In Brazil, the tin reserves are estimated at 989,000 ton (2009), 0.6% of which is in Pará Consumption in Asia is determined by use in solders for the electronics sector and, in the rest of the world, for the packaging industry for drinks and food. The increased use of tin is related to the expansion of the Chinese economy, the popularity of consumer electronics goods and the prohibition of lead in solder composition in European Union countries, according to the standards of restrictions on the use of hazardous substances.

Tin Production Chain

Tin is produced from cassiterite ore, typically in electric reduction furnaces, through a pyrometallurgical process that breaks down the molecules of oxygen of tin, transforming them into the crude tin. The ore then passes through a series of processes for the separation of other metals associated with the tin (Figure 10).

FIGURE 10 - PRODUCTION PROCESS OF TIN.



Source: SEICOM, 2013.

The metal tin is used to coat metal plates in a process called "tinning", which aims to assign antioxidant properties to end products. The tinning is done mainly through two processes: hot dipping and electrolytic deposition. It is also used extensively for the production of metal alloys and solders. Thus, the main industrial uses of metallic tin are in the steel industry for the production of tin-plate; in the welding industry; in the chemical industry: in the production of *Pewter objects,* and in production of bronze

Production Chain of Tin in Pará State

In the state of Pará, there is only the mining of the cassiterite ore, sold in raw form to industries in the states of São Paulo and Pernambuco. There are projects to install a tin smelter in the municipality of São Félix do Xingu, but the projects depend on environmental and land planning in the city, among other things.

Potentialities of the tin production chain in the state of Pará

The potential for vertical integration of the tin chain in Pará is related to the implementation of plans for the installation of metallurgical for the smelting of metallic tin in the southeastern region of the state, thereby opening the range of possibilities for the production of tinned metal packaging or even, in the future, the production of solders.

2.2.2 Non-metallic minerals

I - Mineral Water

In the state of Pará, the aquifers of Alter do Chão, Itapecuru, Barreiras and Pirabas are the ones most used for public supply, and about 70% of Pará's municipalities are wholly or partially supplied by groundwater.

Alter do Chão is considered the most important reservoir of groundwater in the Northern Region, whose occurrence is practically restricted to the Brazilian Amazon, in the sedimentary basins of Solimões and Amazonas; with reserves of approximately 86,400 Km^3 of water, being the largest aquifer in the world, surpassing even the Guarani Aquifer, whose reserves are estimated at 45,000 Km^3 (Abreu et al, 2006). Considering only the area corresponding to Pará, in the Amazon's Paleozoic Basin, the reserves of Alter do Chão are around 48,000 km^3 (Table 15).

TABLE 15 - AQUIFERS AND RESERVES OF WATER IN THE AMAZON REGION - ESTIMATED VOLUME

NAME OF SEDIMENTARY BASIN	AREA (KM^2)	FORMATIONS (UP TO 1000/1500M)	MAXIMUM THICKNESS (M)	THICKNESS AQUIFERS (KM)	POROSITY	VOLUME (KM^2)
ACRE	150,000	Solimões	2,200	-	20%	
SOLIMÕES	400,000	Alter do Chão (deeper)	1,000	0.48	20%	38,400
AMAZON	500,000	Alter do Chão (less deep)	1,250	0.48	20%	48,000
MOUTH OF THE AMAZON RIVER (MARAJÓ)	268,000	Tucunaré/Pirarucu/ Orange	8,000	0.40	20%	21,440
PARÁ- MARANHÃO	48,000	Areinhas	566	0.25	20%	2,400
PARANAÍBA (PART -1/2 OF THE WHOLE)	300,000	Itapecuru	724	0.20	20%	12,000
BARREIRINHAS (PART - 2/3 OF THE WHOLE)	40,000	Barreiras/Pirabas	720	0.25	20%	2,000
TACUTU	1,200	Boa Vista	120	0.10	20%	24
TOTAL	**1,707,200**					**124,264**

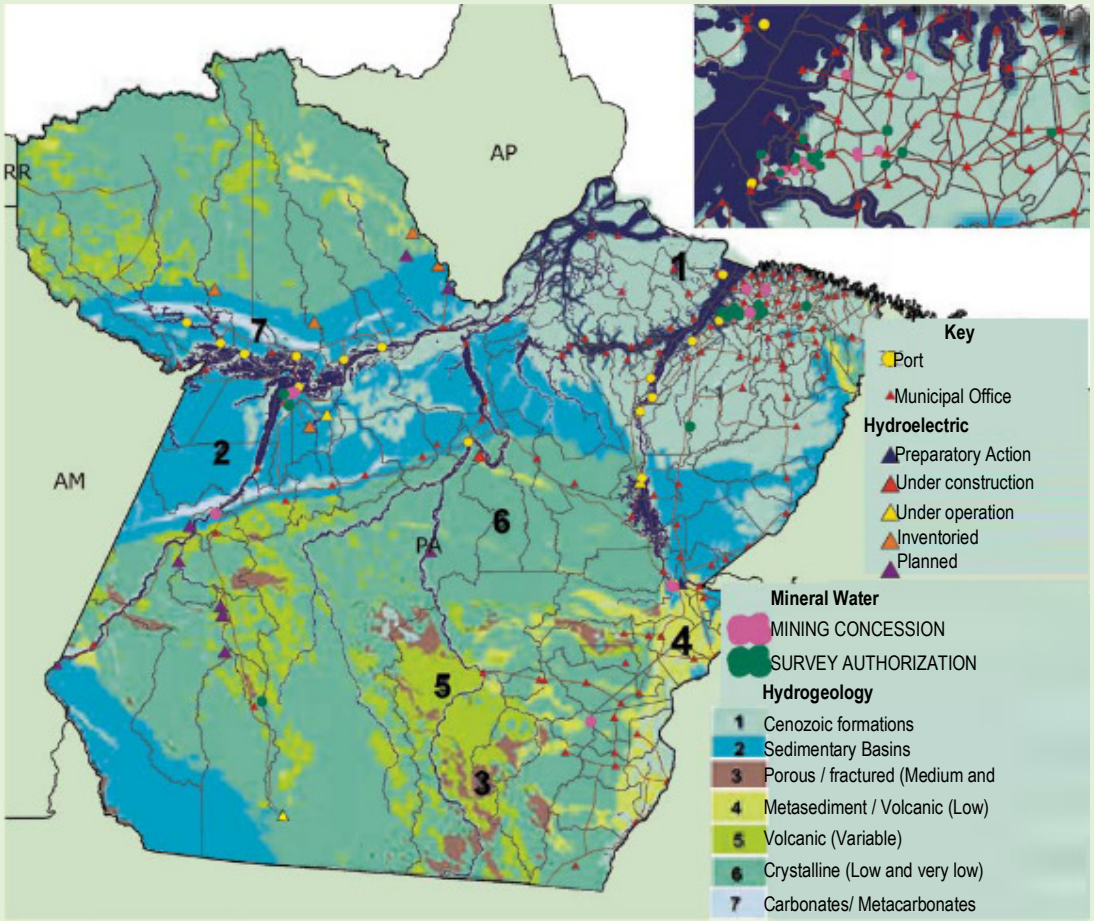
Sources: Abreu et al (2006). Name, area, formations and maximum thickness: Petrobrás (1994); Thickness of Aquifers: Petrobrás (1994) and, specifically the Formation Alter-do-Chão, Tancredi (1996); Porosity: Tancredi (1996), specifically for the Alter-do-Chão Formation, adopted as a standard for the other basins.
Volume = Thickness of Aquifer x Area of the Basin x 0.20

The groundwater of Pará, in general, is of good quality, with low to medium mineralization and mean pH ranging between 4.8 and 8.0 (CPRM, 2013), although 60% of the territory is seated in a crystalline environment, that is, it is geologically favorable to groundwater, leading to large-scale use of surface water of rivers, lakes etc.. Thus, considering that much of the subsoil is made up of sedimentary rocks, the state of Pará has large reserves of underground water, of good quality and easy to access, as, for example, the water used in the production of beer and soft drinks from a mouth that is more than 300 meters deep.

Pará's territory has a potential area of 1124.70 km2 for groundwater. The per capita water availability is of 181629 m3 / inhabitant / year, while in Pernambuco, where access to water is considered critical, this value is only 1,187 m3 / inhabitant / year (DNPM, 2009).

The mining titles of DNPM (2013) indicate that there are 22 mining concessions and 17 survey permits for mineral water in the state of Pará, located in the districts of Ananindeua, Belém, Benevides, Curuçá, Castanhal, Marituba, Santa Isabel do Pará, Terra Alta, Vigia, Santa Bárbara do Pará, Peixe-Boi, Itaituba, Santarém and Marabá, in addition to 25 applications for other types of titles, featured in Map 11, which also shows the hydrogeological resources of the state of Pará

MAP 11 - MINING TITLES AND HYDROGEOLOGY OF MINERAL WATER IN PARÁ.



Source: SEICOM, 2013.

CHART 25 - MINERAL WATER PRODUCTION IN PARÁ.

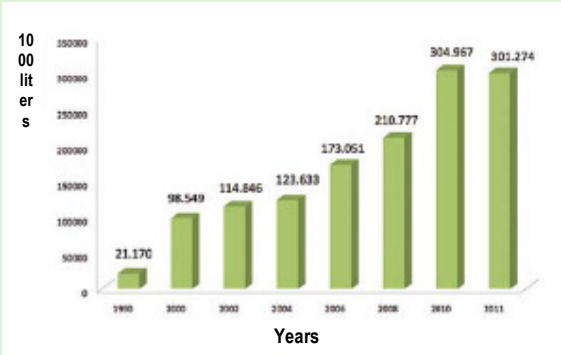
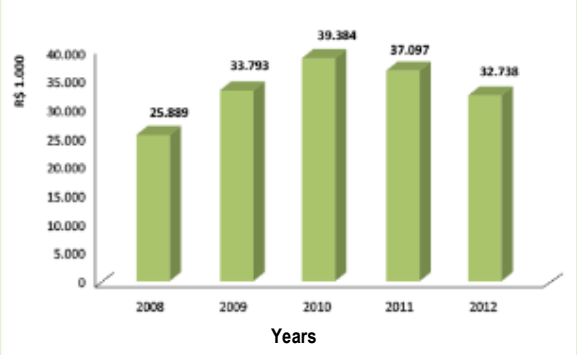


CHART 26 - SALE OF MINERAL WATER IN PARÁ (R$ THOUSAND).



Source: DNPM.

TABLE 16 - PER CAPITA CONSUMPTION OF MINERAL WATER IN BRAZIL, REGIONS AND PARÁ -2000/2012.

PER CAPITA CONSUMPTION (in liters)	BRAZIL (A)	PARÁ (B)	(B) / (A)%
2000	31.4	8.9	28.4
2011	88.6	39.2	44.2

Source: DNPM, 2012.

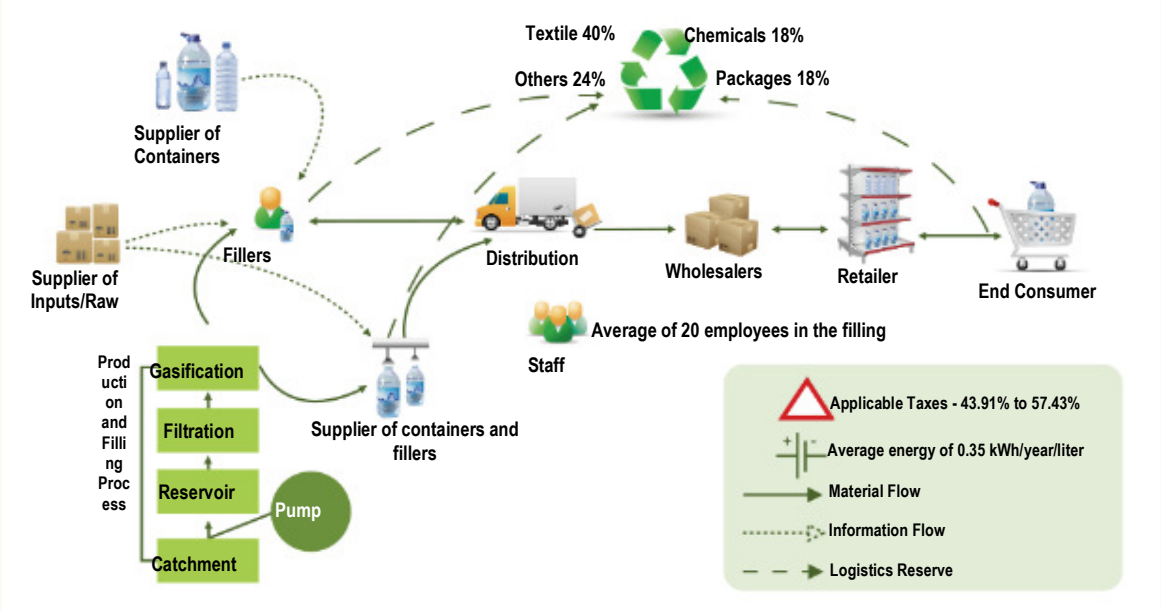
The expansion of the bottled water segment is a global trend and, among beverages, bottled water is the one that has been growing the most in terms of consumption. Brazil is already the fourth largest consumer market after the United States, China and Mexico. It is the seventh largest producer, growing around 20% per annum (ANP, 2012).

The state of Pará stands out in the North region. In the 1990s, the average annual growth rate of water production was 15%. In the following decade, it rose to 11%. And a similar behavior occurs with sales, with both presenting a small inflection in 2012 because of the crisis (Charts 25 and 26).

In absolute terms, the production of the state of Pará (2011) is around 300 million liters, which means a per capita consumption of 39 liters. It is observed that, although the per capita consumption is rising, both in Brazil and in the state of Pará, the average consumption of the state still accounts for only 44% of the national average (Table 16).

In the process of production to marketing, bottled water is removed from underground, then it is filtered and carbonated. The filling stage uses disposable packages like glasses, bottles and carboys, except for the 20 liter carboy, then, there is the filling, placement of the seal, label and packaging of the package, among others (Figure 11).

FIGURE 11 - BOTTLING AND LOGISTICAL PROCESS OF MINERAL WATER IN PARÁ.



Source: SEICOM, 2013.

Of the companies operating in the state of Pará, there are those that produce their own containers, those that buy their containers in the local market from other bottling companies, or even companies outside the state that deal exclusively with containers. As for the inputs, a large portion is provided by companies in the East and South of the country, generating a long cycle of replenishment and the need for large inventories (Ferreira Filho et al, 2010).

As for recycling (reverse logistics), this practice is still nascent in the state of Pará, because, in the South and Southeast regions, it is a more developed practice, where, out of the recycled pet bottles, about 40% are absorbed by the textile industry (BEVERAGE, 2012).

The main companies in the state of Pará are: Indaiá Brasil Águas Minerais, Benevides Águas S/A, Água Mineral Estrela Dalva, Água Mineral Mar Doce, Belágua - Belém Águas Ltda., Água Mineral Terra Alta and Água Mineral Yara, Karajás, Floratta and Granágua.

II - Aggregates for Construction and for Clay for Bricks

Construction aggregates is the term used to identify a segment of mining that produces unprocessed or processed mineral materials that are immediately used in the construction

industry, represented mainly by sand, crushed stone and pebble (Brazilian Mineral Balance 2001).

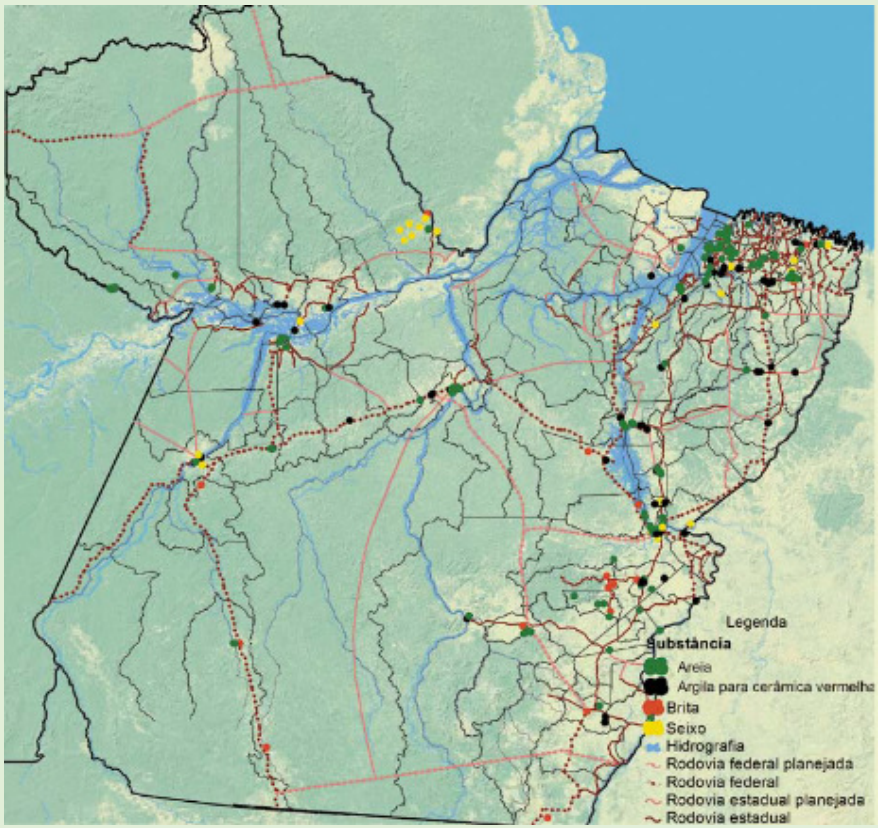
When the Brazilian mineral production has the internal market as a vector for analysis, the aggregates stand out, specially sand and crushed stone, whose consumption of 631 million tons in 2011 generated sales of R$ 22.5 billion, representing 0.6% of Brazil's GDP, with an expected average annual growth of 3% for sand and 5% for crushed stone[20].

In Pará state, according to DNPM, the mining of aggregates and clay for bricks formally takes place in 94 towns, usually on the outskirts of the municipal governmental offices, both in an artisanal and industrial way, contributing to job creation and income generation in the municipalities in Pará. According to DNPM's authorities, there are currently 496 Licensing proceedings and 19 Mining Concession proceedings, all of which are active (Map 12).

Although it is formally present in 65% of Pará's municipalities, the production of aggregates and clay for bricks shows significant concentrations in the Northeast, mainly, and Southeast regions of Pará, and an incipient growth in the western region and in the areas of influence of major integration highways, such as BR 010 (Belem - Brasilia), BR 163 (Cuiabá - Santarém), BR 230 (Trans-Amazon) and BR 316 (Pará - Maranhão).

In the Northeast of Pará, the production is concentrated in the municipalities of Ourém (pebble, sand and crushed stone), Capitão Poço (pebble, sand and crushed stone), Tracuateua (crushed stone), where there is the only crushed stone unit that supplies all the RMB, Irituia (clay) and São Miguel do Guamá (clay), and São Miguel do Guamá and Irituia house the main ceramic production district in the country, with around 40 plans, which create more than three thousand direct jobs in those municipalities.

MAP 12 - PRODUCTION OF AGGREGATES FOR CIVIL CONSTRUCTION AND CLAY FOR BRICKS



Source: SEICOM, 2013.

20For 2012, the estimated production and demand for aggregates is 700 Mt [410 Mt of sand (60%) and 290 Mt of crushed stone (40%)], with expected gross sales of R$ 30.2 billion. For 2013, demand is estimated to be of 727 Mt, including 423 Mt of sand and 304 Mt of crushed stone (Brasil Mineral Magazine, No. 324, November 2012).

There is, in DNPM 110, active proceedings for aggregates, with 23 granted between 1981 to 2006 and the remainder from 2007 (Figure 27); which reflects the growing demand of the metropolitan region of Belém (RMB), possibly due to the construction boom.

Pará's capital and the municipalities that make up the RMB are among the largest consumers of aggregates for the construction of the entire northern region, because of the strong expansion of the residential housing segment and major engineering works. Based on surveys conducted in several concrete producers and offices in the capital, Nogueira Junior et al (2007, apud Oliveira & Silva, 2011) found that almost all of coarse aggregates used in the manufacture of concrete, in Belém, consist of quartz pebbles from 12 fields located in Ourém.

CHART 27 - MINING AREAS THAT HAVE APPLIED FOR LICENSING IN THE MESOREGION OF NORTHEASTERN PARÁ, IN THE PERIOD FROM 1981 TO 2006, AND FROM 2007 ONWARDS.

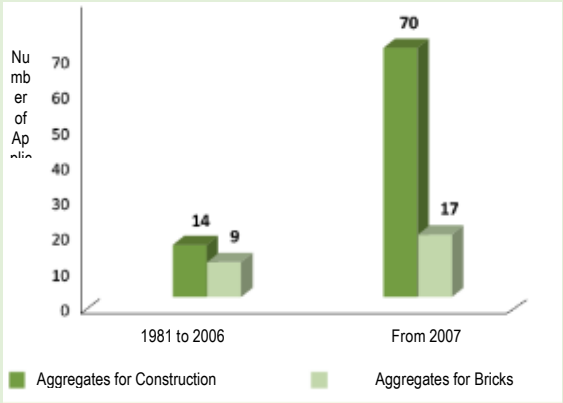


CHART 28 - NUMBER OF APPLICATIONS IN THE SOUTHEAST MESOREGION OF PARÁ, IN THE PERIOD FROM 1981 TO 2006, AND FROM 2007 ONWARDS.

Source: DNPM – Prepared by SEICOM

Another major consumer of the state is the Southeastern Mesoregion of Pará, composed of 39 municipalities, 1.7 million inhabitants - 22% of Pará's population (IBGE, 2010), an area of 297,000 km ^{2} (24% of the state) and reasonable access infrastructure, whose economy is heavily driven by the mining industry. This segment plans to invest heavily in the region in the next five years.

According to the Mining Cadastre (DNPM), there are 178 active applications for construction aggregates, 87% of which (155) refer to mineral rights granted since 2007 (Chart 28), which shows the strong expansion of this activity in the last seven years, reflecting the growth of the construction industry to serve the engineering works necessary for the implementation of large mining projects, especially in the province of Carajás.

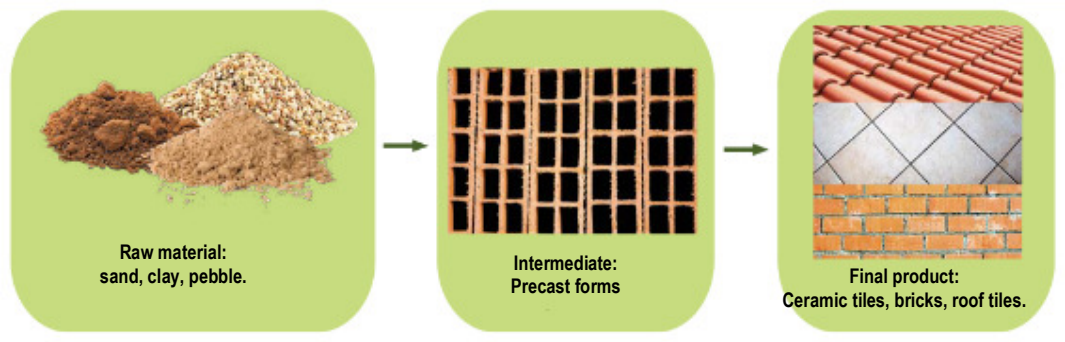
The Western Region of Pará also excels and with rising prospects, due to the investments in the energy sector in the coming years. The expected construction of six hydroelectric power plants in the Tapajós basin represents a potential demand for construction aggregates in the order of 1.6 million m^3 of crushed stone and 1.5 million m^3 of sand, according to calculations made by technicians of SEICOM/DDI [21] based on the volume of concrete needed to build these hydroelectric power plants.

Another highlight of the Western Region of the state is the construction of 12 ports in Miritituba, in the municipality of Itaituba, where about 40 million tons of grain produced in Mato Grosso are expected to go through. The demand for aggregates is related to civil works for installation of cargo transportation companies, such as the giant American trading giants Bunge and Cargill, as well as logistics operators, such as Hidrovias do Brasil, CIANPORT, UNIRIOS and TERFRON, all of which are already present in the region[22].

21 An amount equivalent to 2.8 Mt of crushed stone and 2.4 Mt of sand.
22 Valor Econômico Paper - CAD A - BRAZIL - 27/3/2013.

It is important to stress that the construction aggregates are also the basis for the manufacture of various ceramic products, such as tiles, bricks, precast items, pipes etc.. (Figure 12) and Pará already has significant production of these goods.

FIGURE 12 - STEPS OF THE MINERAL TRANSFORMATION.



Source: SEICOM, 2013.

Jobs and Financial Compensation in the Aggregates segment

Table 17 lists the mining and transformation processes in terms of persons employed by Mesoregion of the State. It is noted that, in the mining step, there are 1600 people employed, 32% of whom are from the RMB and 22% from Northeastern Pará. In the transformation stage, there are almost 10 thousand people employed, 37% of whom are from Northeastern Pará and 28% from Southeastern Pará. The Southwest and Lower Amazon Regions are the regions that have the smallest number of people employed in this activity. The aggregates sector, considering the mining and transformation steps, employs 11,600 people in Pará.

TABLE 17 - PERSONS EMPLOYED (2010) IN EACH ACTIVITY, VALUE OF CFEM (2012) ON AGGREGATES FOR CONSTRUCTION AND CLAY FOR BRICKS BY MESOREGION AND STATE OF PARÁ.

FEDERATION UNIT AND GEOGRAPHICAL MESOREGION	PEOPLE EMPLOYED - 2010				CFEM REVENUES (R$ 1,000) - 2012			
	MINING OF STONES, SAND AND CLAY	MANUFACTURING OF CERAMIC PRODUCTS	TOTAL	SHARE (%) OF THE TOTAL	AGGREGATES FOR CONSTRUCTION	CLAY BY CFEM BRICKS		PART (%)
PARÁ	1,631	9,928	11,559	100%	1,403	190	1,593	100%
BAIXO AMAZONAS	296	769	1,065	9%	15	3	18	1%
MARAJÓ	112	1,270	1,382	12%	0	20	20	1%
BELÉM METROPOLITAN REGION	524	771	1,295	11%	70	20	90	6%
NORTHEAST PARÁ	358	3,625	3,983	34%	122	62	184	12%
SOUTHWEST PARÁ	67	756	823	7%	34	38	72	5%
SOUTHEAST PARÁ	275	2,737	3,012	26%	1,161	47	1,208	75%

Source: IBGE - Demographic Census/DNPM; Prepared by: SEICOM, 2013.
Note: We consider the number of persons employed in the main activity exercised, where work in an economic activity is the exercise of paid work, unpaid work and work in production for own consumption.

Although of little importance compared to metallic minerals, aggregates represent a major portion of governmental revenue through the collection of CFEM tax. In Pará's southeast mesoregionn, CFEM revenues in 2012 represented 75% of the total state revenues relating to those minerals (Table 17). In the case of crushed stone, it is worth highlighting one company that, by itself, in the reference year, paid R$ 392,000 of CFEM tax, which represented 96% of the total contribution of this material, with a turnover of around R$ 70 million.

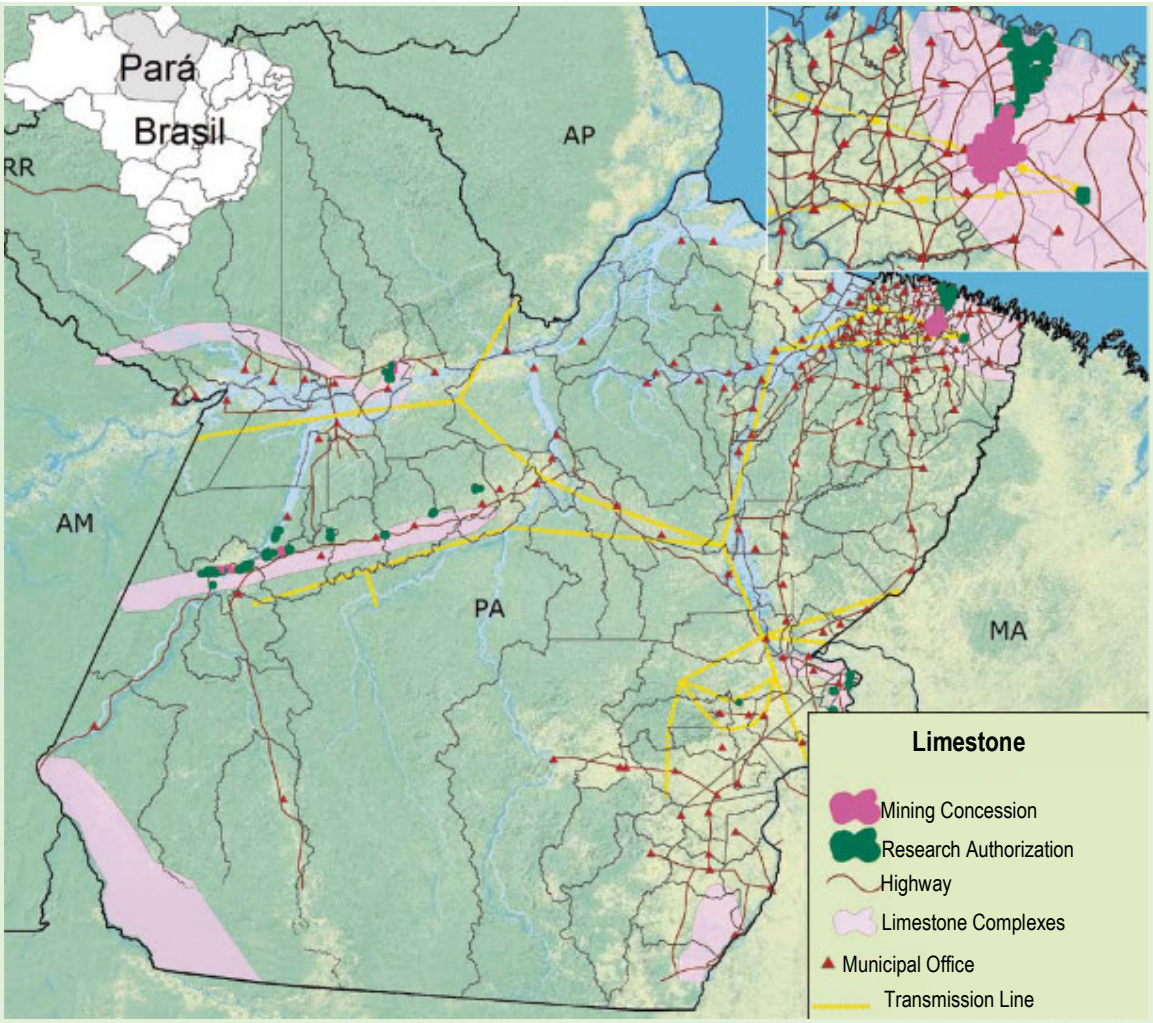
Finally, considering the social-economic importance of the production of aggregates and clay for bricks, there is a need to insert a technical-operational structure that allows planning, restructuring, modernizing and redeeming the effective governance of this mineral sector, acting as a mediator and guarantor element of the political, economic, social and environmental balance required for full contribution of the social mining to consolidate changes that can reduce the concentration of income and social inequalities in the state.

III - Limestone

Limestone [23] is used for different purposes, including construction, steel for the manufacturing of lime and cement, through agricultural input for liming of soils, among others. However, the main products of the limestone with higher added value have been the GCC *(ground calcium carbonate*) and PCC *(precipitated calcium carbonate*), which are widely used in the industries of paper, paint, chemicals and other, increasingly demanding products that are finer and of higher quality (J. MENDO, 2009).

The mineable reserves of limestone in Brazil reach 44 billion tons and Pará accounts for only 1.3% of this total, with estimated reserves of 554 million tons, well distributed throughout the state territory. It is noteworthy that these reserves can be considered as agricultural lime, given the modern techniques used in the correction of soil acidity (rocks / lime) (DNPM/ Mineral Yearbook, 2010), although the vast majority is used in the cement industry, as outlined (Map 13).

MAP 13 - MINERAL TITLES OF LIMESTONE IN PARÁ.



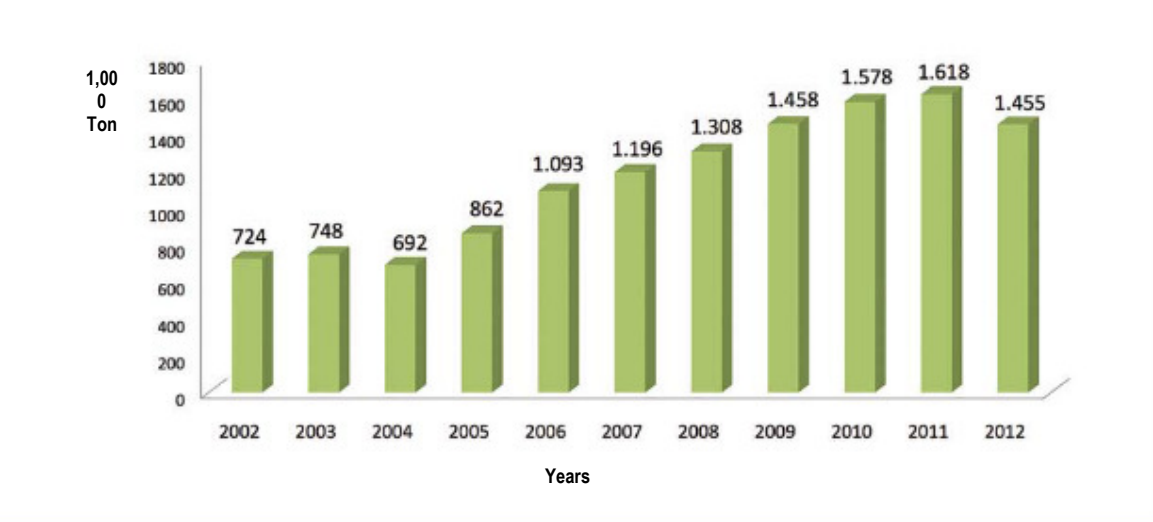
Source: DNPM, 2013; Prepared by: SEICOM, 2013.

Pará has good conditions for decentralized production of lime powder, when we compare the existing mining titles - 42 mining concessions, 69 survey permits and 87 others (DNPM, 2013) - there are broad prospects for investments that may generate conditions that are favorable to the municipalities of Aveiro, Bonito, Capanema, Curionópolis, Itaituba, Monte Alegre, Peixe-Boi and São Geraldo do Araguaia.

23 The main mineral content of lime is calcita (calcium carbonate - CaC03), and it may contain smaller amounts of magnesium carbonate, silica, clay and other minerals.

In the 2002-2012 period, Pará's limestone production increased from 724,000 to 1.455 million t / year, which means an average annual increase of 6.6%. Considering the decades of 1990-2000 and 2000-2010, the average rate of output growth was 4.6% and 7.8%, respectively, which reflects a significant growth trend, noting that the state of Pará produced 1,636,043 tons of cement in 2012 (ICNS 2012).

CHART 29 - EVOLUTION OF PRODUCTION OF LIME IN THE STATE OF PARA, 2002-2012.

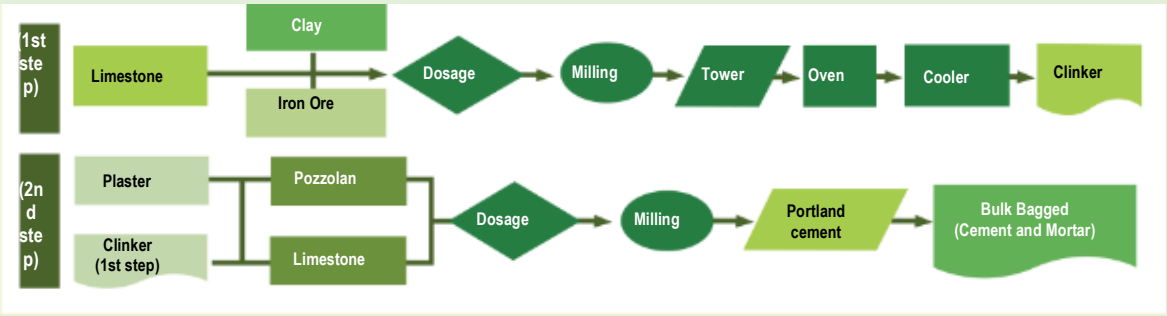


Source: DNPM / Mineral Economics of Pará State, 2013.

The occupation of the workforce in activities related to the production and beneficiation of limestone in the state of Pará, like in the rest of the country, remained relatively stable over the past five years, employing on average 966 direct workers in 2008 (MTE / RAIS, 2008) , a number that is expected to increase by approximately 500 more workers in 2014, when the Votorantim factory in the city of Primavera starts operating in Northeastern Pará.

Figure 13 illustrates the manufacture of dry route cement. In a first step, after being removed from the mine and crushed, limestone is mixed with clay and iron ore in a process that includes cooling and grinding to obtain the clinker - which is the cement in a primary stage - which leaves the oven at about 80 C. In a second step, siliceous material and gypsum are added to the clinker, followed by new grinding to obtain cement and mortar in commercial form.

FIGURE 13 - FLOW CHART OF THE MANUFACTURING PROCESS OF CEMENT



Source: Adapted from Votorantim Cement Group, 2012.

Almost all the lime produced in the state of Pará (over 98%) is destined for the cement industry. The factories of CIBRASA, in the municipality of Capanema, and ITACIMPASA, in the city of Itaituba, of which Companhia Brasileira de Equipamentos (CBE) is the main operator, supply the cement plants of Pará and Amazonas.

Besides the cement industry, the expectation is for high consumption of agricultural lime, given the growing trend of agribusiness in Pará and the need to maintain or increase the productivity of the soil. According to EMATER, Pará uses less than half the recommended lime to correct the acidity of the various soil types in the state. This means that a higher or lower agricultural production will depend on the behavior of the commodity prices, as well as on public policies in favor of increased use of limestone and, consequently, on the equation between demand and supply of this mineral at competitive prices (DNPM-2009).

Although Pará has large reserves of limestone, those intended for the production of soil corrective products are poorly distributed in relation to the complexes of agricultural production. In 2013, there are, in DNPM, six mining proceedings of Applications for License Registration, in the Licensing phase; and seven in Licensing Application phase. And, in seven of these cases, the type of use is solely for soil correction. And the others are for the use both as soil amendments and for crushed stone. All these proceedings are concentrated in the cities of Palestina do Pará (Southeast Region) and Rurópolis, in the Western Region of the subregion of Médio Tapajós. In 2012, the production of lime for soil amendments reached 63 tons (ANP, 2013).

The production of agricultural lime is performed in the municipalities of Monte Alegre, Santana do Araguaia and Palestina do Pará, where the Globo Verde Mineração company operates, since 2003.

It is important to highlight that the Lime Law was enacted (Law number 12.389/2011) which aims to educate the farmers about the importance of liming in agriculture. In 2013, the Federal Government also issued the National Plan for Organic Production and Agroecology [24] with an initial investment of R$ 8.8 billion to be spent over the next three years, which will have a strong impact on agricultural production and, as a consequence, the consumption of agricultural lime.

The supply of agricultural lime is conditional on: price per ton; cost of transport; geological framework, increasing productivity and / or agricultural expansion and new technological requirements for mining fronts, among others.

In terms of technology, besides the limestone for liming, there is a technology that provides for the remineralization of soils that have been depleted by natural or man-made processes, by adding powders of rocks containing appreciable amounts of macronutrients such as PK, Ca Mg and micronutrients such as V, Mo, Zn and others, called "stonemeal" that, through Law No. 12,890, of December 2013, was included as a category of inputs for agriculture.

IV - Kaolin

Kaolin [25] is a mineral used in various applications in the industries of: paper, paints, ceramics, plastics, rubber, catalyst, glass fiber, pharmaceuticals, cosmetics, adhesives and fertilizers, among others. In 2011, the world production of kaolin was 33 million tons. Brazil ranks 5th in the world ranking, with approximately 2 million tons. (DNPM,2011). Brazilian reserves of kaolin (measured + indicated + inferred) are 24.5 billion tons, 9.4 billion of which have been measured. They are reserves of extremely high whiteness, purity and quality for international use, especially in the paper industry. The states of Amazonas, Pará and Amapá are the most prominent ones, participating, respectively, with 63%, 19% and 9% of the total of Brazilian reserves (CPRM, 2013). And with the growing demand for specialty papers used mainly in advertising campaigns, the expectations of growth in the consumption of kaolin for coating are promising.

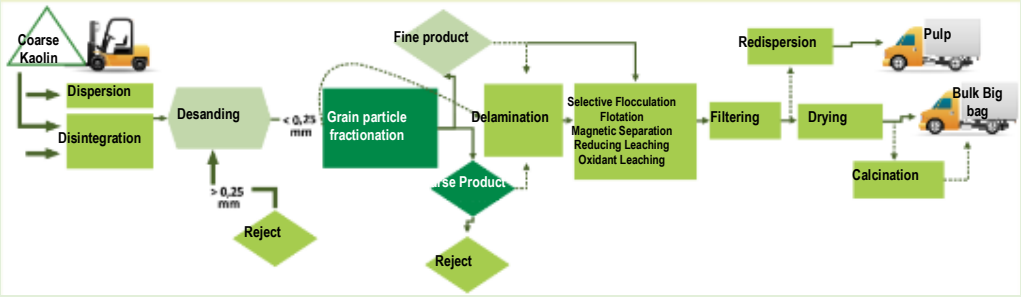
Since it usually associated with impurities, kaolin has to be processed (either through a dry or wet route) in order to meet the specifications of the market. The first, which is the simplest one, is intended for the types of kaolin that have whiteness and particle size that is appropriate for the market for which they are destined. The wet route process involves the steps of dispersion, fractionation in hydrocyclone or centrifuge, magnetic separation, selective flocculation, chemical bleaching, filtering and drying, as shown in the simplified schematic drawing of Figure 14 (CETEM, 2005).

Pará is the main producer in the country, through three mines in operation, with two of the

24 http://portal.mda.gov.br/portal/institucional/planapo
25It is a rock formed by a group of hydrated silicates of aluminum, mainly kaolinite and halosita. Although the mineral kaolinite (Al203.2SiO2.2H2O) is the main constituent of kaolin, there are other elements usually present, besides aluminum, silicon, hydrogen and oxygen.

largest national producers located in the kaolin producing district Rio Capim, in the municipality of Ipixuna do Pará, where the ore mining activity employed 205 workers, in 2011 (MTE/RAIS, 2012). Besides the five mining concessions in Ipixuna do Pará, there are, in DNPM (2013), 23 valid mining proceedings of Survey Permit, and 51 more proceedings of Mining Application, Survey Application and availability for kaolin in the municipalities of Aurora do Pará, Paragominas, Santa Izabel do Pará, Inhangapi, Santarém and Aveiro (Map 14).

FIGURE 14 - SIMPLIFIED DIAGRAM OF WASHED BENEFICIATION OF KAOLIN.

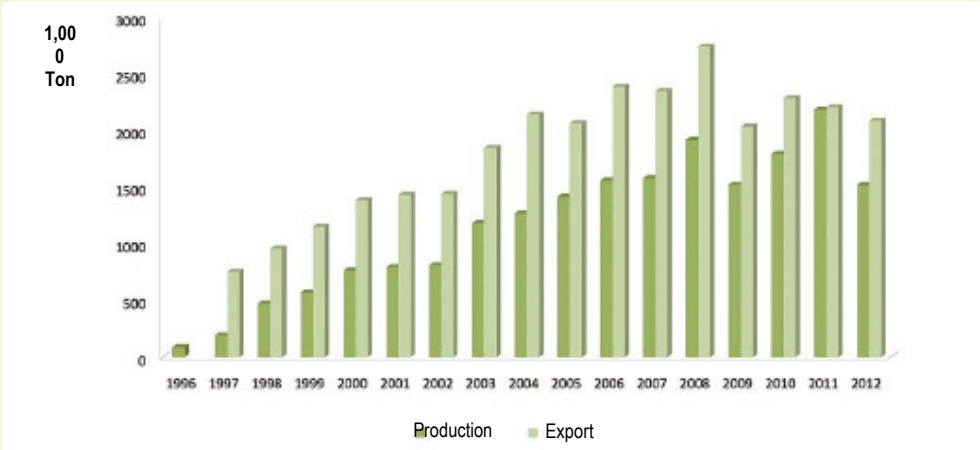


Source: Adapted from Votorantim Cement Group, 2012.

95% of the kaolin in the country is produced by the companies Imerys Rio Capim Caulim (IRCC) and Pará Pigmentos SA (PPSA/Imerys), both in Ipixuna do Pará, and Caulim da Amazônia SA (CADAM/ KaMin LLC) that operates a strip mine in Vitória do Jari, in the State of Amapá, and the beneficiation in Munguba, State of Pará, where it has its own port. Due to contracts executed, 88% of the production serves the foreign market (ANP, 2012). Of the Kaolin sold in the domestic market, approximately 3% is intended for the manufacturing of cement; the other uses are related to the industry of paper, ceramics and paints, among others.

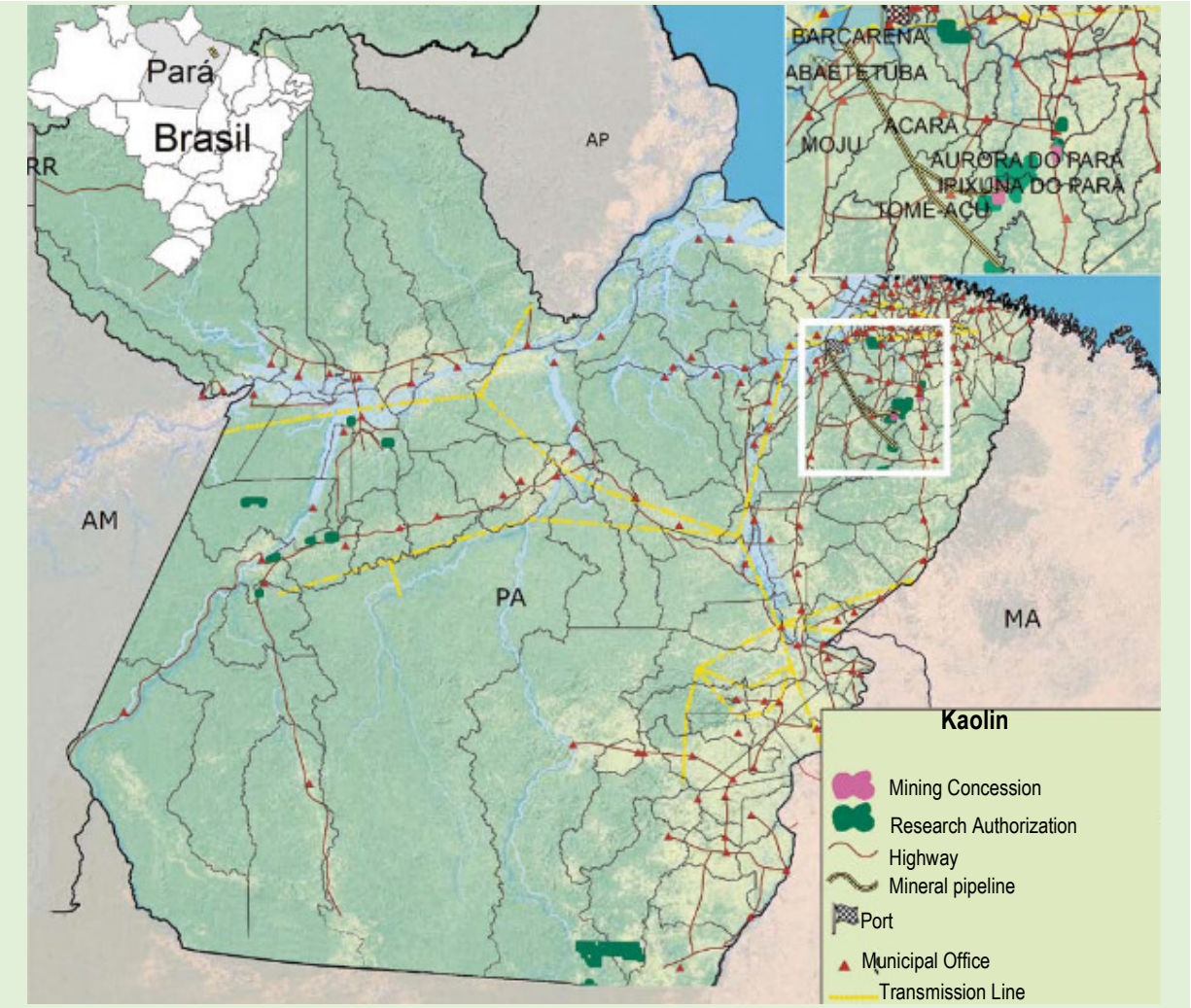
The production and mainly the exports of kaolin have grown over the past fifteen years. In 2012, kaolin production accounted for 1.8% of the exports of ores and Pará had 19 countries as a destination, with Belgium being the main destination, followed by the United States, totaling more than US$ 233 million in exports revenues. The fall in demand for kaolin in the 2009-2010 period, was mainly due to the world crisis. In 2012, the slowdown of the Chinese economy and lower growth in Europe, USA and Japan, the world's leading consumers of the product, resulted in declining exports and international prices of kaolin. The behavior of the production and export of kaolin is shown in Figure 30.

CHART 30 - EVOLUTION OF PRODUCTION AND EXPORTATION OF KAOLIN IN THE STATE OF PARÁ (1996-2012).



Source: DNPM / Mineral Economics of Pará State, 2013.

MAP 14 - MINERAL TITLES OF KAOLIN IN PARÁ.



Source: DNPM, 2013; Prepared by: SEICOM, 2013.

In Imerys (IRCC) in Ipixuna do Pará, 99% of the kaolin produced is intended for the paper industry. Imerys' mine only removes the sand and, after this step, the raw ore is transported through a 158-km-long mining pipeline to Barcarena, where it undergoes several processes with the purpose of increasing the degree of purity and whiteness. In the PPSA mine, also in Ipixuna do Pará, the ore is transferred to Barcarena only after being processed through a 180 km long pipeline, where 5% of the production is destined for paint industries and the other 95% to the paper industries. Imerys and PPSA have a port terminal for handling kaolin in the forms that kaolin is sold, that is, in bulk, pulp and even in big bags (1 ton bags).

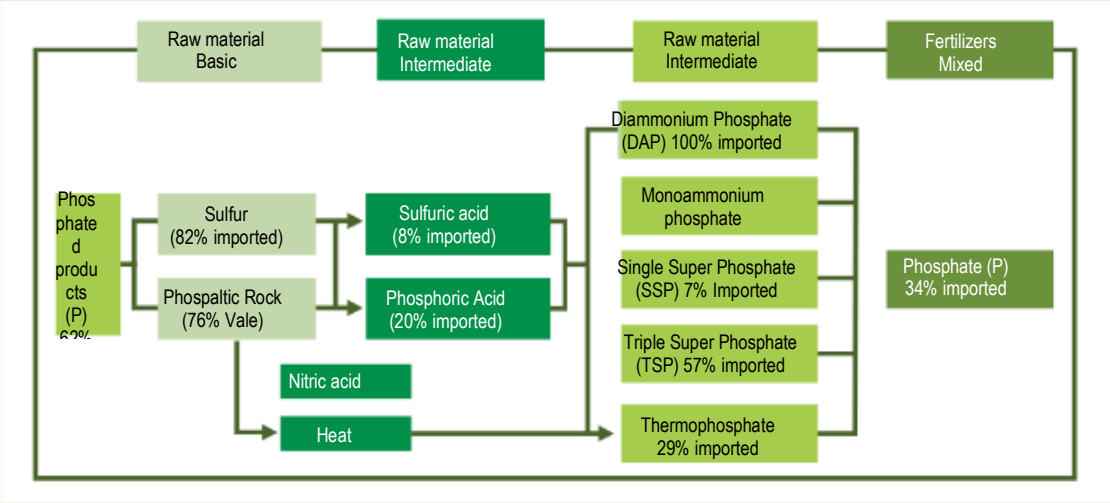
With the expansion work at the plant in Pará, coupled with the decommissioning of a unit in England, IRCC plans to produce 1.6 million tons per year, due to the quality of kaolin in the state (CPRM, 2013). Since 2008, the cosmetic industry of Pará, Chamma da Amazônia, began producing a kaolin-based line of Imerys. The products have the seal of ANVISA and are dermatologically tested. With the works of urban mobility and infrastructure of the Acceleration Program (PAC) and Minha Casa Minha Vida program in the state, run by the Federal Government, and especially with the rise of the new middle class, there have been new favorable perspectives of expansion of the local demand. Another possibility for verticalization of the use of kaolin in the state is to reactivate the industry of ceramic tiles, as occurred in the 1980s, with INCA (Indústrias de Cerâmica da Amazônia) and AZPA (Azulejos do Pará), given the promising potential for the production of bricks, limestone and construction aggregates.

V - Phosphate

The phosphate with sulfur and potassium comprises the group known as "agrominerals".

Brazil relies heavily on imports of these substances. In the case of phosphate, it produces only 50% of its consumption needs. Phosphate is the raw material for the preparation of phosphate products (Figure 15), such as purified acids, animal nutrition supplements, fertilizers for agriculture, soft drinks, food products, industrial detergents, metal treatment, drug and water treatment (CETEM 2010).

FIGURE 15 - FLOW CHART OF PRODUCTION OF PHOSPHATE, NPK COMPONENT.



Source: CETEM, prepared by SEICOM, 2013;

The Brazilian phosphate rock production is located primarily in the Southeast and Midwest regions; 86% of the demand for phosphate rock depends on the fertilizer market [26] and about 70% of the rock fertilizer is intended for use in phosphoric acid production. Brazil accounts for about 4% of production and 9% of the world demand. (J. MENDO, 2009).

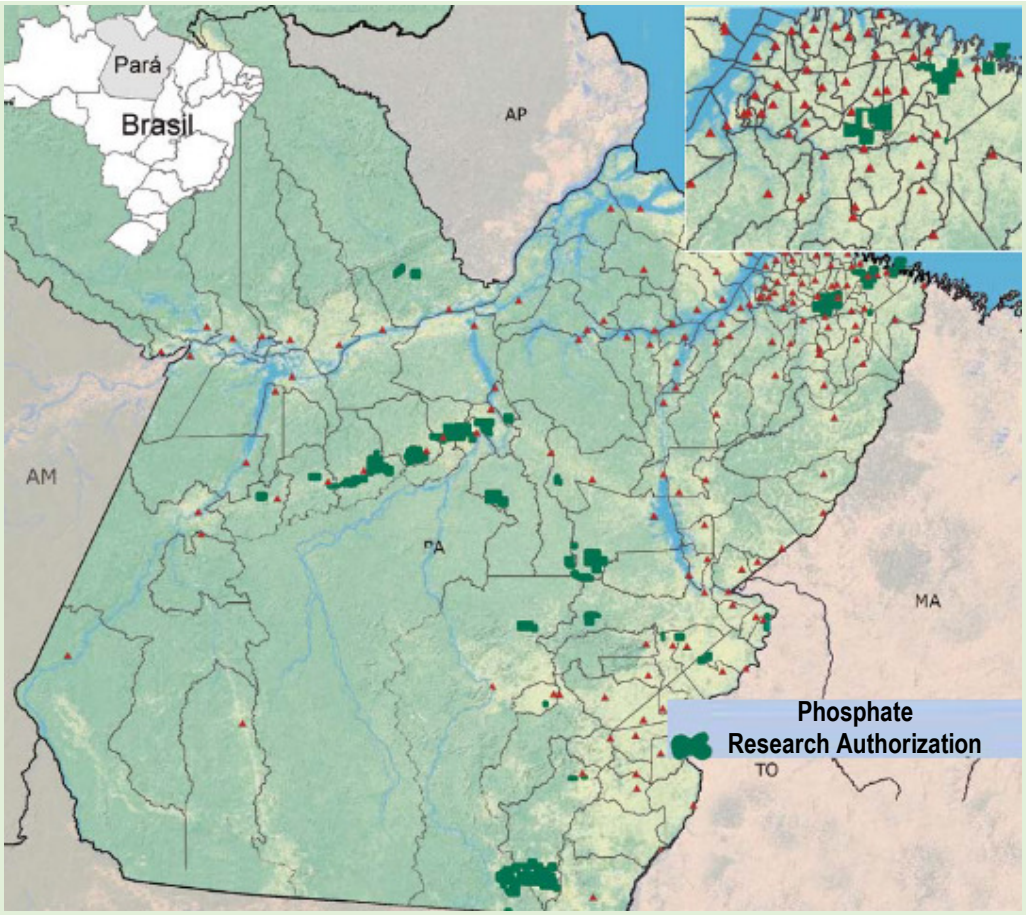
The potentiality of phosphate in Pará lies mainly in the Alkaline-Ultrabasic-Carbonatitic Complex of Maecuru, which is a body of about 8 km, located in the municipality of Monte Alegre, with estimated 200 million tons reserves of ores, with an average content of 15%. (PASTANA, 1999). There are also other bodies of carbonatite-alkaline nature, the main ones being those of Maraconaí and Mutum in Almeirim and Oriximiná respectively. There is also information about deposits of aluminous phosphate accumulations in northeastern Pará, in Sapucaia, municipality of Bonito.

The current mining proceedings for phosphate in Pará (Map 15) refer only to the Authorization for Research, covering the municipalities of: Almeirim, Altamira, Bonito, Canaã dos Carajás, Capanema, Castanhal, Cumaru do Norte, Curionópolis, Faro, Itupiranga, Marabá, Monte Alegre, Novo Repartimento, Oriximiná, Parauapebas, Santa Izabel do Pará, Santa Luzia do Pará, São Félix do Xingu, São Geraldo do Araguaia, Tracuateua and Viseu (DNPM, 2013).

In northeastern Pará, it is worth highlighting company Rio Verde Minerais, Projeto Fosfatar, Sapucaia and Boa Vista mines, in the municipality of Bonito, which is already in the implementation phase of the first Aluminum Termophosphate plant in Brazil, with forecast initial production of 8,000 t / month, in April 2014. The project includes an initial investment of R$ 30 million and is expected to create 103 direct jobs in the industrialization process. As positive factors, it includes: businesses near the state capital, infrastructure, resources and favorable access and especially the proximity to consumer markets (PA, MT, MA), which creates a climate conducive to business expansion. Rio Verde Minerais has other research projects in phosphate in the state of Pará, in the municipalities of Monte Alegre and Curuá.

MAP 15 - PHOSPHATE SURVEY PERMIT IN PARÁ.

26 The production chain of the fertilizer industry in Brazil is composed of the ore mining sector, which provides the phosphate rock, sulfur and potassium rocks, the segment that produces the intermediate raw materials such as sulfuric acid, phosphoric acid and ammonia anhydrous, the segment producer of simple fertilizers and the segment that produces mixed fertilizers and complex pellets (NPK).



Source: DNPM, Prepared by SEICOM, 2013.

There is also the prediction of a large phosphate mine of MBAC, in São Félix do Xingu, called "Santana Project" which has the advantage of strategic regional integration, which changes the paradigm of production of commodities for export, in which its product is intended for local markets and has close relation with the expansion of agribusiness.

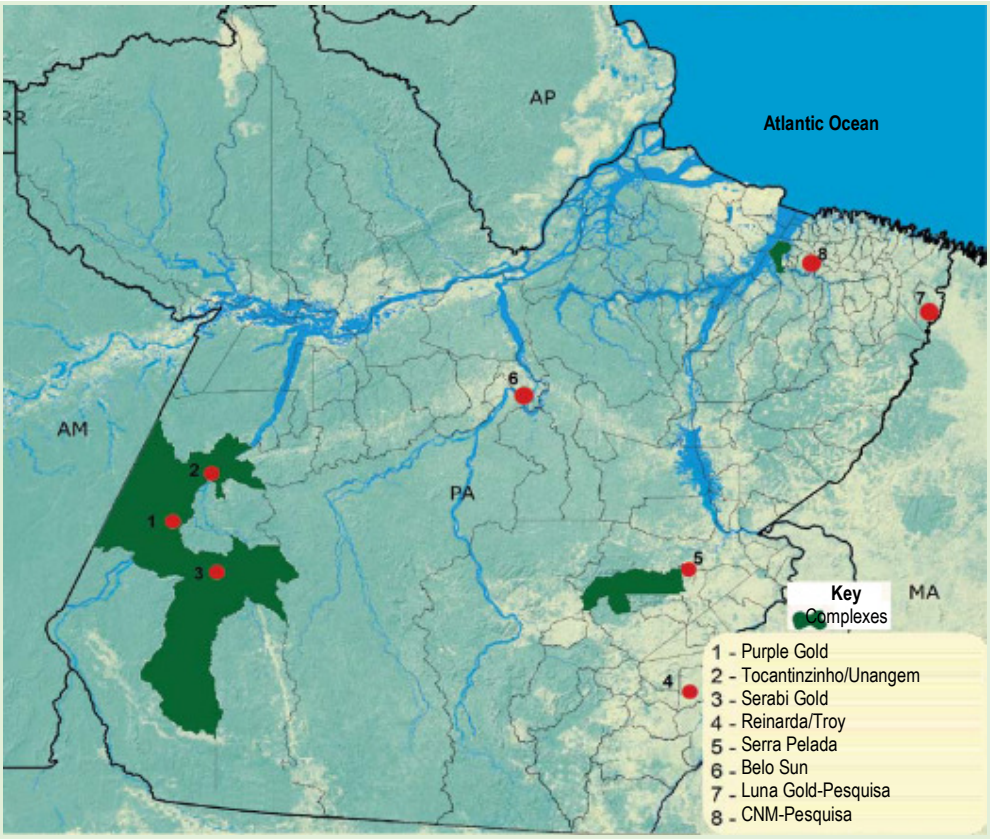
VI - Gems, Precious Metals and Jewelry

The "Program for Development of the Gems and Jewellery Sector Pará", better known as "Jeweller Complex of Pará", began in 1988, by initiative of the State Government, to add value to the mineral production, historically marketed in its unprocessed form and with a limited socioeconomic return. This program included the creation of three complexes for the development of the sector: in the capital and in the West and Southeast regions of the state. The Belém Complex is relatively consolidated, but the internalization of the program made little progress, hence the importance of resuming and expanding this policy.

At the beginning of the implementation of the Program, the tax issue was considered as an inhibitor, so a policy of tax deferral was created for the sector, through Decree No. 5375, of July 11, 2002. From then on, all internal operations, from the sale of raw materials to the final product, were exempted from VAT, including inputs and machinery, and the rate for interstate operations was set at 5%.

The jewelry trade has also benefited from Decree No. 5497, of September 12, 2002, which reduced the tax burden applied to marketing to 12%, as a way to encourage the consumption of that good. This set of actions in the tax area favored the emergence of new production units. From 75 units in 1999, the segment has expanded to 450 in 2004, and the average income of the producer went from R$ 150 in 1999 to R$ 500 in 2004 (IBGM, 2005).

MAP 16 - COMPLEXES OF GEMS AND THE MAIN GOLD PROJECTS IN PARÁ



Source: SEICOM, 2013.

IMAGE 6 – SÃO JOSÉ LIBERTO SPACE.
SOURCE: IGAMA, 2013.

Belém Complex

Since 2002, the Program's actions were transferred to ASJL (Associação São José Liberto or the São José Liberto Association) and, since 2005, the ESJL (Espaço São José Liberto or São José Liberto Space) has been run by an OS (Organização Social or Social Organization), IGAMA (Instituto de Gemas de Jóias da Amazônia = Institute of Jewel Gems of the Amazon), through a Management Agreement signed with the state government, under the supervision of SEICOM. IGAMA promotes actions to qualify designers, jewelers, gem cutters, artisans and producers of handmade packaging, in addition to training, along with SEBRAE, professionals linked to the Jeweller Complex in the areas of marketing and new markets for Pará's gem.

According to IGAMA, which has been managing the ESJL since 2007, 7,100 professionals have already been trained. In 2013 the formal space houses 68 companies, 144 goldsmiths, 40 designers and the product of 647 craftsmen, which stimulate a whole chain of suppliers and service providers. The professionals of the Complex have received important awards, including the Ashanti Auditions in the 2002 edition (Clara Amorim), 2010 edition (Lidia Abrahim) and 2012 edition (Selma Montenegro). In addition, from January 2007 to November 2013, ESJL has already received 1.5 million visitors.

After the implementation of the goals set out in the Management Agreement, there has been an expansion of the results. Between January and October 2013, 500 professionals in the production chain of gems, jewelry and handicrafts were trained. In the same period, 4,540 pieces of jewelry were curated and 1,418 gems were evaluated to be sold, generating sales revenues of around R$ 800 thousand. With the completion and preparation of the Marketing Plan of ESJL, agreed in the Management Agreement, and the closer partnerships with travel companies, it was possible to include the space in the city sightseeing tour, which favored the increase of visitors, allowing ESJL to receive approximately 243,000 people, only between January and October 2013, and 34 technical and scientific visits to educational institutions.

Western Pará Complex - Itaituba

The Complex of Gems and Jewels of Western Pará is expected to be deployed in the city of Itaituba, due to the large amount of gold and gems marketed without the addition of value (informal mining). It is noteworthy that the jewelry industry is one of the main losers with the illegality of the mines, since it cannot sell and, mainly, export its products without a certificate of origin [27] .

In this sense, a solution that has proved workable in other regions of the country [28] is the implementation of a Local Productive Arrangement (APL) of Gems and Jewels, as this type of production organization promotes the involvement of the society in a production dynamics that results in greater and more sustainable benefits. It is important to highlight that gold companies formally established in Itaituba can act as anchors [29] of APL. Besides gold, there are, in region, occurrences of diamond, amethyst, rock crystal, topaz, garnet, smoky quartz, among other gems.

Pará Southeast Complex - Paraupebas

The initiative to extend the project of Gems and Jewelry Southeast of Pará stems from the great production potential of the region (Table 6), since there are, in nine of the 14 municipalities in the region, occurrences and, in many cases, reserves already identified of gems that range from diamonds to rock crystal.

TABLE 6 - MINERAL POTENTIAL OF GEMS AND JEWELRY BY MUNICIPALITY IN SOUTHEAST PARA.

MUNICIPALITY	MINERAL POTENTIAL
Conceição do Araguaia	Hyaline quartz, amethyst and opal.
Curionópolis	Gold and Malachite.
Eldorado dos Carajás	Rock crystal, smoky quartz, red quartz and amethyst.
Floresta do Araguaia	Hyaline quartz.
Itupiranga	Diamonds.
Marabá	Amethyst, citrine, rock crystal, smoky quartz and diamonds.
Parauapebas	Amethyst and citrine.
São Geraldo do Araguaia	Quartz, tourmaline, rutile, diamonds and opal.
São João do Araguaia	Smoky quartz and citrine.

Source: IDESP, 1994.

The amethyst of the municipality of Marabá, for example, has been known internationally since the 1980s, but up until now, it is mined and sold without being processed locally, without creating job and income opportunities for other regions, rather than prioritizing the local inhabitants.

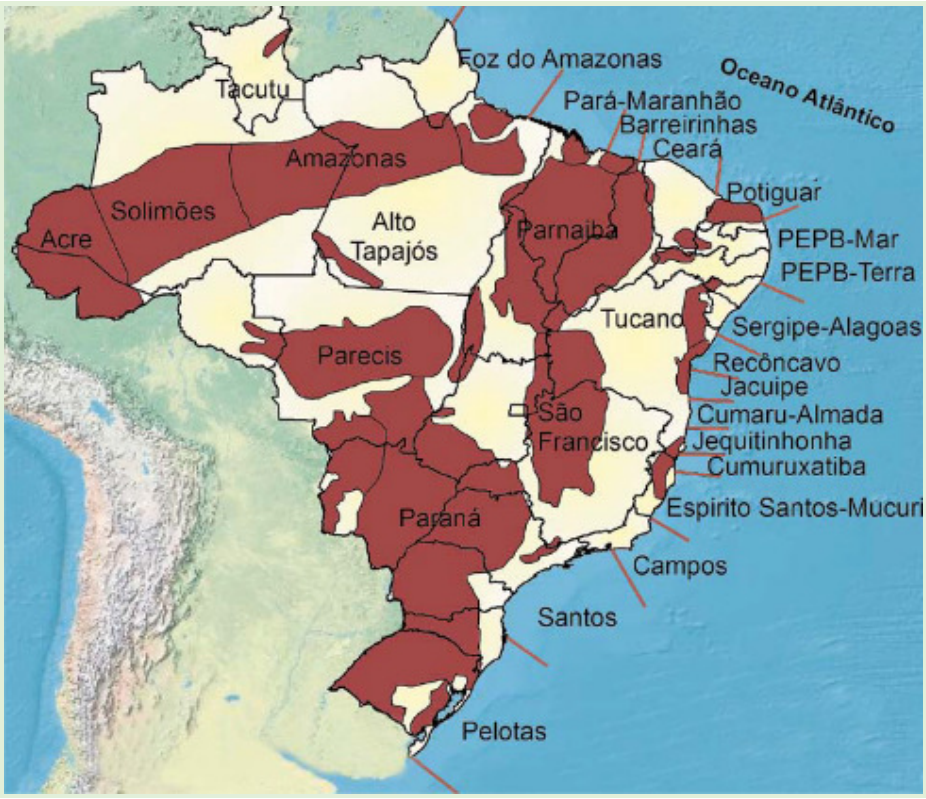
The first actions for the implementation of this Complex began with the partnership with SEBRAE/PA for the purchase of equipment, machinery and specialized consulting services to offer mineral craft workshops in the municipality of Floresta do Araguaia, and silversmithing, casting and polishing of gems, in the municipality of Parauapebas.

27 According to Law No. 11685, of June 2, 2008, in its art. 9, if the product does not have mineral ownership evidencing the source area of production, it is not possible to sell it legally.
28 The APL of gems and jewels of Pedro II-PI, Limeira, SP, Soledad-RS, etc.
29 An anchor company is a concept used to describe companies that play a leading role for a group of small and medium-sized companies that supply products and services to such anchor company.

VIII - Oil and Gas

Pará produces neither oil nor gas, but there are promising expectations for the next ten years due to its strategic location, both in relation to the Amazon and the Equatorial Province. Pará borders, or it is in the influence area of several sedimentary basins (Map 17), some of which are being developed by companies such as Shell, PETROBRAS, DEVON and OGX, and others are still in the data collection phase.

MAP 17 - PARA'S POSITION REGARDING THE SEDIMENTARY BASINS.



Source: www.geopolíticadopetroleo.wordpress.com Prepared by SEICOM.

The prospects are favorable for the frontier basins, such as the Pará-Maranhão and Parnaíba and Amazônia. Equally important is the development of the Barreirinhas Basin (in Maranhão State). Available data (Table 7) show that, if there is the possibility of commercial production, the supply of new energy supplies, especially natural gas and its byproducts, such as diesel oil and fuel oil, can leverage Para's industrial sector, especially the metallic mineral based sector, which demands a lot of energy. The new prospects for the production of oil and natural gas are in line with the other ones, also in the same region.

TABLE 7 - OIL AND NATURAL GAS RESOURCES IN PARÁ'S BORDERING OR NEIGHBORING SEDIMENTARY BASINS.

SEDIMENTARY BASIN	RESOURCES	
	PETROLEUM	NATURAL GAS
PARÁ- MARANHÃO	2.5 million barrels	7.2 billion cubic feet
PARNAÍBA	-	20 - 200 billion cubic feet 5 trillion cubic feet (estimate)
BARREIRINHAS	5.4 billion barrels	-
AMAZON	-	72 billion cubic meters
SOLIMÕES	69 million cubic meters	-

Source: ANP, 2013.

It is important to highlight that more than mere speculation, oil drilling already has the

potential to boost government revenue (ISSQN tax of service providers) to municipalities that are being analyzed.

VIII - Rare Earth

The Rare Earth Elements (REE) are minerals used in the manufacture of components of high technology products and are represented in the periodic table by the group of lanthanides, together with scandium (Sc) and yttrium (Y). Most REE is associated with three minerals: monazite and bastnaesita, for the light REE, and xenotymio, for heavy REE, according to Lapido Loreiro (2013).

There are numerous applications of REE due to the properties of lightness and strength, which motivates the use in state-of-the-art products (*smartphones*, sunglasses, bottles of wine etc.), in the military (night vision goggles and robot aircraft), in modern medicine (MRI), non-polluting equipment (hybrid cars and wind turbines), among others, as shown in Table 8, which lists the chemical elements and their applications.

Unlike the name, these elements are not as rare as one may think, but they are scattered. China is the largest miner and manufacturer of REE in the world. Large producers depend on it, just like Brazil does.

Like SINFERBASE (2012), MBAC Fertilizantes completed the geological and economic viability studies in the municipality of Araxá, in Minas Gerais, where REE minerals were identified and then an application for mining was filed with DNPM. The company is likely to be one of the first to produce them in Brazil.

TABLE 8 - CHEMICAL ELEMENTS OF RARE EARTHS, SCANDIUM AND YTTRIUM AND THEIR APPLICATIONS.

ELEMENT	APPLICATIONS
CERIUM (EC)	Thermoelectricity; wine bottles against ultraviolet rays; petroleum cracking; ceramics and glass; polishing powder.
Dysprosium (DY)	Metal alloy for electric motors based permanent magnets; hard drive; miniaturized motors for power tools; ceramics, matches.
Erbium (ER)	Sunglasses; stained glass; optical fibers; lasers; nuclear applications.
Europium (EU)	LED screens; matches.
GADOLINIUM (GD)	Magnetic refrigeration (contrast agent in magnetic resonance imaging); advanced equipment for the U.S. military (optical detection); glasses and ceramics.
Holmium (HO)	Nuclear applications; ceramics and lasers.
Lanthanum (LA)	Advanced equipment for the U.S. military; automotive catalysis.
Lutetium (LU)	Single crystal scintillators.
Neodymium (ND)	Metal alloy for electric motors based on permanent magnets; present in smartphones (the microphone, vibrator motors) and headphones; Sunglasses (infrared filters); miniaturized motors for power tools; pigmentose lasers.
Praseodymium (PR)	Sunglasses; ceramics; glass and pigments.
Promethium (PM)	Nuclear batteries; measurement devices and matches.
Samarium (SM)	It aids to convert sound into electrical currents in magnetic sensors of a guitar; used in control rods for nuclear reactors and some microwave filters.
Terbium (TB)	Thermoelectricity, electric motors based permanent magnets; LED screens; fluorescent lamps.
TULIUM (TM)	Tube of electron beams and visualization of medical images.
Ytterbium (YB)	Chemical and metallurgical industry
Yttrium (Y)	Superconductors and capacitors; advanced equipment for the U.S. military (radars); fluorescent lamps.
Scandium (SC)	Aerospace, baseball bats, nuclear applications, lighting and superconductors.

Source: National Geographic/ 2011, Lapido-Loreiro/2013 and CERTI/2013.

Pará has a good chance of being a supplier of raw material for REE. In the state, there are few publications available on the subject, explaining the real interest of research, exploration and use in mines [30] . Pará has five survey applications filed with DNPM. It is speculated that there is still no commercial production of pure elements, but they can be sold as a byproduct in concentrations of chromium, nickel, copper, or lead (ANP, 2009), since trade of pure ore requires suitable technology for separation of lanthanides, and yttrium scandium, which is complex and expensive.

The recent geological mapping work undertaken by CPRM in the Tocantins River basin, in the context of the Amazonian Craton, in Central Brazil Shield, has revealed the favorability of the cratonic region for surveys of REE. The highlight is the Arapari Unit, where they were recorded the highest levels of thorium in aerogeophysics maps, high content of monazite and geochemical anomalies of REE (Cerium and Lanthanum) and Yttrium. This is very favorable context for containing bentonite deposits of REE, similar to what occurs in the Jequie Belt (State of Bahia), where mineralization of this type are known (CPRM, in press). The work of CPRM still emphasizes that the above area:

> (...) Has a good logistics infrastructure (in terms of Amazonia), abundant labor, is linked to the national road network and is located near the Tucuruí Hydroelectric Powerplant. Under these conditions, even small deposits can be economically viable. CPRM-Belém continues, in regional terms, doing research and, at the current level of knowledge, Intrusive Suite Arapari can be considered as a promising target for regional research of REE and, therefore, a new frontier for research of these elements in the state of Pará.

Another area that deserves attention is the Tin Province of São Félix do Xingu, known as one of the largest producers of tin in the state of Pará, which presents a geological / metallogenic context that is favorable to the Sn mineralization associated with Nb , as in the Mining District Pitinga (AM), where a world-class Sn deposit contains Nb, Ta and F as coproducts, in addition to Zr, Y REE and Li as potential byproducts (Prado, 2006).

30 Being discussed (September 2013) by the Senate.

3

CHAPTER

Trends of growth in Mining

3 GROWTH TRENDS IN MINING AND MINERAL TRANSFORMATION

It is of great importance to identify the dynamics of the mineral goods market and the factors that determine such motion for mineral policy, since it allows us to anticipate trends and, thus, to be better prepared to take advantage of the good times, the "bonanzas" and prevent adverse situations.

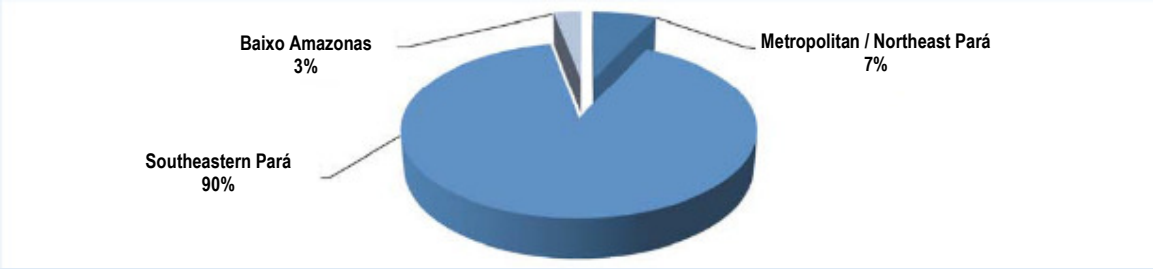
3.1 FORECAST OF NEW INVESTMENTS

The estimated investment in mining and the corresponding manpower required for the next year was based on information provided by FIEPA / NETWORKS [31] and trend analysis, support from the Institute of Social, Economic and Environmental Development of Pará (IDESP).

3.1.1 Investment in Mining (Mineral Extraction Industry)

The largest investments in mining already happen and will happen in the municipalities of Southeast Pará (Chart 31).

CHART 31 - DISTRIBUTION OF INVESTMENTS IN MINERALS BY REGION.



Prepared by: REDES/FIEPA and adjusted by PEM

According to REDES, up until 2017, Pará receive investments of R$ 55 billion in mining that will generate around 42,000 jobs (Table 18). This corresponds to a cost of **R$ 1.309 million per job created.**

TABLE 18 - INVESTMENT IN MINING (2013-2017). DISTRIBUTION BY MINERAL PRODUCTS.

PRODUCT	PROJECT	LOCATION	VALUE OF INVESTMENT (MILLION REALS)	JOB CREATION
BAUXITE	Hydro Bauxite **	Paragominas	974.00	1.100
	ALCOA **	Juruti	600.00	800
	Mineração Rio do Norte**	Oriximiná and Terra Santa	612.00	600
	Bauxita Votorantim *	Rondon do Pará	2,640.00	6.000
SUBTOTAL			**4.826,00**	**8.500**
COPPER	Salobo II**, Vale's Project	Marabá	2,052.00	2.970
	Vale Cristalino*	Curionópolis	5,000.00	8.940
	Vale -118 Oxidado*	Canaã do Carajás	1,092.00	2.586
	Mineração Caraiba*	Tucumã	550.00	500
SUBTOTAL			**8.694,00**	**14.996**

31 Investments in mining in Pará, whether in mining or mineral processing, that are occurring or planned for a period of five years, are regularly published by the Federation of Industries of the State of Pará (FIEPA) through the REDES program, based on information provided by companies and class entities. The goal of FIEPA is to alert local companies to prepare to meet the demands for goods and services, in addition to qualifying the necessary manpower to seize the opportunities that will be generated from these investments.

TABLE 18 - INVESTMENT IN MINING (2013-2017). DISTRIBUTION BY MINERAL PRODUCTS.				
PRODUCT	**PROJECT**	**LOCATION**	**VALUE OF INVESTMENT (MILLION REALS)**	**JOB CREATION**
IRON	Serra Leste*, Vale Project	Curionópolis	912.00	2.200
	Vale - Project S11 D*	Canaã do Carajás	24,000.00	7.228
	Vale - Expansion in Carajás **	Parauapebas	5,130.00	3.700
	Mineração Buritirama (Iron alloy)*	Breu Branco	160.00	320
SUBTOTAL			**30.202,00**	**13.448**
PHOSPHATE	MB AC Fertilizer*	SÃO FÉLIX DO XINGU	600.00***	700
MANGANESE	Mineração Buritirama * (Port)	Barcarena	100.00	70
NICKEL	Anglo American Nickel *	São Feliz do Xingu	9,400.00	3.500
GOLD	Colossus *	Curionópolis	320.00***	650
	Belo Sun (Gold) *	Senador José Porfírio	590.00***	500
SUBTOTAL			**910,00**	**1.150**
GRAND TOTAL			**54.732,00**	**42.364**

* Deployment Projects; **Expansion projects; * Only bauxite mining *** The company plans to double such investments after the project implementation (information verbally provided by the companies).
Source: FIEPA / Networks; Prepared by: SEICOM, 2013.

Over the next five years, the iron ore will absorb 55% of total investments, followed by nickel (17%), copper (16%) and bauxite (9%), as shown in Chart 32. However, due to the capital intensity per unit produced, especially in the case of iron, the corresponding labor will not play the same profile. So, copper will account for the largest share of employment (35%), followed by iron (32%) and bauxite (20%).

CHART 32 - INVESTMENTS IN ORE MINING.

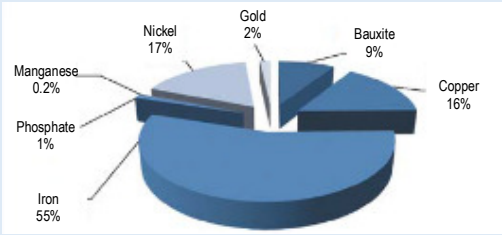
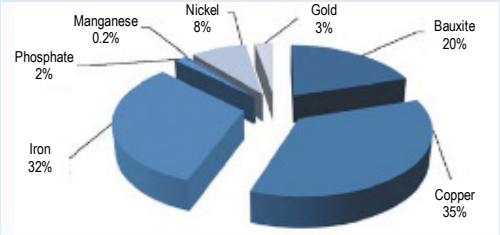


CHART 33 - CREATION OF JOBS IN ORE MINING.



Prepared by: SEICOM, 2013.

The major mining venture in the state, which is also the world's largest, is the extraction of iron in Mine S11 D in Canaã do Carajás (Box II).

Investments in non-ferrous metal ores (nickel, copper and bauxite) open important windows of opportunities for the consolidation of value chains. Gold has small share, around 2%, in new investments. The other substances did not stand out significantly.

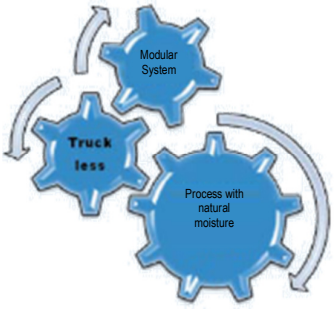
IMAGE 7 - ORE STACKING SYSTEM. SOURCE: VALE, 2013.

BOX II - PROJECT S11D

IMAGE 8 - MODULE ASSEMBLY ON PROJECT S11D, AT CANAÃ DO CARAJÁS.
SOURCE: VALE.

The new iron ore project of Vale, S11 D, located in the municipality of Canaã dos Carajás, is the largest project to iron ore strip mining in the world. The name refers to the geographic location of Body S11, Block D.

The mineral potential of the body S11 is 10 billion tons of iron ore, and the D block alone has 2.78 billion tons of reserves. In 2017, the project is expected to start with the production of 90 million tons / year that, added to the one in Carajás, will offer 230 million tons / year of iron, which will significantly strengthen the Brazilian exports of ores. The estimated expenditures for the S11D are of US$ 19.5 billion between mine, plant and logistical support (Vale, 2012). It will create around 30,000 direct jobs during the implementation phase and 2,600 during operation. From a technological standpoint, the project represents an advance over traditional plants due to three innovations, most of which are imported from Germany:



1- Beneficiation of the ore in natural moisture

It will reduce by 93% the consumption of water in the process, eliminating one of the major problems of mining, which is the tailings pond, avoiding significant environmental impacts.

2 - Equipment of comminution of ores in modules

Technology originating in oil rigs that, besides being automated, it can be easily disassembled and transported to other areas, using concrete only in the foundations of equipment;

3 - Truckless System

There is no presence of off-road trucks, the ore will be transported by belts, which reduces greenhouse gas emissions, in addition to other benefits such as reducing the consumption of diesel and electric power.

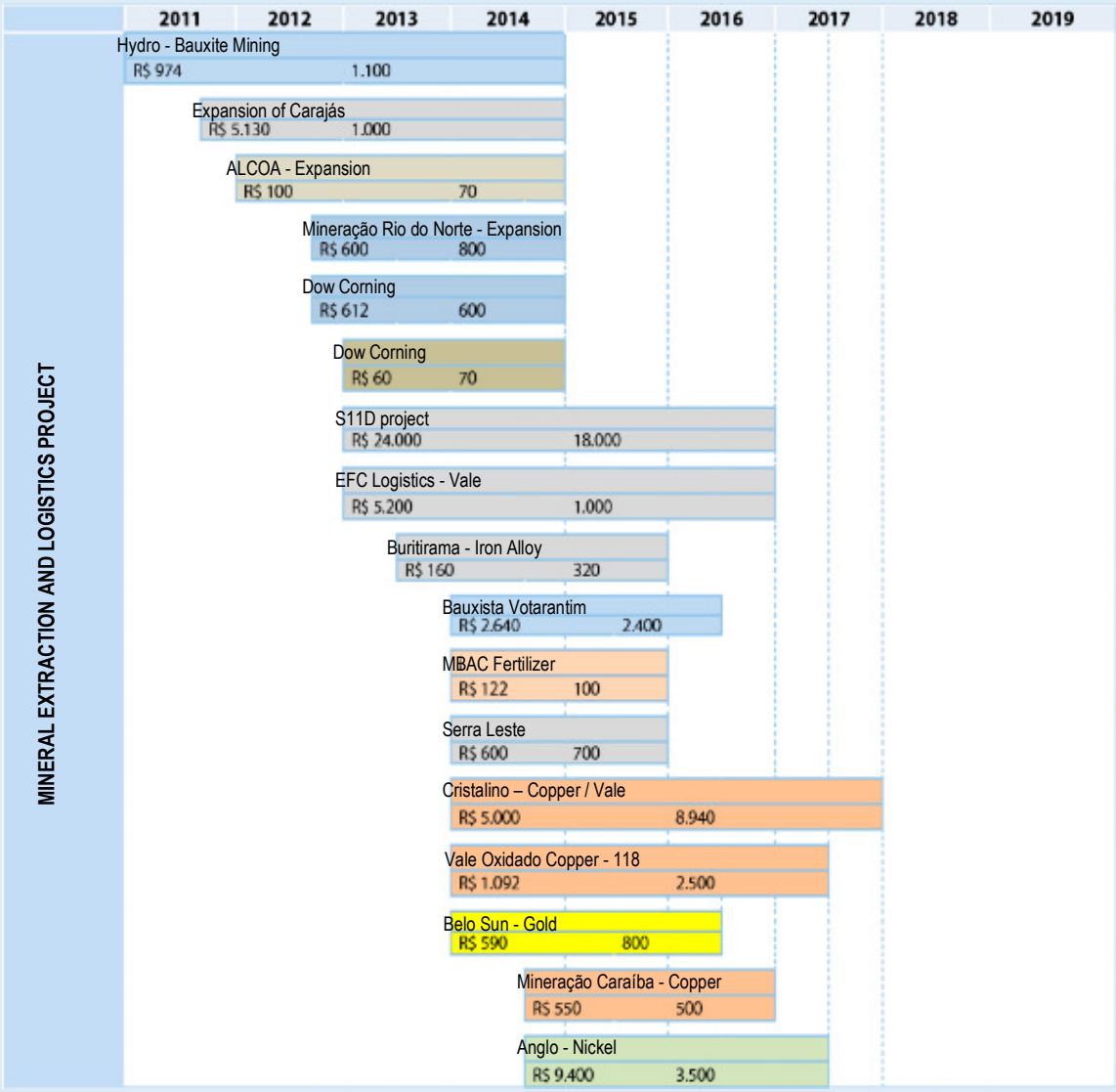
IMAGE 9 - CONSTRUCTION SITE OF PROJECT S11D.

IMAGE 10 - ORE DISTRIBUTION SYSTEM POWERED BY CONVEYOR BELTS.

The logistical support to the project also includes the expansion of 504 km of existing lines of road iron, comprising the refurbishment of 226 km, as well as construction of 101 km from the railway station to southeastern Pará Provided that is truly committed to the development of Pará, the SI 1D project may encourage a new cycle of productive expansion, to enable strengthening the supply chain, because along with the Carajás project would greatly increase purchases of inputs and goods and services stimulating the emergence and growth of new companies, which means more investment to the region.

Table 9 describes, in a timeline, new investments in mining to be generated in Pará The year 2014 stands out as the largest concentration of investments in the sector.

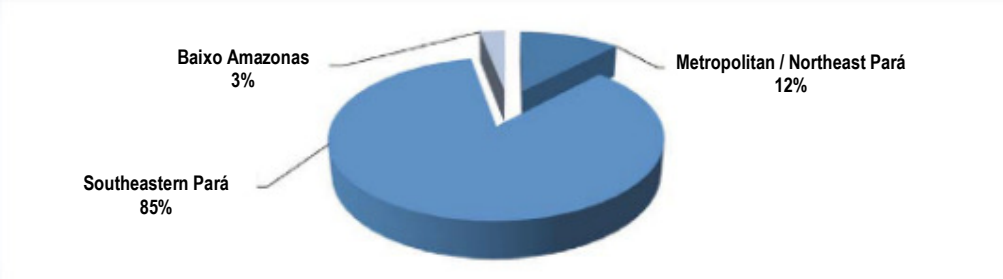
TABLE 9 - SCHEDULE OF INVESTMENTS IN MINERAL EXTRACTION. INFORMATION ON VALUE OF INVESTMENT R$ X 106. THE VALUE CORRESPONDS TO JOBS THAT WILL BE CREATED.



Prepared by: SEICOM, 2013

It is expected that, at the peak of the construction phase, 42,000 jobs will be created in mining, 85% of which are concentrated in the Southeast of Pará, 12% in RMB and Northeast Pará and 3% in the Lower Amazon (Chart 34).

CHART 34 - DISTRIBUTION OF JOBS FOR NEW INVESTMENT



Prepared by: REDES/FIEPA and adjusted by PEM

3.1.2 Investments in Mining Logistics

Necessary to support the mining industry, investments in logistics are represented by works that aim to encourage additional shipping due to increased extraction will occur after the completion of the planned investments in mining. With respect to the private sector, the investments made by Vale and Mineração Buritirama stand out (Table 19).

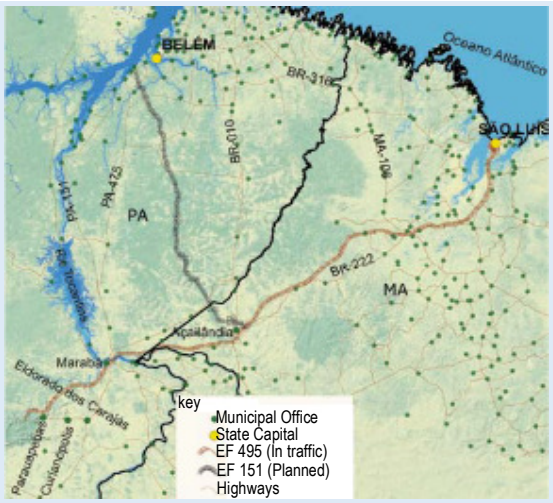
TABLE 19 - INVESTMENT IN LOGISTICS IN 2012 TO 2016.

PRODUCT	PROJECT	LOCATION	VALUE OF INVESTMENT (MILLION REALS)	JOB CREATION
LOGISTICS	Vale Logística Estrada de Ferro de Carajás - Carajás Railroad (EFC)**	Southeast of Pará	5.200	1.000
	Mineração Buritirama (Port)*	Marabá	36	200
TOTAL			**5.236**	**1.200**

* Implementation/deployment Projects
** Expansion projects
Source: REDES/FIEPA, 2012; Prepared by: SEICOM, 2013.

The largest investment in logistics, which is already occurring, is the doubling of the Carajás Railroad (EFC). It is the construction of 604 km of railroads (Map 18 and Figure 11), linking 56 crossing yards, all along the railroad.

MAP 18 - MAP WITH THE DESIGN OF EFC THAT INTEGRATES THE STATES OF PARÁ AND MARANHÃO.



Prepared by: SEICOM

IMAGE 11 - EFC DUPLICATION WORKS.
SOURCE: VALE, 2013.

When the amount of investment in mining is compared to that planned for the mineral processing industry, it is possible to notice the maintenance and strengthening of the model of production of commodities for export, which has characterized the mineral production of Pará.

3.1.3 Investment in Mineral Transformation

This segment of the industry involves the use of mineral resources at the end of mineral chain, such as:

a. Product from steel, such as the manufacture of items designed to support the construction of industries and logistics with the manufacturing of conveyors, wagons and others;

b. Steelmaking with the production of long steel and steel plates;

c. The aluminum industry;

d. The cement industry;

e. Other products related to the industry from the mineral processing.

The main mineral processing projects in the process of implementation and those that have been planned are described in Table 20. The estimate for the next five years is the investment of R$ 19.3 billion in this sector, which will create 34,000 jobs, which implies an **average employment cost of R$ 568,000,** therefore, 43% of the cost of the employment generated by the mining stage.

TABLE 20 - INVESTMENTS IN MINERAL PROCESSING.

PRODUCT	PROJECT	LOCATION	VALUE OF INVESTMENT (MILLION REALS)	JOB CREATION
STEEL	ALPA -Siderúrgica Vale *	Marabá	8,000	18.000
	Expansion - SINOBRAS **	Marabá	200	700
	ALINE - Integrated Plant (Aço Cearense and Vale)*	Marabá	1,600	1.500
SUBTOTAL			**9.740**	**20,200**
ALUMINA	Hydro CAP Alumina*	Barcarena	4,000	4.700
	Alumina Votorantim*	Rondon do Pará	3,960	6.000
SUBTOTAL			**7.960**	**10,700**
ALUMINUM	Alloys (Aluminum)*	Barcarena	200	300
CEMENT	Votorantim Cimentos (Plant)*	Primavera	800	1.500
		Marabá	300	1.200
SUBTOTAL			**1.100**	**2,700**
METAL SILICON	Dow Corning**	Breu Branco	60	70
METAL (MANUFACTURING)	Rexxam Amazônia Ltda.**	Benevides	127	137
	Mercúrio (Conveyor Belts)	Marabá	115	200
	Oyamota**	Castanhal	30	700
SUBTOTAL			**267**	**1,000**
GRAND TOTAL			**19.392**	**35,007**

* Implementation/deployment Projects
** Expansion projects
* Because it is an integrated project, it was divided and only the production of alumina was left in the table
Source: FIEPA/REDES, 2012; Prepared by SEICOM, 2013.

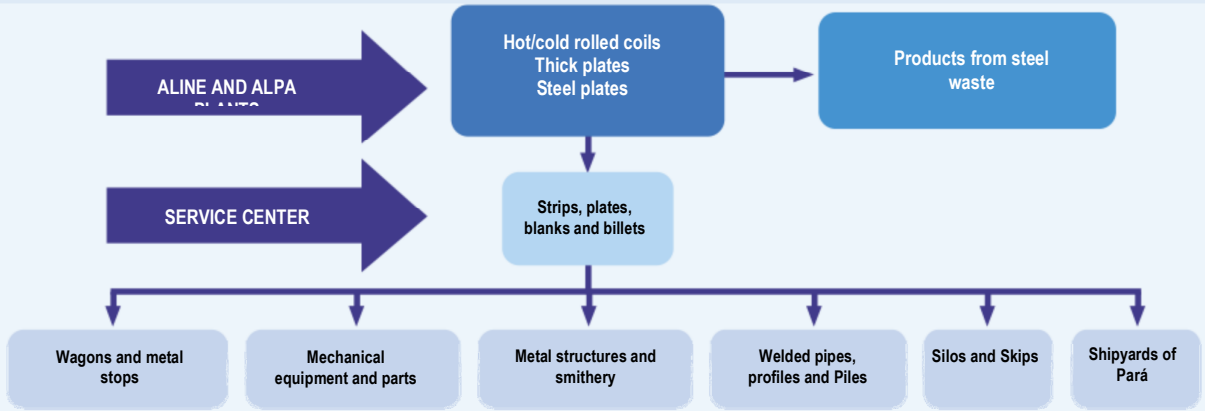
When compared with the predictions of the mining industry, it is observed that, in value terms, it represents only 35%, but in terms of jobs, it is 80%. However, 71% of this prediction depends on the deployment of ALPA (Aços Laminados do Pará) - BOX III

BOX III – AÇÕS LAMINADOS DO PARÁ (ALPA)

The ALPA (Aços Laminados do Pará = Rolled Steels of Pará) steel mill was officially launched by the former president of Brazil, Luiz Inácio Lula da Silva, and former president of Vale, Roger Agnelli, on June 22, 2010, on Highway BR-230 (Trans) in Marabá, Carajás region, igniting the flame of hope for a new perspective for the development of the state from its mineral base.

IMAGE 12 - EARTHMOVING OF THE LAND INTENDED FOR ALPA ON BR 230 HIGHWAY IN MARABÁ.

The new steel mill is designed to produce 2.5 million tons of steel plates, and 700000 t would be processed in another industrial lamination unit, called ALINE, a partnership between Vale and the Aços Cearense Group, for the manufacture of hot and cold rolled coils to be converted subsequently into products for industrial use, enabling and inducing the emergence of various ventures, besides integrating the Industrial Districts in Pará and the entire Northern Region. The use of steel waste for industrial use in the construction chain was also included. The following flowchart illustrates this proposal:



INDUSTRIAL STEEL PROJECTS BASED ON STEEL PRODUCTS OF FLAT STEELS

ALPA was awarded a permit and began the earthworks in 2011, causing great expectation and influencing many developments in the region, such as construction. The new president of Vale, Murilo Ferreira stated, in an interview to newspaper Valor [32] on 27/06/2011 and 28/11/2011, that the investment in ALPA was needed due to the fact that mining was losing the domestic market, with the Brazilian steel mills resort to their own mines to escape the volatility of iron prices in the global market.

However, several factors led Vale to suspend investment and the new implementation schedule is still uncertain. As a counterpoint, it appears that, in parallel, Companhia Siderúrgica do Pecém (CSP), in Ceará State, a partnership of Vale with the Posco and Dongkuk companies, both from South Korea, ALPA and the subsequent project that will use the iron of Pará, which is normally being built, scheduled to go into operation in September 2015.

Just as in mining, large investments in mineral processing should occur in southeast Pará, more precisely in the city of Marabá, which will receive 91% of the investment, and 9% in the Metropolitan Region of Belém and northeastern Pará.

32 Article entitled "Vale novo impulso a siderurgia para defender o mercado" ("Vale stimulates the steel milling activity to defend the market"), published on June/27/2011 in the Business ("Empresas") section

With respect to the relative contribution of each product of mineral processing, in terms of investments and work, there is a very symmetrical profile, with steel in first place (47%), followed by alumina (44%) and cement (6%) in both items (Chart 35 and 36).

CHART 35 - CREATION OF JOBS IN PROCESSING/PRODUCTS.

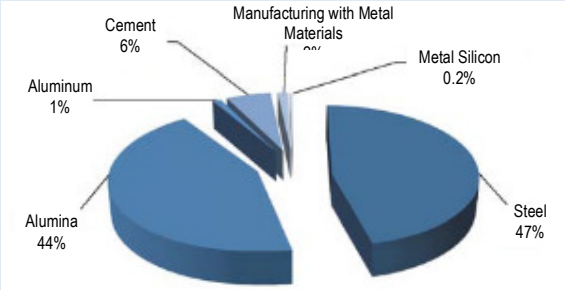
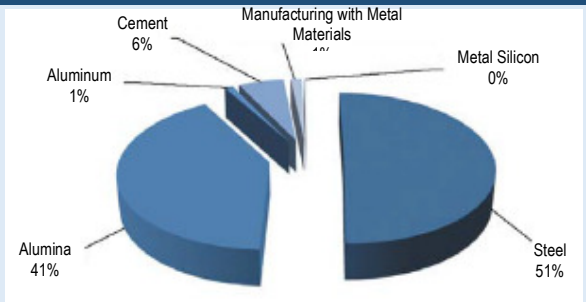


CHART 36 - INVESTMENTS IN TRANSFORMATION BY PRODUCTS.

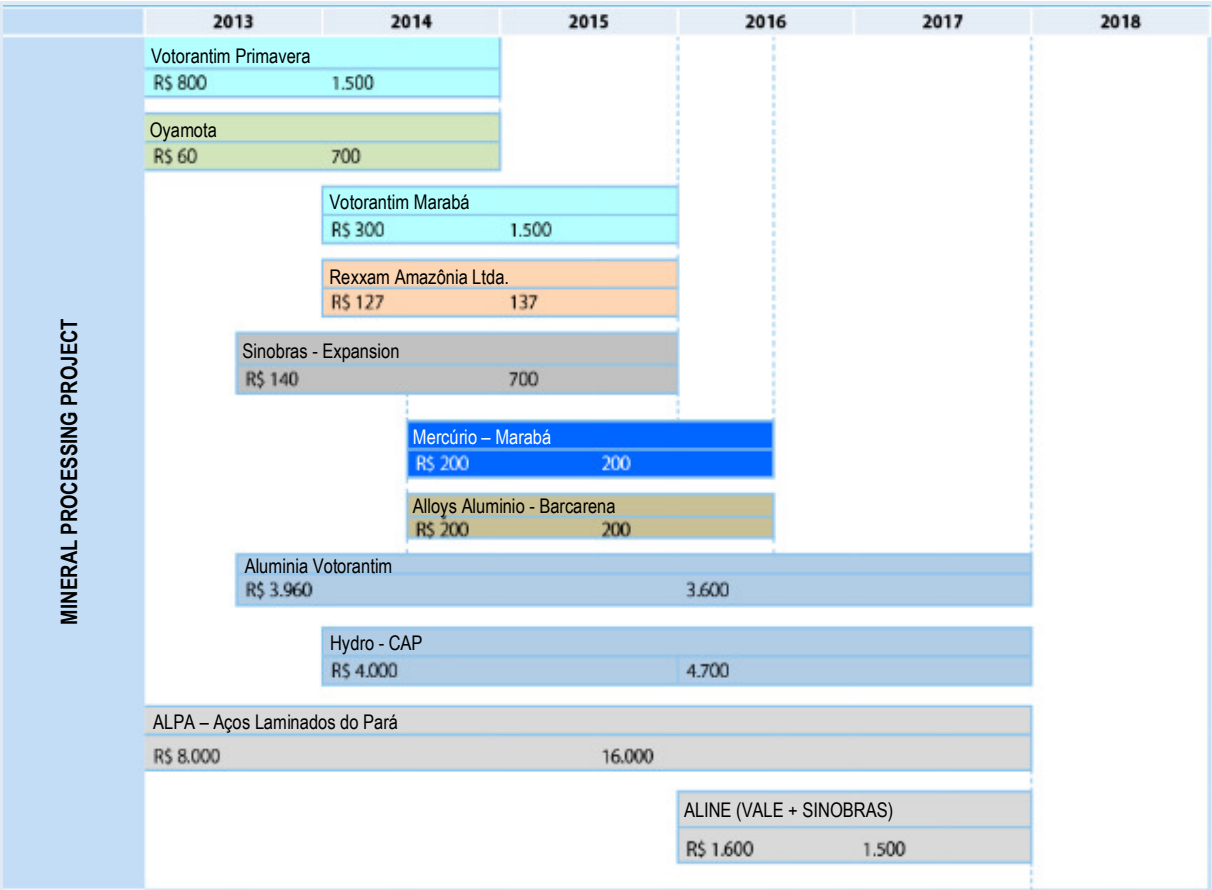


Prepared by: SEICOM, 2013.

Thus, the major investments that are tied to the implementation of ALPA (BOX III) are expected to occur in the production of long and flat steel, corresponding to 51% of the total. The concentration of these ventures in the city of Marabá will require the support from policies on industrial clusters in order to facilitate the emergence of positive socioeconomic externalities, as well as increase in productivity and competitiveness.

In a timeline, from 2013 to 2018, investments in mineral processing will be more concentrated in 2015 (Table 10).

TABLE 10 - SCHEDULE OF INVESTMENTS IN MINERAL PROCESSING.



Prepared by: SEICOM, 2013

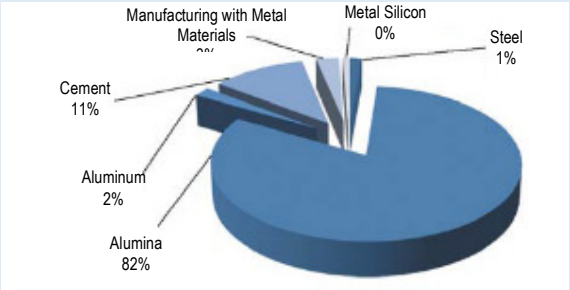
3.1.3.1 Scenario of investments in processing, without ALPA

If ALPA is not implemented, the investment in ALINE Project [33] probably will not occur either, therefore, the investments in the processing industry will be strongly reduced (Table 21 and Chart 37):

TABLE 21 - INVESTMENTS IN TRANSFORMATION WITHOUT THE ALPA PROJECT.

PRODUCT	VALUE (R$ XI06)
Steel	200.00
Alumina	7,960.00
Aluminum	200.00
Cement	1,100.00
Manufacturing with Metal Materials	267.00
Metal Silicon	60.00
TOTAL	**9,787.00**

CHART 37 - PERCENTAGE DISTRIBUTION OF INVESTMENTS BY PRODUCTS



Source: SEICOM, 2013

In this new scenario, investments in steel that, before, represented 51% of transformation projects, would be reduced to 3%, and alumina projects would represent 82% of the cement plants of Votorantim with 11%, followed by fabricated metals with 3% and aluminum with 2%.

The 19,500 jobs for the deployment stage would no longer be offered, nor would the 9,000 workers in the supply chain be used. Without ALPA, therefore, the planned jobs would decline more than 50%, from 35 thousand to 15.3 mil.

Also there would not be the new investment demanded by ALPA, down the chain, which would create new opportunities and ample possibilities for a technological leap in various segments of the industry of Pará.

With ALPA, the investments in processing would represent 31%. Without ALPA, the investments in mineral processing will be reduced to 18.5% of the total planned investment in the mining industry.

3.1.4 New investments and employment dynamics

According to the project phase: deployment, expansion and operation of the industrial plant, the profile of the workforce to serve the mining projects has different characteristics.

In the implementation and expansion, the manpower must serve mainly companies of the base industry [34], in particular, construction, manufacturing of equipment, structures, sheet metal shop and electromechanical assembly. There is also the creation of jobs in supporting companies such as management, production of uniforms, food, transportation, safety, environment, health and training, among others.

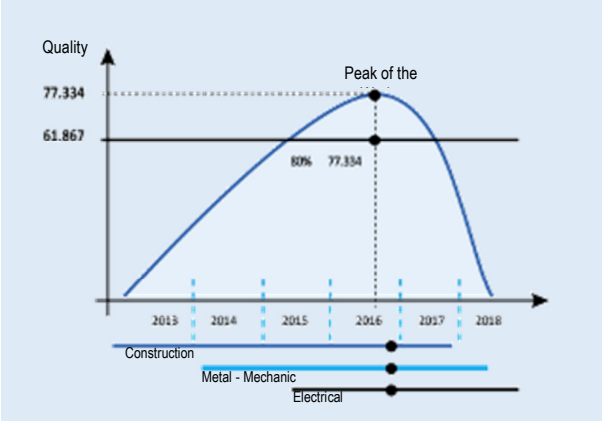
For operation of the industrial plant, the regional work force employed in the implementation phase is usually used. The new industry will require managers, engineers and technical staff. Out of the amount of labor planned by project, according to the education level, participation usually follows the following profile: 14% have a higher education degree, 16% have a technical degree and 70% have a high school degree (Votorantim, Rondon Project).

Thus, the expected profile of the workforce to be employed, from new investments in 2030, is as follows: 15,000 jobs at senior level, 17000 at the technical level and 73000 at the high school level[35] .

33 The Aline or Industrial II Project is an industrial and multimodal logistics plant under construction, which will bring together an industry of rolled steels (Steels Rolled Para-ALPA), one port (Port of New Maraba), and a road network for interconnection with Industrial District I.
34 They are industries that build other industries.
35Numbers can vary according to the level of automation of the industrial plant, with the need for a larger number of employees at the technical level, up to 35% of the total being required. Table 2 was taken as the bases and it indicates that the creation of jobs due to the operation of the plants until 2030.

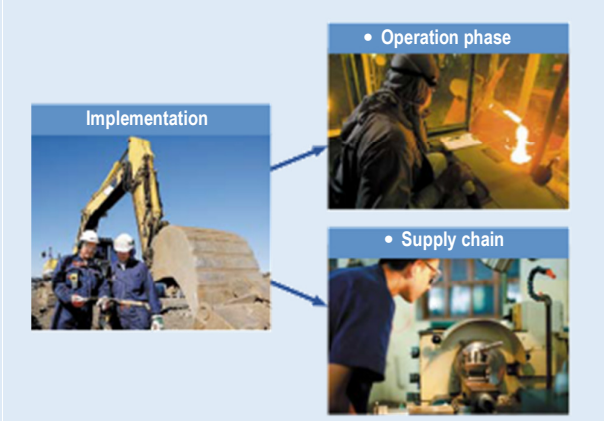
Considering only the forecast until 2017, it is estimated that the peak of construction will occur in mid-2016, when 77,334 jobs will be offered. About 20% of these job openings (Freitas, 2009) will probably be filled by technicians from other regions, but, 61,867 workers (Chart 38) in support to civil construction works and electromechanical assembly and fabrication will come from the site.

CHART 38 - PROVISION OF LABOR TO THE IMPLEMENTATION OF PROJECTS.



Source: FIEPA/REDES, 2012; Prepared by SEICOM.

FIGURE 16 - FLOW OF LABOUR, FROM DEPLOYMENT TO THE OPERATION



Source: SEICOM, 2013.

IMAGE 13 - CONSTRUCTION OF GALLERIES FOR CONVEYOR BELTS IN THE IRON MINING PROJECT IN CARAJÁS BY THE INTEGRAL COMPANY

It is important to highlight what happens to the workers after the implementation of the projects. The operation stage is responsible for the number of direct jobs in the mining industry [36] and, as a rule, the workers that become specialists during deployment are used in the industry itself and the other part join the supply chain that was created to serve the new industry, especially in the service sector (Figure 16).

A contingent of highly skilled technicians, mostly from out of state, will move to new works being implemented in other locations, while others will work locally or return to their place of origin.

IMAGE 14 - MAINTENANCE OF ASSEMBLY IN THE CRUSHING SYSTEM AND ORE TRANSPORTATION.

In Pará, the development of local industries that have emerged from the demands of mining is already significant. One of the biggest "cases" of success and cooperation between an "anchor company" [37] , suppliers and institutions, according to FIEPA / REDES, was the electromechanical assembly was of the Sossego Project (copper ore), which involved the most qualified Pará Metalworking industries, in a consortium mode of supply. The service, whose material was supplied by the contractor, reduced costs and allowed significant improvements with respect to the management and technology of local firms.

IMAGE 15 - CONVEYOR BELTS OF THE SOSSEGO PROJECT THAT MOVE MATERIAL FROM THE MINE TO THE ORE COMMINUTION SYSTEM, WHOSE WORK RESULTS FROM THE PARTNERSHIP AND COOPERATION BETWEEN THE COMPANY, SUPPLIERS AND INSTITUTIONS.

36 The direct jobs in the operation of plants range from 10 to 15% of those created in the implementation phase, depending on the level of automation of the projects.
37 See Glossary.

Another important factor provided by the mining industry was the attraction of industrial technology companies, whose partnership with local suppliers has raised both the technological and the management level. One such example is that of Escosoldering that installed, in Paraupebas, an industrial unit for the surface treatment of wear plates.

According to FIEPA [38], there is still little integration / cooperation of these companies with the educational institutions, which represents a great opportunity for actions to be stimulated by PEM-2030.

In this sense, the production of commodities, besides the possibility of increasing the trade balance may favor the local creation of an environment of innovation. Although still embryonic, this possibility is already in Pará, as was the case of the partnership with the Federal University of Pará (UFPA), for the creation of Mining and Materials Engineering courses, which today are integrated into the productive sector of the region. They may intensify with the implementation of the Federal University of the South and Southeast of Pará (UNIFESSPA), which emerged from the splitting of the campus of the Federal University of Pará in Marabá.

By analyzing the future of the industry in Brazil, Lazzarine (2012) states that "the productive chains of commodities, especially in upstream sectors, has proven to be dynamic and innovative", and that "the production of commodities involves complex industrial chains and it has invested in research, development and innovation. " However, this opportunity, in general, occurs outside of the mining area, because of the limited local responsiveness.

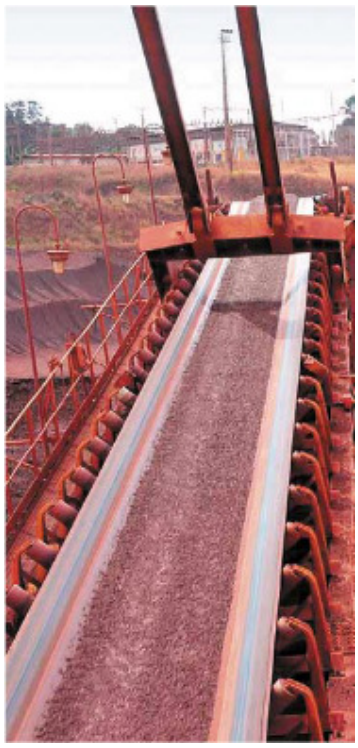


IMAGE 16 – TRANSPORTATION TECNOLOGY OF SOLID GRAINS

3.2 PRODUCTION ESTIMATE

3.2.1 Mining

3.2.1.1 Metallic minerals

The estimated production of metallic minerals, until 2030, was based on two methodologies: 1) until 2017, information on new investments and the related increase in regional production, provided by organizations such as the FIEPA / REDES, Association of Mineral Industries of Pará (Simineral) and other representatives of the sector, were considered; 2) as of 2017, a model developed by the Institute of Economic, Social and Environmental Development of Pará - IDESP was used as the basis

TABLE 22 - PROJECTION OF INCREASE IN PRODUCTION OF METALLIC MINERALS.

MINERALS	VARIABLES	UNIT	2012	2015	12/15.	2022	15/22	2025	22/25	2030	25/30
BAUXITE	Production	ton. X 1000	31,318	35,500	13%	45,000	27%	47,000	4%	50,000	6%
	Export		16,500	16,500	1%	20,000	29%	19,500	-3%	25,000	28%
	Consumption		15,000	20,000	33%	25,000	25%	27,500	10%	30,000	9%
COPPER	Production	ton. X 1000	406	650	60%	700	8%	850	21%	1,100	57%
	Export		386	625	62%	670	7%	815	22%	1,065	59%
	Consumption		20	25	25%	30	20%	35	17%	35	17%
IRON	Production	ton. X 1000	107,140	140,000	31%	250,000	79%	270,000	8%	300,000	11%
	Export		106,910	139,590	31%	249,550	79%	269,530	8%	299,500	11%
	Consumption		230	410	78%	450	10%	470	4%	500	6%

38 Federation of Industries of Pará / Engineering, 2009.

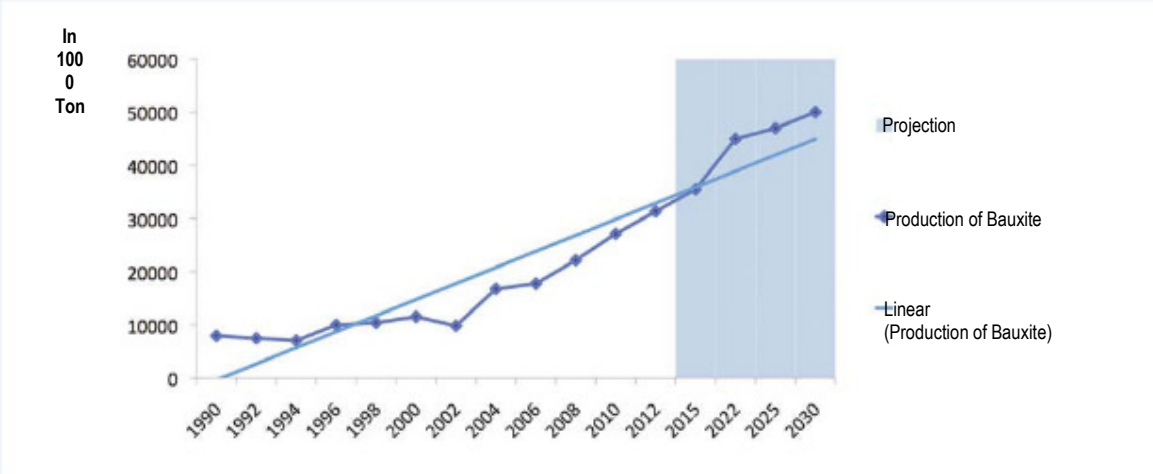
TABLE 22 - PROJECTION OF INCREASE IN PRODUCTION OF METALLIC MINERALS.											
MINERALS	**VARIABLES**	**UNIT**	**2012**	**2015**	**12/15.**	**2022**	**15/22**	**2025**	**22/25**	**2030**	**25/30**
NICKEL	Production	ton. X 1000	24	54	125%	110	104%	120	9%	130	8%
	Export		22	54	145%	110	182%	120	9%	130	8%
	Consumption										
MANGANESE	Production	ton. X 1000	2,234	2,700	121%	3,000	11%	3,100	3%	3,200	3%
	Export		2,234	2,700	121%	3,000	11%	3,100	3%	3,200	7%
	Consumption										
TOTAL	**Production**	**ton. X 1000**	**141,122**	**178,908**	**27%**	**298,810**	**67%**	**321,070**	**7%**	**354,430**	**10%**
	Export		**125,870**	**159,473**	**27%**	**273,330**	**71%**	**293,065**	**7%**	**328,895**	**12%**
	Consumption		**15,250**	**20,435**	**34%**	**25,480**	**25%**	**28,005**	**10%**	**30,535**	**9%**

Prepared by: SEICOM, 2013.

a) Bauxite

Pará produced 31.3 million tonnes of bauxite in 2012. Considering the expansion projects of Norsk Hydro in Paragominas, and the implementation of Votorantim's plant in Rondon do Pará, this production will expand to 35.5 million t / year in 2015 and to 50 million tons in 2030, considering that the increments will be of 7,700 thousand tons in 2017 (1st phase) and 15,000 tons / year by 2022 (2nd phase). This expansion will represent a very significant change in the average annual rates of growth, while in 1990, this rate was 3.5% in the 2000s, dropped to 8% in 2010 and will go to 12% in 2020.

CHART 39 - BAUXITE PRODUCTION IN PARÁ, 1990-2012, AND FORECAST FOR 2030.



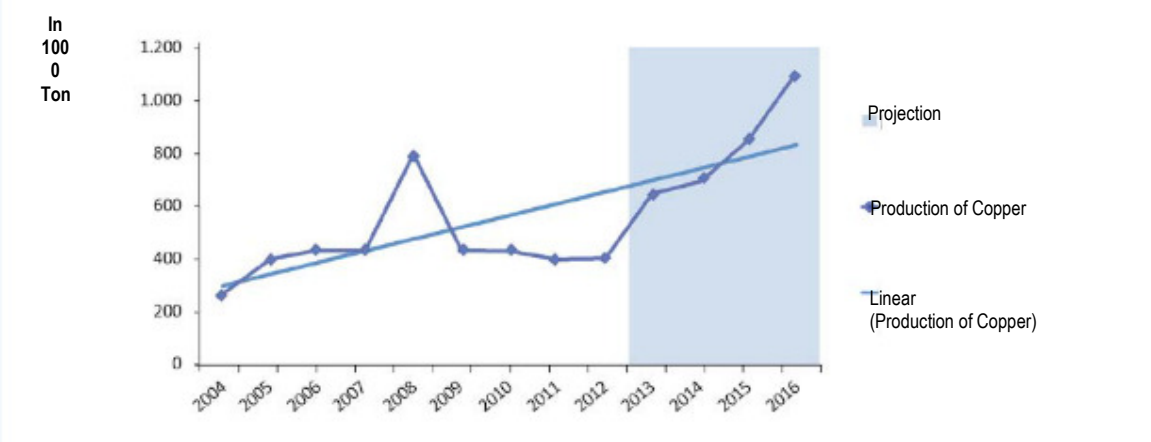
Prepared by: SEICOM, 2013.

b) Copper

Vale is a large company that, so far, has been exploring the copper of the Sossego and Salobo mines. There is also Serabi that produces a residual quantity, as a byproduct of its gold mine in Itaituba. According to the planned investments, it is estimated that copper production will change, from the current 400,000 in 2012 to 1.1 million t / year in 2030 (Chart 40). This addition will be possible due to the entry into operation of the three projects included in the Carajás region, which are: Crystalino, 118 and Alemão, of Vale, and other smaller deposits as of Avanco, for example.

Of All metallic minerals, copper is one that presents the best characteristics for the maintenance of high prices. According to experts, the global forecast is for a deficit of supply around 200 million tonnes in 2015.

CHART 40 - PRODUCTION OF COPPER IN PARÁ, 1990-2012, AND FORECAST UNTIL 2030.



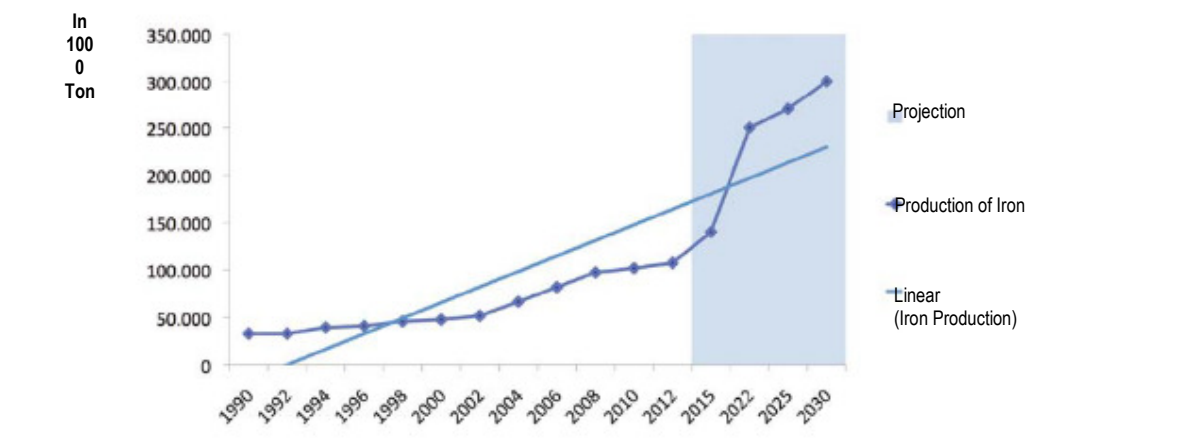
Prepared by: SEICOM, 2013.

c) Iron

In order to project the growth in iron mining, we considered mainly the S11D and Serra Leste projects, both of Vale, which by 2030 will triple the current production capacity, going from 107 million tons in 2012 to 300 million in 2030. Other existing projects due to the pig iron market do not show a strong perspective that influences the figures presented. Today, the iron market accounts for 67% of the ore exported from Pará, and with the two projects, this number could reach 80% within the next five years.

Of all the metals, iron was the one that had the highest increase in price. However, the high concentration of sales to China is worrisome, because it leaves the producer vulnerable, depending on a single market. However, as a counterpoint, the Carajás mines are those with the lowest production costs in the world, as well as the highest levels, ensuring profitability, even in a context of great price fluctuation.

CHART 41 - PRODUCTION OF IRON IN PARA, 1990-2012, AND FORECAST UNTIL 2030.

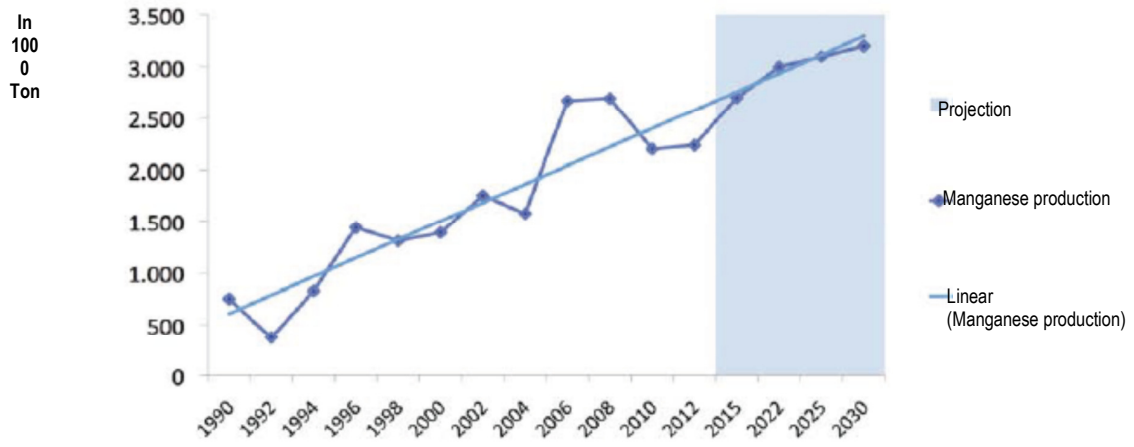


Prepared by: SEICOM, 2013.

d) Manganese

There is no information on new investments in manganese, whose main producers are Vale and Mineração Buritirama, respectively in Parauapebas and Marabá. The expected useful life of the current mines is around 20 and 12 years, respectively (DNPM, 2013). Considering the historical growth trend, it is estimated that current production of 2.2 million tons in 2012 may reach a maximum of 3.2 million tons in 2030.

CHART 42 - PRODUCTION OF MANGANESE IN PARÁ, 1990-2012, AND FORECAST UNTIL 2030.



Prepared by: SEICOM, 2013.

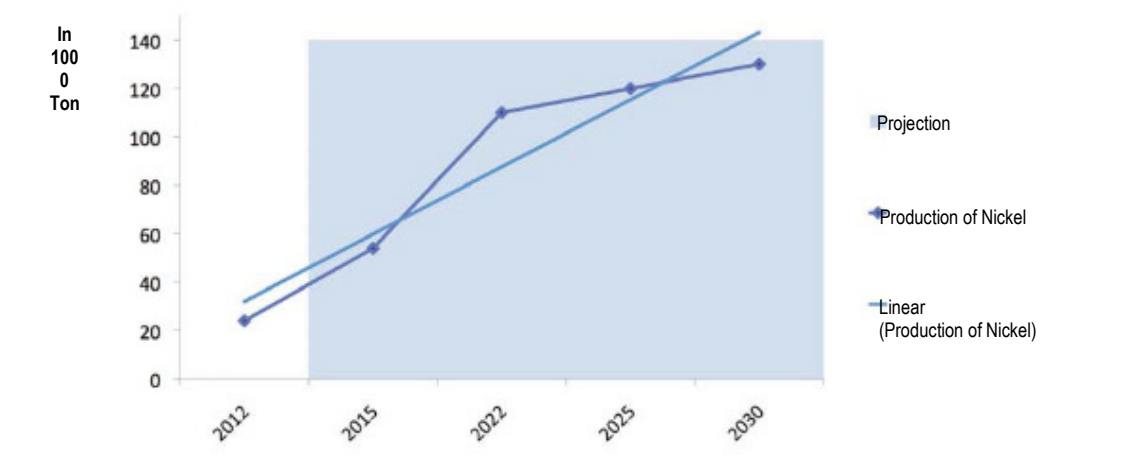
e) Nickel

In addition, there is no clear perspective for the nickel market, which so far is quite retracted on the global stage, with the price of the metal far from the levels of 2007/2008. Among the metal products, nickel is the one whose price has fluctuated the most, going from approximately US$ 50000/t in 2007 to US$ 17000/t in 2013.

The Onça Puma Project, of Vale, with production capacity of 54 thousand tons / year, approximately, of ferronickel, was paralyzed by the end of October 2013 due to structural failure of the furnaces, which resulted in significant reduction of production, which was resumed in the first week of November 2013, initially with only one furnace. The projection for 2015 considers a positive scenario for this project.

Anglo American announced the Jacaré Project, which is still undergoing economic viability study and scheduled for deployment between 2015 and 2019. There are plans for two plants with different technological routes for the mining of ore (pyrometallurgical and hydrometallurgical), which is why the production will increase as of 2022. It is estimated that from 2019 onwards, production will reach 35,000 t/y of nickel iron, 47,000 t/y of electrolytic nickel and 5,400 t/y of cobalt, with 12,000 jobs at the peak of the deployment process, between 2015 and 2019, but, after in operation, about 1,500 direct jobs, 3,000 indirect jobs more, totaling 4,500 jobs. There is also the Vermelho nickel reserve, of Vale, which still has no prospects for investment.

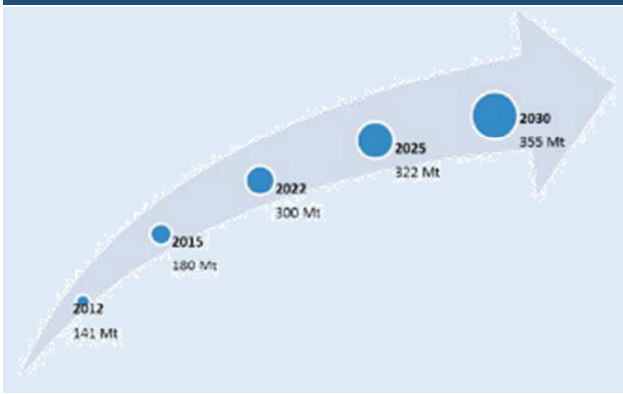
CHART 43 - PRODUCTION OF NICKEL IN PARA, 1990-2012, AND FORECAST UNTIL 2030.



Prepared by: SEICOM, 2013.

Figure 17 consolidates information on the production of minerals, noting that the current scale will nearly triple by 2030.

FIGURE 17 - EVOLUTION OF PRODUCTION OF METAL IN TX 1000



The dramatic increase in the scale of production has, as a counter point, the reduction in the life of the mines. Therefore, less time to plan and implement actions for development through the mineral base. What does this mean for Pará? Payment of royalties, ICMS tax, generation of revenues for the country, impacts on the finances and socioeconomics of mining cities. Which cities will grow and which will decrease? Which externalities will occur? Will regional inequalities be reduced or increased?

Prepared by: SEICOM, 2013.

3.2.1.2 Non-metallic minerals

Industrial or non-metallic minerals are significant in Pará, due to the use of kaolin in various industries and clay and limestone for the cement and construction chain.

TABLE 23 - PROJECTED PRODUCTION OF NON-METALLIC MINERALS

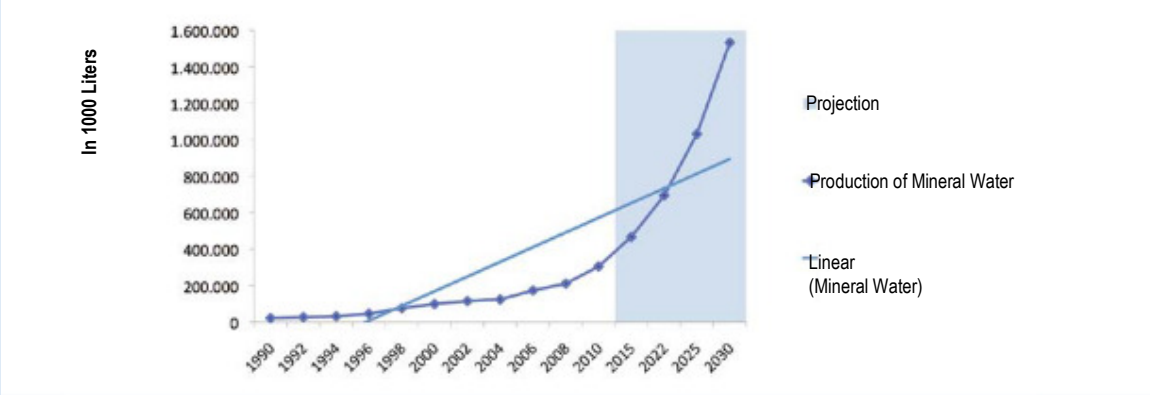
MINERALS	VARIABLES	UNIT	2012	2015	12/15	2022	15/22	2025	22/25	2030	22/30
WATER MINERAL	Production	liters	357,419	466,744	31%	693,731	49%	1,031,107	49%	1,532,556	49%
	Export										
	Consumption		357,419	466,744	31%	693,731	49%	1,031,107	49%	1,532,556	49%
CLAY	Production	ton x 1000	4,400	5,500	25%	7,500	36%	8,500	13%	9,000	6%
	Export										
	Consumption		4,400	5,500	25%	7,500	46%	8,500		9,000	20%
KAOLIN	Production	ton x 1000	2,087	2,300	5%	2,500	9%	2,600	4%	2,700	8%
	Export		1,867	2,070	5%	2,250	9%	2,050	-9%	2,100	7%
	Consumption		220	230	5%	250	9%	550	120%	600	8%
LIMESTONE	Production	ton x 1000	2,147	2,318	8%	3,500	51%	3,800	9%	4,100	8%
	Import										
	Consumption		2,147	2,318	8%	3,500	51%	3,800	9%	4,100	8%
AGGREGATES FOR CONSTRUCTION**	Production	ton x 1000	7,593	8,200	8%	12,383	51%	13,497	9%	14,577	8%
	Import										
	Consumption		7,593	8,200	8%	12,383	51%	13,497	9%	14,577	8%
PHOSPHATE (SSP + TSP + DCP)	Production	ton x 1000		180		880	389%	1,000	13%	1,150	15%
	Import										
	Consumption*			180		880	389	1,000	13%	1,150	15%
TOTAL	**PRODUCTION**	**TONX 1000**	**16,227**	**18,498**	**14%**	**26,763**	**45%**	**29,397**	**10%**	**31,527**	**7%**
	EXPORTS		**1,867**	**2,070**	**11%**	**2,250**	**9%**	**2,050**	**-9%**	**2,100**	**2%**
	CONSUMPTION		**14,360**	**16,428**	**14%**	**23,633**	**44%**	**27,347**	**16%**	**29,427**	**8%**

* Production is geared to the domestic market (Brazil)
** Sand, gravel and clay (shale)
Note: The total does not include the production of mineral water, whose unit of measure is in liters
Prepared by: SEICOM, 2013.

a) Mineral Water

The production of mineral water, for 15 years, was one of the items designed with the support of IDESP considering the time series data, population growth, income growth, price stability of the water the last five years, increase in the number of distributors of mineral water, combined with the difficulty in meeting the demand from the public system that shall leverage this industry in the coming years.

CHART 44 - MINERAL WATER PRODUCTION IN PARÁ, 1990-2012, AND FORECAST UNTIL 2030.



Prepared by: SEICOM, 2013.

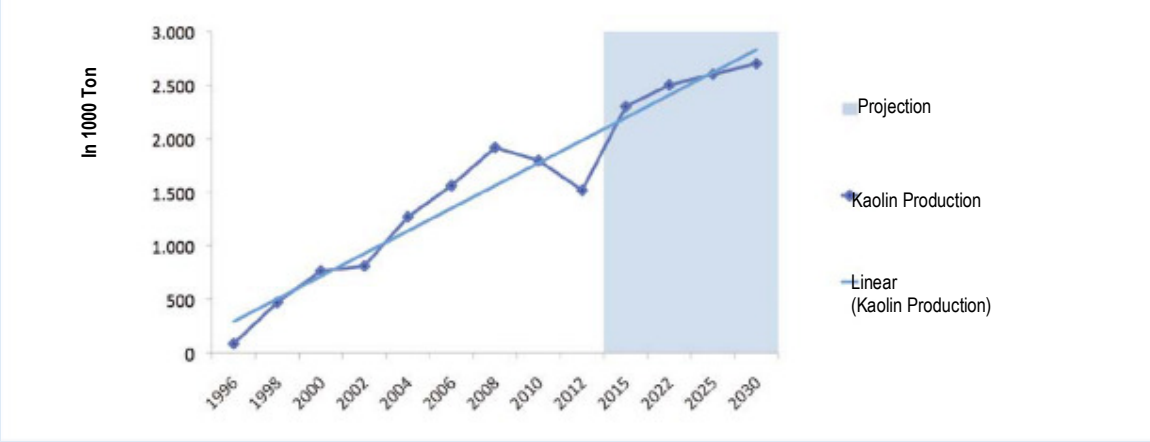
b) Clay

The evolution of the clay mining market and other ceramic projects depends crucially on the construction industry. This industry has had a good evolution in southeastern Pará, due to the presence of important mining projects.

c) Kaolin

With respect to kaolin, there are three companies that are today part of the same group, Imerys Rio Capim Caulim (IRCC), Pará Pigmentos (PPSA) and Caulim da Amazônia (CADAM). There is the prospect of new investment in the region over the next 15 years; the increase in production will occur depending on the demands of the global market. In addition, the demand may increase due to the noblest ceramic products, such as sanitary wares, in addition to the offering and distribution of the consumption of biofertilizers [39] made from kaolin.

CHART 45 - KAOLIN PRODUCTION IN PARÁ, 1990-2012, AND FORECAST UNTIL 2030.



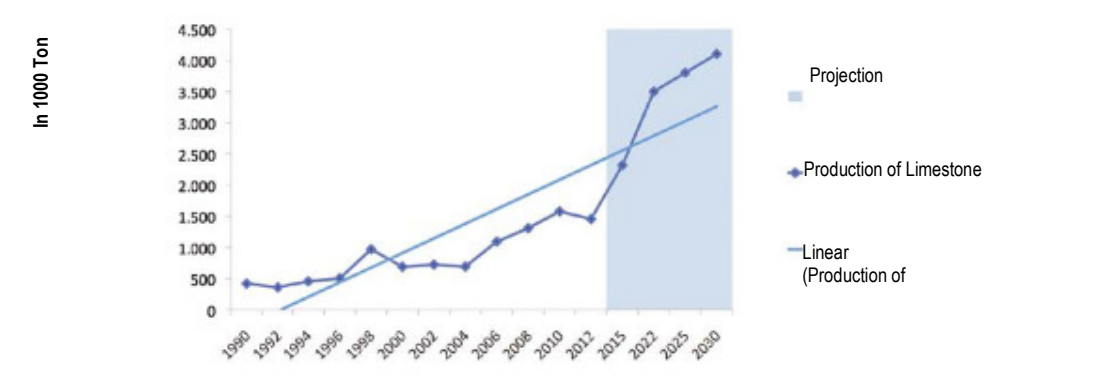
Prepared by: SEICOM, 2013.

39 Combination of minerals with organic fertilizers

d) Limestone

In 2007, the Votorantim Group installed a cement plant in Barcarena which produces from raw materials (clinker), which are currently imported. This import will no longer occur when after the integration with factory Votorantim Cement Group, which is being installed in the city of Primavera and it is scheduled to go into operation in 2014. The plant will use locally mined limestone as raw material, with planned production capacity to 1.55 million tonnes of crude ore per year, which will require 1,200 jobs during construction and 500 in operation.

CHART 46 - PRODUCTION OF LIME FOR CEMENT IN PARÁ, 1990-2012, AND FORECAST UNTIL 2030.

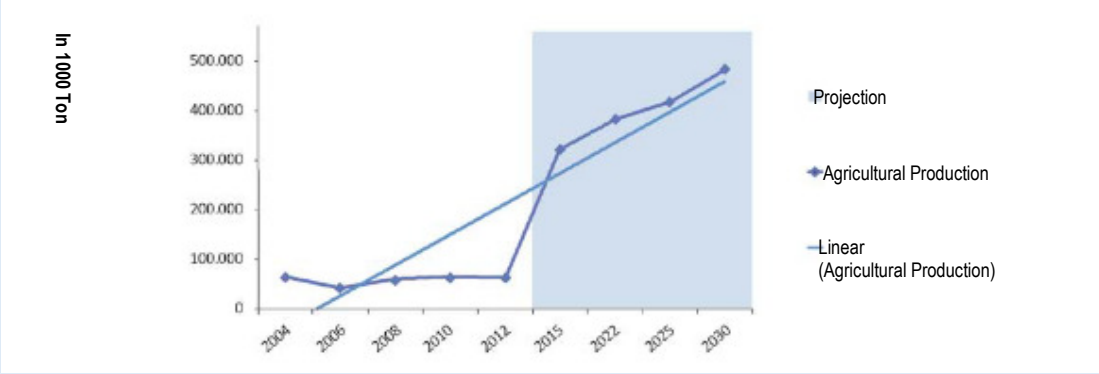


Prepared by: SEICOM, 2013.

The project also provides for a built area of 56 hectares and 331 for the factory for limestone mine, whose investment is estimated at R$ 390 million. The target markets are the North and Northeast regions. Given this context, it is estimated that the production of limestone for cement will nearly double in two decades, from 2100 t in 2012 to 4100 t in 2030 (Chart 46).

As for limestone for soil amendments, projections were made considering the need for liming in the areas harvested in the state. In 2012, Pará recorded 900,000 hectares of harvested area for food and fruit crops (IBGE, 2013). Beginning with a very conservative estimate, it was estimated that the potential demand of 1,500 tons of agricultural lime would be necessary to prepare these areas. Considering that, by 2011, only one company producing agricultural lime in the state and, even with the inclusion of new companies, there is a big gap when considering the potential supply, since there will be a lag of 470 thousand tons by 2030. According to company information, there is an expectation of growth from 305 thousand tons in 2014 to 320 tons in 2016. Considering the annual growth rate of 3%, a production of 484 thousand tons in 2030 has been estimated (Chart 47).

CHART 47 - PRODUCTION OF AGRICULTURAL LIME IN PARÁ, 1990-2012, AND FORECAST UNTIL 2030.



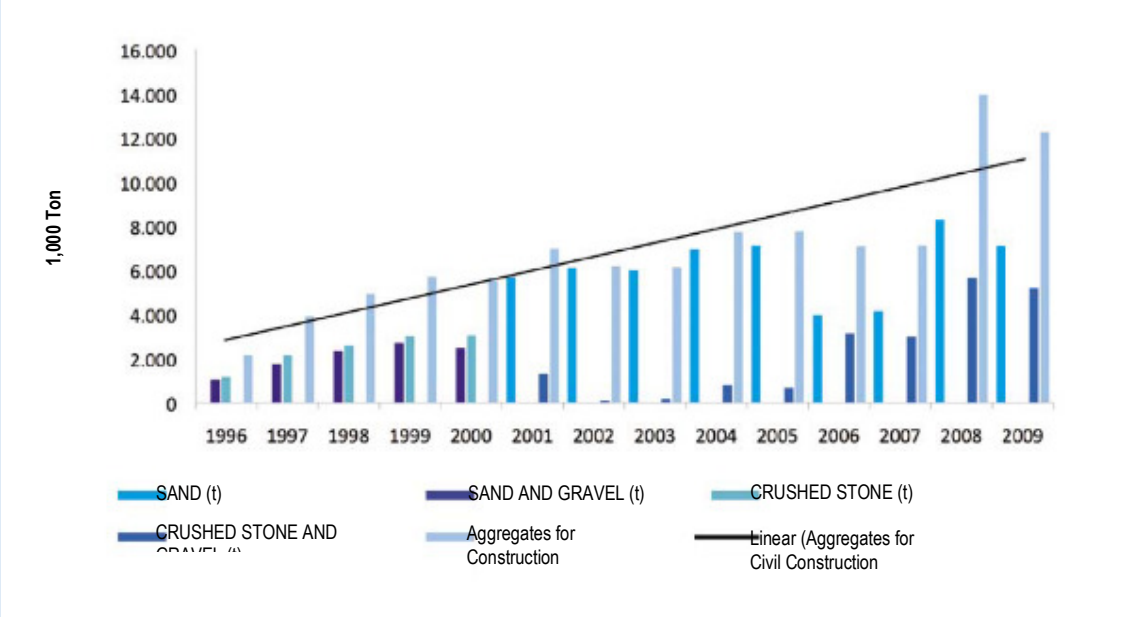
Prepared by: SEICOM, 2013.

The prospect of increased demand for agricultural lime is a fact, when one takes into account the requirements of the new Brazilian Forest Code, which limits the incorporation of new areas, which means that the growth of production, necessarily, has to happen based on increased productivity and, therefore, it is essential to amend the soil.

e) Aggregates for Construction

In the state of Pará, the segment of construction aggregates (ACC) and Clay for Red Ceramics (ACV) represented 4% of the domestic consumption and 7.1% of the Gross Value Added of the state in 2010, according to IBGE. The consumption of ACC and ACV in the state of Pará has followed, during the period from 1996 to 2009, an upward trend, with more pronounced changes for ACV in the 2001-2006 period.

CHART 48 - EVOLUTION OF PRODUCTION (1000 tons) OF CONSTRUCTION AGGREGATES IN PARÁ, 1996-2009.



Source: Brazilian Mineral Yearbook.

Since it is an industry of low per capita consumption [3.5 t per capita in 2011 (IBRAM, 2012)], it becomes less sensitive to the impact of the global crisis, since it is produced and consumed in the local market or, sometimes regional market. The demand is expected to rise in coming years, especially with the effective implementation of infrastructure works planned to take place in Pará, such as hydroelectric dams, ports, roads, besides the actual mining projects, among others. It is worth noting the programs of the Federal Government, such as "Water and Light for All", My Home, My Life, Better City and Citizen Community, which broaden perspectives of increasing demand of these minerals in the state, in the short and medium term.

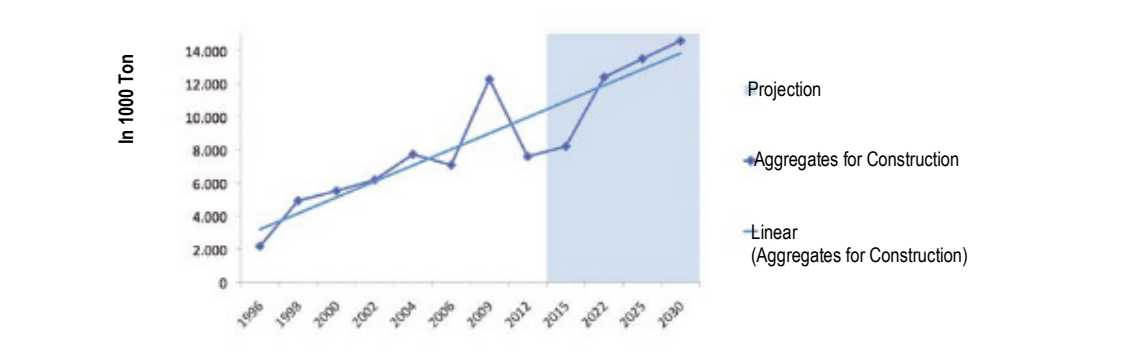
The positive projections also take into account the housing deficit, which in the state of Pará is of 12.7%, or approximately 290000 dwellings (IPEA, 2013) and the so-called "demographic bonus", besides the fact that the number of persons per household is shrinking, especially in the 25-40 age group; phenomenon that started in 2003, with an expected peak in 2022, when the national demand for construction aggregates is around 1.12 billion tons (Anepac, 2013) and complete the cycle in 2034, with an average increase of 6 % in demand per year, the State of Pará is likely to get close to one hundred million tons demanded at the peak, especially due to household consumption via higher wages and credit. (ANEPAC, 2013). Table 24 shows the amounts to be invested by the Growth Acceleration Program - PAC 2 in Pará and the respective works cited.

TABLE 24 - RESOURCES FROM PAC 2 ESTABLISHED FOR PARÁ, AMOUNTS IN R$ MILLIONS.				
AXIS	2011-2014	POST 2014	2011 TO 2014, REGIONAL*	POST-2014, REGIONAL*
TRANSPORTATION	3,448	1,337	376	11
ENERGY	22,228	31,358	11,055	18,390
BETTER CITY	667	1,006		
CITIZEN COMMUNITY	455	23		
MY HOUSE, MY LIFE**	5,178	299		
WATER AND LIGHT TO ALL **	2,530	380		
TOTAL	34,505	34,402	11,431	18,401

* Projects covering more than one state.
** Estimated values for distribution from 2011 to 2014 and post 2014.
Source: Ministry of Planning PAC/2, 2013.

These materials are mainly represented by the sum of the mining of crushed stone, sand and pebble (gravel). Its consumption is directly linked to the evolution of the building and infrastructure construction works taking place and which are likely to intensify in the state in coming years. As a basis for the projection of the production, we adopted the growth of the market of cement and clay products by 2030.

CHART 49 - PRODUCTION OF AGGREGATES FOR CONSTRUCTION IN PARÁ, 1990-2012, AND FORECAST UNTIL 2030.

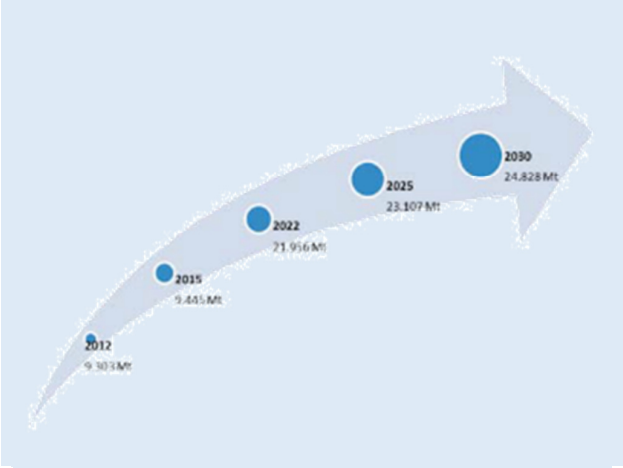


Prepared by: SEICOM, 2013.

a. Phosphate

For this projection, we considered the project that the company MBAC Fertilizantes will deploy in Sao Felix do Xingu, whose first stage will produce 475,000 tonnes of granulated SSP (superphosphate phosphate), 25,000 tons of TSP (triple super phosphate) and 200,000 tons of granulated DCP (dicalcium phosphate for animal feed), as of 2016, and it could double production, reaching 1,000 tons of phosphate, in 2020. The investments are estimated at R$ 1.2 billion, R$ 800 million of which in the implementation of the first phase, and R$ 400 million for the second phase, and forecast of operation between 2016 and 2017.

FIGURE 18 - EVOLUTION OF PRODUCTION OF NON-METALLIC PRODUCTS IN TX 1000



Source: Prepared by: SEICOM, 2013.

Figure 18 consolidates information about the amount of non-metallic goods.

3.2.1.3 Gold and gems (gold and precious stones)

TABLE 25 - PROJECTION OF PRODUCTION FOR GEMS AND GOLD.

MINERALS	VARIABLES	UNIT	2012	2015	12/15	2022	15/22	2025	22/25	2030	22/30
GEMS	Production	Ton	573	688	20%	963	140%	1,150	19%	1,348	17%
	Export		568	681	20%	953	140%	1,130	19%	1,313	16%
	Consumption		5	7	40%	10	140%	20	100%	35	75%
GOLD	Production	Ton	5.6	6.5	16%	7.5	15%	8	7%	8.5	13%
	Export		1.3	1.8	38%	2.7	50%	3	19%	3.8	40%
	Consumption										
TOTAL	**PRODUCTION**	**TON**	**579**	**695**	**20%**	**971**	**40%**	**1,158**	**19%**	**1,357**	**17%**
	EXPORTS		**569**	**683**	**20%**	**956**	**40%**	**1,133**	**19%**	**1,317**	**16%**
	CONSUMPTION		**5**	**7**	**40%**	**10**	**43%**	**20**	**100%**	**35**	**75%**

Source: Prepared by: SEICOM, 2013.

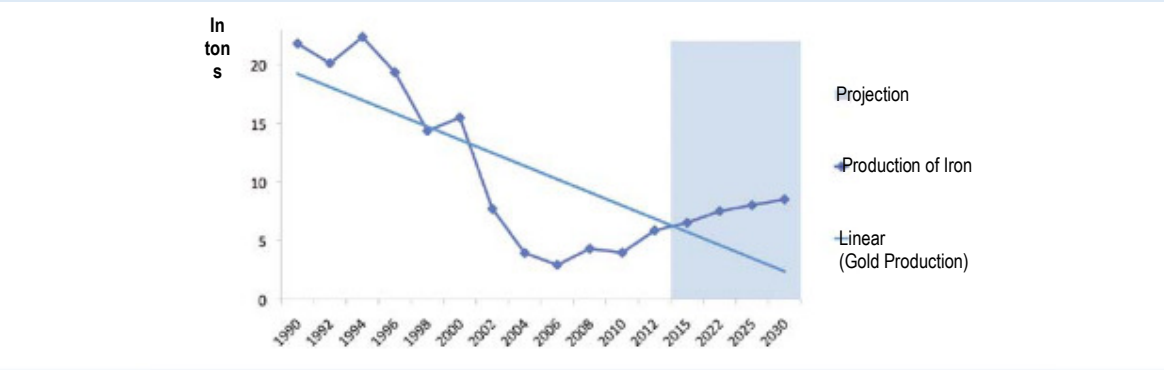
b. Gems

There is great potential for the production and added value, but there is also very real lack of geological potential, which requires an effort to recognize the areas. Out of what is produced from the mining activity, only a small amount is worked out in some parts of the state, particularly in the São José Liberto space, in Belém, but most is exported crude, generating employment opportunities and income in other regions of the country.

c. Gold

Pará produces gold both from mining and from companies (Chapter 2). If the planned investments are made by the firms and, considering the trend of migration from informal mining to small mining, it is estimated that current production of 5.8 t has the potential to reach 8.5 t in 2030. It is noteworthy that, in the case of gold, the life of the mines has been dwindling.

CHART 50 - GOLD PRODUCTION IN PARÁ, 1990-2012, AND FORECAST UNTIL 2030.



Prepared by: SEICOM, 2013.

3.2.1.4 Oil and Gas

Pará produces neither oil nor gas up until this moment. However, approximately R$ 157.5 million is being invested in the basins of the Amazon and the mouth of the Amazon River, in aerial-geophysical survey for detection of bouger and magnetic anomalies, and processing and reprocessing of old seismic data to enhance interpretation.

In the Paleozoic Basin of Amazon, there are already two fields being developed: the Azulão and Japiim fields with reserves of 2.42 MM barrels of oil and 5015.31 MM m^3 of gas, in the neighboring state of Amazonas, but very close to the border with Pará, with the same geological structure that gave oil and gas. Further west, in the Solimões Sedimentary Basin, there is the 3rd largest oil and gas producing basin, with 104,500 barrels of oil equivalent - boe / day (Annatto, Amazonas). In this same basin, further east, now in the state of Pará, there is great potential for shale gas in the Barreirinha Formation.

3.2.2 Mineral Processing

It involves industry segments that are downstream of the mining activities and use mineral goods as raw materials.

TABLE 26 - PROCESSING OF METALLIC MINERALS.

PRODUCTS	VARIABLES	UNIT	2012	2015	12/15	2022	15/22	2025	22/25	2030	22/30
LONG STEEL *	Production	ton x 1000	319	450	41%	800	33%	820	3%	850	1%
	North		73	158	115%	320	52%	380	19%	425	26%
	Northeast		118	180	53%	320	33%	310	-3%	315	-7%
	South		128	113	-12%	160	7%	130	-19%	111	-44%
FLAT STEEL	Production	ton x 1000				2,500		2,500	0%	2,500	0%
	Export					1,800		1,650	-8%	1,400	-15%
	Consumption					700		850	21%	1,100	29%
ALUMINA	Production	ton x 1000	7,500	7,500	0%	19,500	160%	20,500	5%	22,000	7%
	Export		6,550	6,550	0%	18,300	179%	19,200	5%	20,500	7%
	Consumption		950	1,100	0%	1,200	9%	1,300	8%	1,500	25%
ALUMINUM	Production	ton x 1000	475	470	-1%	500	6%	520	4%	550	4%
	Export		443	425	-4%	445	4%	420	-6%	430	2%
	Consumption		32	45	41%	55	22%	100	82%	120	18%
PIG IRON	Production	ton x 1000	971	980	1%	1100	1%	1,200	9%	1,350	13%
	Export		971	980	1%	1100	1%	1,200	9%	1,350	13%
	Consumption										
Silicon METALLIC	Production	ton x 1000	38	45	18%	56	24%	67	20%	78	16%
	Export		38	45	18%	56	24%	67	20%	78	16%
	Consumption										

Note: * Manufacture of long products with distribution in the North, Northeast and South regions.
Source: SEICOM, 2013.

3.2.1.1 Metallic minerals

a) Steels

In the case of steels, the following ones were considered:

- Long steel - production and expansion of SINOBRAS to about 600000 t by 2015 (Box I)
- Plans - the deployment of ALPA, with an initial production of 2.5 million t / year (Box III)

a) **Alumina / Aluminum**

With respect to alumina, we considered the ongoing project of Votorantim in Rondon do Pará, planned for 3 million tons / year and the implementation of Companhia de Alumina do Pará (CAP), development of Norsk Hydro in Barcarena with expansion from 7,500 t in 2012 to 22,000 t in 2030.

Aluminum production should not take a leap, because of barriers with regard to market fundamentals, in addition to internal problems of competitiveness, including high consumption and high cost of energy.

IMAGE 17 - TECHNICIAN PERFORMING WELDING OPERATIONS IN THE PROCESSING INDUSTRY.
SOURCE: VALOR NEWSPAPER

b) Pig Iron

There are three companies producing pig iron in Marabá: Ibérica, Sidepar and Sinobras. The pig iron industry was exporting 1.8 million t in 2008, with the product reaching the highest value in the international market, US$ 800.00 / t (Sindiferpa). As of 2009, the market suffered a sharp drop due to the international crisis and reduction of steel manufacturing in Western countries.

There were also problems related to the increase in the price of iron ore and difficulties in obtaining charcoal, the main material used for the production of pig iron.

There is, to date, no fact that shows great prospects of return to the production that these industries had before 2009. Thus, the expectation is that the current production of 971 tonnes in 2012 will only to pass 1,350 tonnes in 2030.

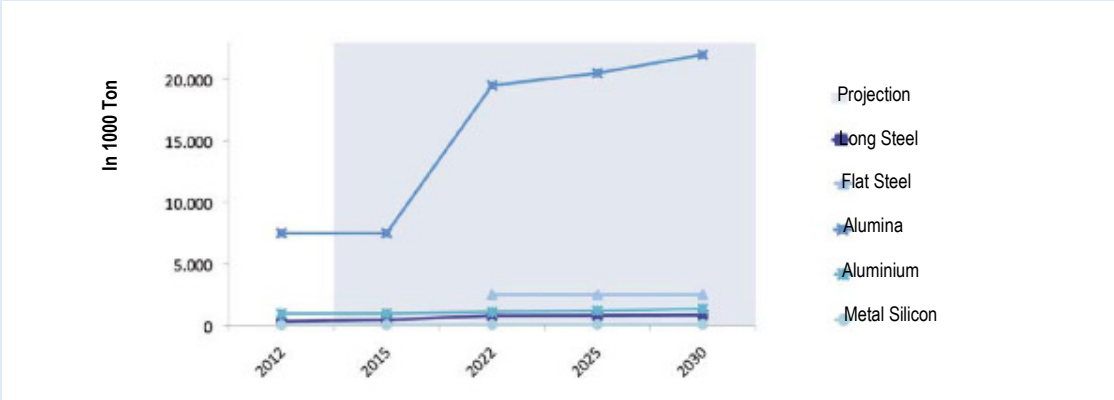
d) Metal Silicon

In 2012, the production of silicon metal from American company Dow Corning, in the municipality of Breu Branco, was around 44,000 tons. The company has four electric furnaces for reducing iron ore, whose main raw material is quartz that comes from three mines. The main one is mine Mojú, which is 10 minutes away from the plant by road, already exhausted, serving as a quartzite and pebble washing plant. The others are mines Sororó, in the municipality of São Geraldo do Araguaia (southern Pará) and Ourém mine in the municipality of the same name, in the Northeastern region of the State.

To date, there is no prospect for the exploration of new mines in Pará, so there is also the forecast of a significant increase in production of the product widely used in the information technology industry.

Figure 51 summarizes the production and processing of metal ores and forecast through 2030.

CHART 51 - PRODUCTION OF PROCESSING OF METALLIC MINERALS BY 2012 AND FORECAST UNTIL 2030.



Prepared by: SEICOM, 2013.

3.2.1.2 Non-metallic minerals

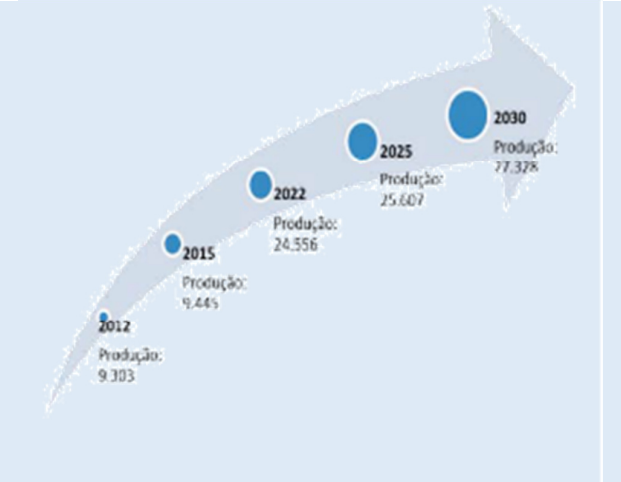
Pará is featured in this segment due to the large presence of clay in the soil of Pará. This type of industry appears in almost all regions of the state, either as rudimentary and handmade processes, or through sophisticated industries with vacuum extruders, continuous furnaces, automated processes, generating high production and reduction of direct jobs.

The municipality of São Miguel do Guama in northeastern Pará is considered the main potter-ceramic complex in Northern Brazil, with approximately 47 plants, responsible for generating 3000 direct jobs and monthly manufacturing of 30 million bricks and nine million roof tiles. The Construction industry of Pará is the major client and the link downstream of the red ceramic industry chain. (SEICOM/SINDICER, 2012).

The complex has been the subject of numerous studies and initiatives of public and private entities, with the proposal of forming a policy for APL development with training, consulting, quality / metrology programs, geological studies, alternative fuels and energy efficiency.

It is noteworthy that this market has grown substantially in southern Pará, due to the major mineral projects that are being established there and culminating in population growth, demanding more and more the construction of buildings. Figure 19 consolidates information about the projections of production of the mineral processing industry. Current trends indicate that production must double by 2030.

FIGURE 19 - EVOLUTION OF THE MINERAL PROCESSING PRODUCTION IN TX 1000



Prepared by: SEICOM, 2013.

3.3 LABOUR IN THE MINERAL INDUSTRY

The growth of investments of the mineral industries and their supply chains is reflected in the boom of the labor market. In recent years, the National Employment System (SINE) has recorded excess vacancies. One hypothesis is that the supply of skilled labor cannot meet the demand of the enterprises. The following factors have been listed as probable causes (FREITAS 2009, GIAMBIA- GI; PORTO 2013):

a) Shortage of skilled workers;

b) Few course offerings, due to lack of resources to meet the demands of the market;

c) Low level of formal education of the EAP (Economically Active Population);

d) Lack of courses that meet the demands for the installation and operation of industrial plants such as top-level technologists, automation technicians, electromechanical assemblers, welders and others.

Due to the great demand for labor caused by the construction of the Belo Monte Hydroelectric Plant, the path for the arrival of workers from other states was expanded. This was the case of skilled construction workers from Niquelândia (Goiás) that, with the reduction of investments that occurred there, came to meet the demands of the mining industry in the Southeast of Pará

The new project of Vale, S11 D should require around 2,600 permanent employees in the region.

For the analysis of trends on the future of the labor market in the mineral industry of Pará, we considered job creation [40] according to four modes: 1) directly employed in mining; 2) contractors from companies engaged by mining companies - indirect labor; 3) mining-induced jobs

40 It is noteworthy that there is no study in the literature that clearly shows, with well structured and scientifically proven technical coefficients, the ratio between the direct jobs, indirect jobs, those produced by the effects of overflow (spillover), and the ones that are created in the supporting infrastructure. The 51 MI ER N AL states that the mineral industry creates approximately thirteen (13) jobs along its chain, with the following multipliers: 9.5 on each direct job in the industries of transformation and suppliers; 3.5 on each direct job or for permanent outsourced people or in projects of the mining industry. However, the union has neither the methodological bases nor the data sources that gave rise to such numbers. In addition, when considering the regional characteristics and patterns of industrialization of Brazilian states, it is possible to notice the immense heterogeneity, suggesting that there are large numbers of these disproportions, according to the region in focus.

- *spill-over* ; and 4) employees in the logistics infrastructure and support - indirect jobs; which are described as follows:

- **Direct jobs:** jobs that are generated directly in the anchor industry, i.e., their managers, administrative staff (top and middle level), engineers, skilled technicians and supporting sectors.
- **Contractors:** made up of those working with suppliers, which in turn have contracts with the large enterprise, providing services internally within the industry. As an example: industrial maintenance, building maintenance, electromechanical assembly, industrial cleaning, electronics and property security, food, waste management, gardening, transport of cargo and people, among others. The so-called in-company stores are considered outsourced jobs.
- **Induced jobs:** the jobs that are created as a result of the business environment produced by the anchor company and its contractors, such as: hotels, restaurants, shops and specialized workshops, safety, education and training services for labor, among others.
- **Support structure:** made up of sectors aimed at providing support for companies to develop their activities, as an example: banking and financial services, health care, public transportation, entertainment, medicine, hygiene etc..

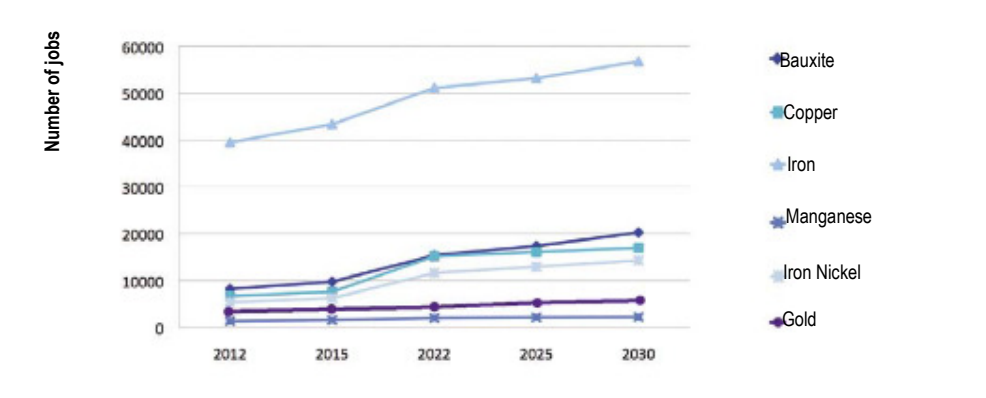
As a reference, the surveys of FIEPA / REDES were used [41], based on information provided by companies, where it is estimated that the indirect jobs amount to about three times the direct jobs. Thus, the jobs were arranged to represent the generation of outsourced jobs, induced jobs and the ones in the supporting infrastructure, considering that some companies are common suppliers of various mining companies.

3.3.1 Labor in the mining of metallic products

The importance of the mining of metal ores can be noticed in the creation of jobs. Considering the projections in the state of Pará, there will be by 2030, according to the investments in mineral mining, a considerable increase in direct jobs and, consequently, the indirect jobs and induced jobs. As shown in Table 27.

According to Table 27, the proportion between the different forms of employment is as follows: direct jobs (22%), outsourced jobs (15%), induced jobs (52%) and jobs in the supporting infrastructure (10%). Therefore, the direct jobs represent only a small portion of the various employment opportunities that mining provides. Considering the four categories, jobs related to the mining of metallic minerals are expected to reach, by 2030, approximately 116,266 jobs, and iron ore accounts for more than 50% (Chart 52).

CHART 52 - TIME PROJECTION OF JOBS IN THE METAL MINERALS INDUSTRY.



Prepared by: SEICOM, 2013.

41 2008/2009 Reports and Pará Investments 2012 - 2016, 3rd Edition

TABLE 27 - CREATION OF JOBS IN METALLIC MINERALS INDUSTRY.										
MINERAL INDUSTRY	TYPE OF JOB	2012	2015	12/15	2022	16/22	2025	22/25	2030	25/30
BAUXITE	Direct jobs	1,836	2,200	20%	3,436	56%	3,900	14%	4,500	31%
	Contractors	1,200	1,800	50%	2,100	17%	2,730	30%	2,200	5%
	Induced jobs	4,308	4,800	11%	8,208	71%	8,970	9%	11,300	38%
	Support structure	862	960		1,642		1,794		2,260	
SUBTOTAL		**8.206**	**9,760**	**20%**	**15,386**	**58%**	**17,394**	**13%**	**20,260**	**32%**
COPPER	Direct jobs	1,500	1,700	13%	3,400	100%	3,600	6%	3,800	6%
	Contractors	975	1,105		2,210		2,340		2,470	
	Induced jobs	3,525	3,995		7,990		8,460		8,930	
	Support structure	705	799		1,598		1,692		1,786	
SUBTOTAL		**6.705**	**7,599**		**15,198**		**16,092**		**16,986**	
IRON	Direct jobs	8,836	9,700	10%	11,436	18%	11,900	4%	12,700	7%
	Contractors	5,743	6,305		7,433		7,735		8,255	
	Induced jobs	20,765	22,795		26,875		27,965		29,845	
	Support structure	4,153	4,559		5,375		5,593		5,969	
SUBTOTAL		**39.497**	**43,359**		**51,119**		**53,193**		**56,769**	
MANGANESE	Direct jobs	300	350	17%	450	29%	480	7%	500	4%
	Contractors	195	228		293		312		325	
	Induced jobs	705	823		1,058		1,128		1,175	
	Support structure	141	165		212		226		235	
SUBTOTAL		**1.341**	**1,565**		**2,012**		**2,146**		**2,235**	
GOLD	Direct jobs	750	850	13%	1,050	15%	1,150	10%	1,323	15%
	Contractors	563	638		683		748		822	
	Induced jobs	1,688	1,913		2,468		2,703		2,973	
	Support structure	338	383		57		541		595	
SUBTOTAL		**3.338**	**3,783**		**4,257**		**5,141**		**5,712**	
NICKEL	Direct jobs	1,200	1,400	17%	2,600	86%	2,900	12%	3,200	10%
	Contractors	780	910		1,690		1,885		2,080	
	Induced jobs	2,820	3,290		6,110		6,815		7,520	
	Support structure	564	658		1,222		1,363		1,504	
SUBTOTAL		**5.364**	**6,258**		**11,622**		**12,963**		**14,304**	
TOTAL JOBS		**64.450**	**72,323**		**99,593**		**106,928**		**116,266**	

Source: Preparation of PEM.

a) Bauxite

The creation of jobs is directly linked to the expansion of the Bauxite Project of Paragominas, the integrated Project of Votorantim in Rondon do Pará and maintenance of the production volume in MRN (Mineração Rio do Norte). After iron, bauxite mining represents the largest mineral production of the state. There will be an increase in total jobs created, from 8,206 in 2012 to 20,260 in 2030.

b) Copper

As there is a strong prospect for growth of copper production in Pará, which already has the Sossego Project and it is in 2 the phase of the Solobo Project in Marabá, other projects located in the Southeast of the state should contribute to the increase in jobs related to the exploration of this ore. The job posts will increase from 6,705 in 2012 to 16,986 in 2030.

c) Iron

Although the production of iron ore has a chance to double by 2030, the creation of jobs will not expand at the same rate, because of technological investments in the extraction step, which will allow doubling the productivity per employee, from 12,000 t / year in 2012 to 24,000 t / year in 2030. However, in absolute terms, the jobs are expected to increase from 39,497 in 2012 to 56,769 in 2030.

d) Manganese

By the end of 2013, there was no announcement of establishment of new industries and there was no significant increase in production of this ore, so there is no prospect of additional job creation compared to 2012.

e) Nickel (FeNi alloy)

The investments in this sector have not been confirmed yet, although they are part of the portfolio of companies Anglo American and Vale. If such investments are actually made, the jobs created will grow from 5,364 in 2012 to 14,304 in 2030.

f) Gold

According to projections made on the basis of the next investments and production that is officially informed by DNPM, the number of jobs created may go from the 3,338 jobs in 2012 to 5,712 by 2030.

3.3.2 Labor in the mining of non-metallic products

The increase in jobs, over the next 15 years, followed the projection of increase in production and the same dynamics in other industries such as ceramics, construction aggregate industries, which used few contractors.

TABLE 28 - CREATION OF JOBS IN THE NON-METALLIC MINERALS INDUSTRY.

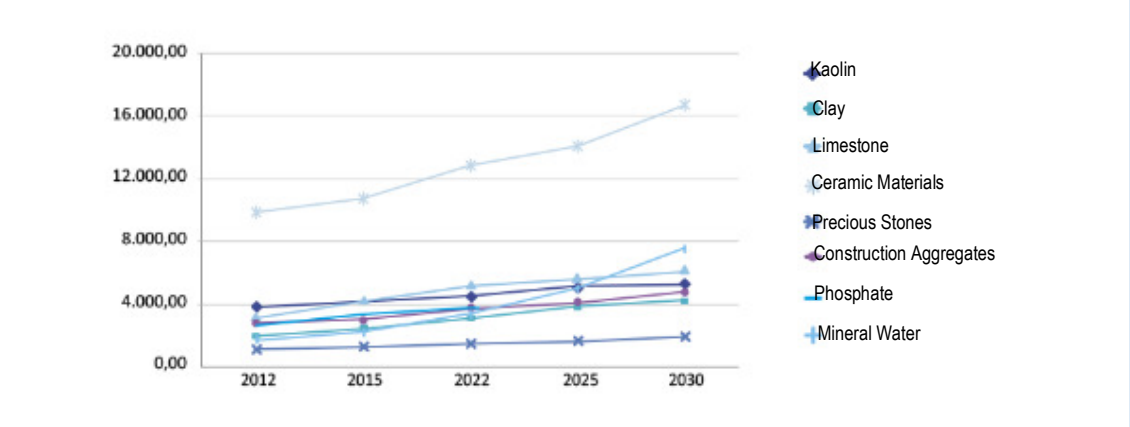
MINERAL INDUSTRY	TYPE OF JOB	2012	2015	15/12	2022	22/15	2025	25/22	2030	30/25
KAOLIN	Direct jobs	862	930	8%	1,023	10%	1,150	12%	1,350	17%
	Contractors	647	698		767		863		882	
	Induced jobs	1,940	2,093		2,302		2,588		2,647	
	Support structure	388	419		460		518		529	
	SUBTOTAL	**3.836**	**4,139**		**4,552**		**5,118**		**5,409**	
CLAY	Direct jobs	961	1,200	25%	1,560	30%	1,794	15%	2,028	15%
	Contractors	67	84		109		142		126	
	Induced jobs	769	960		1,248		1,622		1,866	
	Support structure	154	192		250		324		287	
	SUBTOTAL	**1.951**	**2,436**		**3,167**		**3,883**		**4,306**	
LIMESTONE	Direct jobs	700	950	36%	1,140	20%	1,250	10%	1,450	20%
	Contractors	525	713		855		938		1,026	
	Induced jobs	1,575	2,138		2,565		2,813		3,078	
	Support structure	315	428		513		563		616	
	SUBTOTAL	**3.115**	**4,228**		**5,073**		**5,563**		**6,170**	
PRECIOUS STONES	Direct jobs	573	650	13%	748	15%	822	10%	972	18%
	Contractors	40	46		52		58		68	
	Induced jobs	458	520		598		658		777	
	Support structure	92	104		120		132		155	
	SUBTOTAL	**1.163**	**1,320**		**1,517**		**1,669**		**1,973**	
CERAMIC MATERIALS (NON-REFRACTORY)	Direct jobs	4,835	5,220	8%	6,264	20%	6,890	10%	8,143	30%
	Contractors	338	365		438		482		570	
	Induced jobs	3,868	4,176		5,011		5,512		6,515	
	Support structure	774	835		1,002		1,102		1,303	
	SUBTOTAL	**9.815**	**10,597**		**12,716**		**13,988**		**16,531**	
AGGREGATES, PARÁ CONSTRUCTION	Direct jobs	1,403	1,515	8%	1,818	20%	2,000	10%	2,364	30%
	Contractors	98	106		127		140		165	
	Induced jobs	1,122	1,212		1,455		1,600		1,891	
	Support structure	224	242		291		320		378	
	SUBTOTAL	**2.848**	**3,076**		**3,691**		**4,060**		**4,798**	
MINERAL WATER	Direct jobs	850	1,105	30%	1,646	49%	2,453	49%	3,655	49%
	Contractors	60	77		115		172		256	
	Induced jobs	680	884		1,317		1,963		2,924	
	Support structure	170	221		329		491		731	
	SUBTOTAL	**1.760**	**2,287**		**3,408**		**5,078**		**7,566**	
PHOSPHATE	Direct jobs				600		750	25%	825	10%
	Contractors				450		563		619	
	Induced jobs				1,350		1,688		1,856	
	Support structure				270		338		371	
	SUBTOTAL				**2,670**		**3,338**		**3,671**	
TOTAL JOBS		**24.488**	**29,577**	**13%**	**37,644**	**7%**	**42,758**	**14%**	**50,424**	**23%**

(*) It refers to non-refractory minerals for use in construction.
Source: SEICOM, 2013.

Regarding the jobs created by the mining of non-metallic minerals, there is no clear trend, since there is no evidence that production will grow exponentially. On the contrary, there is a general view that employment in this branch of industry is likely to be reduced due new technologies used for the extraction and comminution of ores.

According to Table 28, there is an expectation of increase in the creation of jobs in the non-metallic minerals mining industry, which, by 2030, is expected to reach approximately 50,424 jobs (Chart 53).

CHART 53 - CREATION OF JOBS IN THE NON-METALLIC MINERAL INDUSTRY FROM 2015 TO 2030.



Prepared by: SEICOM, 2013.

a) Kaolin

There is no projected significant increase in the long term, or new projects to be implemented, but there is an expected increase of 3,836 jobs in 2012 to 5,409 in 2013, only because of the increase in production.

b) Aggregates and clay for bricks

They are products directly employed in the construction industry and are expected to follow the evolution of the increase in investments in buildings. There is an estimated increase of 1,951 jobs in 2012 to 4,306 in 2030. However, as there is a high degree of informality in this segment, when the programs aimed at formalization begin to take effect, this number is likely to increase.

c) Limestone

Responsible for the cement manufacturing industry and is expected to undergo a big boost in the coming years, due to new investments that will be made by Votorantim, in the municipalities of Primavera and Marabá, going from 3,115 jobs in 2012 to an expected amount of 6,170 jobs in 2030.

e) Precious stones

The production indicators, due to the large informality of the sector, are still unclear and, assuming that there are no new facts that cause an increase in the value addition, the data indicate that there will be an expansion of 1,101 jobs in 2012 to 1,973 in 2030.

f) Ceramics

There will be an increase due to the demands for construction, mainly in southeast Pará, where consumption has increased and, also due to the support to major investments, the number of jobs is expected to increase from 9,815 to 16,531.

g) Phosphate

With the implementation of new projects, 2,500 new jobs are expected to be created in construction, with 800 direct jobs and 500 indirect jobs during the operation phase, in 2017. This extractive industry could reach a total of 3,671 jobs in 2030, including direct jobs, contractors, induced jobs and support jobs.

h) Mineral Water

Except for the geologists, mining engineers and health professionals, this industry does not require skilled labor. Thus, most of the staff comes from the installation site itself. In the filling process companies use 20 employees on average (MENDO J., 2009). Thus, for the projection of the jobs in this segment, first we considered SEICOM's information on the volume of jobs listed in the register of companies that extract mineral water and that benefit from or have applied for tax incentives; subsequently, we will consider the production / worker ration that allowed us to estimate the number of workers by the total production in the state. Thus, from an approximate amount of 1,760 jobs, this segment will reach, in 2030, a total of approximately 7,566 jobs.

3.3.3 Labor in mineral processing

As already stressed, the creation of jobs in this sector is conditional on the implementation of ALPA that, in the production of flat steels, could contribute to the creation of jobs in other ventures. The forecast of jobs created, by substance and by category, is described in Table 29.

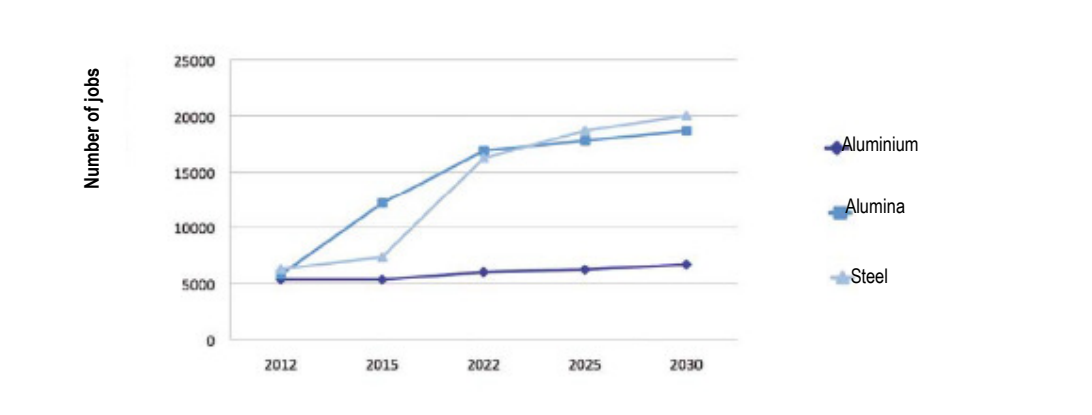
TABLE 29 - CREATION OF JOBS IN THE MINERAL PROCESSING INDUSTRY.

JOB PROCESSING TYPE		2012	2015	14/15	2022	16/22	2025	22/25	2030	25/30
ALUMINUM	Direct jobs	1,200	1,200	0%	1,350	13%	1,400	4%	1,500	7%
	Contractors	900	900		1,013		1,050		1,125	
	Induced jobs	2,700	2,700		3,038		3,150		3,375	
	Support structure	540	540		608		630		675	
SUBTOTAL		**5,340**	**5,340**		**6,008**		**6,230**		**6,675**	
ALUMINA	Direct jobs	1,300	2,730	110%	3,800	39%	4,000	5%	4,200	5%
	Contractors	975	2,048		2,850		3,000		3,150	
	Induced jobs	2,925	6,143		8,550		9,000		9,450	
	Support structure	585	1,229		1,710		1,800		1,890	
SUBTOTAL		**5.785**	**12,149**		**16,910**		**17,800**		**18,690**	
STEEL	Direct jobs	1,410	1,650	17%	3,650	121%	4,200	15%	4,500	8%
	Contractors	1,058	1,238		2,738		3,150		3,375	
	Induced jobs	3,173	3,713		8,213		9,450		10,125	
	Support structure	635	743		1,643		1,890		2,025	
SUBTOTAL		**6,275**	**7,343**		**16,243**		**18,690**		**20,025**	
COPPER PLATES	Direct jobs	140								
	Contractors	105								
	Induced jobs	315								
	Support structure	63								
SUBTOTAL		**623**								
TOTAL JOBS		**18,023**	**24,831**	**38%**	**39,160**	**58%**	**42,720**	**9%**	**45,390**	**8%**

Source: SEICOM, 2013.

Figure 54 shows the creation of jobs, revealing that all, at the moment, are at the same level, however, alumina is expected to create the largest number of jobs by 2030.

CHART 54 - EVOLUTION OF JOBS IN MINERAL PROCESSING.



Source: Preparation of PEM.

a) Alumina / Aluminum

Under the same assumptions of the mineral processing, it appears that, with respect to aluminum, there is no anticipated increase in demand for labor, because of the uncertainties that surround the future of this industry in Brazil, and particularly in the State of Pará.

According to projections, unless there are new facts involving the attraction of new businesses down the chain, the jobs will go from 5,340 in 2013 to 6,675 in 2030.

The performance of the labor market in the alumina industry will follow the pace that will be established by the increase in production that will be set by Votorantim and Companhia de Alumina do Pará (CAP).

IMAGE 18 - TECHNICIAN ANALYZING THE BAUXISTE IN VOTORANTIM'S PROJECT IN RONDON DO PARÁ. SOURCE: VOTORANTIM.

So there is the expectation of increase from 5,785 jobs now to 18,690 in 2030.

b) Steel

The dynamics of the labor market, in the steel industry, will reflect the increase in the production of Sinobras and especially the deployment of the ALPA Project, which will create a specific type of dynamics in the state. In addition to the direct jobs and their supply chain, there will be pressure for new investments downstream, either with their product line or through their industrial waste.

If the investments are made, the creation of jobs will go from the current 6,275 jobs in 2012 to 20,035 in 2030.

c) Copper Plates

With respect to copper, there is still a clear perspective, since Usina Hidrometalúrgica de Canaã, installed to produce copper plates with 99% purity, has momentarily suspended its activities in order to evaluate technology issues and costs, especially with respect to energy.

In addition, there is an expectation of employment of 40,940 workers in the manufacturing industry, by 2030.

3.3.4 Job creation summary

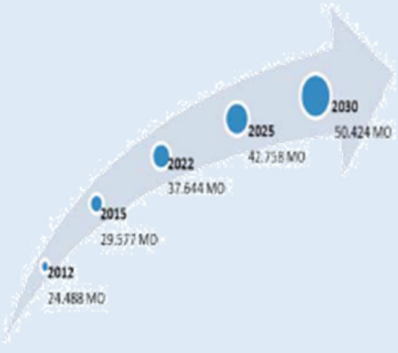
It is possible to notice that there will be a net increase of 105,120 jobs between 2012 and 2030. This information, when added to demanding segments, as well as to the municipality where it will happen, is very important in order for establish strategies with respect to the qualification and preparation of labor, around 5.289/year, considering all the categories involved. A summary of job creation between 2012 and 2030 is shown in in Table 30.

TABLE 30 - FORECAST OF JOBS CREATED * TOTALS BY INDUSTRY SECTOR.						
YEAR	INDUSTRY	JOBS CREATED				
		DIRECT JOBS	CONTRACTORS	INDUCED JOBS	SUPPORT INFRASTRUCTURE	TOTAL
2012	Metal materials	14,422	9,456	33,810	6,762	64,450
	Nonmetallic materials	10,184	1,775	10,412	2,116	24,488
	Transformation	4,050	3,038	9,113	1,823	18,023
	TOTAL (2012)	**28,656**	**14,268**	**53,335**	**10,701**	**106,960**
2030	Metal materials	26,023	16,152	61,743	12,349	116,266
	Nonmetallic materials	20,787	3,712	21,554	4,371	50,424
	Transformation	10,200	7,650	22,950	4,590	45,390
	TOTAL (2030)	**57,010**	**27,514**	**106,247**	**21,310**	**212,081**
INCREASE (2030-2012)	Metal materials	11,601	6,696	27,933	5,587	51,816
	Nonmetallic materials	10,603	1,937	11,142	2,255	25,937
	Transformation	6,150	4,613	13,838	2,768	27,368
	TOTAL	**28,354**	**13,246**	**52,912**	**10,609**	**105,120**

(*) direct jobs, indirect jobs, induced jobs and jobs in the supporting infrastructure
Source: Prepared for the PEM

Figures 20, 21 and 22 show the evolution of this demand, over time, by industry segment.

FIGURE 20 - LABOR IN MINING.



Source: information from Table 27

FIGURE 21 - LABOR IN NON-METALLIC MATERIALS.

Source: information from Table 28

FIGURE 22 - LABOR IN THE PROCESSING INDUSTRY.

Source: information from Table 29

It is important to highlight that, although with a lower value of investments, mineral processing and support sectors are expected to double the creation of jobs, reaching, in 2030, a percentage of 152%, compared to 2012.

Finally, it is important to promote, in the case of Pará's economy, the development of the construction industry, due to the use of steel and iron that the new clean construction technologies bring, as well as metalworking, because of the demand for metal-based products. Both industries are able to attract and encourage the flourishing of new industries and meet the high demand for goods and services for mineral extraction and processing projects.

IMAGE 19 - STEEL USED IN THE CONSTRUCTION INDUSTRY.
SOURCE: VALOR NEWSPAPER.

For Pará, what will be the meaning of all this forecast investments in the extractive and manufacturing industries, as well as the increase in production, outsourced services, new demands for labor, etc.?

Which public policy measures must be recommended for the state to seize the good opportunities, get away from the unfavorable weather conditions and enjoy the good cycles to promote its development, reducing poverty and inequality?

This range of investments in the mining and mineral processing industry will have significant impacts on the economic and environmental panorama of Pará.

One of the most important ones will be the movement of the people in search of employment and income opportunities, and this will exert intense pressure on public services in towns that still lack basic structure capable of even meeting the needs of their current population. Moreover, many of these migratory groups consists of people with low or no qualification that will end up filling low-paying positions that are often temporary or that will even work in the informal economy.

Another significant pressure is exerted on the local infrastructure of energy, transport and communications. The intensification of mining-metallurgical activities will also strengthen the existing industrial complexes, and it will enable the installation of new ones, leading both to the enhancement of the mining industry and the development of variety of goods and support services. The construction of production plants and infrastructure projects, as well as demographic expansion, will severely increase the demand for raw materials for the construction industry, notably timber and mineral inputs.

The increase in mining and metallurgical production can also generate ample opportunities of effects that are favorable to the development of the State, but that is why it is necessary to propose and implement policies to enhance positive effects, including the **training of the human capital formation, coordination and integration of production chains** and improvement in the **quality of the management of the** municipalities.

Providing opportunities for **the training of manpower** to take up jobs in core activities and in the supply chain is critical, because such jobs require skilled workers with good qualifications in technical and higher-education roles, not only in mining and metallurgy activities, but also in a series of related activities, such as construction, transportation, food and lodging, maintenance and technical services, among others. Thus, the possibility of increasing the wage profile and income of the local population is intimately related to the quality of their educational background.

The promotion of the **coordination and integration of activities** with other mining-metallurgical production chains, which are expanding in Pará's economy, is another point of vital importance, since there are other sectors that have demands for inputs and labor that are as significant as the mineral sector, particularly the beef cattle and dairy , agribusiness and metalworking sectors, which can act as a productive axis of integration among the others. These sectors have common problems, such as land and environmental regulation, lack of skilled manpower and infrastructure deficiency. Therefore, the activities of vocational training at the technical level, along with the provision of logistics and infrastructure equipment, accompanied by institutional measures for the resolution of land-related and environment-related outstanding issues, could compete for the promotion of integrated development of these production chains, sharing the offer of centers of training, logistics and energy infrastructure, as well as the services of construction and maintenance of facilities and equipment.

The development of effective strategies to promote **the improvement of the quality of local public management** , both at the state and municipal level, is an indispensable condition. Therefore, the governmental institutions, in the state and the municipalities, shall be adequately prepared to design and execute the processes for managing the changes and consolidation of the production bases and social organization in the territories for which they are responsible. Moreover, such projects need to be designed and implemented in order to enable broad participation of various representative segments of local society, such as government, academia, business community and civil society. Thus, localities could become able to establish joint goals of local development, through a "coordination" of interests that allows a more homogeneous distribution of the benefits of economic growth generated by productive activities related to the mining industry.

4

CHAPTER

Contraints of the Future of Mining

4. FUTURE CONSTRAINTS

The ability to anticipate trends and uncertainties, in order to prepare society for future events is an essential ingredient of a long-term strategy. Knowing the past, its evolution and recent dynamics, and especially to know where you are going and where you want to go on the horizon of the next two decades is essential for the proper planning of the development of the state, through its mineral base.

Some questions, which comprise the critical uncertainties, help to understand the relevance of the long-term planning for the mining sector in the State of Pará, such as:

1. **How will the global economy behave, particularly in China and other emerging countries, which are major consumers of minerals?**
2. **In this context, what will be influence of the global dynamics on the home environment? What are the current and new competitors in the international market?**
3. **How will the national and state economies evolve?**
4. **In the medium and long term, what are the effects of the new regulatory framework for mining?**
5. **Will Pará attract productive investment and sustain its economic growth at a high level?**
6. **What are the effects of the des-industrialization on the dynamics of domestic demand for minerals?**
7. **How will the cost of energy evolve to maintain the competitiveness of the mining and mineral processing industry, particularly in the production of aluminum?**
8. **How will the social indicators in the state involve?**
9. **In that same time frame, will there be any progress in the degree of political and institutional coordination of the social, economic and political player that influence the dynamics of Pará? In other words, how will the awareness of a common future for the state be disseminated?**
10. **What will Pará be like in 2030? Will it be innovative, sustainable and with the proper quality or a stagnant and degraded state, marked by severe social and environmental liabilities arising from the purely extractive model?**
11. **Will there be progress in the projects aimed at the vertical integration of the mineral production in the state for the addition of value to iron, copper and aluminum? E.g. deployment of ALPA and ALINE in Marabá?**
12. **Will Pará provide the logistics that is necessary to attract new infrastructure investments, such as industrial districts. ZPE (Zona de Processamento de Exportação = Export Processing Zone), in addition to the fiscal incentive policy?**
13. **Will there be an evolution in the bases for innovation, technology, training and qualification of manpower for improvement in the levels of local productivity and competitiveness?**
14. **Will the business sector of Pará be prepared to contribute to the competitiveness of local suppliers?**

There is no single answer for each one of these questions. The answers are many and, depending on the combinations between the constraints of the future, they will shape alternative futures - or scenarios. The future, therefore, is space open to various possibilities and fraught with uncertainty.

To deal with these uncertain factors, it is very important to organize, systematize and define uncertainties. Thus, favorable events that will occur in the future of the mining industry in Pará can be leveraged to extend the range of regional benefits, which can be done, for example, through cooperation between the actors that make up and influence the mineral sector and the government at its three levels (federal, state and local), suppliers of goods and services, associations, development banks and institutions for teaching and research, among others. Similarly, adverse events can be circumvented, provided there is proper strategy and, similarly, cooperation and synergy between the actions of many lobbying groups that make up the mineral sector.

The National Mining Plan [42] outlined four scenarios, including the scenario "Na Trilha da Sustentabilidade" ("On the path to sustainability") was chosen to better reflect the desirable future for the Brazilian mineral policy. The Mineral Plan of Pará, by following the methodology of the National Plan, also adopted the "Trail of Sustainability" scenario. However, since it is a unit of the Federation and since it is located in a peripheral region of the country, there was the need to make some adjustments, mainly regarding the factors - including political ones - that will determine the future of Pará, in its socioeconomic context.

Thus, from the workshops held by SEICOM with partner organizations, and interviews with government officials, academics, businessmen and experts in the field of mining, we selected 13 key variables that will determine the future in the context of Pará. The variables were arranged in the Structural Analysis Matrix - variable/variable that identifies those with the greatest influence (sum of the last column) and those with a higher degree of dependence (the sum of the last line). Weights 0-3 were assigned to the variables, according to the expertise of all those involved in the process (Table 11).

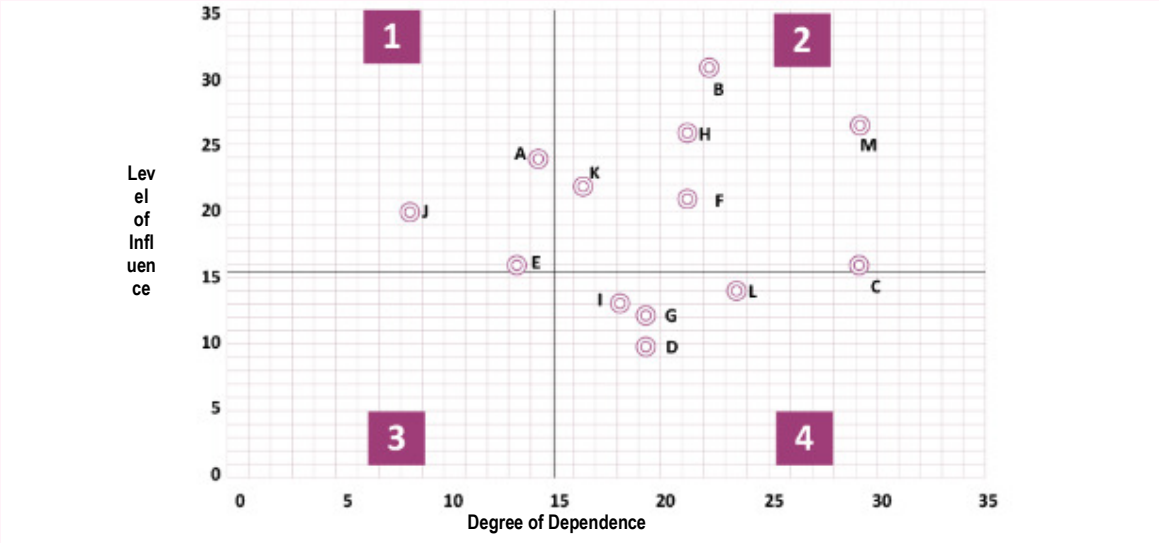
42 http://www.mme.gov.br/mme /galerías/arquívos/notícías/2011/PNM_2030.pdf (see page 71)

TABLE 11 - DEGREE OF INFLUENCE OF THE MINING VARIABLES														
VARIABLE	A	B	C	D	E	F	G	H	I	J	K	L	M	DEGREE OF INFLUENCE
A = WORLD ECONOMY	0	3	3	i	i	3	i	2	2	1	2	2	**3**	24
B = NATIONAL ECONOMY	1	0	3	2	3	2	3	3	2	3	3	3	**3**	31
C = STATE ECONOMY	0	2	0	1	0	1	1	2	1	1	2	2	**3**	16
D = WORK QUALIFICATION	0	1	2	0	0	1	1	1	1	0	0	1	**2**	10
E = COST OF ENERGY	1	1	2	0	0	2	2	2	1	0	0	2	**3**	16
F = INTERNATIONAL MARKET COMPETITION	2	3	3	1	0	0	1	2	2	1	2	1	**3**	21
G = CLUSTERING POLICIES	0	0	1	2	0	1	0	1	2	0	1	2	**2**	12
H = INFRASTRUCTURE	2	2	3	2	2	3	3	0	2	0	1	3	**3**	26
E = LOGISTICS														
I = INVESTMENT IN TECHNOLOGY	1	1	1	2	2	1	1	1	0	0	0	1	**2**	13
J = NEW MINERAL FRAMEWORK	3	3	3	1	0	2	1	1	1	0	3	1	**1**	20
K = TAX ISSUE	2	3	3	2	2	2	2	2	1	0	0	2	**1**	22
L = SOCIAL ISSUE	0	1	2	3	0	0	1	1	1	1	1	0	**3**	14
M = ENVIRONMENTAL	**2**	**2**	**3**	**2**	**3**	**3**	**2**	**3**	**2**	**1**	**1**	**3**	**0**	**27**
DEGREE OF DEPENDENCE	14	22	29	19	13	21	19	21	18	8	16	23	**29**	

Prepared by: SEICOM, 2013.

The variables are distributed in the quadrants of Figure 23. Those in quadrant 1 have high power of influence over the other, so, they are of strategic importance because they have a low degree of dependence on other variables in the system. The second quadrant concentrated the largest number of variables; note that they have high power of influence, but also a high level of dependence on these variables of the system. Those in quadrant 4 have little influence and are highly dependent on the dynamics of those that are in quadrants 1 and 2. None of the variables reached quadrant 3, which represents the variables with little influence and low degree of dependence on others.

FIGURE 23 - DIAGRAM OF INFLUENCE AND DEPENDENCE FOR PARÁ'S MINING.



Source: SEICOM, 2013.

The 13 variables are:

Quadrant 1 A = The Dynamics of the World Economy J = New Regulatory Framework E = Energy Cost	Quadrant 2 B = Dynamics of the National Economy M = Environmental Dimension H = Infrastructure and Logistics in Pará K = Tax and Fiscal Policies F = Competition in the International Market C = State and Local Economy
Quadrant 3 There were no variables selected	Quadrant 4 L = Social Dimension I = Investment in Science, Technology and Innovation G = Policies to Promote the Economies of Agglomeration D = Qualification Level of the Manpower.

4.1 DYNAMICS OF THE WORLD ECONOMY

The global economy is the condition of great power to influence the dynamics of the national economy and local economy, because it is the largest consumer market of minerals from Pará It should be noted that the global economy, although it has still not recovered from the economic crisis, has good prospects for the ore market.

The demand fundamentals are strongly determined by increased consumption, coupled with population growth and the rise of the middle class in developing countries. On the supply side, the challenges are the discoveries and feasibility of new mines, given the increasing restrictions on access to new production areas. This indicates that the demand for minerals has a strong chance to remain high, taking into account the particularities of each asset and the consumer countries.

In just over two decades, there has been a dramatic change in Pará's trading partners (Charts 55 and 56). In 1990, European countries were the main consumers, accounting for 47% of purchases; in 2012, Asian countries now account for 59%, with absolute highlight for China, which buys 33% of exports from Pará, an amount equivalent to R$ 4.9 billion (MDIC, 2012).

CHART 55 - KEY BUSINESS PARTNERS OF PARÁ, 1990.

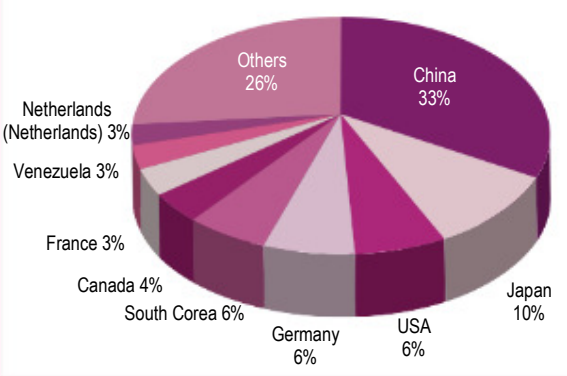
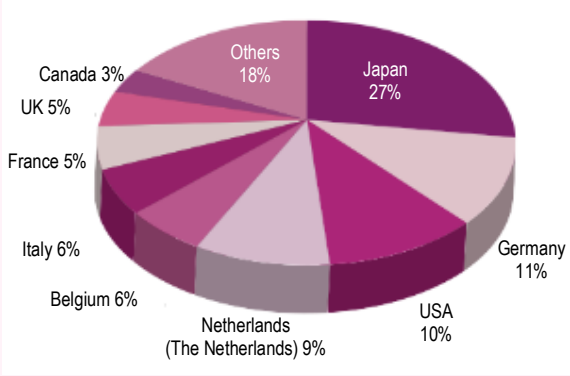


CHART 56 - KEY BUSINESS PARTNERS OF PARÁ, 2012.



Source: MDIC.

Since the early 2000s, China has become the world's largest buyer of mineral *commodities* , especially iron, accounting, in 2011, for 40% of the world's demand.

Notwithstanding the significant socioeconomic disparities between countries, economic growth projections from the International Monetary Fund (IMF) for the BRICS (Brazil, Russia, India, China and South Africa) show that China and India will still lead the GDP rates and developed countries will grow more modestly. However, the forecasts for 2017 are of much lower rates compared to 2007 (Table 30).

TABLE 30 - PERCENTAGE GROWTH OF THE WORLD'S GDP (2007-2017).

COUNTRIES	GDP PERCENTAGE GROWTH										
	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017
BRAZIL	6.0	5.1	-0.3	7.5	2.7	1.5	3.9	4.2	4.2	4.1	4.1
CHINA	14.0	9.6	9.2	10.4	9.2	7.9	8.2	8.5	8.5	8.5	8.5
INDIA	10.0	6.9	5.9	10.0	6.9	4.9	5.9	6.4	6.7	6.9	7.0
JAPAN	2.2	-1.0	-5.5	4.5	-0.7	2.2	1.2	1.0	1.2	1.0	1.0
RUSSIA	8.5	5.2	-7.8	4.3	4.3	3.7	3.8	3.9	3.9	3.9	3.8
UNITED STATES	2.0	-0.3	-3.0	2.4	1.8	2.2	2.1	3.0	3.4	3.4	3.4
EUROPEAN UNION	3.4	0.6	-4.2	2.0	1.6	-0.2	0.5	1.5	1.9	2.0	2.0

Source: International Monetary Fund, 2013.

Given this scenario of economic growth, the pace of market growth in recent years (the so-called "commodity supercycle[43]") is unlikely to continue. Overall, the IMF forecasts that the world economy is expected to register an average growth of 4.6% in 2017, below the average of 5.3% recorded in 2010, but higher than the 3.6% expected for 2013.

43 Erten, Bílge and Ocampo, José Antônío. Super Cycles of Commodity Prices Since the Mid-Nineteenth Century. World DevelopmentVol. 44, pages 14-30, 2013.

TABLE 31 - ESTIMATED GDP GROWTH (%) BY COUNTRY AND ECONOMIC GROUPS.					
COUNTRIES AND ECONOMIC GROUPS	ESTIMATED GROWTH -% GDP				
	2013	2014	2015	2016	2017
WORLD	3.6	4.1	4.4	4.5	4.6
ADVANCED ECONOMIES	1.5	2.2	2.6	2.7	2.7
EUROZONE	0.2	1.2	1.5	1.7	1.7
G7	1.5	2.2	2.5	2.5	2.5
NEW COUNTRIES INDUSTRIALIZED IN ASIA	3.6	4.1	4.2	4.2	4.3
EUROPEAN UNION	0.5	1.5	1.9	2.0	2.0
EMERGING ECONOMIES	5.6	5.9	6.0	6.1	6.2
CENTRAL AND EASTERN EUROPE	2.6	3.2	3.5	3.7	3.8
COMMONWEALTH OF INDEPENDENT STATES	4.1	4.2	4.2	4.1	4.1
DEVELOPING COUNTRIES IN ASIA	7.2	7.5	7.6	7.7	7.7
ASSOCIATION OF SOUTHEAST ASIAN NATIONS	5.8	5.7	5.8	6.0	6.0
LATIN AMERICA AND THE CARIBBEAN	3.9	4.0	4.0	4.0	4.0
MIDDLE EAST AND NORTH AFRICA	3.7	3.8	4.3	4.5	4.5
SUBSAHARAN AFRICA	5.7	5.6	5.8	5.7	5.8
OTHER ADVANCED ECONOMIES, LESS G7 AND EUROZONE.	3.0	3.5	3.6	3.5	3.6

Source: International Monetary Fund 2013.

If the trend shown during the crisis continues, emerging economies will overtake the developed economies and grow at a rate of 6.2% in the same period.

Despite the good fundamentals, forecasts point to a dynamism that is lower than that shown in the early 2000s. In the specific case of Pará, the global economy is what defines almost all of the demand for minerals, especially metal minerals. The expected slowdown in China will certainly have an impact on the global market of *commodities,* **particularly iron ore, which is the flagship export of Pará.**

4.2 DYNAMICS OF THE NATIONAL ECONOMY

According to the diagram of influence and dependence, the national economy is the main determinant of the dynamics of economic development of Pará, at its highest level of influence. The state of Pará and, as a consequence, projects associated with the mining sector, depend on federal projects, for infrastructure and logistics, on federal funds through arrangements, as well as on private projects through financing of federal banks, on incentives and on differentiated lines, among others.

However, there are structural problems that hinder a greater dynamism of the domestic economy. The rates of domestic investment, as a percentage of GDP in the period 2000-2012, show that gross fixed capital formation (GFCF) has been and remains very low, below the expected rate, both with regard to investment in the private sector, and in regard to public sector investment. The investment / GDP ratio, average for the world, between 2002 and 2011 was 23%, while the national ratio was 17% in the same period (Table 32).

TABLE 32 - GROSS FIXED CAPITAL FORMATION.					
YEAR	GROSS FIXED CAPITAL FORMATION (GFCF)				
	CONSTRUCTION	MACHINERY AND EQUIPMENT	OTHERS	CHANGES IN INVENTORIES	GFCF/GDP
1995	44.5	48.9	8.3	-1.6	18.3
1996	48.2	43.5	7.3	1.0	16.9
1997	49.5	43.1	7.0	0.3	17.4
1998	51.9	40.8	6.9	0.3	17.0
1999	50.6	37.2	7.8	4.4	15.7

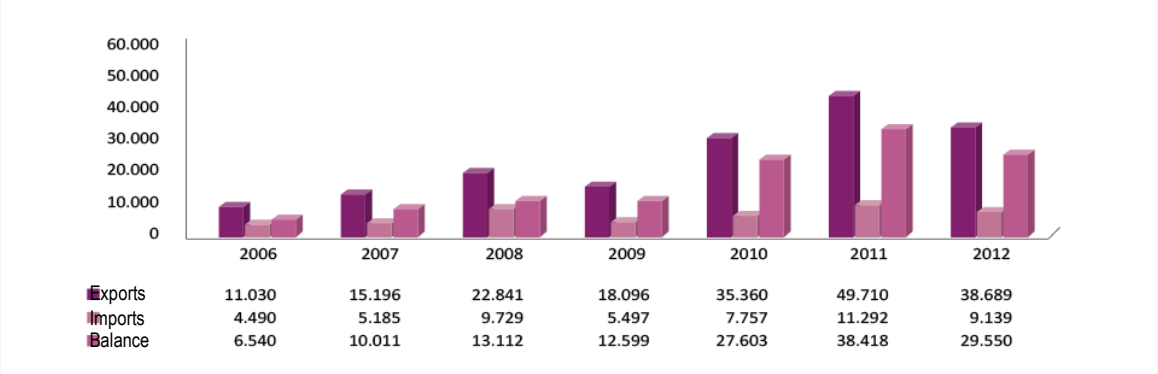
2000	45.7	39.3	7.1	7.9	16.8
2001	43.9	43.3	7.3	5.5	17.0
2002	47.8	44.8	8.5	-1.2	16.4
2003	42.8	45.3	8.7	3.1	15.3
2004	41.1	45	7.9	6.0	16.1
2005	41.6	49	7.7	1.6	15.9
2006	39.6	50.6	7.8	1.9	16.4
2007	36.5	51.5	7.2	4.8	17.4
2008	33.5	52.4	6.5	7.6	19.1
2009	42.8	50.8	7.7	-1.3	18.1
2010	39.1	50.5	6.6	3.8	19.5
2011	40.4	51.2	6.1	2.3	19.3

Source: International Monetary Fund, 2013.

The growth prospects of Brazilian GDP, prepared by the Central Bank (BCB) and by the IMF are different from the projections made by the National Mining Plan. For the Brazilian Central Bank, the Brazilian economy will grow only 2.5% in 2013 against 3.9% originally presented by the IMF, while the National Plan, in the "On the Trail of Sustainability" scenario, estimated an average annual growth of 5% .

The economic crisis had negative effects on the production of the global industry and, therefore, on the consumption of metals that also have negatively effects on the GDP. Brazil has registered a decline in exports during the years of intensification of the crisis (Chart 57), which produces a negative effect on the balance of Brazil's mineral balance.

CHART 57 - BRAZILIAN MINERAL TRADE BALANCE - US$ MILLIONS (FOB)



Source: MDIC, 2013.

IMAGE 20 - IRON ORE.
SOURCE: VALOR NEWSPAPER.

The national economy faces a clear process of deindustrialization, while there has been a growth in imports of mineral based products, which creates a negative impact on the domestic steel industry, whose production capacity is being used in only 60% (Valor Econômico, of January 14th, 2014).

An alternative adopted by the steel industry to cope with this difficult environment and at the same time minimize the rising costs of production was the development of captive mines, like what steelmakers are doing, to acquire iron ore mines in a strategy of vertical integration of production.

4.3 QUALIFICATION LEVEL OF THE MANPOWER

The education, training and qualification of manpower still pose a serious barrier to the absorption of greater benefits from ore extraction and from the processing industries and supply companies in the state of Pará. This is a paradox faced by businesses and institutions in everyday life, when we consider the scenario of low unemployment, where most jobs are in the service sector, but with low qualification.

The low educational level of the Economically Active Population (EAP) contributes to the low employment scenario. In Pará, only 31.7% of young people up to the age of 19, finish high school (INEP and SEPROS 2012) [3], which is a minimum requirement for entry into the labor market, which has become increasingly demanding, and the high school dropout rate is of 20.6% (INEP and SEPROS, 2012), one of the largest in Brazil.

There is huge demand for technical-level professionals, who have the responsibility to operate machines and equipment, handling instruments, supervising manufacturing processes, managing environmental policies and labor safety and assessing the quality. However, there are not many technical courses being offered. In some mining cities such as Marabá, the number of courses is not even 2% of the total job openings, including primary, high school and higher educational levels (Industrial Development Plan of the Municipality). That is one of the reasons why the companies turn to professionals from other states.

In general, large companies are better able to mitigate the problems with lack of skills of the workforce and even induce partnerships with other institutions to meet specific demands. The suppliers attempt, in various ways, to provide the qualification to minimize the lack of manpower and migration of their best employees to large companies and other regions.

Another fact is that **the number of direct jobs in the extraction and processing industry is starting to dwindle due to innovations and the level of automation.** Mining companies seek high income workers (i.e., the expert, who is able to perform various tasks) by offering them, in return, the best salaries. Thus, **the greatest opportunities are in the supply chain** (outsource jobs, induced jobs and jobs in the supporting infrastructure), instead of those in big mining companies.

Table 12 shows examples of existing common technologies that expand the possibilities of specialization and, consequently, increase in productivity, exchange of labor, management and supplier companies.

TABLE 12 - SIMILAR TECHNOLOGIES AMONG THE ORE MINING AND ORE PROCESSING INDUSTRIES.

COMMON TECHNOLOGIES		
TYPE	**APPLICATION**	**INDUSTRIES**
AUTOMATION AND CONTROL	Automatic control of the production process through electronic panels and computers.	Mining and mineral processing
INFORMATION	Use of software and hardware for the optimization of production processes and management of projects.	
STORAGE OF MATERIALS	Use of iron tanks, stainless steel tanks and concrete silos.	
CRUSHING, GRINDING AND SCREENING	Process of comminution and classification of the ore.	
STACKING	Use of specialized mechanical equipment	
TRANSPORT OF SOLID GRAINS	Through conveyor belts, pipelines and specialty vehicles.	
METAL STRUCTURES (LIGHT, MEDIUM AND HEAVY)	Warehouses, support for pipes and conveyors, equipment, chutes, galleries.	
SHEET METAL SHOP	Tanks, silos and pressure vessels. Use of Stainless Steel	
CIVIL BASES OF STATIC AND DYNAMIC EQUIPMENT	Support of static equipment, dynamic equipment, machines, engines and others	
INDUSTRIAL ASSEMBLY	Movement engineering with rigging and welding operations	

ENVIRONMENTAL MANAGEMENT	Technology to reduce emissions, pollutants, effluent and solid waste treatment	Mining and mineral processing
INDUSTRIAL MAINTENANCE	Use of stereos, vibration gauges, light, lasers and developers.	
CONTRACT AND PROCESS MANAGEMENT	Planning, technologies for monitoring and measuring the progress of works	
LAMINATION AND CASTING	Process for transforming the molten material into billets, blooms or slabs.	Steel mills
CALCINATION	Decomposition of carbonates and elimination of hydration water.	Mining industries, kaolin and alumina

Prepared by: SEICOM, 2013.

The processes described above require skilled labor, especially in regards to mechanical engineering, automation and control engineering, environmental engineering, metallurgical engineering, civil engineering and industrial maintenance engineering. Professionals specializing in information technologies (IT) are also indispensable to the process, as well as technical professionals.

Thus, in order for the benefits of mineral production to be internalized, through the creation of direct and indirect jobs, it is necessary to make investments in an educational process that encourages the training and qualification of skilled labor and which meets the economic needs of the state's production base.

4.4 COMPETITION IN THE INTERNATIONAL MARKET

Current and new competitors in the international market represent opportunities and threats to the competitiveness of the mining companies operating in the state, considering the variables that may influence this dynamics of the global markets, such as innovation, technology, support infrastructure, worker productivity and exchange rates, among others. Therefore, the projection of revenues, by 2030, may suffer external influence.

The clash in the international market occurs mainly with metallic minerals, iron, bauxite, copper, manganese and processed minerals, such as alumina, aluminum and pig iron. Kaolin is the only non-metal ore of significance in the list of exported products.

In the case of kaolin, Brazil and China are the largest producers, and since the production of paper has developed new technologies that reduce the use and the recycling, plants have sought to innovate with products derived from kaolin and to use it in other segments.

Special attention shall be given to the iron ore that is heavily influenced by demand from China, which now accounts for half of global steel production, considering that this ore corresponds to 67% (MDIC / SECEX 2013) of the value exported by Pará and that, although China is the world's largest producer, Pará's iron ore has to cope with extensive competition from Australia, a country considered a benchmark in technology and specialization of labor.

Since the down swing in the price of *commodities* has reduced the return of projects, companies have chosen to cut costs and maximize efficiency, looking to work with deposits of low production cost. One example is the S11 Project D, of Vale, because its innovation and the high quality of its ore provide ample conditions to keep Vale competitive in relation to other international players.

4.5 INFRASTRUCTURE AND LOGISTICS

A variable that has a great power of influence, the logistics infrastructure is essential and fundamental to Pará and Brazil, to ensure both domestic consumption and exports. In this sense, the Growth Acceleration Program (PAC, in Portuguese) was created by the government to stimulate planning and the resumption of investments in infrastructure projects[44]. In 2013, the PAC investments totaled R$ 665 billion, R$ 43 billion (6.5%) of which was allocated to Pará, of an estimated total of R$ 98.74 billion, to be invested in transportation, energy, sanitation and housing, among others.

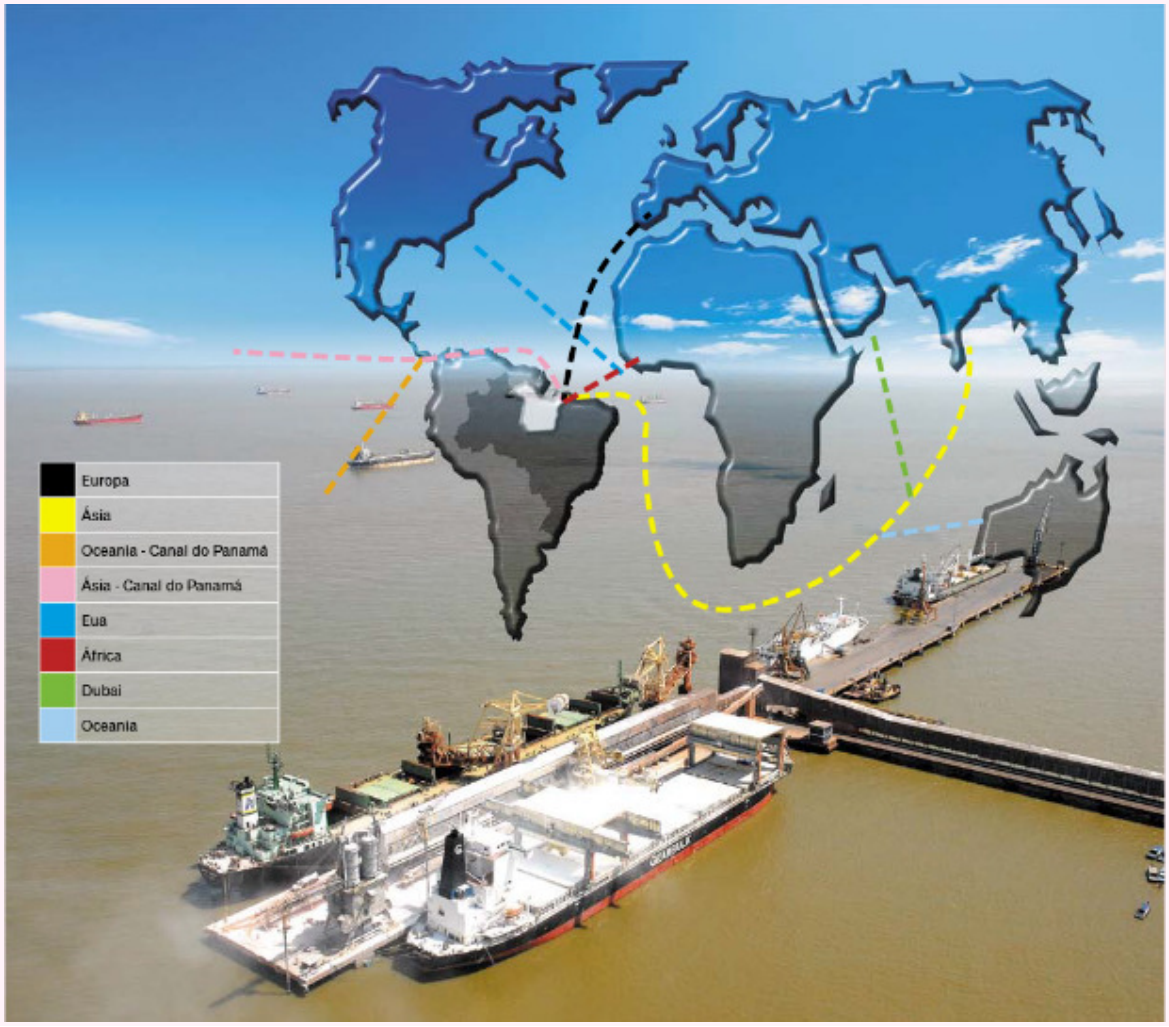
The state of Pará, given its immense basin, its strategic geographical location, its multimodal fitness (Figure 24), and especially the expansion of the Panama Canal, scheduled for the first half of 2015, will be able to consolidate itself as a best commercial route from Brazil to the

44Between 2007 and 2010, investments of R$ 656.6 billion in logistics and energetic, social and urban infrastructure were scheduled. The second stage of the program, PAC 2, began in 2011 with investments of R$ 204.4 billion, approximately 21% of which is estimated for the 2011 to 2014 period.

main global consumer market - Asia. But for that, it is necessary to prioritize investments.

There is evidence that the logistics infrastructure is a prerequisite to the viability of the expansion of mineral production, as well as to ensure that the economic activity effectively becomes a vector of socioeconomic development for different regions of the state of Pará. The consolidation of logistics modes will allow companies that are part of the mineral supply chains to intensify their activities, by multiplying their production capacity, besides contributing positively to the improvement of the living standards of the local population.

FIGURE 24 - SEA ROUTES OF THE BARCARENA PORT



Source: CDO, 2012.

The geographical configuration and the logistics structure of the state reveal that Pará's territory is divided into two major logistical "axes": the East axis and the West axis (Map 19).

MAP 19 - LOGISTICAL WEST AND EAST AXES OF PARÁ.

Source: SEICOM, 2012.

The East axis, which is more developed, covers the integration regions: Metropolitana (RMB), Guamá, Tocantins, Rio Capim, Lago de Tucuruí, Carajás and Araguaia. In this axis, it is worth highlighting the major projects of the Carajás Mineral Province, the steel-metallurgical projects of Paraupebas and Marabá, the kaolin and bauxite extraction plants in Ipixuna and Paragominas, the industries of material for construction, red ceramic and cement, of Northeast Pará and the metallurgical park, of Barcarena.

The West axis, less developed, includes the regions of integration of Tapajós and Baixo Amazonas, where gold and gems stand out in the municipalities of Itaituba, Jacareacanga and Novo Progresso, cement, in Itaituba, and bauxite in the municipalities of Juruti, Oriximiná and Terra Santa. The horizontal integration between the two axes is performed by the waterway of the Amazon River, where large ships carry large loads of bauxite in Oriximiná/Barcarena direction.

And with respect to the main logistical modes in the East axis, the Carajás/São Luís Railway is of particular importance, because it transports the mineral production of Vale to the Port of Ponta da Madeira and Itaqui, in Maranhão. The startup of mine S11D required the duplication of this railroad. We emphasize that the use of this mode is an exclusive prerogative of Vale, and this seriously undermines the viability of projects that could be developed by other companies, along the region crossed by the railroad. Thus, breaking the monopoly of the use of this form of transport is a prerequisite for the expansion and consolidation of mineral supply chains in East and

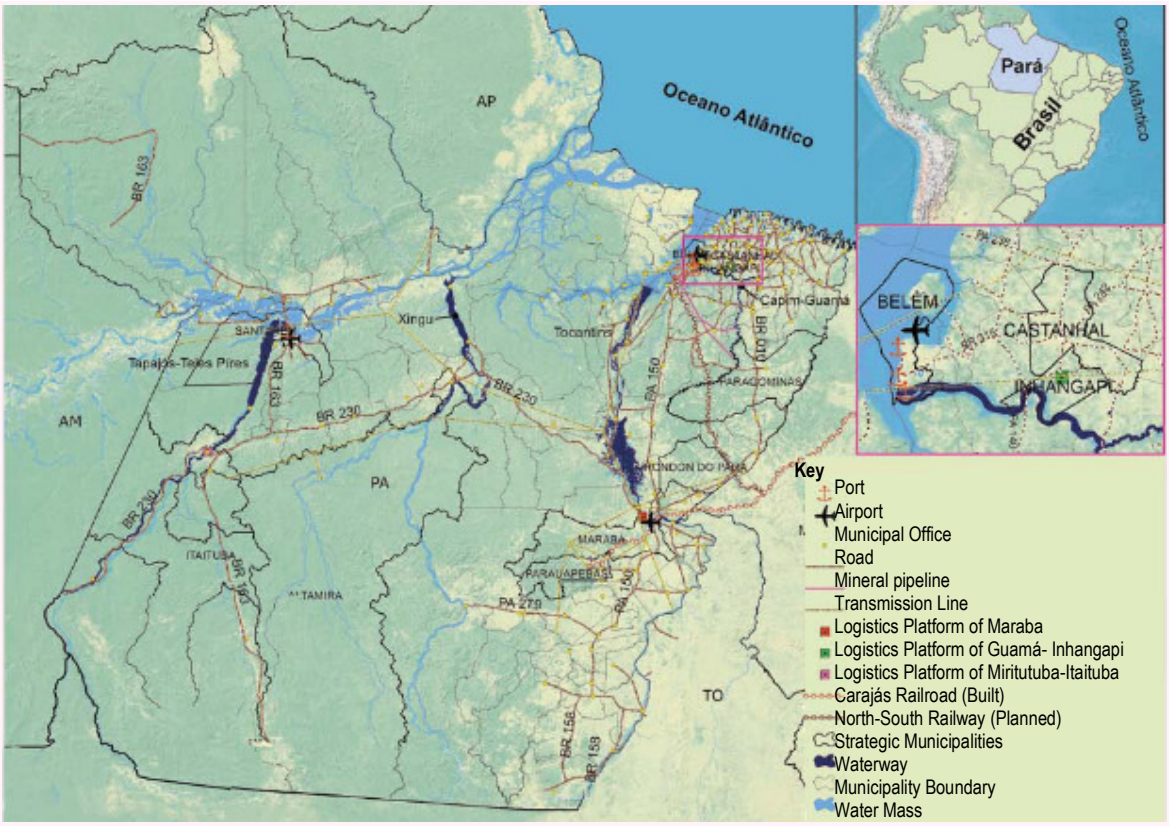
Southeast of Pará.

Another crucial railroad to the state's development is the continuation of Railroad 151 - North-south, linking the towns of Barcarena/Pará to Açailândia/Maranhã and which will feature a rail spur to the future *Hub Port* Espadarte in the municipality of Curuçá. This route will allow terrestrial integration, for loads of large volume and weight between Carajas, the metallurgical park and Port Vila de Conde, in Barcarena. The construction of two spurs will allow the connection of this railway with the bauxite extraction plants in the municipalities of Rondon do Pará and Paragominas, ensuring the provision of services to the Votorantim and Norks Hydro projects, respectively. This will have a strong impact on the creation of an environment conducive to attracting new businesses and vendors.

Other highlights are the highways BR's-230 (Trans-amazon), 010 (Belém-Brasília), 316, 155 (Redenção-Marabá), 158 (Redenção - Santana do Araguaia) and 222 (Marabá - D.Elizeu), in addition to the PAs - 150 (Mojú - Redenção) and 279 (SF Xingu - Xinguara), linking the major towns of eastern Pará with the rest of Brazil. The BR-316 highway links the RMB to the producing areas of inputs and goods for the construction industry in the Northeast of Pará. BR-010 connects the major bases for the extraction of kaolin and bauxite in the municipalities of Ipixuna and Paragominas. The East axis has, as the main roads, PA-150 and BR-155 highways, linking the RMB to the Carajás Mineral Province and the future steel and metal-mechanic complexes.

Another key project for mineral developments in Pará is the implementation of the production of phosphate fertilizers in São Félix do Xingu, whose access will be provided through the municipality of Santana do Araguaia, partially interconnected through the BR-155 highway.

MAP 20 - LARGE WORKS OF LOGISTICS INFRASTRUCTURE IN PARÁ.



Source: SEICOM, 2012.

As for port projects, we highlight:

- The expansion of the Vila do Conde terminal, which is critical to the alumina production expansion projects and deployment of an aluminum artifact production complex in the Industrial District and in the Barcarena ZPE;
- The effective deployment of the largest Logistical, Industrial and Naval Port Complex *(Hub Port)* in South and Latin America, in the municipality of Curuçá, in the Salgado region, 120 km from Belém, also important to the economy of the region and the country. This terminal will allow overcoming the physical and operational limitations of the Vila do Conde Port;
- Another key piece to the regional economy is the implementation of the Tocantins Waterway in the Marabá/ Barcarena direction, which is currently prevented by the existence of a large block of rock in the bed of the Tocantins River, known as "Pedral do Lourenço". The overthrow of such rock is essential to enable the navigability of the waterway and ensure the transport of the mineral, metalworking and farming production of Southeastern Pará and Mato Grosso regions towards the port terminals of Barcarena and Curuçá.

As for the so-called West axis, it is worth highlighting the importance of the completion of the paving of the BR-163 highway, which will enable integration of the Brazilian Midwest to Southwest Pará. This will serve mainly as an export route of agricultural *commodities* from the Midwest to the overseas market through the Port Complex of Miritituba in Itaituba, and through the Port of Santarém and loads of Manaus Free Zone, with a view to supplying the domestic market. It will also facilitate the effective ordering of the production of gems and precious metals in the region, enabling the organization of informal mining cooperatives and small mining cooperatives that operate in this region. The completion of this highway will represent an exponential increase in the movement and expansion of human occupation of this territory. An EVETEA (Estudo de Viabilidade Técnica e Ambiental = Technical and Environmental Feasibility Study) is also being carried out for the Ferronorte trunk rail, which will connect the cities of Cuiabá (Mato Grosso State) and Santarém (Pará State), in parallel with the BR-163 highway route.

Doing the horizontal interconnection in the west/east direction of the state, the Madeira-Amazonas River waterway is navigable, but it depends on the construction of a network of waterway terminals, as well as on more modern and safer vessels to transport cargo and passengers. Another important waterway is the Teles Pires-Tapajós,0 which is the best alternative for the transport of grain from the Brazilian Midwest through the Brazilian Northern Arc [45] . Besides the modernization of the waterway network, the state also needs to ensure the modernization and expansion of the airport network, which now has major terminals in Belém, Santarém, Marabá, Carajás, Altamira and Itaituba. The first four are able to receive large aircraft.

4.6 COST OF ENERGY

To contribute effectively to the development of Pará, the mining industry needs to be competitive. Among the domestic production costs, besides the supporting infrastructure, qualified staff and productivity of labor, there is the cost of energy, as one of the critical factors and, to some extent, a barrier to the vertical integration process and the attraction of new investments. In this sense, it is an item that must be prioritized, particularly with regard to the area of innovation in energy efficiency programs. This is of particular interest to the aluminum industry, considering downstream investments, such as cables for energy and manufacturing of tools, with ample scope for expansion of the chain. Therefore, the issue of energy today constitutes a great challenge (threat) for the growth of the industrial chain in the state.

The 2012 sustainability report of ALBRAS [46] highlights that:

> "... the cost of electricity, derived from the contract with Eletronorte in 2004, has been rising on an almost exponential scale, making, not only ALBRAS but also ALUMAR in the state of Maranhão, increasingly uncompetitive in the international market, putting at risk the very existence of the aluminum industry in Brazil. "

45 However, these new hydroelectric projects for the Amazon do not include the locks, so the history repeats itself one more time.
46 Available via internet (www.albras.net).

According to these representatives of the business sector, among other political and economic players, the cost of electricity is an important barrier for the expansion of mineral processing projects in the state. To produce one ton of primary aluminum, the cost of electricity reaches 46% of the total, being considered the largest input to obtain the product.

The current level of the cost of energy causes not only aluminum, but also other electricity-intensive products, to be uncompetitive in relation to the world market. In other projects, in which the energy required depends on the heat generation, there are prospects of cost reduction through alternative sources, such as gas (LNG).

Although electricity has fallen by 20% between December and January/2013, the cost to the Brazilian industry increased and, in the balance of the period up to November 2013, this decrease was reduced to 12.1% because of adjustments made by the distribution companies and activation of the thermal power plants (FIRJAN 2013). According to the industry, the price has not reached the desired level.

Therefore, in addition to aluminum, transformation processes, such as copper plates and others that are hostages of high electricity usage, have yet to establish a strategy for reducing the cost, including direct participation in investments in power generation. And a design depends on a broad cooperative action among all stakeholders and the company. Government, public and private entities and research institutions.

4.7 POLICIES IN FAVOR OF THE AGGLOMERATION ECONOMIES

The real prospect of vertical integration and consolidation of the mineral production chains in the state, preferably through productive agglomerations are constraints that influence the future scenario and that have a high degree of influence. In this regard, the steel sector gains prominence, represented by SINOBRAS (Box I) with opportunities to leverage new investments downstream. However, the continued implementation of ALPA (Box III) would be highly impactful and strategic, because ALPA, in partnership with ALINE (joint investment of Vale and Aços Cearense), would make a rolling mill for the production of hot and cold rolled coils.

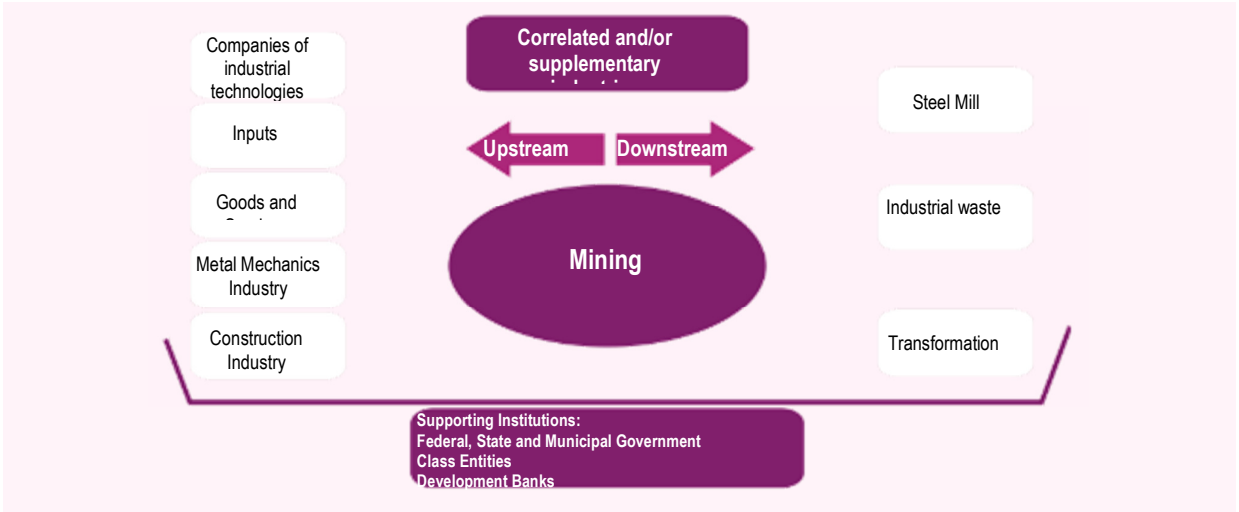
IMAGE 21 - MANUFACTURING OF FLAT STEEL (STEEL PLATES), AS IT HAD BEEN PLANNED FOR ALPA IN MARABÁ.
SOURCE: VALOR NEWSPAPER.

Such projects could lead to the establishment of service centers for preparation of materials for use in construction, mechanical and naval metal industries, among others, with the possibility of promoting the integration of the Industrial Districts in the North of the country and generating increasing demands for metal products .

These activities would favor the expansion of industrial clusters in the vicinity of the ore extraction and processing projects, with the potential to generate economic externalities, better quality jobs, specialties, remuneration and policies to improve the sustainability and competitiveness of enterprises, favored by cooperation among governments, associations and educational institutions. These clusters would also include related industries, trade and services companies that would extend the benefits and indicators of employment and income internalization (Figure 25).

IMAGE 22 - MANUFACTURE OF STEEL PLATES.
SOURCE: VALOR NEWSPAPER.

FIGURE 25 - BUSINESS ENVIRONMENT WITH THE MINING INDUSTRY AS AN INDUCER, TOGETHER WITH THE PLAYERS THAT CAN COOPERATE TO FAVOR THE INTEGRATION AND ECONOMIC EXTERNALITIES.



Source: SEICOM, 2012.

Figure 25 illustrates this model, with the mineral industry in the center, suppliers of goods and services upstream, the steelmakers and other segments of transformation, including industries that use waste as inputs, from a perspective of industrial ecology, [47] downstream. In the horizontal chain, we find the related or complementary industries that, although not directly involved in the vertical integration, share technologies, customers and suppliers, contributing to the economies of scale and specialization. Government agencies, professional associations, class entities, public and private development banks, in addition to educational and research institutions, also participate in this arrangement. The cooperation can occur between the mining industry, which is the inducer, directly with the various players in the vicinity or among the players of the vicinity. Table 13 describes the process of interaction between the players and gives a better understanding of the cooperation, which is one of the key variables for business expansion and maximization of benefits arising from the mineral industry.

To consolidate the major mineral chains in general (iron, copper and bauxite) and for the coming of national and global manufacturers of metallic products, light metal alloys and other items, a favorable business environment must be created, which means, first, a responsible and efficient state bureaucracy structure, in addition to the offer of infrastructure, clear regulation rules, available of areas in the industrial districts, besides the effective implementation of the Free Export Zone (ZPE), in Barcarena, among other municipalities .

In addition, modern policies to encourage the production, along with the support of the federal and municipal governments, are essential supplements to this process. We emphasize that the construction of an environment for innovation is already happening with the policies of the state government and the projects of the Science and Technology Parks (PCTs) that are planned for the State Development Complexes.

Better training of the managerial staff and local managers will also be a prerequisite for the desirable future. This requires the adoption of modern technologies, in the management of businesses, in service contracts, in the work with financial and market indicators, which requires a policy strongly grounded on a knowledge base. In this new scenario, productivity/quality and human resources will be required to give sustainability to the projects. The cooperative work to improve the business environment, having the government as its inductor, will be the unique advantage in the new scenario.

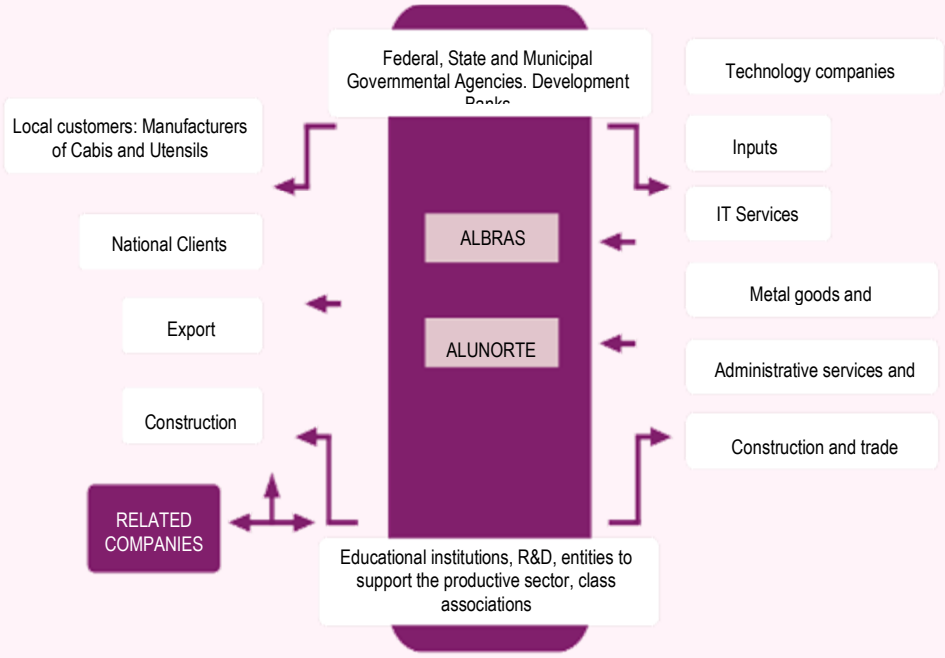
47 Gameíro , J. Silva M. L. P. Aplicação do Conceito de Ecologia Industrial ao Sistema de Gestão Integrada: Vantagens e Melhorias Ambientais Associadas .Key Ele- ments for a Sustaínable World: Energy, Water and Climate Change. São Paulo - Brazil - May 20th-22nd - 2009 (available at http://www.advancesíncleanerpro- ductíon.net/second/fíles/sessoes/5b/3/J.%20Gameíro%20-%20Resumo%20Exp.pdf acessado em 30 de novembro de 2013)

TABLE 13 - COOPERATION MATRIX.							
COOPERATION MATRIX	**MINING INDUSTRY**	**RELATED INDUSTRIES**	**SUPPLIERS**	**CLASS ENTITIES**	**EDUCATIONAL INSTITUTIONS**	**GOVERNMENT**	**FINANCIAL INSTITUTIONS**
MINING INDUSTRIES	Share industrial technology companies, suppliers. Support training, technology and the establishment of chains.		Provide support in the access to credit, technological solutions, training, investment certification.	Business meetings, training courses, support to new investments, investment attraction.	Innovation, technology, vocational training. Partnership in technology parks.	Partnership due to the support to professional training, incentives to suppliers and innovation actions.	Access to supplier credit*, supporting studies.
RELATED INDUSTRIES							
SUPPLIERS	Supplies, technology solutions, integration with commerce and local service.		Partnerships and consortia and subcontracting.	Associations, business generation, formation of partnerships.	Integration due to the support to the innovation, technology, training and mining chains.	Integration of common interests between regional suppliers and companies.	Access to credit, financial products, support to innovation and new technologies.
CLASS ENTITIES	Support to the solution of delivery barriers, integration with suppliers, institutional support.		Support to management, training and the integration between suppliers, institutional representation.	Integration of common interests between regional suppliers and companies.	Participation via Corporate Universities. Joint training programs	Integration of common interests between regional suppliers and companies.	Access to credit and financial products, information on associates and the business.
EDUCATIONAL INSTITUTIONS	Professional training, research, technology and innovation. Services through technological parks.			Partnerships for training and management of businesses.	Integration to support the demands for professional training, technology and innovation.	Partnership in professional training, technology and innovation activities	Joint studies on the behavior of industrial chains.
GOVERNMENT	Attraction of new investments, safety, legislation, support to vocational training, innovation, technology, tax incentives, certification and infrastructure necessary to improve competitiveness.			Integration of common interests between regional suppliers and companies.	Partnership in professional training, technology and innovation activities	Joint actions to improve the business environment and competitiveness	Partnership in technical studies and development support programs.
FINANCIAL INSTITUTIONS	Financial products, insurance, access to credit from suppliers, technical studies, support to the formation of chains.		Access to credit, financial products, support to innovation and new technologies	Partnership to support the associates, offers of financial products and technical studies.	Support in technical studies on the potential of the production chains.	Management of development support programs, technical studies in support of new technologies	Integration and partnerships to expand the supply of credit, financing programs and products for development.

Prepared by: SEICOM, 2013.

BOX IV – ALUMINIUM AGGLOMERATE.

In Pará state, the aluminum chain is the one that stands out the most for the highest degree of vertical integration and interaction with other actors and economic sectors. This particular characteristic creates an environment conducive to the consolidation of a Local Productive Arrangement (APL) for mining and metallurgy, involving the municipalities of Barcarena, Abaetetuba, Castanhal, Ananindeua and Belém. This potential APL has a center radial characteristic, which reflects the existence of one or more large "anchor companies" in the regional economy, with suppliers and activities revolving around these companies; pronounced hierarchization in inter-firm relationships, whose dynamism depends on the position that the anchor company occupies in the domestic and international markets. In this case, ALBRAS and HYDRO ALUNORTE act as anchors of an APL that involves customers, suppliers, companies that carry out activities directly linked to the production of raw materials and metal products, organizations involved in a wide range of related sectors, governmental and non-governmental institutions, as well as universities and research centers, as follows



On the supply side, HYDRO ALUNORTE is the largest alumina refinery in the world - about 85% of its production is exported; the remaining 15% fuel supply, via trucks, ALBRAS, its neighbor in the industrial park of Barcarena. ALBRAS, in turn, exports 93% of its production. In 2012, HYDRO ALUNORTE and ALBRA together accounted for 88% of the export value of Barcarena and 13% of the value of exports from Pará. ALBRAS stands out as one of the largest 'primary aluminum' processing companies in Brazil and, although most of the aluminum is destined to other countries through the port of Vila do Conde, there are some local industries that are served by the company.

TABLE 14 - LOCAL CUSTOMERS OF ALBRAS.

COMPANY	AMOUNT OF ALUMINUM DEMANDED	MANUFACTURED PRODUCT	LOCATION	NUMBER OF EMPLOYEES	MARKET (DESTINATION OF SALES)
ALUBAR Metals	28,5	Cables for power transmission	Barcarena	320	National and International
ALUPAN Indústria e Comércio Ltda.	1,76	Housewares	Castanhal	45	Regional and other states
PISA -Pará Industrial S/A	1,44	Housewares and discs	Belém	30	Regional and other states

Source: Valor Newspaper (July/12/2012). Prepared by SEICOM.

BOX V - INNOVATION IN THE MINING AND MINERAL PROCESSING BUSINESS ENVIRONMENT.

The *cases* of innovation happening in the business environment, made possible by ore extraction and processing projects in the state of Pará, are still poorly known and disclosed, probably for lack of an appropriate strategy for recording, monitoring and disseminating such projects.

The geographical proximity between large projects and local businesses favor the formal and informal contacts that allow early resolution of supply barriers, stimulating innovation in some cases, be it in management, in processes or in products, by local suppliers.

Another little-noticed fact is the presence of a significant number of companies that own industrial technologies that are usually patented and which are indispensable in the production process, be it in mineral extraction or in mineral processing, and which, after implementing the large projects, continue to act in Pará without any greater integration with the education and research institutions in the state.

The table below presents examples of the most relevant cases of innovation occurred in Pará based on this interaction.

TABLE 15 - MOST RELEVANT "CASES" OF INNOVATIONS OCCURRED IN THE STATE OF PARÁ.

LOCAL SUPPLIER	COMPANY	LOCAL	INNOVATION
Oyamota	ALBRAS	Barcarena	Oven cleaning equipment
Consórcio Metal Mecânico *	Vale - Sossego Project	Canaã	Joint management of the electromechanical assembly of the project
Tecnosolda	Alcoa	Juruti	Underwater welding process at the ore shipment port
	Norsk Hydro	Paragominas	Maintenance of pipeline with live line
Reciclei	Vale Carajás	Parauapebas	Manufacture of bumpers with rubber waste
Integral	MGS Sandivig**	Parauapebas	Serial manufacture of structures for ore transportation
Retífica Souza	Mineração Rio do Norte	Santarém/ Oriximiná	Technology for machining of railway parts

*The metalworking consortium brought together five large companies of the sector (Estaleiro Maguary, Integral, Imaço, MIB and Oyamota) all from Pará and that, at that moment, needed that stimulus to grow and position them in the market.

**One of the industrial technology companies, specializing in the transportation of solid grains. Source: REDES/FIEPA.

IMAGE 23 - UNDERWATER WELDING IN JURUTI.
SOURCE: TECNOSOLDA.

IMAGE 24 - SERIAL PRODUCTION OF STRUCTURES FOR CONVEYOR BELTS BY THE PARTNER THAT OWNS THE TECHNOLOGY + LOCAL SUPPLIER IN PARAUAPEBAS.
SOURCE: SEICOM, 2011.

Like this one, there are many other innovative actions being implemented. This reveals a clear need for the integration among governmental institutions, class entities and educational institutions to enlarge the capture and dissemination of these cases, with the purpose of consolidating and developing this kind of expertise in the State of Pará.

4.8 POLICY ON SCIENCE, TECHNOLOGY AND INNOVATION FOR MINING

The Policy on Science, Technology and Innovation (ST&I) for mining in the state of Pará proved to be one variable that depended a lot on the other variables that defined the system. In Pará, this policy aims to promote sustainable development. Therefore, it shall propose measures to reduce the environmental impacts generated by the extraction, beneficiation and processing of mineral resources, as well as for the development of sustainable productive activities, capable of ensuring social and economic progress after exhaustion of the reserves.

The ST&I policy shall also:

- Propose strategies for generation and dissemination of technological innovations, in order to increase the value of the mineral production through vertical integration and consolidation of chains and clusters, based on the provision of products and services of superior quality and higher technology.
- Submit and implement proposals for the qualification of human resources, to ensure greater competitiveness for the enterprises, especially micro and small companies (MSEs) members of networks of suppliers of goods and services to the mining and mineral processing industries.
- Enable the enhancement of employment and income indicators, enabling the creation of jobs for skilled labor and generation of job offers for technicians and skilled professionals, providing opportunities to reduce poverty and inequality, and contributing to the improvement of social status indicators.

In order to formulate proposals and develop strategies for implementation of the STI policy for mining, the State must have the support of a set of scientific research and higher education organizations, which have the task of training human resources for research and development of technological innovations, in line with the objectives set out in this PEM. Thus, this network of ST&I institutions shall maintain an integrated routine activity for the valuation of mineral assets and the promotion of sustainable development.

In the whole state, besides the universities, there are few entities dedicated to the theme. It is worth highlighting the ITV (Technology Institute of Vale), created by the mining company Vale and dedicated to scientific research and postgraduate educational activities. Since 2013, ITV offers a vocational master's degree with two lines of research: Sustainability in Mining and Sustainability of Vegetable Resources. The State is also implementing the SENAI Institute for Innovation in Mineral Technology (ISI-TM) [48], which will have the purpose of building the capacity of Brazilian industries in the mining sector for competitiveness, through technological innovation. This institute aims to be a reference in advanced research on mineral processing engineering in Brazil. Pará's ISI will focus on Exploration, Mining, Mineral Processing and Metallurgy; it will be installed in the Park of Science and Technology of Guamá (PCT Guama), on the campus of the Federal University of Pará (UFPA), in the city of Belém/Pará.

The process of adding value to the mining industry necessarily requires a strong ST&I policy. To this end, this PEM proposes to extend the operation of the Center for Mineral Technology (CETEM) [49] to Pará, which can be done by means of an Institute of Mineral Technology of Pará. The mission of such Institute will be to generate and disseminate technological innovations to add value to the research, extraction and mineral processing activities in the state of Pará. The purpose, with the implementation of this institute, is to achieve the following objectives:

- Developing Competitive Intelligence and Knowledge Management tools in the mining sector.

48The National Service of Industrial Learning (SENAI), in conjunction with the National Confederation of Industry - CNI, has structure, since 2013, a network of 23 Innovation Institutes, aiming to promote the strengthening of the Brazilian industry through technology innovation. The SENAI Innovation Institutes (ISIS) are expected to integrate a national network of research and innovation, and each unit will have a specific field of operation.
49CETEM (http://www.cetem.gov.br/) Is a scientific research institution that operates in the field of mineral technological development; it was created in 1978 and it is linked to the Ministry of Science, Technology and Innovation (MCTI).

- Perform actions to encourage the production and dissemination of scientific and technological knowledge.
- Implement effective communication channels with society.
- Promote vertical integration and competitiveness of mineral supply chains, as well as strategies for supply chains addenda.
- Encourage the development of mineral-based APLs.
- Promote the social and productive organization of small-scale mining in the 'social minerals', 'gems' and 'precious metals' sectors.
- Implement energy efficiency programs in the mining industry.
- Develop tools and techniques for reclamation of degraded areas and reduction of environmental impacts on mining.

4.9 NEW REGULATORY FRAMEWORK OF MINING

Although the foundations of the minerals market signaled good prospects, the new regulatory framework is a source of uncertainty, because it may generate alternative scenarios (Box VI), which complicates the analysis of royalty trends, access to mining titles, the regulatory system and all other items that are being fully discussed. This may change some projections and require revisions of this PEM.

In principle, positively, it is expected that the new legislation may encourage new investments, attracting *private equity* funds, which may be used to meet the needs of additional resources for the expansion of the mineral production in the same way that other mining countries do. There are also issues related to the reduction of the time of the mineral exploration concession and the auctioning for minerals that are considered strategic, which will not have a significant and negative impact on the attraction of new investments to Brazil.

There is also the expectation of suspension of mineral rights in the case of exploration projects, or which are not implemented within five years. This fact opens space for new players (Chinese and South Korean companies showing interest in investing in the country).

It is important to note that the proposal to substitute the new Mineral Framework presents the possibility of exemptions and tax incentives to companies that use their waste appropriately[50].

4.10. TAX AND FISCAL POLICIES

Among the tax benefits of mining, the State is in charge of imposing the ICMS, TFRM and the benefit of the CFEM portions (23%). However, as described in item 1.7, the ICMS benefit is minimal, because of the "Law Kandir", since the mineral production of Pará is primarily sent to exports. It is worth noting that, in addition to the payment of ICMS for basic and semi-manufactured products, the Act gives credits for ICMS that is paid on the inputs used in the production process. Thus, in order to prevent the accumulation of tax credits, the Government of Pará enacted State Law number 6307 of 17/July/2000, which gives special tax treatment to the aluminum chain. This measure caused the **18% nominal load** of ICMS to be reduced to a **effective rate of just over 2%.**

With respect to the CFEM, which is critical to the finances of mining cities that benefit from 65% of what is paid, there is the expectation that the new framework of mining will allow the transparent management of CFEM in order to contribute more effectively to strengthen the objectives the mining policy.

It is essential to ensure that mining will promote the development of the region, without damaging the competitiveness of the mining industry. CFEM, which in Brazil primarily benefits the producing municipality, is a very important element for the acceptance of the mining activity by the local government and, unlike the case in many Latin American countries where communities live element in constant conflict with mining, it has the potential to induce actions for good social interaction.

50 http://www.mme.gov.br/sgm/menu/Novo_Marco_da_Mineracao.html

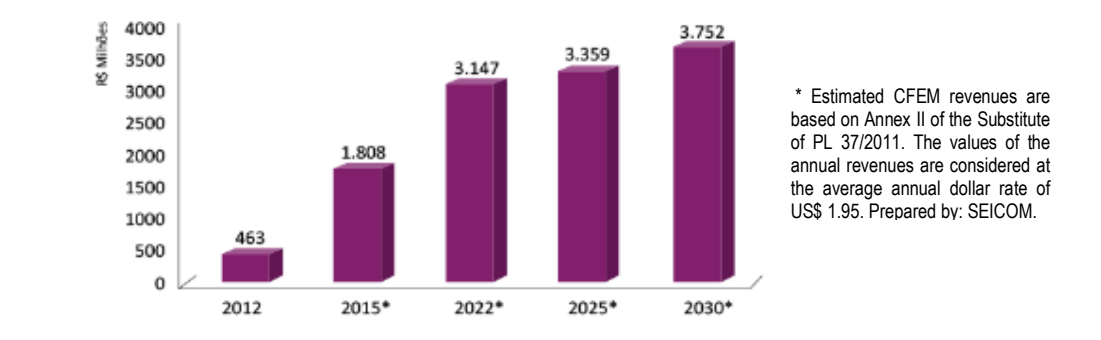
BOX VI - PROJECTION OF CFEM REVENUES AFTER THE SUBSTITUION OF THE NEW REGULATORY FRAMEWORK OF MINING.

Pará is looking forward to the changes in the criteria for calculating the CFEM, which will come together with the new Mineral Regulatory Framework, which has been under discussion in the House of Representatives, since July 2013. Although it is still in a preliminary stage and still subject to changes, the Substitute of PL 37/2011 reaffirms that gross sales are the basis of calculation, only allowing the deduction of taxes on the sale and, in its Annex II, it presents the proposed six rate layers, including the possibility of one mineral having different rates, depending on its final use:

MINERAL GOOD	RATE
Diamond and gold - when extracted by informal mining - and other precious stones	0.2%
Mineral water, construction aggregates (sand, crushed stone, sand, clay), agrominerals (limestone for amendments, potassium and phosphorus)	0.5%
Tungsten	1.0%
Mineral coal	1.5%
Bauxite, limestone, manganese, kaolin and niobium	2.0%
Diamond, gold, iron, graphite, rare earth and other substances.	4.0%

Based on this normative and considering the projected quantity and price estimates from the announcement of investment by firms and their expectations of future prices, we projected the CFEM revenues for the state of CFEM, by substance and by beneficiary.

CHART 58 - ESTIMATE OF CFEM REVENUES IN PARÁ, 2015-2030*.



At current values, the CFEM proceeds would be multiplied by eight, going from R$ 463 million in 2012 to R$ 3.7 billion in 2030. Iron ore is and will still be the main mineral good in the State. However, its relative share will tend to decline, from 88% in 2012 to 56% in 2030, with the development of other mines, such as nickel and copper, provided that the planned investments are made, contributing to the diversification of the mineral production of the state.

CHART 59 - PARTICIPATION OF THE CFEM REVENUES BY SUBSTANCE IN PARÁ, 2015 – 2030*.

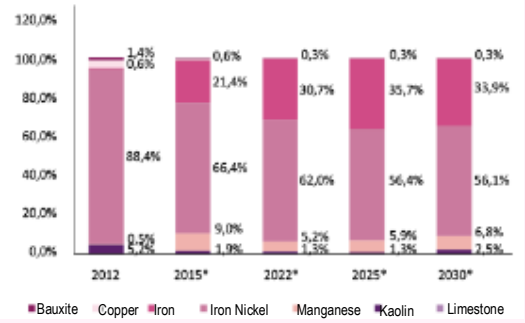
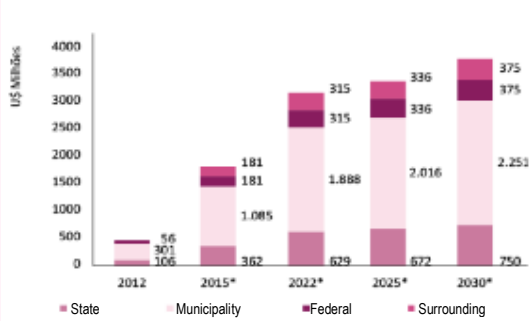


CHART 60 - ESTIMATED CFEM REVENUES BY QUOTA PART, 2015-2030 *.



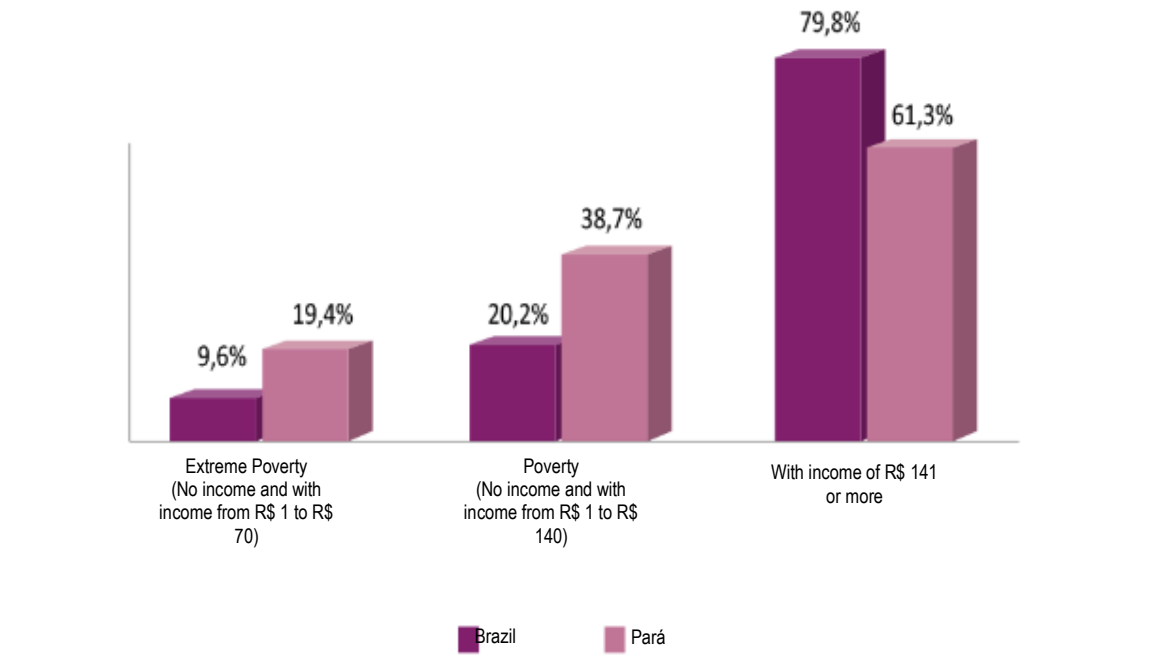
* Same as the previous chart

An important novelty brought by the Substitute law is the extension of the CFEM benefits to the non-mining municipalities in the vicinity, which are impacted by the mining activity, but which are not entitled to any CFEM proceeds under the current law. Under the new proposal, they will receive 10% of the amount collected. It is estimated that in 2030, these municipalities will receive something around R$ 375 million. Thus, in 2012, 55 municipalities in Pará benefited from the CFEM proceeds, but after the new rule, there will be at least 77 cities benefited.

4.11 SOCIAL DIMENSION

Unlike the other states of the Federation, Pará has a high social liability, since more than one third of its population is below the poverty line, which is twice the national average which, in turn, is already quite high (Chart 61). In absolute numbers, around 1.5 million people live below the poverty line, which represents 19.4% of the total population.

CHART 61 - BRAZIL AND PARÁ - POPULATION BY INCOME STATUS.



Source: IBGE - 2010 Census.

With regard to the social issues, SEICOM has made efforts to bring business organizations that settle in the state closer to the management of existing social policies in Pará, by presenting actions, plans and projects in the areas of education, health, safety, culture, among others. State representatives believe that when different players, especially economic players know and reinforce public policies, there are mutual gains and real possibilities of success.

Along with this great social liability, Pará has enviable environmental assets, because around 60% of the land area of the state is preserved spaces that are specially protected. Despite the importance of this global ecosystem, this condition imposes restrictions on the use and occupation of the territory, requires the effective incorporation of this context into both public and corporate policies.

In the case of indigenous lands, which make up a quarter of the land area of the state, their use is still part of the field of critical uncertainties, since there is no legal basis for its use in the mining activities. There are also vast parts of the territory (around 20%) composed of sustainable use areas, which are home to thousands of families living off of forest resources. The coexistence of this traditional population with mining activities is not always stress-free, as illustrated by the case of Juruti (Box VII).

BOX VII - JURUTI - ALCOA.

Large mining projects in Pará are already part of the landscape of many municipalities, and are the focus of debates about land seizures by large enterprises, and their interference with the local way of production. Within this scenario, we highlight the municipality of Juruti, which is the base for the 'Juriti Bauxite Project" of ALCOA, with an estimated reserve of 700 million tons, whose extraction will occur in three plateaus: Capiranga, Guaraná and Mauari.

The mine being explored is located in Juruti Velho, more precisely in the area of the Agricultural-Extractivist Settlement Program (PAE in Portuguese) of Juruti Velho, with a population living mainly off of traditional fishing and subsistence agriculture. However, the community of Velho Juruti invoked the tradition of their ancestors Muirapinimas and Mundurukus and were recognized by INCRA/Santarém as legitimate owners of the land rights, by signing with the INCRA the Concession Agreement of Real Right of Use (CCDRU) and then they proceeded to negotiate directly with ALCOA to receive the money referring to the right of use, which is now a result of CCDRU, and this is an unprecedented fact in the history of large projects in the Amazon. In addition to this recognition, they are entitled to the payment of damages and the compensation provided in the environmental licensing.

The history of large mining projects in Pará will start to be written differently after the Juruti case, because the affected population becomes the main protagonist of this story, when they organize themselves and liase with other players.

4.12 ENVIRONMENT - SUSTAINABILITY DIMENSION

The environment is one of the main variables that have a lot of power of influence on the dynamics of the mineral sector, because of the rules it imposes on business activities and also for their high level of dependence, since the conditions of physical and biotic resources, beyond the man-made ones, are the result of the economic growth model and the way productive activities use natural attributes and the territory in its entirety. Therefore, the environmental dimension is one of the main determinants of the future development of Pará, from its mineral base.

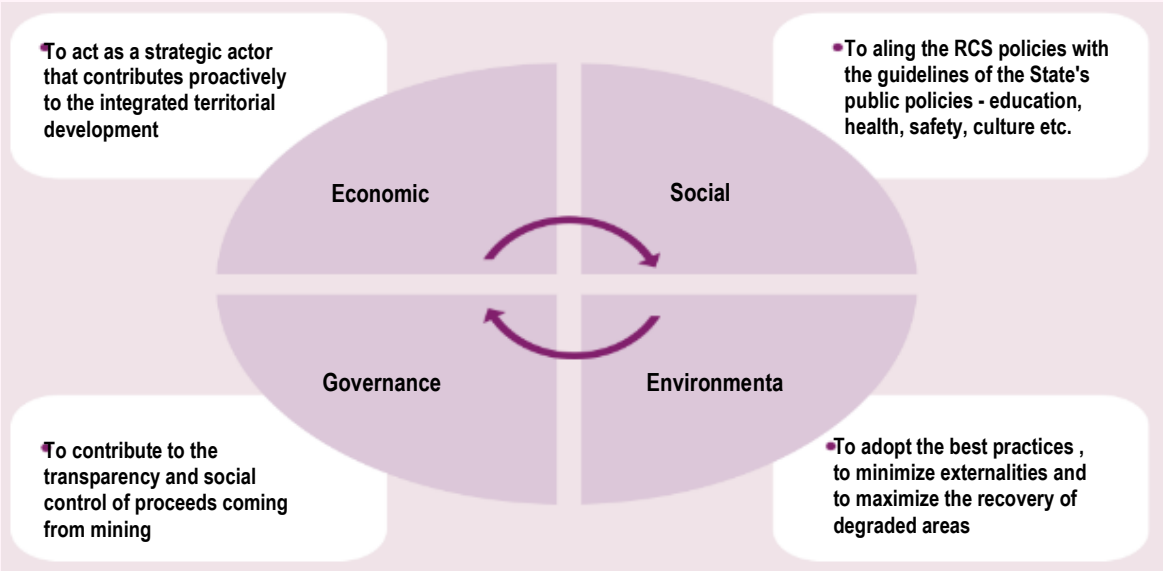
More than the physical environment, it is necessary to consider, in this dimension, a broader spectrum, which has to do with sustainability. This comes back to what was established by Rio +20 twenty-five years after it was proposed by launching the challenge of sustainable development goals as the goals of the millennium (2000-2015) [51] **.**

In this context, the Government of Pará explicitly assumed the goal of zero net deforestation by 2020 [52] besides the relentless combat to poverty and inequality in the state. Considering that approximately 60% of the state territory is composed of specially protected areas, in addition to poverty and inequality, this goal implies the need for improvements, both in private investment, which should be more sustainable, and in public policies in general, which should govern the ways to overcome the challenges.

The four classic dimensions of sustainability are illustrated in Figure 26, which highlights the main recommendations in order for the mineral industry to be a major protagonist of regional sustainability.

51 Reference to sustainable development goals
52 Green Cities Program - www.municipiosverdes.com.br

FIGURE 26 - CLASSIC DIMENSIONS OF SUSTAINABILITY.



Source: SEICOM, 2013.

However, one of the most critical issues that profoundly affects the dynamics of mining is environmental licensing, due to a number of complex issues that hinder both the development of studies and procedures required by the business sector, and the assessment by the licensing body, such as: low quality of environmental studies, complexity of rules that bind and hinder the segmented analysis, difficulty in understanding key issues of technical reviewers who, in turn, do not always have extensive knowledge about the various dimensions that mining cover, among others [53]. Box VIII presents some highlights on the environmental licensing policy of Pará.

BOX VIII - ISSUES GUIDING THE ENVIRONMENTAL LICENSING OR PERMIT FOR MINING.

The proposition that environmental licensing is an instrument of the National Environmental Policy (Law No. 6.938/1981) shows its importance to assess the potential environmental impacts arising from the use of environmental resources, and when it brings together this instrument of Environmental Impact Assessment (EIA) for mining, it redoubles its importance, since it recognizes that the use of mineral resources has an impact on the environment as a whole.

CONAMA Resolution No. 237/1997 defines environmental licensing as an administrative procedure that evaluates the contents of the environmental studies for projects and activities that use environmental resources and that are effective or potentially polluting and, also, that cause environmental damage. This demonstrates that the overwhelming majority of enterprises and activities are obliged to environmental licensing, for besides those who are in Annex 1, the environmental agencies of the States, Federal District and Municipalities can and should complete the list, because of administrative competence common treated by art. 23 of the Federal Constitution of 1988.

53 See the SEICOM's initiative when it created the Working Group for Improving the Environmental License in manifacturing - GTAPLAM (http://seicom.pa.gov. br/sem-categoría/grupo-de-trabalho-para-aperfeícoamento-do-processo-de-licenciamento-ambiental-na-mineracao-gtaplam/)

Starting with the legal concept of degradation of environmental quality brought by art. 3 , Law No. 6.938/1981, which underlies the concept of environmental impact addressed by CONAMA Resolution No. 01/86, any activity within mining has environmental impacts, and the impacts from the entire mineral chain are relevant and must be handled carefully since mining is a risky activity and it is impossible to restore the resource. Thus, environmental and mining laws govern exactly what has to be required within the licensing for this type of activity.

The environmental license for the mining activity itself encompasses the external standards, especially when it involves the Prior Environmental Impact Study and Environmental Impact Assessment - EIA / RIMA, considering the significant impact that it has on the environment. By way of example, it is worth highlighting: the use of the Forest Code (Law No. 12.651/2012) due to the obligation of the legal reserve and restrictions on the use of APPs of the Law of the National Water Resources Policy (Law 9.433/1997), due to the necessity of granting water resources, of CONAMA Resolution that deals with the publications of the applications and receipt of environmental permits (no. 06/1986) of the Act that established the National System of Conservation Units (Law No. 9.985/2000) because of the environmental compensation, the Resolution that provides specially for the EIA / RIMA (No. 01/1986), of the resolution that provides for the public hearings (n ° 09/1987), Decree No. 6.640/08 that has as its object the protection of existing natural cavities in Brazil.

In the field of state law , we can cite Law No. 5.887/95 dealing with the State Environmental Policy, Law No. 5.887/94 that has, as its purpose, the popular participation in decisions related to the environment and Law number 5.793/94 on the Mining and Hydro Policy.

The combination of all these regulations and their enforcement is essential to the granting of the environmental license at the end of the proceedings.

Because of its importance, licensing, for being dynamic, must accompany mainly the needs of the society where it will have an impact will be generated because the presentation of compensation programs, under the laws, do not represent effective tools, especially when it comes to the socioeconomic impacts. Considering what defines Brazilian environmental legislation, political actors involved in environmental licensing processes have difficulties in dealing efficiently with impacts of socio-economic order and, accordingly, compensation provided by reason of the granting of the license does not actually offset the impacts on the social environment. In turn, the technical teams that are responsible for the assessment need strengthening, continuous interaction and capacity building, in order to improve the dynamics and the quality of the analyses and environmental studies, which also require on the part of the entrepreneur, good quality in such studies.

The license requires efficiency and quality, otherwise its main goal, environmental sustainability, will only be in academic books and speeches.

Box IX highlights an issue not explored in Brazilian mineral policy, but that is highlighted growing internationally, which is the mine closure (or decommissioning) and inserted in this issue, the role of financial guarantees. Certainly, on the horizon of this PEM, this issue will have increasing importance.

BOX IX - FINANCIAL GUARANTEE IN MINING PROJECTS - IRAN F. MACHADO *

Some developed nations have been concerned about the issue of abandoned mines since the late 1980s. In June 1991, the first laws on the issue of mine closure were enacted by the province of Ontario, Canada (Mackasey, 1992). Since then, there were similar laws in other Canadian provinces, apart from Australia, United States and other developed countries. The key point of the new legislation was to internalize the costs of environmental remediation of the mine site within the budget of the mining company that held the mining rights. In addition, a financial guarantee had to be deposited by the company prior to the opening of the mine. If the cash guarantee was not deposited, the government would not authorize the start of the mining project. This government initiative aimed to stop the expansion process of the environmental liabilities already measured in the late 1980s. Several instruments were accepted as financial collateral, namely:

- Irrevocable letter of credit (bank guarantees to the government under specific conditions)
- *Performance bond* (Insurer financially responsible for all claims up to a certain limit)
- *Cash trust fund* (Fund established by the company in a certain amount to cover the costs of rehabilitation)
- Insurance policy (including bonuses, accumulated cash and protection against exceeding the credit limit)
- Captive insurance company (a company owned by the insured to isolate the owner's risks)

Other institutions have recognized the legitimacy of the new legislation and have started to recommend it within the concept of best practices to be adopted by the mining industry (World Bank, 2008,2009 a, 2009 b and 2010; ICMM, 2005 and 2008). More recently, in a seminar held in Johannesburg, South Africa, Worrall et al (2008) addressed the issue of the environmental liabilities of Australia and other countries, as shown in the table below.

COUNTRY	NUMBER OF SITES	RELIABILITY OF INFORMATION
USA	600,000+	Precarious
Australia	30,433	Median
UK	11,700	Median
Canada	10,100	Good
South Africa	8,000	Median
Japan	5,500	Good
Sweden	1,000	Good
Rest of the world	Probably millions	very precarious

Note that no country in Latin America, including Brazil, is part of the group of countries presented in the Table above. This is a gap to be filled in the coming years, to the knowledge of the society in these countries. It is a measure of transparency that cannot be postponed indefinitely.

In Brazil, the environmental liability of mining, which has received more attention from the governments is that resulting from coal mining in southern Santa Catarina, which started in the late nineteenth century. The hydrographic network of the region was seriously affected, impairing the quality of life of the population residing there. More than ten years ago, "the Public Prosecution Office of the State of SC" sentence the coal companies to pay for the environmental liability worth 96 million dollars and stipulated a period of three years for the recovery of these areas, with the obligation to provide rehabilitation projects in six months, otherwise a fine of 1% or US$ 960,000 a month would be applied" (Nascimento et al., s / d). The schedule was not followed. More recently, it was reported that "the Court of Santa Catarina sentenced all companies to compensate for the environmental damage in the coalfield region and to recover the damaged areas. Of the more than six thousand hectares that the Court considered that had been compromised, about one third had been recovered or was in the process of recovery by the end of 2012. The deadline is 2020. " (Yano, 2013).

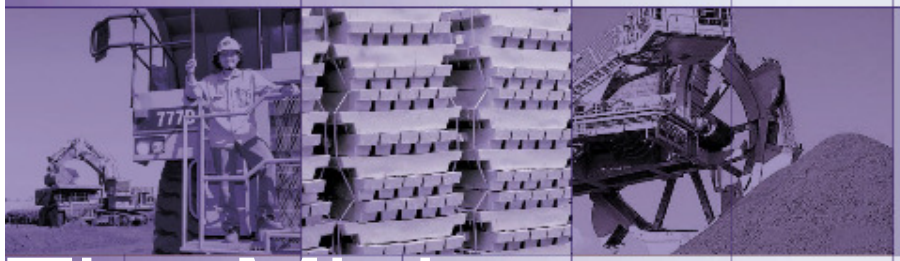
While mining in Pará is in full expansion, the state has recorded cases of closure of large mines such as the gold mine of Vale, Igarapé Bahia (1990-2002) and, as the Amazon region's icon, it is worth highlighting the closure of manganese mine in Amapa (1957-1997) which was not done free of trauma. In fact, a good process of mine closure requires good planning that occurs at the opening of the mine and the financial guarantees are the bridge for that.

* Consultant and Professor of Unicamp (SP) that voluntarily cooperated with this plan (SP).

In summary, the 13 variables presented integrate the major issues that determine the challenges and opportunities that the mining activity offers to the state of Pará We have seen that many of them are independent of the will of the state (dynamics of the global and national economy, competition in the international market etc..), while others can be changed (policies for agglomeration economies, ST&I, efficacy in environmental licensing, programs of qualification of manpower etc.). These issues are important to minimize the adversities and leverage the opportunities as well as to leverage the development process of the state on a sustainable basis, through its mining activity, in all its stages, from research to mineral processing .

5

CHAPTER



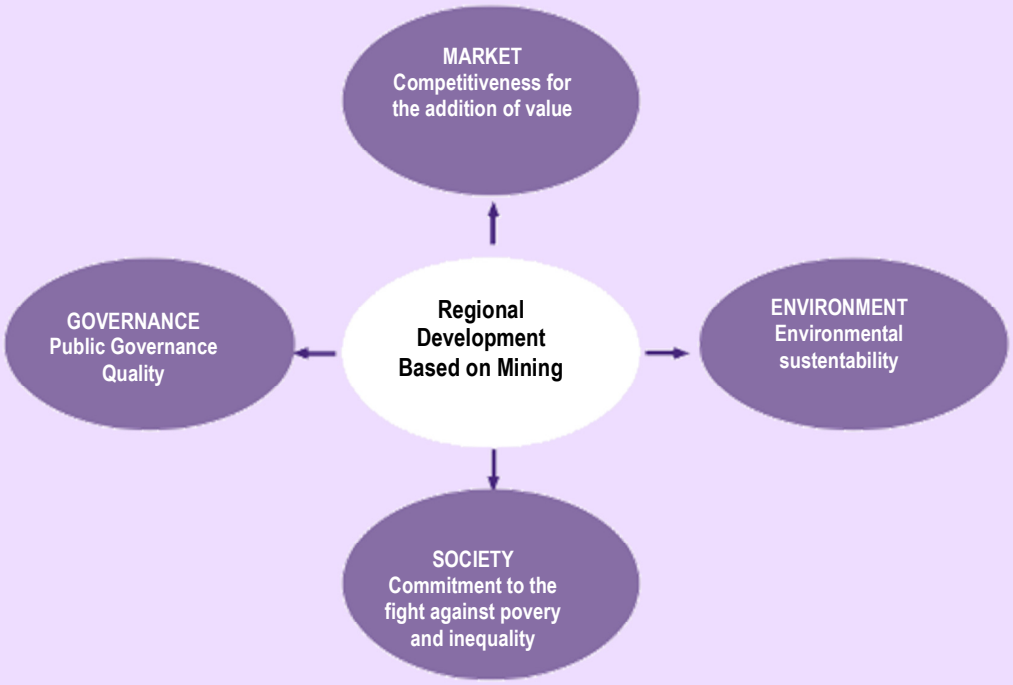
The Mining Plan

5.0 PLAN - GOALS, POLICIES, STRATEGIES AND ACTIONS

5.1 OBJECTIVES AND GUIDELINES

Thus, the main objective of PEM-2030 is to serve as a planning tool for good management of mineral resources, based on the sustainable use and on the addition of value to minerals and the territory, with the purpose of promoting competitiveness and combating poverty and inequality in Pará (Figure 27) .

FIGURE 27 - REGIONAL DEVELOPMENT BASED ON MINING



Source: SEICOM, 2013.

Three guidelines (three Cs) underpin the PEM-2030: **Consensus, Cooperation and Commitment.**

Consensus in order to obtain a minimal understanding of critical issues on complex issues, but for strategic regional development based on mining, through thematic forums or technical chambers.

Cooperation among public institutions (local, state and federal), private sector entities and civil societies to perform structural actions and projects that have, in mining, a platform for the development of the state.

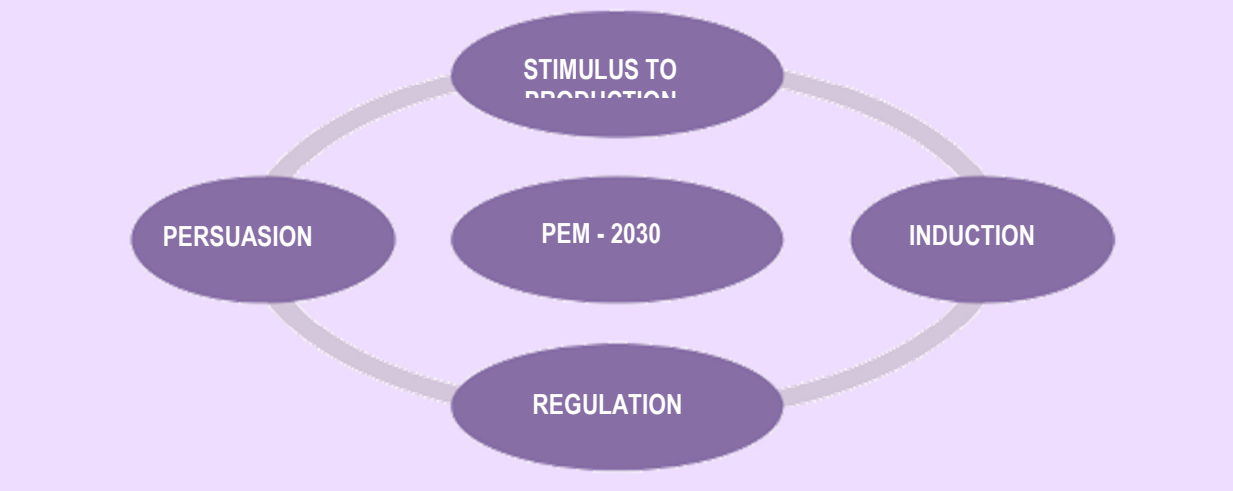
Commitment between the mineral sector (understood as an activity that ranges from the geological survey up to transformation process), the government and society with the aim of promoting the development of the State of Pará.

From the retrospective analysis of the consequences of the mineral activity in the development of the state, it became evident that the desirable future will not come as a natural consequence. Rather, it will require deliberate effort of planning and implementation, based on sound public policies that indicate, clearly and objectively, the path to follow. This path is called the strategy.

5.2 STRATEGIES AND ACTIONS

The PEM-2030 strategies are structured into four lines: 1) stimulus to production, 2) regulation, 3) induction and 4) persuasion (Figure 28).

FIGURE 28 - STRATEGIES OF PEM-2030



Prepared by: SEICOM, 2013.

Strategy 1 - Stimulus to Mineral Production

It aims to encourage the development of activities considered relevant to achieve the goals of the PEM-2030, which can structure and underpin the mineral economics in a way that is fully integrated into the other socioeconomic segments of Pará.

Strategy 2 - Regulation of the Mineral Activity

As a basic function of the state, the regulation of the economic activity is essential to establish parameters, guide behavior, stimulate the activities of agents in addition to treat, in an analytical manner, the information about the regulated sectors. Mining in Protected Areas, informal mining, extraction of construction aggregates, among others, are examples of sensitive activities that have strong environmental and social implications, therefore, they cannot be ignored in the regulatory policy of the state.

Strategy 3 - Induction to mining activities

Activities of high strategic interest for the state are unlikely to occur spontaneously; on the contrary, the experience of other countries and regions reveals that the "visible hand" of the state is required to make it happen.

Strategy 4 - Persuasion to mining activities

There are certain actions that, although they are not part of the scope for which the State has direct jurisdiction, have profound impact on the quality and efficiency of state public policy. Examples are the RSC actions of the companies and the use of CFEM by the mining municipalities. There are also actions that, although they are part of the public policy, require extensive coordination with other spheres of government and even with different bodies of the same sphere of government. This requires an appropriate communication strategy and dissemination of proposals in order to ensure the commitment of these partners and therefore the effectiveness of public policy.

These strategies have four dimensions: 1) Environment 2) Society 3) Market, and 4) Public governance, as shown in Table 16.

TABLE 16 - OBJECTIVES TO BE ACHIEVED BY AXIS,		
STRATEGY	**AREA**	**ENVIRONMENT**
STIMULUS TO PRODUCTION	Minerals that are strategic for Pará;	Knowing and sizing the socioeconomic and environmental externalities of the mining sector
	Mineral-based APLs	Promote the environmental monitoring and recovery
	Gems, precious metals and jewelry	Establish a specific GTAPLAM* specific for gems, precious metals and jewels
	Mineral inputs for agriculture	Establish GTAPLAM* specific to agrominerals
REGULATION	Mining activity	Promote recovery of degraded areas
	Extraction and sale of aggregates for Construction and for Clay for Bricks	Map features using the ecological-economic zoning base
	Mining in protected areas in Pará	Integrate the procedures among federal entities, considering the transversality of the theme
INDUCTION	Addition of value in the consolidated mining industry	Review criteria and environmental constraints for licensing
	Technological research and innovation for development of the mining industry	Map and stimulate specific research for waste treatment
	Development of mineral research and geological knowledge.	Transform the GTAPLAM* into a public policy
PERSUASION	Use of the CFEM in a regional development strategy	Implement the shared environmental management model and the environmental observatory
	Corporate social responsibility (CSR) linked to regional development policies	Encourage policies for integrated environmental management planning
	Actions of mineral public governance.	Draw up guidelines for the State Plan of Mining Waste Management

Source: Action plan resulting from the 13 thematic workshops; prepared by SEICOM .

ACCORDING TO THE STRATEGIES AND PRIORITY AREAS OF PEM.		
SOCIETY	**MARKET**	**GOVERNANCE**
Stimulate critical groups at universities and institutes; engage scholarship students and liaise with the legislative basis	Define the strategic matrix and attraction of mineral investments (market research): abundant, scarce and critical	Create Thematic Forum. To develop competent and stable technical staff
Implement professional training and qualification	Implement a program for certification (quality label) and modernization	Create Thematic Forum. Implement the mineral APL Observatory
Implement the continuous professional training and qualification program	Implement a program for certification of the raw material and finished product	Create a Steering Committee (with different municipalities and inside each municipality) and own laws
Implement a program of training on good practices	Map the deposits, demand areas and attract investors	Create a Sectorial Chamber
Promote and foster the establishment of associations and cooperatives	Implement a program for certification of origin	Conduct inspections by integrating and involving different institutions
Develop a regional plan for training of manpower for this mineral chain	Encourage entrepreneurship in the sector. Productive use of decommissioned areas	Promote decentralization of the mineral management, licensing and supervision
Map socioeconomic conditions of the residents of PAs with mineral activity	Develop a guide of systematized technical information for the miner	Ensure the participation of the state mining agency in the creation of new protected areas in Pará, as well as in the actions of the Mining Plan
Diagnose demands, mobilize entities and qualify the labor	Encourage the development and use of RD&I in the mineral industry	Create permanent and decentralized forums by segment
Encourage the granting of research and innovation scholarships, internships, course offerings and in-company trainee programs	Stimulate the creation of business incubators. Liaison of the companies with the ST&I Parks	Train public managers to strengthen Pará's ST&I** in the mining areas
Implement a program to stimulate the hiring of interns in the private mapping	Treat geology as an activity that drives the economy at present, services, laboratories, etc.	Create an interagency forum, a Center for Mineral Technology and an Information Network
Encourage the creation of Regional Guidance Centers for immigrants, focusing on professional qualification	Encourage the diversification of the economic activity and the creation of an Exhaustion Fund	Encourage the good public management and transparency. Implementation of the 21 Development Agenda
Build reliable social statistics and knowledge base	Encourage the creation of corporate communication programs that are appropriate to the local reality	Bring CSR policies closer to the policies aimed at the Social Development of the State
Create a State System for Socioeconomic Monitoring of Areas with mineral activities and which have been mined	Promote professional training and increase the use of local labor	Mediate conflicts between public and private interests for development of the State

GTAPLAM (Grupo de Trabalho para o Aperfeiçoamento do Processo de Licenciamento = Working Group for the Advancement of the Licensing Process)
APL (Arranjo Produtivo Local = Local Productive Arrangement)
Environmental for Mining.
MO (Mão de Obra = Labor) / PA - (Preservation Unit)
ST & I - Science, Technology and Innovation
RP&I - Research, Development and Innovation
CFEM - Financial Compensation for the Extraction of Minerals

The strategies, actions and programs presented were collectively prepared during the 13 workshops held throughout 2012 and 2013.

5.2.1 Strategy 1 - Stimulus to Mineral Production Projects

IMAGE 25 - EXTRACTION OF LIMESTONE

Projects

1) To promote the market for mineral inputs for agriculture, Pará is the area for the expansion of the new agricultural frontier, mainly in the South, Southeast and West regions of the state, along the BR 163 highway. The use of mineral inputs for agriculture, such as dolomitic limestone and calcifico, phosphate, potassium, rock dust, among others, should be promoted in order to bring the deposits closer to the current consumption needs, in order to guarantee the best conditions of supply and demand , at competitive prices.

Activities

- GTAPLAM specific to agrominerals
- Program and training for proper use practices;
- Map the deposits, demand areas and attract investors in order to increase production;
- Create the Sectorial Chamber of Mineral Inputs for Agriculture;

2) Promote APLs based on minerals - pottery and mineral crafts: productive arrangements are forms of organization of clusters of firms in order to increase efficiency and competitiveness, particularly for Small and Medium Enterprises (SMEs). In the case of the ceramic pottery industry and mineral crafts, the APL (cluster) model has been shown in other regions as an effective strategy to promote SMEs.

Activities

- Monitoring program and environmental recovery of areas degraded by mining;
- Professional training program (mineral extensionism);
- Program for certification (quality label) and modernization
- Creation of mass center;
- Create a mineral APL Thematic Forum;
- Implementation of the mineral APL Observatory.

3) Advance the segment of precious metals, gems and jewelry - this is the continuation of a program of the State Government: "Pará's Jewelry Complex", which began in 1988 with the goal of adding value to the mineral production historically marketed in an unprocessed form. This program aims to develop three Complexes for the sector in Belém, Itaituba and Marabá. The program in Belém is consolidated, but the same has not happened in other areas. Moreover, even in Belém, there is need for improvement.

Activities

- Specific GTAPLAM for gems, precious metals and jewels
- Continuous professional qualification program;
- Program for certification of the raw material and finished product, innovation and PDI;
- Creation of a Steering Committee (inside each municipality) and own laws

4) Stimulate the production of minerals that are strategic for Pará - the good management of mineral resources cannot dispense with detailed information for defining the minerals that are strategic for the state and the areas of special interest that should be promoted, besides knowing the relative nature of the ore / technology / economy with the purpose of determining priorities, among other critical matters that relate to that category as well.

Activities

- Know and monitor socioeconomic and environmental costs in the mining sector;
- Promote the creation of critical groups at universities and institutes; engage scholarship students and liaise with the legislature;
- Strategic matrix of minerals: abundant, scarce and critical;
- Thematic Forum on minerals that are critical to Pará;
- Competent and stable body for the State's official activities.

IMAGE 26 - WHEN THE ENVIRONMENTAL LICENSE OS OBTAINED, THE TRAINING AND LECTURES ON HEALTH, OCCUPATIONAL SAFETY AND ENVIRONMENTAL MANAGEMENT EDUCATION ARE REQUIRED FOR LICENSING OF MINING ACTIVITIES.

5.2.2 Strategy 2 - Regulation of the Activity Mineral, Projects:

Projects:

1) Sort the mining activity - Pará has lived with mining activities for decades. In the past, there were policies, programs and projects for the sector, but they were not resilient. In contrast, they only lasted while they were being funded by a public entity. There are thousands of people scattered in the four corners of the state, whose activity has had a very expressive social-environmental impact, so they cannot be subject only to spontaneous forces of the market.

Activities:

- Recovery of degraded areas in mines;
- Stimulus to the creation of associations and cooperatives;
- Certification of the origin of the raw material;
- Supervision/inspections in an integrated and inter-institutional manner;

2) Sort the activity of extraction and marketing of construction aggregates and clay for brick - Besides being a labor-intensive activity, whose production is intended exclusively for the domestic market, provided that it meets legal requirements, enhances the generation of tax revenues, jobs and minimizes externalities, especially in remnants of this type of mining.

Activities:

- Strengthening of SEMMAS. Mapping of resources within the ecological-economic zoning;
- Formulation of a Regional Plan for training of manpower for the mineral chain;
- Stimulus to entrepreneurship in the sector. Productive use of decommissioned areas;
- Decentralization of the mineral management, licensing and supervision

3) Set rules for mining in protected areas in Pará - The main mineral projects of the State (MRN and Vale) are inside PAs, which shows a long history of coexistence between an activity considered to be of high potential for impact with areas of special ecological balance. However, there is significant disparity between the treatment given to the ecological environment and that given to the socioeconomic environment, which may be a reflect of the idea of the "myth of demographic vacuum" in these PAs, and this assumption contradicts the need for socio-productive inclusion and improvement in the development indicators of the state.

Activities

- Integrate the procedures among federal entities, considering the transversality of the theme;
- Promote the mapping of the socioeconomic conditions of the residents of PAs with mining activities;
- Develop a guide of systematized technical information for the miner;
- Ensure the participation of SEICOM in Management Councils and in the creation of new protected areas in Pará.

5.2.3 Strategy 3 - Induction to Mining Activities

IMAGE 27 – PANEL ON THE COMPETITIVE INDUSTRY

Projects:

1) Induce the addition of value in the consolidated mineral industry - Adding value to minerals extracted in Pará is a longstanding claim. However, much more than just a "political will", there is the need for extensive preparation on the part of government and partner institutions for the creation of an environment that, in fact, allows overcoming the historical barriers that prevent this from occurring, and which creates conditions for attracting companies producing relevant goods and services to the process technology. Moreover, given the diversity of minerals, it is essential to scale the priorities, in order to generate the synergies that are necessary for the concentrated effort on the part of these different institutions.

Activities

- Review criteria and environmental conditions for licensing;
- Diagnose demands, mobilize entities and qualify the labor;
- Encourage the development and use of RD&I in the mineral industry;
- Creation of permanent and decentralized forums, by industry;
- Collaborate for the deployment of a fiber-optic network, particularly in regions that are home to large projects.

2) Induce survey actions and technological innovation for the development of the mineral industry - according to the OECD report [54], among the endogenous determinants of development, innovation is the one that allows longer lasting results. However, it does not flourish where there is no favorable environment. The creation of favorable environment, in turn, is the result of several synergistic and cumulative factors, in which several institutions make a difference, but they require, above all, the clarity of the importance of these activities, as strategic and as the condition for a more sustainable future.

Activities

- Map and stimulate specific research for waste treatment;
- Encourage the granting of research and innovation scholarships, internships, course offerings and in-company trainee programs;
- Stimulate the creation of business incubators. Liaison of the companies with the ST&I Parks;
- Train public managers to strengthen Pará's ST&I in the mining areas.

3) Promote the development of mineral exploration and geological development - Geological knowledge is important, not only for identification of minerals that can be mined with an economic purpose, but also for a series of public actions, such as the identification of areas at risk of occupation, knowledge of the land for the purposes of infrastructure, development of master plans, land use and zoning policies, among others. However, the geological knowledge of Pará is very low. Thus, it is necessary to expand this knowledge, both to guide the process of use and occupation of the territory, and to enhance the generation of wealth from the mineral base.

Activities

- Transform the GTAPLAM into a public policy
- Develop a program to stimulate the hiring of interns in geological mapping activities of the private sector;
- Treat geology as an activity that drives the economy at present, offering services, technology, jobs, etc.
- Create an interagency forum, a Center for Mineral Technology and an Information

54 Organization for Economic Cooperation and Development

Network.

IMAGE 28 - PRODUCTION CHAIN OF MANIOC: GOAL OF TECHNICAL COOPERATION AGREEMENT BETWEEN EMATER AND MINERAÇÃO RIO DO NORTE

5.2.4 Strategy 4 - Persuasion to mining activities, Project:

1) Encourage the use of mineral royalties in a regional development strategy - The *royalties* that, in Brazil, are represented by CFEM, constitute one of the main benefits of the mining activity which includes particularly the municipalities where mining occurs. This is a great achievement of the mining municipalities. However, there are important issues to overcome, such as: sustainable use of that income, financial concentration *versus* spending capacity, excessive dependence on mining and mineral income, among others. In the case of CFEM, each entity is responsible for its share (12% for the Federal Government, 23% for the State government and 65% for the mining municipality), however, mining generates effects that are not included in this distribution - such as surrounding municipalities; furthermore, we need the support of the State in order to guide the mining cities well on the strategies of regional development through the mining platform.

Activities

- Implement the shared environmental management model and the observatory of the mining municipalities;
- Encourage the creation of Regional Guidance Centers for immigrants, focusing on professional qualification;
- Encourage the diversification of the economic activity and the creation of an Exhaustion Fund;
- Encourage the good public management and transparency. Implementation of 21 development Agenda in areas affected by mining.

2) Encourage actions of corporate social responsibility (CSR) linked to regional development policies - businesses in general and mining in particular shall consider the social and environmental needs of the territories where they operate. As a voluntary action aimed at social issues, CSR is now part of business and competitive strategies can strike a balance between the interests of companies and the goals of the society, provided that they are aligned with public policies.

Activities

- To encourage policies for integrated environmental management of the territory;
- Preparation of reliable social statistics and knowledge base
- Encourage the creation of corporate communication programs that are appropriate to the local reality;
- Bring CSR policies closer to the policies aimed at the Social Development of the State.

3) Implement actions mineral public governance - the term "governance" is linked to the idea of liaison with various institutional bodies (government, unions, trade associations, universities, etc.) to confer legitimacy to the fight against the problems of a territory. It can also be understood as "forms of coordination of powers" and, in the specific case of public governance, of sound management of the activities of the public sphere.

Activities

- Draw up guidelines for the State Plan of Mining Waste Management;
- Create a State System for Socioeconomic Monitoring of Areas with mineral activities and which have been mined;
- Promote professional training and increase the use of local labor;
- Mediate conflicts between public and private interests for development of the State.

Considering the four dimensions, Table 17 summarizes the main actions to be developed by 2030.

TABLE 17 - SUMMARY OF ACTIONS OF PARÁ'S 2030 MINING PLAN.

DIMENSIONS	ACTIONS	PURPOSES
PUBLIC GOVERNANCE	To strengthen Institutions and the Technical Staff of the State Mining Authority.	To establish the state mining authority for regulating mining and inducing regional development, in order to boost the development of territories directly and indirectly affected.
	Integrated Supervision	Conduct the audits for which the state is responsible, according to the specificities of each entity, but in an integrated manner.
	Coordinated Sector Forum	To establish a forum for serving specifically the mining segments with coordinated referrals.
	Observatory of Mineral-Based Productive Arrangements	To establish an observatory to monitor the evolution and scope of mineral-based production arrangements.
HUMAN CAPITAL	Development of people in different segments of mining and in suppliers	To establish a program for training, capacity-building and qualification for execution of the activities directly and indirectly related to mining.
	Stimulus to the creation of associations and cooperatives	To induce firms, especially small and micro ones, and autonomous workers to organize themselves into cooperatives or associations as a means to leverage the development of their business.
	Partnerships with universities and research institutes	To establish partnerships for the development and expansion of technical courses, undergraduate courses, postgraduate courses and research in strategic areas with a view to adding value and expanding the knowledge of mining activities.
	Socioeconomic monitoring of regions with mining	To monitor the socioeconomic aspects of mining regions for the establishment of services and targets to meet their demands.

TABLE 17 - SUMMARY OF ACTIONS OF PARÁ'S 2030 MINING PLAN.		
DIMENSIONS	**ACTIONS**	**PURPOSES**
MARKET	Stimulus to innovation for sustainable mining	To encourage the commitment to the use of technologies that are aimed at optimizing the use of natural resources, minimizing environmental impacts and promoting social development.
	Formalization of small-scale mining	To take people out of informality and raise the degree of formalization of small-scale mining;
	Certification of origin of the product and best practices of mineral management	Create stamp that guarantees and certifies that a particular mineral commodity has merits and is legalized and licensed.
	Densification of economic activities around mining	Induce densification, diversification and strengthening of economic activities around mining.
	Strengthening suppliers	Attract and strengthen suppliers in a way that is consistent with the demand of mining activities and peripheral activities.
	Public-private partnerships to expand the mineral logistics infrastructure and communication	Using mining as regional development platform from logistics integration of mining regions. Expand fiber optic networks in all mining and adjacent regions.
ENVIRONMENT	Development of territories with mining	Establish a plan of goals for development of the municipalities affected by the mining activity, with a view to raising the quality of life and minimizing impacts to the environment.
	Interaction between relevant bodies to improve environmental licensing process for mining activities	Establish sync, clarity and simplification of procedures for efficient implementation of the environmental licensing of mining activities.
	Mining in Conservation Areas specially protected	Establish norms for coexistence of mining activities in specially protected areas, from economic-ecological zoning and mineral entrepreneurial commitment to sustainability.
	Sustainability management and mining processes	Establish compensatory measures for the exploration of minerals in the waste recovery process, in the definition of procedures and standards for the lowest possible environmental aggression.
	Financial guarantees for mine closure	Establish criteria for defining the values for the recovery of degraded areas in the mine closure process, and financial guarantees to meet these demands.

Prepared by: SEICOM, 2013.

6

CHAPTER

Mechanisms **and** instruments of Mining policies

6. MECHANISMS AND INSTRUMENTS OF MINERAL POLICY - SGPEM (SISTEM FOR MANAGEMENT OF THE STATE MINING POLICY)

One of the major challenges for any plan is its implementation and monitoring over time. Accordingly, in order for PEM-2030 to be an actual tool for development and management of public policies in the mining sector of Pará, it is essential to have an effective public governance, which should be done by a State System of Mining Policy Management (SEGPEM).

The SEGPEM shall operate within SEICOM and its purpose is to establish and coordinate an institutional arrangement that encompasses the various federal, state and municipal sector agents involved in the operation of PEM.

The SEGPEM no longer represents a challenge to be faced by the government of Pará due to the complexity and notorious gap between the administrative structures of the mineral-based municipalities. However, it favors the management of policies gestated during the process of democratic construction of the PEM-2030, and it facilitates integration with different sector agents involved in the chain of production and marketing of mineral goods. Furthermore, the system allows the assembly of tight and integrated structures with the other bodies of the direct and indirect administration of the State government, Federal government and Municipal government with representation and / or operation in the State and civil society organizations involved in the issue of mineral resources of Pará .

The purpose of SGPEM is to provide socioproductive sustainability, political and administrative decentralization through the establishment of the regional offices of SEICOM, articulated action planning and partnership programs.

In order to do that, SEGPEM will include the following management tools: Operational Secretariat, Advisory State Council for Mining Policy, decentralized units of Registration and Oversight of mining activities and the financial guarantees for the implementation of actions.

Operational Secretariat of the Mining Plan (SEOPEM)

Successful experiences reveal that if a Plan is well monitored and well assessed, its chance of success increases exponentially. But to do this, efficient management and skilled people are needed, with sufficient decision-making power so that they can perform the proposed actions and initiatives.

Accordingly, we hereby propose the creation of an **Operational Secretariat of PEM-2030 (SEOPEM)** with the task of formulating, implementing and monitoring the range of projects, programs and actions suggested in this Plan, as well as with the task of liaising with other levels of government and other civil society partners and businesses, initiatives that are necessary to transform and transform the actions into effective programs and infrastructure projects, for sustainability of the state, from its mineral platform.

SEOPEM is expected to operate in the organizational structure of SEICOM, and be responsible for conducting the tactical and operational planning proposals, as well as performing actions related to the use of mineral resources, from research policy, the development of mining by production, processing, distribution and trade of mineral commodities.

SEOPEM will monitor the implementation and support of the operation of the activities of the Advisory Board of the State of Pará Mineraria Policy (CEPM / PA) which will be an integrated advisory joint committee of the state government on issues related to PEM-2030 and the global and integrated development and it shall enjoy administrative and programmatic autonomy.

State Advisory Council for Mineral Policy

Through Law No. 5422, of December 29, 1987, Pará created the State Committee for Geology and Mining of Pará However, with the extinction of SEICOM in 2007, the Commission also failed to meet. Considering the new demands that were created by the re-establishment of SEICOM, since November, the Program for monitoring, planning, controlling and supervising the mining activities as well as new assignments that this PEM presents for the mineral policy of the state, it is essential to establish an instrument to ensure the participation of sector players in the

implementation of these policies.

The creation of an Advisory State Council for Mining Policy in Pará (CEPM) will be established through SEGPEM with advisory and strategic level competence, in order to consolidate the planning and development of public mining policies. It will have the participation of representatives from the State government and mining cities, organized civil society and the productive sector, as proposed in Annex III. CEPM will aim to determine priority actions for the mining sector, in line with government guidelines to create mechanisms to encourage the productive sector to achieve more advanced levels of its production chains of minerals, both to serve the domestic market and to increase exports of processed products.

The Executive Coordinators of CEPM will be responsible for the SEOPEM linked to the State Department of Industry and Trade (SEICOM), which will be responsible for ensuring the administrative support and resources needed for the full operation of the actions and activities of the board.

Decentralized units to register, monitor and oversee the Minerals Activities

The PEM-2030 requires an institutional framework comprising a set of rules and state laws and a constitution and an administrative structure compatible with the task assigned to state authorities (Art. 17, section XI. 246, 247 and 248 of the Constitution of the State of Pará). Apart from that, this legal and administrative structure shall be directed to the activities of inspection, registration and monitoring of mining activities.

Specifically with regard to the processes of monitoring and controlling the mining activity, SGPEM provides, to the general public, visibility and efficiency of the State Mineral Policy.

BOX X - POLICY ON MONITORING AND OVERSIGHT OF THE MINING ACTIVITY IN PARÁ

FEE FOR OVERSIGHT, CONTROL, MONITORING OF MINERAL RESOURCES - TFRM AND STATE REGISTRATION AND MINERAL RESOURCES - CERM

On December 28, 2011 Law number 7591 was approved, establishing the Fee for Control, Monitoring and Oversight of the Research, Mining, Exploration and Exploitation of Mineral Resources (TFRM) and the State Register of Control, Monitoring and Oversight of the Research, Mining, Exploration and Exploitation of Mineral Resources (CERM), regulated by Decree number 386 of 23 March 2012 laying down detailed rules and procedures for the submission of the Declaration of Extracted Minerals (DME), as follows:

> Article I The Declaration of Extracted Minerals - DME must be submitted either by payers of the Fee of Control, Monitoring and Oversight of Research , Mining, Exploration and Exploitation of Mineral Resources - TFRM as by those who are exempt and are registered in the State Register of Control, Monitoring and Oversight of Research, Mining, Exploration and Exploitation of Mineral Resources - CERM.

The universe of control, monitoring and control of mineral resources in the state of Pará covers more than 100 municipalities, both those with mining front, and with advanced research activity, in addition to neighboring counties that are impacted.
The CER is a mandatory state registration for persons, physical or legal, who are, in any way authorized to undertake research, mining, exploration or exploitation of mineral resources in the state of Pará and has the following specific objectives:

- Contribute to the State's knowledge of the reality of each segment of the production chain - from geology to mineral processing;
- Provide primary information of the mineral sector in order to scale its socioeconomic contribution in the region;
- Enable the development of public policies to strengthen the mining sector, such as: attracting investments to opportunities identified from the register; qualification and training of skilled manpower regional, allowing the generation of employment and income, among others;
- Encourage public / private partnership of the mineral sector to potentiate opportunities and find solutions to the main problems of the sector.

The monthly payment is TFRM according to the triggering event tonne extracted the value of a Standard Audit Unit (UPF), at most, as there are variations. Are liable for payment of TFRM all metal and minerals except direct use in civil, construction minerals for soil amendments, fertilizer, under Scheme PLG under registration Extraction and micro and small non-metallic mineral mining companies, as provided in Law

Financial Guarantees for Implementation of Actions

In order to ensure minimum resources necessary to leverage the major projects and ensure the effectiveness of initiatives to promote regional development through mining activities, as contained in the EMP-2030, it is proposed that the binding of a minimum percentage of resources, which can be done through budgetary allocation to the agency responsible for mining in the state.

It is suggested, therefore, that the actions necessary to implement the EMP-2030 financial funds are from rents portion of minerals obtained via CFEM. A part of these funds will be directed to promote projects that will be deployed from this Plan and another to boost structuring actions in areas surrounding the mining cities in an attempt to add a set of projects that may limit the tendency of these regions be reduced to mere receptacles of negative externalities from the mining cities and thus can better address benefits generated by mining.

LIST OF FIGURES

Figure 1 - Value Chain of the Aluminium Industry 50
Figure 2 - Copper Production Chain 54
Figure 3 - Illustration of the Iron-Steel Chain 56
Figure 4 - SINOBRAS Furnace 58
Figure 5 - Management Building 59
Figure 6 - SI 50 Rods Used in Construction 59
Figure 7 - Wire Rods, Which Can Be Used On Various Products for Industrial Purposes 59
Figure 8 - Production Chain of Manganese-Based Products. 61
Figure 9 - Production Process of Iron-Nickel 63
Figure 10 - Production Process of Tin. 64
Figure 11 - Bottling and Logistical Process of Mineral Water in Pará 67
Figure 12 - Steps of the Mineral Transformation 70
Figure 13 - Flow Chart of the Manufacturing Process of Cement 72
Figure 14 - Simplified Diagram of Washed Beneficiation of Kaolin 73
Figure 15 - Flow Chart of Production of Phosphate, NPK Component 76
Figure 16 - Flow of Labour, From Deployment to the Operation 93
Figure 17 - Evolution of Production of Metal in Tx 1,000 98
Figure 18 - Evolution of Production of Non-Metallic Products in Tx 1,000 102
Figure 19 - Evolution of the Mineral Processing Production in Tx 1,000 106
Figure 20 - Labor in Mining 113
Figure 21 - Labor in Non-Metallic Materials. 113
Figure 22 - Labor in the Processing Industry 113
Figure 23 - Diagram of Influence And Dependence For Pará's Mining. 120
Figure 24 - Sea Routes of the Barcarena Port 126
Figure 25 - Business environment with the mining industry as an inducer, together with the players that can cooperate to favor the integration and economic externalities 131
Figure 26 - Strategies of Pem-2030 147
Figure 27 - Regional Development Based On Mining 146
Figure 28 - Strategies of PEM-2030 147

LIST OF CHARTS

Chart 1 - Progress of the Number of Survey Permits in the State of Pará (2002-2013) 25
Chart 2 - Increase in the Number of Mining Concessions in the State of Pará (2002-2013) 26
Chart 3 - Evolution of Mineral Production in Pará, 1990-2012 (1990 = 100) 27
Chart 4 - Volume of Exports of Goods from the Mining-Metallurgical Industry in the State of Pará from 1989 to 2012 30
Chart 5 - Value of Exports of Goods from the Mining-Metallurgical Industry in the State of Pará from 1989 to 2012 30
Chart 6 - Exports of the Mineral Mining Industry, Pará - 2012 31
Chart 7 - Exports of the Mineral Processing Industry, Pará - 2012 31
Chart 8 - Evolution of the Trade Balance (Us$ Billion), 2001-2012 31
Chart 9 – Municipalities That Account For Most of the CFEM Revenues, in Pará – 2012 33
Chart 10 - Government Charges of Mining in Proportion to the Exported Value in Pará, (1980-2012) 35
Chart 11 - Distribution (%) of the Mining Industry by Size, Pará - 2011 37
Chart 12 - Distribution (%) of the Transformation Industry by Size, Pará - 2011 37
Chart 13 - Establishment of the Mineral Transformation Industry in the State of Pará, 2011 37
Chart 14 - Evolution of Employment in the Mining and Mineral Transformation Industry in the State of Pará, 2002-2011 37
Chart 15 - Profile of Pará's Export Base, 1990 38

Chart 16 - Profile of Pará's Export Base, 2000 38
Chart 17 - Profile of Pará's Export Base, 2010 38
Chart 18 - Profile of Pará's Export Base, 2012 38
Chart 19 - Distribution of the Production of Informal Gold Mining by Municipality in Pará - 2012 47
Chart 20 - Payment of CFEM Gold (2003 To 2012) 48
Chart 21 - Quotations of Gold Prices (Us$/Troy Ounce), 1975 To 2012 48
Chart 22 - The Industry's Consumption of Aluminium in Brazil in 2011 50
Chart 23 - Apparent Consumption of Steel by the Industry in 2012 56
Chart 24 - Global Nickel Consumption 62
Chart 25 - Mineral Water Production in Pará 65
Chart 26 - Sale of Mineral Water in Pará (R$ Thousand) 65
Chart 27 - Mining Areas That Have Applied For Licensing in the Mesoregion of Northeastern Pará, in the Period from 1981 to 2006, And From 2007 Onwards 68
Chart 28 - Number of Applications in the Southeast Mesoregion of Pará, in the Period from 1981 to 2006, And From 2007 Onwards 68
Chart 29 - Evolution of Production of Lime in the State of Pará, 2002-2012 71
Chart 30 - Evolution of Production and Exportation of Kaolin in the State of Pará (1996-2012) 72
Chart 31 - Distribution of Investments in Minerals by Region 84
Chart 32 - Investments in Ore Mining 85
Chart 33 - Creation of Jobs in Ore Mining 85
Chart 34 - Distribution of Jobs for New Investment 87
Chart 35 - Creation of Jobs in Processing/Products 91
Chart 36 - Investments in Transformation by Products 91
Chart 37 - Percentage Distribution of Investments by Products 92
Chart 38 - Provision of Labor to the Implementation of Projects 93
Chart 39 - Bauxite Production in Pará, 1990-2012, and Forecast For 2030 95
Chart 40 - Production of Copper in Pará, 1990-2012, and Forecast Until 2030 96
Chart 41 - Production of Iron in Pará, 1990-2012, and Forecast Until 2030 96
Chart 42 - Production of Manganese in Pará, 1990-2012, and Forecast Until 2030 97
Chart 43 - Production of Nickel in Pará, 1990-2012, and Forecast Until 2030 97
Chart 44 - Mineral Water Production in Pará, 1990-2012, and Forecast Until 2030 99
Chart 45 - Kaolin Production in Pará, 1990-2012, and Forecast Until 2030 99
Chart 46 - Production of Lime for Cement in Pará, 1990-2012, and Forecast Until 2030 100
Chart 47 - Production of Agricultural Lime in Pará, 1990-2012, and Forecast Until 2030 100
Chart 48 - Evolution of Production (1000 Tons) of Construction Aggregates in Pará, 1996-2009 101
Chart 49 - Production of Aggregates for Construction in Pará, 1990-2012, and Forecast Until 2030 102
Chart 50 - Gold Production in Pará, 1990-2012, And Forecast until 2030 103
Chart 51 - Production of Processing of Metallic Minerals by 2012 and Forecast until 2030 105
Chart 52 - Time Projection of Jobs in the Metal Minerals Industry 107
Chart 53 - Creation of Jobs in the Non-Metallic Mineral Industry from 2015 to 2030 110
Chart 54 - Evolution of Jobs in Mineral Processing 112
Chart 55 - Key Business Partners of Pará, 1990 121
Chart 56 - Key Business Partners of Pará, 2012 121
Chart 57 - Brazilian Mineral Trade Balance - Us$ Millions (Fob) 123
Chart 58 - Estimate of CFEM Revenues in Pará, 2015-2030 137
Chart 59 - Participation of the CFEM Revenues by Substance in Pará, 2015 – 2030 137
Chart 60 - Estimated CFEM Revenues by Quota Part, 2015-2030 137
Chart 61 - Brazil and Pará - Population by Income Status 138

LIST OF MAPS

Map 1 - Dynamics of Mining in Pará....24
Map 2 - Major Projects in Pará....29
Map 3 - Collection of CFEM by Municipality, In Pará, 2012....34
Map 4 - Mining Municipalities Of Pará - Firjan Sub-Index Of Employment And Income, 2000....35
Map 5 - Mining Municipalities Of Pará - Firjan Sub-Index Of Employment And Income, 2010....35
Map 6 - Municipalities with PLG, PLG Application, UCS and TI....43
Map 7 - Especially Reserved Areas in Pará....45
Map 8 - Spatial Distribution of the Aluminum Production Chain in Para....52
Map 9 - Location of Copper Reserves in the Southeast Region of Pará....56
Map 10 - Spatial Location of the Carajás Mines....58
Map 11 - Mining Titles and Hydrogeology of Mineral Water in Pará....65
Map 12 - Production of Aggregates for Civil Construction and Clay for Bricks....68
Map 13 - Mineral Titles of Limestone in Pará....71
Map 14 - Mineral Titles of Kaolin in Pará....75
Map 15 - Phosphate Survey Permit in Pará....76
Map 16 - Complexes of Gems and the Main Gold Projects in Pará....77
Map 17 - Pará's Position Regarding the Sedimentary Basins....81
Map 18 - Map with the Design of EFC that Integrates the States of Pará and Maranhão....88
Map 19 - Logistical West and East Axes of Pará....127
Map 20 - Large Works of Logistics Infrastructure in Pará....128

LIST OF TABLES

Table 1 - History of Mining in Pará State....22
Table 2 - Products of Pará's Mineral Processing Industry....27
Table 3 - Description of Taxes and Incentives by Levels of Government and the Addition of Value in the Mineral Industry....32
Table 4 - Permits for Informal Mining by Municipality in Pará, 2013....44
Table 5 - Social Organizations of Informal Mining in Pará, 2013....46
Table 6 - Mineral Potential of Gems and Jewelry by Municipality in Southeast Pará....78
Table 7 - Oil and Natural Gas Resources in Pará's Bordering or Neighboring Sedimentary Basins....79
Table 8 - Chemical Elements of Rare Earths, Scandium and Yttrium and their Applications....80
Table 9 - Schedule of Investments in Mineral Extraction. Information on Value of Investment R$ X 106. The Value Corresponds to Jobs That Will Be Created....87
Table 10 - Schedule of Investments in Mineral Processing....91
Table 11 - Degree of Influence of the Mining Variables....119
Table 12 - Similar Technologies among the Ore Mining and Ore Processing Industries....124
Table 13 - Cooperation Matrix....132
Table 14 - Local Customers of Albras....133
Table 15 - Most Relevant "Cases" of Innovations Occurred in the State of Pará....134
Table 16 - Objectives to be Achieved by Axis, According to the Strategies and Priority Areas of PEM....148
Table 17 - Summary of Actions of Pará's 2030 Mining Plan....154

LIST OF IMAGES

Image 1 - Beginning of the Babylon of Serra Pelada (1980)....23
Image 2 - Outdoors Informal Mining (Use of Jet Nozzles)....42
Image 3 - Informal Mining in Shafts....42

Image 4 - Informal Mining, Mechanized With PC. 42
Image 5 - Informal Mining With Dredge in the Riverbed. 42
Image 6 - São José Liberto Space. 77
Image 7 - Ore Stacking System. 85
Image 8 - Module Assembly on Project S11d, at Canaã do Carajás. 86
Image 9 - Construction Site of Project S11d. 86
Image 10 - Ore Distribution System Powered by Conveyor Belts 86
Image 11 - EFC Duplication Works. 88
Image 12 - Earthmoving of the Land Intended For Alpa on BR 230 Highway in Marabá. 90
Image 13 - Construction of Galleries For Conveyor Belts in the Iron Mining Project in Carajás by the Integral Company 93
Image 14 - Maintenance of Assembly in the Crushing System and Ore Transportation. 93
Image 15 - Conveyor Belts of the Sossego Project That Move Material from the Mine to the Ore Comminution System, Whose Work Results from the Partnership and Cooperation Between the Company, Suppliers and Institutions. 93
Image 16 - Transportation Technology of Solid Grains 93
Image 17 - Technician Performing Welding Operations in the Processing Industry. 105
Image 18 - Technician Analyzing the Bauxite in Votorantim's Project in Rondon do Pará 112
Image 19 - Steel Used in the Construction Industry. 114
Image 20 - Iron Ore. 124
Image 21 - Manufacturing of Flat Steel (Steel Plates), as It Had Been Planned for Alpa in Marabá 130
Image 22 - Manufacture of Steel Plates 130
Image 23 - Underwater Welding in Juruti 134
Image 24 - Serial Production of Structures for Conveyor Belts by the Partner that Owns the Technology + Local Supplier in Parauapebas 134
Image 25 - Extraction of Limestone 150
Image 26 - When the Environmental License Os Obtained, the Training and Lectures on Health, Occupational Safety and Environmental Management Education are required for Licensing of Mining Activities 151
Image 27 – Panel on the Competitive Industry 152
Image 28 - Production Chain of Manioc: Goal of Technical Cooperation Agreement between Emater and Mineração Rio Do Norte 153

LIST OF TABLES

Table 1 - Summary of Mineral Reserves of Pará State, 2009. 25
Table 2 - Constant Value (Base Year = 2010) of Pará's Mineral Production - 1996/2010 28
Table 3 - Pará, Amazon, Brazil - Manpower Formally Employed in Selected Activities, 2011. 36
Table 4 - Destination of exports of Pará's bauxite, 2000 and 2012. 52
Table 5 - Destination of exports of Pará's alumina, 2000 and 2012. 52
Table 6 - Destination of Exports of Pará's Aluminum, 2000 and 2012. 53
Table 7 - Destination of Exports of Pará's Aluminiferos, 2000 and 2012 53
Table 8 - Exports of copper of Pará State (in 1000 tons). 55
Table 9 - Average Prices of Iron and Steel Products in 2011, and Jobs/Tons Ratio in Pará. 57
Table 10 - exports of iron ore of Pará State (in 1000 tons). 59
Table 11 - Exports of Pig Iron of Pará State (in 1000 Ton) 59
Table 12 - Comparison of Exports of Steel-Metallurgical Products of Pará. 59
Table 13 - Exports of manganese of Pará State (in 1000 tons). 61
Table 14 - Average prices of the nickel production chain in 2011. 62
Table 15 - Aquifers and Reserves of Water in The Amazon Region - Estimated Volume 64
Table 16 - Per Capita Consumption of Mineral Water in Brazil, Regions and Pará -2000/2012. 65

Table 17 - Persons employed (2010) in each activity, value of CFEM (2012) on aggregates for construction and clay for bricks by mesoregion and State of Pará. 69
Table 18 - investment in mining (2013-2017). Distribution by mineral products. 84
Table 19 - Investment in Logistics in 2012 To 2016. 88
Table 20 - Investments in Mineral Processing. 89
Table 21 - Investments in Transformation Without The Alpa Project. 92
Table 22 - Projection of Increase in Production of Metallic Minerals. 94
Table 23 - Projected Production of Non-Metallic Minerals 98
Table 24 - Resources from pac 2 established for Pará, amounts in r$ millions. 102
Table 25 - Projection of Production For Gems and Gold. 103
Table 26 - Processing of Metallic Minerals. 104
Table 27 - Creation of Jobs in Metallic Minerals Industry. 108
Table 28 - Creation of Jobs in The Non-Metallic Minerals Industry. 109
Table 29 - Creation of Jobs in The Mineral Processing Industry. 111
Table 30 - Forecast of Jobs Created * Totals By Industry Sector. 113
Table 31 - Estimated GPD growth (%) by country and economic groups. 122
Table 32 - Gross Fixed Capital Formation. 122

LIST OF BOXES

BOX I - SIDERÚRGICA NORTE BRASIL (SINOSBRAS)) 58
BOX II - PROJECT S11D 86
BOX III - AÇÕS LAMINADOS DO PARÁ (ALPA) 90
BOX IV - ALUMINIUM AGGLOMERATE. 133
BOX V - INNOVATION IN THE MINING AND MINERAL PROCESSING BUSINESS ENVIRONMENT. 134
BOX VI - PROJECTION OF CFEM REVENUES AFTER THE SUBSTITUION OF THE NEW REGULATORY FRAMEWORK OF MINING. 137
BOX VII - JURUTI – ALCOA. 139
BOX VIII - ISSUES GUIDING THE ENVIRONMENTAL LICENSING OR PERMIT FOR MINING. 140
BOX IX - FINANCIAL GUARANTEE IN MINING PROJECTS - IRAN F. MACHADO * 142
BOX X - POLICY ON MONITORING AND OVERSIGHT OF THE MINING ACTIVITY IN PARÁ 159

LIST OF ACRONYMS

ABAL	Brazilian Aluminum Association
ALBRÁS	Alumínio Brasileiro S/A.
ALPA	Rolled Steels Pará
ALUNORTE	Alumina do Norte do Brazil SA
AMOT	Association of Miners of West Tapajós
ANORO	National Association of Gold
ANVISA	Agencia Nacional de Vigilância Sanitária [National Health Surveillance Agency]
APL	Local Productive Arrangement
ASJL	Association São José Liberto
AZPA	Tiles of Pará
BANPARÁ	State Bank of Pará S / A
BASA	Bank of Amazonia
CAP	Companhia de Alumina do Pará
CBE	Companhia Brasileira Equipment
CCDRU	Concession Agreement of Real Right to Use
CEPM	State Council of mining policy
CETEM	Centre for Mineral Technology
CFEM	Financial Compensation for the Exploitation of Mineral Resources
CODIM	Development Company of Mineral Industries
COEMA	Conselho Estadual de Meio Ambiente
COFINS	Contribution to Social Security Financing
COOMIC	Mixed Cooperative of panning the Agouti
COOMIGASP	Joint Cooperative Prospectors Serra Pelada
CPRM	Company Mineral Resources Research
CREA-PA	Regional Council of Engineering and Agronomy of Pará
CT & I	Science, Technology and Innovation.
CVRD	Companhia Vale do Rio Doce-State
DDI	The Development of Industry
DICS	Board of Trade and Service
DIGEM	Director of Geology, Mining and Mineral Processing
DIPAR	Planning Board and Fundraising
DNPM	National Department of Mineral Production
DTVM	Distribution of Securities
EFC	Carajás Railroad
EMATER	Enterprise Technical Assistance and Rural Extension of Pará
ESJL	Space São José Liberto
FADESP	Foundation of Research and Development

FIEPA	Federation of Industries of the State of Pará
FIDESA	Foundation Institute for the Development of Amazonia
FPE	Fund of the United
GCC	Ground Calcium Carbonate
GEIMI	Executive Group of the Mining Industry
GTAPLAM	Working Group on Improving the Environmental Permitting Process in Mining
IBAMA	Brazilian Institute of the Environment and Renewable Natural Resources
IBGE	Brazilian Institute of Geography and Statistics
IBGM	Brazilian Institute of Gems and Precious Metals
ICMBio	Chico Mendes Institute for Biodiversity Conservation
ICMS	Tax on Circulation of Goods and Services
IDESP	Institute of Economic Development, Social Environmental Pará
IFPA	Federal Institute of Education Science and Technology of Pará
Igama	Institute of Gems and Jewels of the Amazon
INCA	Ceramic Industries Amazonia
INCRA	National Institute of Colonization and Agrarian Reform
Internet	International Network of Information
IOF	Tax on Financial Transactions
IPI	Industrialized Products Tax
PROPERTY TAX	Territorial Urban Land Tax
IR	Income Tax
IRCC	Imerys Kaolin Grass River
CIT	Corporate Income Tax
ISSQN	Tax on Services of Any Nature
IUM	Single Tax on Mining
MDIC	Ministério de Desenvolvimento Indústria e Comércio Exterior
MINISTRY OF THE ENVIRONMENT	
MINISTRY OF MINES AND ENERGY	
MP	Ministry of Planning, Budget and Management
MRN	Mining River North
MTE	Ministry of Labour, Employment and Income
NPK	Nitrogen Phosphorus and Potassium
OS	Social Organization
CAP	Program for Accelerated Growth
PAE	Program Settlement Agroextrativista
PCs	Backhoe loaders
PCC	Precipitated Calcium Carbonate
PDA	Membership Development Program

PEM	State Mining Plan
PGC	Great Carajás Programme
GDP	Gross national product
PIS	Social Integration Programs
PLG	Permission Mining prospectors
PL	Bill
PPSA	Pará Pigments S / A
RADAM	Radar Amazon
RAIS	Annual Report of Social Information
RIMA	Environmental Impact Report
RMB	Metropolitan Region of Belém
RSC	Responsabilidade social corporativa = Corporate social responsibility
SEBRAE	Serviço Brasileiro de Apoio à Micro e Pequenas Empresas = Brazilian Service of Support for Micro and Small Companies
SECEX	Secretariade Foreign Trade
SECTI	State Secretariat for Science, Technology and Innovation
SECOP	Secretaria Operacional de Políticas de Incentivos – Operating Department of Incentive Policies
SEDIP	Special State Department of Economic Development and Incentives for Production
SEFA	Secretariat of Finance of Pará
SEICOM	Secretaria de Estado de Indústria, Comércio e Mineração
SEMA	State Department of Environment
SEMMA	Municipal Environment
SEMMAP	Municipal Environment and Production
SEPROS	Special Secretariat for Social Promotion
SETER	Secretary of State for Employment, Labour and Income
SGM	Department of Geology Mining and Mineral Processing
SIMINERAL	Association of Mining Industries
SINDICER	Potters' Union of São Miguel do Guama Area
SSP	Single Super Phosphate
SUDAM	Superintendency for Development of Amazonia
TRFM	Rate Control, Monitoring and Supervision of Research Activities, Mining, Exploration and Exploitation of Mineral Resources
UEPA	University of Pará
UFOPA	Federal University of Western Pará
UFPA	Federal University of Pará
HPP	Hydroelectric
UNAMA	University of Amazonia
ZPE	Export Processing Zone

REFERENCES

ABREU, F. de A. M. de; DUARTE, A. M.; ARAÚJO, J. de R. M. Alter do Chao: o maior aquífero do mundo? UFPA/ IG/Fageo. Informe Técnico. 2006.

ASSOCIAÇÃO BRASILEIRA DAS INDÚSTRIAS DE ÁGUA MINERAL - ABINAM, 2013. Sitio institucional. Disponível em: <http://www.abinam.com.br>. Acesso em: 05 out. 2013.

ACERTAR, Instituto de Pesquisa. **Pesquisa com Usuários de Jóias no Município de Belém - Estado do Pará.** Belém, 2008.

ASSOCIAÇÃO NACIONAL PARA DIFUSÃO DE ADUBOS - ANDA, 2013. Sitio institucional. Disponível em http:// www.anda.org.br. Acesso em: 01 out. 2013.

BACHA, E.; BOLLE, M. de. **O Futuro da Indústria no Brasil:** Desindustrialização em debate. Civilização Brasileira: Rio de Janeiro. 2013. 418 p.

BEVERAGE Marketing Corporation. Consumo Mundial de Água Supera o de Refrigerante. **Agua e Vida:** revista oficial do setor de águas minerais, São Paulo, IMK Relações Públicas, 2009, Ano 11, n 56, p. 28-29.

BEVERAGE Marketing Corporation. Destinação correta. **Agua e Vida:** revista oficial do setor de águas minerais, São Paulo, IMK Relações Públicas, 2012, Ano 13, n 74, p. 08-09.

BONELLI, R. (Org.). A agenda da competitividade do Brasil. FGV. Rio de Janeiro, 2011. 448 p.

CETEM. Agrominerais para o Brasil, 2010. Disponível em: <www.cetem.gov.br/agrominerais/novolivro/cap9.pdf> Acesso em: 10 out. 2013.

CPRM. Ocorrências de agrominerais no Pará, 2013. Sitio institucional. Disponível em http://www.cprm.gov.br. Acesso em: 15 set. 2013.

COLLYER, T. A. et al. **Mapa Gemológico do Estado do Pará.** Instituto de Desenvolvimento Económico, Social e Ambiental do Pará.. Belém: Sudam: IDESP, 1994.

DNPM. **Sumário Mineral Brasileiro, 2011.** Brasília: DNPM. v.31. Versão: Fevereiro/2013 Disponível em http:// www.dnpm.gov.br/. Acesso em: 15 nov. 2013.

DNPM. **Anuário Mineral Brasileiro,** 2009. Disponível em http://www.dnpm.gov.br/. Acesso em: 10 jun. 2013.

DNPM. **Informe Mineral, 2013.** Brasília: DNPM/DIGIPLAM Informe Mineral Janeiro/Julho 2013. Disponível em http://www.dnpm.gov.br/. Acesso em: 10 out. 2013.

DNPM. **Economia Mineral do Estado do Pará, 2011.** Belém: DNPM/ Superintendência - PA. Disponível em http://www.dnpm.gov.br/. Acesso em: 10 out. 2013.

ENRIQUEZ, M. A. R. da S. **Maldição ou Dádiva? Os dilemas do desenvolvimento sustentável a partir de uma base mineira.** Tese de Doutorado - UnB. Brasília, 2007. 449p. FALCÃO, H. **Perfil Analítico de Águas Minerais.** Rio de Janeiro. DNPM. Boletim 49, v.2. 197. 109p. FEDERAÇÃO DAS INDÚSTRIAS DO ESTADO DO PARÁ. **Programa Redes. Investimentos 2012-2016.** Belém, 2012**.**

FERREIRA FILHO, et al. Cadeia de suprimentos da água mineral no estado do Pará: estudo de caso focado nos componentes de desempenho. In: XXX ENCONTRO NACIONAL DE ENGENHARIA DE PRODUÇÃO. São Carlos, SP, Brasil, 12 a15 de outubro de 2010.

FISCHER, Ulrich. **Manual de Tecnologia Metal Mecânica.** São Paulo: Blucher. 2011. 414 p. FREITAS, D. V. **Programa de Desenvolvimento de Fornecedores:** uma estratégia de sucesso. Vitória: SEBRAE, 2009. 280 p.

Fundação Centros de Referência em Tecnologias Inovadoras - CERTI. Workshop incentiva a criação de cadeia produtiva de imãs de alta potência, 2011. Disponível em: http://www.certi.org.br/noticias/workshop- -incentiva-a-criacao-de-cadeia-produtiva-de-imas-de-alta-potencia.html. Acesso em 04 nov. 2013.

GIAMBIAGI, F.; PESSOA, S.; VELOSO, F. **Desenvolvimento Económico:** uma perspectiva brasileira. Campus. Rio de Janeiro, 2013. 450 p.

GLOBO VERDE MINERAÇÃO. Sitio institucional. Disponível em http://globoverdemineracao.blogspot.com.br/p/historia_24.html. Acesso em: 15 out. 2013.

GOVERNO DO ESTADO DO PARÁ, SEICOM. **A Indústria Metal Mecânica do Pará. Situação Atual e Perspectivas.** Belém. 2013. 89 p. HENRIQUES, H. S.; SOARES, M. M. (Coord.). **Políticas e Ações para a**

Cadeia Produtiva de Gemas e Jóias.

Instituto Brasileiro de Gemas e Metais Preciosos (IBGM). Brasília: Brisa, 2005.

IBGE. Base de Dados Agregados. Sistema de Recuperação Automática - SIDRA, 2013. Disponível em: http:// www.sidra.ibge.gov.br/. Acesso em: 08 jun. 2013.

IBGE. Indicadores IBGE. Pesquisa industrial Mensal Produção Física - abril, 2013. Disponível em: http:// www.ibge.gov.br/home/estatistica/indicadores/industria/pimpfbr/pim-pf-br_201304caderno.pdf. Acesso em: 31 .j u 1.2013.

IDESP. Painel de Informação - Produto Interno Bruto, 2013. Disponível em:http://www.idesp.pa.gov.br/paginas/ painelInformacao/produtoInternoBruto.php. Acesso em: 10 jul. 2013.

IMERYS RIO CAPIM CAULIM S/A (IRCC), 2013. Sitio institucional. Disponível em http://www.imerys.com.br. Acesso em: 02 jul. 2013.

JOÃO, X. da S. J. et all . **Geodiversidade do estado do Pará.** - Belém: CPRM, 2013. 258 p.: il. LAPIDO-LOREIRO, F.E. **O Brasil e a Reglobalização da Indústria das Terras Raras.** CETEM/MCTI. Rio de Janeiro - 2013.

LIMA, P. C. R. **Terras - Raras.** n° 17 - Setembro de 2013. Disponível em: http://www12.senado.gov.br/noticias/ jornal/revista-em-discussao. Acessado em 18/11/2013.

LUZ, A. B. et al. Rochas e Minerais Industriais: usos e especificações. 2 ed. - Rio de Janeiro - CETEM/MCT, 2009, p. 255-294.

MDIC. Sistema de Análise das Informações de Comércio Exterior, 2013. Disponível em: http://aliceweb2.mdic. gov.br/. Acesso em 15 out. 2013.

MTE. Base de Dados, 2013. Disponível em: http://bi.mte.gov.br/bgcaged/login.php. Acesso em: 10 jun. 2013.

MENDO, J. **Relatório técnico 38:** Perfil do Calcário, 2009. Disponível em: <http://www.mme.gov.br/sgm/galerias/arquivos/plano_duo_decenal/a_mineracao_brasileira/P27_RT38_Perfil_do_Calcxrio.pdf>. Acesso em: 10 out. 2013.

MENDO, J. **Relatório técnico 53:** Perfil do Fosfato, 2009. Disponível em: <www.mme.gov.br/sgm/galerias/ arquivos/plano_duo_decenal/a_mineracao_brasileira/P29_RT53_Perfil_do_Fosfato.pdf>. Acesso em: 10 out. 2013.

MENDO, J. **Relatório técnico 57:** Perfil da Agua Mineral, 2009. Disponível em:<http://www.mme.gov.br/sgm/ galerias/arquivos/plano_duo_decenal/a_mineracao_brasileira/P31_RT57_Perfil_da_xgua_Mineral.pdf>. Acesso em: 10 out. 2013.

National Geographic. **Ingredientes (chineses) Secretos de (quase) Tudo.** Junho de 2011 - paginas 114 a 122**.**

MBAC FERTILIZANTES: Projeto Santana. Painel de Investimentos 2013-2018. São Paulo. 2013.

MTE/RAIS. **Relação Anual de Informações Sociais - RAIS 2012. Disponível em:** http://portal.mte.gov.br/ rais/. Acesso em: 12 jul. 2013.

OCDE (2013). Relatório Territorial da OCDE: BRASIL 2013, publicação da OCDE.

OLIVEIRA, J. M. F.; MENDES, E. S.; COSTA JUNIOR, C. N. da; GUERRA, E. Arranjos Produtivos Locais de Base Mineral (APLs). **Perspectiva Mineral,** n. 4, ano 1, 24 dez. 2009.

PASTANA, J. M. N. Síntese geológica e favorabilidade para tipos de jazimentos minerais do Município de Monte Alegre-PA. Programa Informações para Gestão Territorial - Estado do Pará, Santarém/Belém: CPRM - PRIMAZ, 1999. 36p. il.

REZENDE, N. das G. de A. da M. **Insumos Minerais para Agricultura e Áreas Potenciais nos Estados do Pará e Amapá** - Belém: CPRM, 2001. 57 p. il.

RIO VERDE MINERALS. Projeto Fosfatar: Auto - Suficiência em fertilizantes para o Pará. Painel de Investimentos. Rio de Janeiro. 2013.

Sindicato Nacional da Indústria de Extração do Ferro e Metais Básicos - SINTERBASE. Noticias do dia 29 maio 2013. Disponível em: www.sinferbase.com.br/noticias.php?id = 1370. Acessado em 04/12/2013.

SIMINERAL. **Anuário Mineral do Pará.** Belém, 2013. 302 p.

TRINDADE, R.; BARBOSA, O. **Extração de Ouro-** Princípios, Tecnologia e Meio Ambiente. Publicação CETEM, Rio de Janeiro, 2002.

VOTORANTIM. Grupo Votorantim, 2013. Sítio Institucional. Disponível em: http://www.votorantimcimentos.com. br/htms-ptb/Default.htm. Acesso em: 11 set. 2013.

ANNEX I

TABLE CFEM AND MAIN TAXES COLLECTED BY THE MINING FROM PARÁ (1980/2012) (U.S. $ thousands)								
Year	**IUM**	**ICMS**	**CFEM**	**IOF**	**TOTAL 2013**	**EXPORTS %**	**(A) / (B)%**	**Mean**
1980	6,800				6,800	75,570	9.00%	8.2%
1981	8,500				8,500	125,111	6.79%	
1982	8,500				8,500	100,081	8.49%	
1983	13,200				13,200	129,021	10.23%	
1984	10,600				10,600	141,471	7.49%	
1985	14,800				14,800	119,510	12.38%	
1986	28,600				28,600	291,403	9.81%	
1987	27,600				27,600	428,324	6.44%	
1988	27,900				27,900	598,475	4.66%	
1989	45,000				45,000	668,460	6.73%	
1990		56,000			56,000	813,796	6.88%	7.2%
1991		57,976	13,881	1,633	71,857	631,823	11.37%	
1992		43,333	9,514	2,312	52,847	866,035	6.10%	
1993		38,105	8,554	2538	46,659	824,655	5.66%	
1994		44,218	10,935	3327	55,153	765,963	7.20%	
1995		56,464	12,709	2452	69,173	912,401	7.58%	
1996		40,503	14,714	405	55,217	1,009,779	5.47%	
1997		10,628	15,987	465	26,615	1,075,584	2.47%	3.7%
1998		10,690	21,199	318	31,889	1,083,754	2.94%	
1999		3,155	18,447	155	21,602	985,293	2.19%	
2000		6,119	23,612	295	29,731	1,045,147	2.84%	
2001		10,713	18,371	218	29,084	1,101,567	2.64%	
2002		15,682	14,530	199	30,212	1,036,832	2.91%	
2003		32,462	26,051	477	58,513	1,092,277	5.36%	
2004		31,179	34,056	445	65,235	1,665,252	3.92%	
2005		79,281	51,292	485	130,573	2,289,735	5.70%	
2006		82,571	61,732	485	144,303	2,969,334	4.86%	
2007		81,030	83,429	485	164,944	3,493,182	4.72%	
2008		90,435	98,312	485	189,233	5,673,21 1	3.34%	
2009		163,720	137,895	485	302,101	4,781,907	6.32%	
2010		115,102	184,940	485	300,527	8,378,924	3.59%	
2011		94,639	251,504	485	346,143	13,374,774	2.59%	
2012		89,131	250,881	485	340,013	10,330,474	3.29%	
TOTAL	191,500	1,392,997	1,362,546	19,119	2,947,043	68,879,124	4.28%	

Source: IDESP.

ANNEX II

Methodological Procedures

Since February 2012, the SEICOM initiated a number of activities involving studies, technical reports, thematic workshops and meetings, among others, culminating in the preparation of the first Mining Plan of Pará (PEM-2030).

To serve as a planning tool for good management of mineral resources, based on sustainable use and on the addition of value to minerals and the territory, with the purpose of promoting competitiveness and combating poverty and inequality in Pará, through the creation of jobs and income and the multiplication of opportunities. Besides the diagnosis of the mineral sector in the State, the PEM indicates guidelines, strategies and actions defined by the Government of Pará to guide the programs necessary for the development of the state from its mineral platform.

PEM 2030 has been prepared by many hands, that is, by a large and diverse group of professionals and representatives of the society. And therefore, the result of a participatory process involving representatives of the state (municipal and state agencies), the business sector, federal and state organizations, teaching, research, science and technology, as well as civil society organizations in general. Social participation was made possible by the use of specific methodologies as the realization of thematic workshops and seminars consolidation.

Thirteen Thematic Workshops were conducted in accordance with the methodology of the National Mining Plan [55] Beyond three seminars Consolidation to integration of the proposed actions. These events were attended by representatives of public, private, universities, research institutes and other organizations of civil society. Importantly, this was a broad participatory process involving 1,300 attendance of 244 entities, including public bodies (101), private entities (70), educational institutions research and Science, Technology and Innovation (ST & I) (20) and entities civil society (53).

Each Thematic Workshop held in an entire day in different cities in the state, all with the presence of representatives of industries related to mining and mineral processing industries. The events were held in Belém, Barcarena Itaituba, Parauapebas Paragominas and Santarém. Generally, by the morning, it was done leveling information, with the participation of lecturers and accredited by the afternoon, the collective construction of proposals, as Table 1, with specialized audience who contributed their experiences to discuss shares to be aggregated to the document, with the assistance of mediation. Throughout the organization and execution of the work of the workshops was the responsibility of Institute for the Development of Amazonia (FIDESA), together with the technicians of SEICOM.

TOPIC OF PRESENTATION AND WORKSHOP			
8:30 a.m.	Official Opening	14.00	Space for exchanging experiences and strategize
9:00 a.m.	Presentation of the Speaker (if any)	14:30	Debates
lOhOO	Opening questions to the lecturer	16:00	Space for mapping potential partners in conducting other workshops (where applicable) / define responsibilities and strategies for continuity of work / end referrals
IlhOO	Presentation of the methodology of work	17:30	Finishing and systematization of work Workshop Evaluation
12:00	Lunch	18.00	CLOSING OUT:

55 National Mining Plan 2030 http://www.mme.gov.br/mme/menu/plano_de_mineracao_2030/plano_nacional_2030.html

The issue presented in each workshop was divided into topics; for each topic, those present had common problems and possible solutions, considering their expertise in the subject. Also suggested the partner institutions responsible for the resolution of these problems, as well as the deadline for the solution.

This set of proposals approved in the workshops was divided between the dimensions considered struc-turantes PEM in 2030, namely: Governance, Market, Environment and Society. The major guidelines have been agreed Consensus, Cooperation and Commitment and, to implement the proposals were grouped around four strategic: 1) Stimulate the production, 2) persuasion, 3) Induction and 4) regulation.

In addition to fixed SEICOM staff and guest researchers, other participants were chosen from the profile of the Office concerned. It should be stressed that only entities and not individual people were invited. However, as the themes of the lectures of the workshops were of public interest, especially those performed within the State, were open to the public, since previously confirmed their presence, which was confirmed by subscription lists, which are contained in appendix to the plan.

As the topics of the workshops were divided into topics, which were discussed by the attendees, with their problems and possible solutions approach, the consensus at the end of the workshop gave rise to a text that would be appropriate to plan.

The contextualization and characterization of mining in Pará, presented in Chapters I and II of the PEM, were based on secondary data available in databases, reports and special publications of a set of public, and private organizations representing the interests of political actors actions involved in the mining sector: National Department of Mineral Production (ANP); Ministry of Mines and Energy (MME); Ministry of Development, Industry and Foreign Trade (MDIC); Ministry of Labour Employment and Earnings (MTE); IRS; Brazilian Institute of Geography and Statistics (IBGE); Centre for Mineral Technology (CETEM); Institute of Economic, Social and Environmental Development of Pará (IDESP); State Department of Environment (SEMA); National Geographic; National Union of Extraction of Iron and Base Metals Industry (SINFERBASE); Geological Survey of Brazil (CPRM); Federation of Industries of Pará (FIEPA); Organizations of Brazilian Cooperatives (OCB-PA); Brazilian Aluminum Association (Abal); Brazil Steel Institute; Business Organizations (Vale, Albras, Votorantim Cement Group and Votorantim Metais). In addition, the indicators FIRJAN Development (IFDM / FIRJAN) index as well as primary data available in the Directors Industry Development (IDD) and Geology, Mining and Mineral Processing (DIGEM) of SEICOM were used.

The Trend Analysis of growth of mining and mineral processing, presented in Chapter III of the PEM was based on secondary data available. The estimated investment in mining and the corresponding manpower required for the next year was based on information provided by FIEPA / NETS and trend analysis, technical support from the IDESP. The estimated production of metallic minerals, 2030, was based on two methodologies: 1) until the year 2017, information on new investments and the related increase in regional production, provided by FIEPA / NETWORKS, by the Union of Mineral Industries of Pará (Simineral) and the other representing the sector were considered; 2) from 2017 was based on a model developed by IDESP.

Based on the diagnosis and trend analysis in Chapter IV the constraints of the future were presented to the mineral sector in Pará From the workshops held by SEICOM, with partner organizations, and interviews with government officials, academics, businessmen and experts in the field of mining, we selected 13 key variables that will determine the future in the context of Pará The variables were arranged in the Structural Analysis Matrix - variable/variable that identifies those with the greatest influence (sum of the last column) and those with a higher degree of dependence (the sum of the last line). Weights 0-3 for the variables were assigned, according to the expertise of all involved.

The preparation of the proposed strategies and actions of the first PEM - 2030, presented in Chapter V, was taken collaboratively and many hands. For this, and several technical meetings, the SEICOM organized 16 meetings, sendo13 thematic workshops and three seminars consolidation of proposals to address critical issues of mining with a strong impact in the state.

DEVELOPMENTS OF THEMATIC WORKSHOPS AND SEMINARS MINING		
TOPIC WORKSHOP	**Location / Date**	**DEVELOPMENTS**
Stimulation of polo gems and jewelery segment of the state of Pará	Belém 09/02/12	Management Agreement ESJL
Mineral-based APLs; Ceramic craft potter and mineral	Belém 03/04/12	Idem, Polo Sao Miguel do Guama
Mining activity: Regularization and formalization	Itaituba 26/06/12	GT-Tapajós
Mineral inputs for agriculture	Belém 14/08/12	GT-Agricultural Input
Research and Technological Innovation for development of the mining industry	Belém 27/0912	Contribution to Plan for Amazon CTI
Mining in protected areas in Pará	Belém 11/12/12	Elements for discussion of environmental policy with the Mineraria COEMA
Adding value in the mineral industry	Belém 21/02/13	Contribution to Plan for Amazon CTI
Mineral royalties and regional development	Parauapebas 20/03/13	Contribution to the New Regulatory Framework Mining
Corporate social responsibility and regional development	Paragominas 07/05/13	Elements for discussion of social responsibility policy with the COEMA
Mineral exploration and geological development	Santarém 28/05/13	Cooperation agreement with CPRM
Social minerals and construction aggregates	Santarém 29/05/13	Mineral social project
Strategic minerals, rare earths and opportunities to Para	Belém 02/08/13	Participation in discussions for the creation of SENAI Innovation Institute - ISI
State Policy and Governance Model for Mining in Pará	Belém 05/09/13	Participation in discussions of the Regulatory Framework of Mining
1 Seminário de Consolidação do Plano de Mineração	Belém 21/11/2013	Absorption contributions from the company to the strategies and actions of the Mining Plan
II Seminário de Consolidação do Plano de Mineração	Parauapebas 26/11/2013	Absorption contributions from the company to the strategies and actions of the Mining Plan
III Seminário de Consolidação do Plano de Mineração	Barcarena 06/12/2013	Absorption contributions from the company to the strategies and actions of the Mining Plan

Prepared by: SEICOM, 2013.

The results of the thematic workshops, either wholly or in part, are already being used in policies and programs SEICOM and partners whose projects can be accessed on the SEICOM page (http://seicom.pa.gov.br/plano-mineracao- 2030 /).

Workshops in 57 thematic lectures (available were presented to *download* SEICOM on the page), along with seminars and consolidation totaled participation of 244 institutions between public, private, civil society, academic and research institutions (see list attached), pointing out problems and solutions, totaling 1,300 participants, 169 proposed actions. Many of these actions are repeated or resemble; thus to optimize implementation efforts, the actions have been brought by four major theme areas: environment, society, market and governance.

These four thematic areas were defined from a model of integrated and participatory management, which seeks to combine the principles of sustainability (the *"Triple bottomline":* environment, business and society) with modern social management (trissetorial model: government, society and market).

The **Axis Environment** lists strategies, projects and action plans related to the goals of conservation and natural resources minimize environmental impacts, in order to promote economic growth by raising the quality of life and ensuring availability of natural resources and ecosystem services associated to the development of productive activities even after the exhaustion of mineral resources.

The **Axle Company** presents strategies, projects and action plans for the formulation and implementation of policies for improving the distribution of income and employment generation. Thus, the PEM-2030 aims to promote the reduction of inequality and poverty through initiatives that enable the socio-productive inclusion as a result of the increase directly or indirectly related to mining economic activities.

The **Axis Market** presents strategies, projects and action plans that aim to increase business competitiveness and add value to mineral production. To this end, proposals for the development of technological innovations that promote increased competitiveness of business sectors involved in mining and mineral processing industries are presented.

The **Governance axis** defines strategies, projects and action plans which aim to improve the quality of public administration, in their different spheres (Federal, State and Municipal). With this objective, the Plan sets out proposals for the modernization of government management, seeking to elevate the effectiveness of public policies and the promotion of socioeconomic development in areas under the influence of mining activities in Pará territory.

ANNEX III

LETTER CREATION OF ADVISORY BOARD POLICY OF THE STATE OF PARÁ MINING

MESSAGE No. _____ / 2012-GG Belém _____ August 2012.

Mr President,

Ladies and gentlemen,

I have the honor to submit the estimated consideration to your Excellencies, under Article 104 of the State Constitution, the Bill amending the Law 6,376 of July 12, 2001, which established the mining policy of the State of Pará and created the Advisory Council of the mining policy of the State of Pará

Law No. 6.376/01, made more than ten years has still great importance in the context of Pará, since is a matter of utmost importance for the economic and social development of the region, however, the Advisory Council of the mining policy State of Pará, created by this Act, a long time is inactive, despite the fact that the Act is in force.

Some members of that Council were abolished or simply remained inert against the effective participation in the Council, in turn, failed to meet after the extinction of the State Department of Industry, Trade and Mining, SEICOM in 2007.

Which occurs in December 2011, through Law No. 7,570, the SEICOM was rebuilt and now has a strong presence in mineral-economic scenario of the State. Thus, it is necessary for the immediate reactivation of the Advisory Council of the mining policy of the State of Pará has to be reformulated in accordance with the rules and entities usual.

Therefore, I take the initiative to forward this Legislative House Bill under discussion, given the imperative to change the Law ' 6.376/01, in an emergency, pursuant preceituados by Article 107 of the State Constitution.

Government Palace, _____ August 2012.

Simão Jatene

Governor of the State of Pará

ANNEX IV

His Excellency

Mr Manoel Carlos Antunes

PRESIDENT OF THE LEGISLATIVE ASSEMBLY OF THE STATE OF PARA

THIS

Draft Law No. _____ of _____ March 2012.

Create the Advisory Council of the mining policy of the State of Pará

The Legislative Assembly of the State of Pará stipulates and I sanction the following Law

TITLE I

Mining of the Policy Advisory Council

CHAPTER IV

Da Constituição do Conselho Estadual de Política Minerária

Article 1 °. It created the State Board of mining policy of the State of Pará, an advisory body, independent and harmonious in relation to other state entities and linked to the Secretary of State for Industry, Commerce and Mining - SEICOM.

Art. 2.

Secretário de Estado de Indústria, Comércio e Mineração - SEICOM;

One (1) representative of the State Department of Labor, Employment and Income - Seter;

One (1) representative of the Secretary of State for the Environment - SEMA;

One (1) representative of the Department of Finance - SEFA;

One (1) representative of the Secretariat of State Science, Technology and Innovation - SECTI;

One (1) representative of the Legislative Assembly;

One (1) representative of the Brazilian Society of Geology, Center-North - SBG-NO or the Association of Professional Geologists of Amazonia - APGAM;

One (1) representative of the Association of Mineral Industries of the State of Pará - Simineral;

One (1) representative institution of higher education and research with a link to the mineral sector;

One (1) representative of organized civil society choose between legally constituted entities and have their status in the protection of the environment;

One (1) representative of the Miners Association of Municipalities of the State of Pará - AMEPA;

One (1) representative of the Union of Workers in Extractive Mineral Industries of the State of Pará;

One (1) representative of the Union of Workers of Mineral Processing.

§ 1. The number of representatives of public authorities shall not exceed the half plus one of the total membership.

§ 2. The appointment of members of the State Council of the mining policy occur by act of the Chief Executive, for a term of two (2) years and renewal will be made in accordance with Article 321, inc. II of the Constitution of the State of Pará;

§ 3. Members of the State Council, representatives of professional bodies classist, shall be nominated to the Executive by the respective representative bodies with an alternate.

§ 4. It should be ensured the participation of one (1) representative of the Public Ministry of the State of Pará, one (1) representative of the National Department of Mineral Production - DNPM, one (1) representative of the Federal Public Ministry and one (1) representative Research Company for Mineral Resources, CPRM, provided guests at all meetings of the Board.

Art. 3.

Must opine on the mining policy of the State to maximize the benefits of the mineral sector to the development of Pará on a sustainable basis;

Guide the Government in respect of mining in all its stages (geology, mining and mineral processing), especially in the formulation of policy for the development and improvement of the mineral sector;

Propose actions that promote the implementation of the policy, considered the national programs and the interests of the State of Pará;

Analyze and evaluate proposals for the implementation of projects in the state sector;

Suggest measures aimed at improving relations and integration of efforts between the public sector with the private sector, to strengthen the sector and better utilization of mineral resources;

Guide the development of programs aimed at improving the mining sectors and combined efforts of different agencies working in these sectors;

Propose actions aimed at strengthening the performance of the Government in regard to the recovery and processing of mineral resources activities.

Art. 4.

Pension Plans

Plenary

Technical Committees

Working Groups

Group of Advisors

Executive Secretariat

§ 1. The Chair of the State Board of Mineraria Policy shall be exercised by the State Secretary of Industry, Commerce and Mining - SEICOM.

§ 2. In addition to the committees specified in paragraph one, others may be created in permanent or temporary, depending on the nature of the matter by Council.

§ 3. The appointment of members of the Commissions responsibility of the President of the Council may participate in them as guests, representatives of government, not mentioned in this Act, or the private sector, or persons of renowned in their respective fields of their performances.

§ 4. The direction of the Executive Secretariat shall be headed by the director of mining SEICOM.

Art. 5. The exercise of the adviser is considered within the public interest, not fitting any type of compensation.

Article 6. Costs associated with the operation of the Board shall be borne appropriations budget-nity of SEICOM.

CHAPTER II

GENERAL PROVISIONS

Art. 7 °. Are hereby repealed sixth to tenth articles of Law no. ° 6.376, of July 12, 2001.

Art.8 °. The Government shall regulate this Law, as applicable, within one hundred and eighty days;

Article 9. This Law shall enter into force upon its publication.

Article 10. The provisions are repealed otherwise.

Government Palace, _____ August 2012.

Simão Jatene

Governor of the State

ANNEX V

List of participants of the thematic workshops

NAME	INSTITUTION / FEDERAL GOVERNMENT AGENCY	NAME	INSTITUTION / FEDERAL GOVERNMENT AGENCY
Adelson da Silva Carvalho	Banco da Amazónia	José Paulo Costa	Banco da Amazónia
Alex Rodrigues de Freitas	DNPM	José Raimundo Abreu de Souza	INMET
André Luiz Santana	DNPM	Jucelino da Silva	SUS
António Maria Zacarias Marques	SUDAM	Lúcia Travassos Costa	CPRM
Bruno Alves de Jesus	MME	Luís Oliveira da Silva	DNPM
Carmem Silva Coelho	Banco da Amazónia	Luiz Fernando (Mineiro)	MME/SGM
Carlos Augusto Pinheiro	ICMBio	Maitê Guedes	ICMBio
Cesar Augusto Dumont Labuto	MP	Manfredo Ximenes	CPRM
César Lisboa Chaves	CPRM	Manoel Imbiriba Junior	CPRM
Cristiane Sousa	CPRM	Marcelo Lacerda Vasquez	CPRM
Daniel Luiz Leal Mangas	EM BRAPA	Marcos António Cordeiro	DNPM
Edésio Macambira	CPRM	Maxiely Searam Ussa Dergamm	OAB
Edgar Pinheiro	Banco da Amazónia	Murilo Resende Machado	ICMBio
Ediléia Soares Pires	DNPM	Nilton Júnior Lopes Rascon	ICMBio
Edson Farias Mello	MME	Oldair La marque	DNPM
Elizete Gaspar	SUDAM	Pedro Bruzzi	MMA
Enir Sebastião Mendes	MME	Ricardo Alexandre Fialho de Oliveira	SIPAM
Fabiany Maria Made e Vellasco	MDIC	Roberto Vilas Bôas	CETEM
Francisco Alfaia	Banco da Amazónia	Rosária Sena Cardoso Farias	ICMBio
Firmino Corrêa Júnior	CPRM	Samir Nahass	MME
Firmino Coutinho Junior	CPRM	Sávio de Jesus Tourinho da Cunha	Banco da Amazónia
Francisco Waldir Silveira	CPRM	Tânia Keiler Argolo	CPRM
Gerson Buss	ICMBio	Telma Rodrigues	Caixa Económica Federal
Helder Nonato Araújo Batista	ICMBio	Thiago Marques de Almeida	DNPM
Hugo Américo Rubert Schaedler	IBAMA	Valter José Marques	CPRM
Jackson de Figueiredo Neto	CETEM	Xaf da Silva Jorge João	CPRM
João Bosco Braga	DNPM		
NAME	**INSTITUTION / BODY PUBLIC STATE**	**NAME**	**INSTITUTION / BODY PUBLIC STATE**
Adeilton Ferraz Ribeiro	IASEP	José Dias de Carvalho Zurutuza	IDESP
Adriana Mendonça de Araújo Bellesi	SETER	José Jaco Barroso	SAGRI
Agata Alves Alves	SEICOM	José Maria do Nascimento Pastana	SEICOM
Alberto Arruda	SECTI	José Pereira dos Santos	BANPARA
Alessandra da Silva Souza	SEMA	José Ribamar Nogueira	SAGRI
Alexandre de Melo Araújo	SEICOM	José Waterloo Leal	CREA-PA
Alexandre Galvão	SAGRI	Júlio Cesar Júnior	SEMA
Altevir Rezende	SAGRI	Junilce Carla da Silva Lobato	SEICOM
Amanda Lima	SEICOM	Leidiane Pereira de Oliveira	SEMA
Ambrózio Hajime Ichihara	SEICOM	Lilian Poliana Sousa Gualberto	EM ATER
Ana Cláudia Oliveira Andrade	IDESP	Liliane Pereira de Oliveira	SEMA
Ana Claudia Silva	SEICOM	Lívia Maria Araújo Cavalcante	SEICOM
Ana Lúcia Augusto	MP/PA	Lorena Passos Costa	SEICOM
Ana Maria Moreira	SEMA	Lourival da Silva Ribeiro Júnior	SEICOM
Anderson Pimentel Amaral	SEICOM	Lucas Felipe Fukushima	SEICOM
Anderson Tavares do Carmo	SEMA	Lucélia Cândida Guedes Guester	SEICOM
André C. Silva Melo	SECTI	Luciana Malcher	SEAS
André Costa	SEMA	Luís Augusto M. Cesar	SEMA
André Luiz Ferreira e Silva	SEFA	Luís Felipe Marques Cordeiro	EMTAER
Andreia Dantas Costa	SEMA	Luís Otávio Maranhão Júnior	SEICOM
Artur Fernandes Silva Mascarenhas	SEICOM	Marcélia da Silva Corrêa	SEMA

NAME	INSTITUTION / BODY PUBLIC STATE	NAME	INSTITUTION / BODY PUBLIC STATE
António Bentes Figueiredo Neto	ARCON	Marcelo Gadelha Machado	SEMA
Arthur Boa ventura de Azevedo Pereira	SEMA	Márcia Cristina Sarges de Oliveira	SEMA
Benedita Araújo	SETER	Marcial Maciel de Oliveira	SECTI
Benedito Evandro Barros da Silva	SEMA	Marco António Silva Lima	SEICOM
Bernardo de Oliveira Araújo	SEICOM	Marcus Vinícius Moraes	BANPARA
Brenda Batista Cirilo	SEMA	Maria Amélia Rodrigues S. Enríquez	SEICOM
Bruno de Souza Sodré	SECTI	Maria de Nazaré Barreto Dergan	EMTAER
Bruno Yoheiji Kono Ramos	ITERPA	Maria do Socorro Souza Lola	BANPARA
Carlos Alberto Cardoso	SEFA	Maria Glaucia Pacheco Moreira	IDESP
Carlos de Jesus Cristino Filho	SEICOM	Maria Suely Margalho do Vale	SEAD
Cassiano F. Ribeiro	IDESP	Marjorie Barros Neves	SEICOM
Celso A. Trierweiler	SEDIP	Marta Helenise Maia Amorim	IDESP
Charles Benedito Gemaque Souza	SEMA	Matheus Severo Lopes	SEMA
Christiane Silva Negrão	SECTI	Mônica Ferreira dos Santos	SEPAQ
Cláudia Medeiros Lobato	BANPARA	Mônica Marques Moura	SEICOM
Daniel de Oliveira	SEMA	Murilo Augusto Carreteiro Chaves	SEICOM
Daniel Rendeiro	SETER	Nanety Cristina Alves dos Santos	IDESP
Daniela Mayumi Kiyatake	SEMA	Nelsivaldo de Jesus Bargas	SECTI
David Oliveira Luz	SEMA	Niceia Mara Pereira dos Santos	SEMA
Denivaldo Dias Pinheiro	SECTI	Nilson Chaves	FCPTN
Deoclécio Neves Cordeiro Júnior	PARATUR	Nívia Gláucia Pereira	SEMA
Domenico Faciola Branco	SEMA	PatrickOliveira Avelar	EGPA
Douglas Dinelly Ribeiro	SEICOM	Paulo Fabrício Maués da Silva	SEMA
Ediberto Rosário Abreu	SEJUH	Pierre Sena	SEDIP
Edson da Silva e Silva	IDESP	Raimundo de Sá	EMATER
Edwin Júnior Araújo da Silva	CDI	Raimundo Jorge Raiol	SEMA
Eduardo Rodrigues Costa	Advising the Governor of Pará	Raimundo Nonato Pimentel	SEDIP
Eliana dos Santos Zacca	SAGRI	Raimundo Nonato Ribeiro	EMATER
Elielton Alves Amador	SEDIP	Regiane do S. do Espírito Santo Rego	MP/PA
Elineuza Faria da Silva Trindade	SEMA	Renata Melo dos Reis Dias	SEMA
Ernildo César da Silva Serafim	SEMA	Renato Miranda Braga	SEICOM
Etiane de Souza Silva	IDEFLOR	Roberta do Nascimento Cabá	SEMA
Eugênio Nunes Tavares	SETER	Roberta Sertão Lira	SEMA
Eva de Fátima da Silva	SEMA	Roberto Carlos de Pinho Furtado	SEDIP
Evandra Priscilla Souza da S. Vilacoert	SEMA	Roberto lanes da Rocha Vieira	EMTAER
Fábio Ferreira Cardoso	SEMA	Rodrigo de Almeida Fernandes	SEICOM
Fátima Cristina Marques Ferreira	SEMA	Rodrigo dos Santos Lima	EMTAER
Fernanda Almeida Cunha	SEMA	Rodrigo Garcia	SEICOM
Flávia Cardoso Farias	SEMA	Rodrigo Vieira Benaduce	SEMA
Francisco Salutiano Silva	EM ATER	Rosângela Andrade Pinheiro	SEMA
George de Lima Valois	IPHAN	Rosinete das Graças F. N. Navegantes	IDESP
Geraldo Narciso da Rocha Filho	SECTI	Samir Bestene	SEMA
Gerson Medeiros da Silva	SAGRI	Sandra Maria Maia Sampaio	SEICOM
Gisa Bassalo	SECTI	Sebastião dos Santos	SEMA
Gilberto Felipe Gomes de Castro	SEMA	Sérgio Augusto	SEICOM
Gleidison da Silva Souza	SEMA	Sérgio Campos	SAGRI
Gozanlo Henrique Enríquez	SEDIP	Sérgio Castro Gomes	IDESP
Hailton Cesar Pimentel Fialho	SEMA	Sérgio Menezes	SAGRI
Helder Abdon Gaspar	SEICOM	Shirley Soares Prata	SEMA
Hellen Martins	SEICOM	Sidney Rosa	SEDIP
Heloisa Helena Veio Ramos	MP/PA	Sônia Mendes de Abreu	SEICOM
Jamily Sampaio Ribeiro	FCPTN	Tanice da Silva Aguiar	SEMA
Janete dos Santos Lima	SEMA	Tarcísio Feitosa da Silva	MP/PA
Igor Charles Alves	SEMA	Telma Lúcia Araújo	SEMA
Iolene Freitas de Azevedo	SEMA	Tereza Cristina de Souza Freitas	SEMA
Israel Nazareno Athayde	SEICOM	Terezinha Silva da Costa	SEDIP
Isaias Barbosa Júnior	SECTI	Uzelinda Martins Moreira	SEFA
Jean Carlos Almeida	SEMA	Verónica Rodrigues	SEICOM

João Lima	SEMA	Victor António Falcão	SEICOM
João Paulo Costa Lima	SECTI	Wellington Cezarde Andrade Souza	SEMA
Jocilete de Almeida Ribeiro	SEMA	Willian Ferreira Sousa	SEICOM
Jonas Veiga	IDESP	Wilson Luiz Ribeiro da Costa	SEICOM
Jorge Eduardo Macedo Simões	IDESP	Wilton Marcello Teixeira	SEICOM
NAME	**INSTITUTION / BODY MUNICIPAL GOVERNMENT**	**NAME**	**INSTITUTION / BODY MUNICIPAL GOVERNMENT**
AdamorTuji	Parauapebas City Government	Keila Maria Santos Lima	Paragominas City Government
Agenor Garcia	Parauapebas City Government	Kyuca Torres	SEMAD - Paraupebas
Albino Soares Lopes	SEMEC - Paragominas	Laura Lograd o Mourão	SEMMAP - Itaituba
AlcirG. da Silva	Parauapebas City Government	Leany Santos	Parauapebas City Government
Aldeny Araújo	Parauapebas City Government	Luciana Sousa Sá	Parauapebas City Government
Alessandra Martins	Parauapebas City Government	Luciene 0. Silva	Parauapebas City Government
Alfredo José Mendes	SEMMAP - Itaituba	Lucinete Carvalho Tavares	Board of Paragominas
Aline Maia dos Santos Nunes	Council on Social Work Paragominas	Luiz Garcia	People's Bank of Paraupebas
Anaisa Duarte	Parauapebas City Government	Luiz Marcelo Abreu	SEMMECT-Paraupebas
Anderson George	Parauapebas City Government	Manoel Soares da Silva	SEMEC - Paragominas
André Silva Pinto	Parauapebas City Government	Marcelo Erick Deuzico	SEMMA - Santarém
Andreia Sampaio	Parauapebas City Government	Marcelo Pontes	Parauapebas City Government
Andreia Alves	Parauapebas City Government	Marco Aurélio Dolzane	Prefecture Juruti
Andreia T. Oliveira	Parauapebas City Government	Marcos António Abreu do Amaral	SEMAGRI - Paragominas
Andressa Melo	Parauapebas City Government	Marcos M. Ribeiro	Parauapebas City Government
And reza de Paula Oliveira Guedes	SEMMA - Paragominas	Marcos Moura Gentil	Santarém City Government
Angelo Silva Moraes	SEMMAP - Itaituba	Maria Angélica de Sousa	SEMMECT - Paraupebas
Angenita Cantanhede Soares	Guardianship Council Paragominas	Maria Aparecida Luciano	Sec of Culture Paragominas
António Hilton M. Santos	SEMMAP - Itaituba	Maria Beatriz Silva	Parauapebas City Government
António Ivan	SEMMA - Paraupebas	Maria da Glória de Souza Feitosa	SEMMA - Paragominas
António Pontes	Town of Eldorado dos Carajás	Maria das Dores Silva	Parauapebas City Government
Belonice Corrêa	Board of Paragominas	Maria de L. da Silva	Parauapebas City Government
Bismarks Lima	Parauapebas City Government	Maria do Carmo Pereira	SEMED - Paraupebas
Calvino Pereira da Silveira Junior	SEMEC - Paragominas	Maria Genilda	SEMAGRA - Itaituba
Carlos Alberto Pereira	Parauapebas City Government	Maria Ivete Bastos dos Santos	Board of Santarém
Célio Rocha	Parauapebas City Government	Maria José Maia	Santarém City Government
Célio Costa	Parauapebas City Government	Maria José Monteiro	SEMAD - Paraupebas
Chico Brito	Parauapebas City Government	Maria Rosenilde Oliveira	Council of Child and Adolescent Paragominas
Christian Calisto	Parauapebas City Government	Mariléia S. Moraes	AM
Cibele S. O. Setúbal	Parauapebas City Government	Marilene Dias	Parauapebas City Government
Claudei Badaleira de Souza	SEMEC - Paragominas	Mário Alves Caetano	Legal Secretary Paragominas
Cláudio Maria	Parauapebas City Government	Mário José de Miranda	SEMINFRA-Itaituba
Creuza Reis	SMPM - Paraupebas	Mário Monteiro	Parauapebas City Government
Cristiane Araújo	SEMMAP - Itaituba	Maruza Waldeck Dias	Santarém City Government
DagmarJosé Pereira	Seden - Paraupebas	Mauricio D. Moreira	Parauapebas City Government
Daliane Silva	Parauapebas City Government	Maurivene Rocha	Parauapebas City Government
Daniel Silveiro Silva	Parauapebas City Government	Meire Souza	Parauapebas City Government
Danilo da Silva Trindade	SEMAGRI - Paragominas	Monique A. Oliveira	Parauapebas City Government
Dario Veloso	Parauapebas City Government	Nadierde Jesus	Parauapebas City Government
Debora Mayara	Town of Paraupebas	Nancinele Navarro	Seden - Paraupebas
Denise Terezinha Gabriel	Board of Paragominas	Nara Maria de Souza Bezerra	Santarém City Government

Dilson Silva Farias	Town of Paraupebas	Natasha F. Carrolo	SEMMA - Paraupebas
Diomar Farias de Carvalho	SEMAGRI - Paragominas	Nathalia Pontes	Parauapebas City Government
NAME	**INSTITUTION / BODY MUNICIPAL GOVERNMENT**	**NAME**	**INSTITUTION / BODY MUNICIPAL GOVERNMENT**
Douglas S. Mendes	Parauapebas City Government	Nathalya Brito	Parauapebas City Government
Ednéia Guedes de Oliveira	SEMMAP - Itaituba	Neuraci P. Braga	Parauapebas City Government
Eduardo Cassiano N. de Souza	Sec of Culture Paragominas	Neusa de Jesus Pinheiro	Prefecture Ulianópolis
Edvânia Ferreira	Town of Eldorado dos Carajás	Neusenir Alves	Parauapebas City Government
Eli Ramos	Parauapebas City Government	Odair Araújo Santana	Paragominas City Government
Eliane Batista	Parauapebas City Government	Odilom Rocha	Board of Paraupebas
Eliane Lima	Parauapebas City Government	Odilson António Silva Picanço	SEMUR-Paragominas
Eliane Sousa Silva	Parauapebas City Government	Oscar da Luz Prestros	SEMAGRI - Paragominas
Elias de Alencar Santos	Parauapebas City Government	Pablo R. F. Silva	Parauapebas City Government
Elide M. da Silva	Parauapebas City Government	Paula Fernanda Antunes	PGMI - Itaituba
Elielma de Oliveira Ferreira	SEMEC - Paragominas	Paulo Alternar Melo do Nascimento	SEMMA - Paragominas
ElueniDalferth	Parauapebas City Government	Paulo Pombo Tocantins	Paragominas City Government
Erasmo de Jesus	SEMAGRI - Paraupebas	Pedro Celson Bentes Castro	Santarém City Government
Erotildes Rodrigues	SEMMAP - Itaituba	Podalyro Neto	SEMMA - Santarém
Every Geniguens Tomaz Aquino	Municipality of Obidos	Rafaela Cabral Couto	SEMMA - Paraupebas
Felipe Zagalo	SEMMA - Paragominas	Raimunda de Araújo	Parauapebas City Government
Francisco de Assis da Silva	Board of Paragominas	Raimundo Edilson da Silva	Sec of Culture Paragominas
Francisco L. Cordeiro	Parauapebas City Government	Raimundo Matias Mota	Parauapebas City Government
Genivaldo Miranda da Costa	Parauapebas City Government	Raimundo Pereira	Santarém City Government
Geovana B. Silva	Parauapebas City Government	Raimundo Rodrigues	Parauapebas City Government
Gesmar R. Costa	Parauapebas City Government	Renato G. Pascoal	Parauapebas City Government
Gilmaria C. Aguiar	Parauapebas City Government	Rita S. Almeida	Parauapebas City Government
Gilvan Capestrano	Section of Planning and Development - Paragominas	Roberto Nagribão	Board of Paragominas
Gleicy Lira	SEMMA - Santarém	Romero Pinho Barros	Parauapebas City Government
Heleno Costa	Seden - Paraupebas	Rosa Heloisa Santos	Women's Council of Paraupebas
Herielson Mariano Cantuária da Silva	SEMAGRI - Paragominas	Ruy Galvão Ferreira Filho	SEMMAP - Itaituba
Ilene Nascimento	Parauapebas City Government	Schellby P. Cardoso	Parauapebas City Government
Isabel G. Cruz	Parauapebas City Government	Sebastião Cruz	Seden - Paraupebas
Isaias Neto	Parauapebas City Government	Selma Tahora Ferreira	SEMEC - Paragominas
ítalo Ipojucam	Hall deMarabá	Shirlian Rodrigues	SEMED - Paraupebas
Ivanaldo Braz Simplício	Parauapebas City Government	Siléia de Lima Pessoa	SEMMAP - Itaituba
Ivelise Corrêa Santana	SEMEC - Paragominas	Silvio de Paiva Macedo	SEMAGRA - Itaituba
Ivo Lubrina de Castro	SEMMAP - Itaituba	Sinalma Pinto	Women's Council of Paraupebas
Jean Alencar	Parauapebas City Government	Socorro Rama	Parauapebas City Government
Joacir Alves	Parauapebas City Government	Socorro S. Nunes	Parauapebas City Government
João Carlos Camerini	Attorney General of Santarém	Sonaery M. Nascimento	Parauapebas City Government
João Manoel Fernandes	SEMAGRI - Paragominas	Tateane Souza	Parauapebas City Government
João Santos da Silva	SEMMA - Santarém	Terezinha de Jesus	Parauapebas City Government
João Tadeu da Silva Campos	Parauapebas City Government	Terezinha Guimarães	SEMMA - Paraupebas
Joel B. Alves	SEMMA - Paraupebas	Valdemir Soares	SEMMAP - Itaituba
Jorleidi Antunes Arruda	Paragominas City Government	Valfredo Marques Junior	Itartuba City Government

Jose de Almeida	Parauapebas City Government	ValmirO. Mariano	Parauapebas City Government
José Garcia	Parauapebas City Government	Vera Francisca Batista Ferreira	Civil Police
José Gonçalves de Almeida	Parauapebas City Government	Wady Sobrinho	SEMAD - Paraupebas
José Maria Silva Vieira	Sec of Culture Paragominas	Wanderson F. Silva	Parauapebas City Government
José Omar Arrais	Parauapebas City Government	Wanterlor Bandeira	SEMOB - Paraupebas
Josineto F. Oliveira	Board of Paraupebas	Yuri dos Santos Ferreira	Board of Maraba
Jubal Cabral Filho	Itartuba City Government	Zacarias Chagas Filho	Town of Eldorado dos Carajás
Juliana Oliveira	Parauapebas City Government	Zoênio Silva	Parauapebas City Government
Karina Gomes	Parauapebas City Government		
NAME	**PRIVATE INITIATIVE**	**NAME**	**PRIVATE INITIATIVE**
Adalberto Augusto Rodrigues	Joias do Pará	Juliana Carvalho	SIMINERA L/Colossus Mineração
Adeilson Alves Porto	Mineração Gold do Agua Azul	Kelly Pinho Teixeira	SENAR/PA
Adria Souza Cirino	Mineração Gold do Agua Azul	Kleider Araújo	Mídia livre Comunicação
Alessandra Lopes de Oliveira	Rede TV	Leonardo Neves	SIMINERA L/Vale
Alexandre Mesquita	SENAI/PA	Lorena Sacramento	FAEPA
Allyson Cavalcante	MRN	Luci Fabris	TV Missão
Alonso Rogério Chagas	Residencial Olga Moreira	Lúcia Peres	SENAI/PA
Amauri A. Oliveira	CONSULPLAN	Luciana Castro	SENAR/PA
Ana Cláudia Pingarilho	FIEPA	Luciano Torres Madeira	SIMINERA L/Vale
Ana Franco	SIMINERA L/ALCOA	Luís Carlos Almeida	FAEPA
Ana Lúcia Santos	SEBRAE	Luiz António Bandeira	Consultoria
Ana Paula Everdosa dos Santos	SIMINERA L / Hydro	Luiz Pinto Júnior	FIEPA
André Gemani	MRN	Maluzia Fernandes de Oliveira	SESI-PA
André Reis	Simineral	Mareei Souza	FIEPA
António Wilson Pereira	North Plan	Marcelo Araújo	SEBRAE
Armando Pingarilho	SIMINERA L / Mining Colossus	Marcelo Fernandez	Mining St. Francis of Assisi
Benedito Farias de Almeida	Sindicer	Marcelo Marques	FAEPA
Bertram Heinze	ITV	Marcelo Noberto Huber	Eco Amazonia
Carlos Alberto Alves	GBAP Consulting and Mining	Marcelo Silva	Company Santa Rosa
Carlos Alberto Schenato	BM Engineering	Marco António Nascimento	SIMINERA L / Hydro Paragominas
Carlos Fernandes Xavier	FAEPA	Marinaldo Barbosa	TV Paragominas
Cecília Tatiana Mesquita	Hydro Paragominas BV	Mauro Farias Gato	FAEPA
Cesar Augusto Vasconcelos Pires	SIMINERA L / Hydro	Miguel Angel Alvarado Omana	GEORADAR
Ciromar Hupp	Sind. Trade Paragominas	Milene Maués	SIMINERA L / ALCOA
Cláudio Santos	Local Newspapers	Monique de Melo	Amazon TV
Daniel Santos	SIMINERA L / MRN	Nubia Maria Santiago	SENAR / PA
Dayana Alves	Liberal TV	Paula Queiroz	SIMINERA L / Colossus Mining
Denys Magno Sacomi Correia	Zoopec	Pedro Edvan de Souza Lima	TV Network
Devaney Cristina Cardoso Araújo	SIMINERA L / Hydro Paragominas	Raimundo Gonçalves Barbosa	Sindicer
Dilson Augusto Capucho Frazão	FAEPA	Raimundo Nonato Oliveira	SEBRAE / Paraupebas
Dirceu Frederico	ANORO	Raphael Sampaio	Advocacy Vale
Eduardo Machado	Cipasa Urbanism	Raul da Rocha Tavares	FIEPA
Elza Moreira	SENAI / PA	Renato Ribeiro Ciminelli	Polo Excellence Mineral and Metallurgical Minas Gerais
Eugênio Andrade	SINPRODUZ / Paraupebas	Ricardo Dias Caruso	SIMINERA L / Hydro Paragominas
Evandro Diniz Soares	ED Consulting	Roberto Doll Agnol	SIMINERA L / Vale
Evelinede Paula Serena Vianna	SIMINERA L / Hydro Paragominas	Roberto Gianetti	SearchMinerals
Fábio Araújo Mendes	SIMINERA L / Mining Paragominas	Rodrigo Alan Moraes Cavalcante	SENAR / PA
Fernando Brandão	SENAI	Ronaldo Jorge Lima	IBRAM
Francinaldo Magno	SIMINERA L / Vale	Roque Reis	Mineral Magazine Brazil
Francisco Brito	SEBRAE	Sandro Ferreira Miranda	GEORADAR
Francisco Moura	Framur Construction	Saulo Assunção Lobo	SIMINERA L / Vale
Franklin Roberto Lima dos Santos	SEISMIC / GEORADAR	Seme Sefrian Júnior	WVS - Mining
Georgiani Arruda Titau	SEBRAE	Sérgio Augusto Oliveira	Simineral / Votorantim Metais
Gilmar Silva Azevedo	Gauteng Building Materials	Sérgio Valente	SENAI

Giuliana Mara Patrício de Souza	SIMINERA L / Hydro Paragominas	Shelma Lúcia Lombardi de Kato	CMG Mining Ltda.
Gustavo Guimarães Rios	SIMINERA L / Vale	Silvia Vieira	Tapajós Station
Humberto José Macias	SENAI / PA	Solange Mota	FIEPA
Ilene Castro dos Santos	FIDESA	Tamires Luana da Fonseca Dias	BM Engineering
NAME	PRIVATE INITIATIVE	NAME	PRIVATE INITIATIVE
Ivan Lopes da Silva Filho	SENAI	Tamires Rego de Andrade	Zoopec
Jacir Reis	Simineral / Hydro Paragominas	Tânia Margareth Dutra da Costa	FIDESA
Jaider Ferreira de Assis	Uliana Fripago Refrigerator S / A	Tatiane Faro Noronha	SEBRAE
Janderson Rodrigues	SIMINERA L / Vale	Themis Solange Pantoja	Simineral / Hydro Paragominas
Jean Silara	Amazon TV	Vicente Honorato da Silva Penha	SENAI / PA
João Amorim	Jewels of Pará	Vicente Honorato Penha	SENAI / PA
João Vieira	Magellan	Vilson Schuber	SEBRAE
Jonas F. Silva	CMG Mining Ltda.	Wilder Leal	SIMINERA L / Vale
José António Lira	SEBRAE	Yuri Jordy Figueiredo	Attorney:
José do Egypto Soares Filho	FIEPA	Zilda Pantoja de Lima	FIDESA
José Haroldo Chaves Paula	Simineral / Hydro Paragominas		
NAME	ACADEMIES OF EDUCATION	NAME	ACADEMIES OF EDUCATION
Ademil Mescouto	UFRA	Joangela Luclécia Lima Silva	EETEPA-Paragominas
Adrian Bruno Pereira	EETEPA-Paragominas	João Feitosa	UFOPA
Adriana Teixeira de Araújo	IFPA	João Felipe dos Santos do Nascimento	UFOPA
Adriana Vilaça dos Santos	UFPA	João Martins Júnior	UEPA
Adson Caxias Pinheiro	UFPA	João Meireles Rodrigues	EETEPA-Paragominas
Ailanna Maria de Araújo Silva	IFPA	João Moreira Filho	UFOPA
Ailton Oliveira da SILVA	EETEPA-Paragominas	João Victor da Conceição	IFPA
Albert Souza dos Santos	IFPA	Joelma Lobo	UFPA
Alcione do Socorro S. de Souza	EETEPA-Paragominas	Joice Garcia Pereira Nunes	EETEPA-Paragominas
Aldo Sousa Campos	UFOPA	Jorge Mendonça de Sousa	IFPA
Alegria dos Santos Leite	UFPA	José Maciel Veigas Pereira	EETEPA-Paragominas
Alexdos Santos	UFPA	José Mareio Oliveira da Silva	UFRA
Alex Ferreira da Silva	IFPA	José Otávio Magno Pires	UNAMA
Alex Santos da Silva	EETEPA-Paragominas	José Raimundo Corrêa Ferreira	UFRA
Junior Alexandre Cardoso de Sousa	IFPA - Federal Institute of Para	José Santos Nascimento Filho	EETEPA
Alexandre Luiz Amarante Mesquita	UFPA/ITEC	José Seixas Lourenço	UFOPA
Aline Gamboa Nogueira	UFOPA	Joseli Marinho da Conceição Freitas	IFPA
Alinne Beatriz Almeida	IFPA - Federal Institute of Para	Kaleb Lima Ribeiro	UFOPA
Aluyma Campos Amaral	UFOPA	Karen Liliane Batista Cunha	IFPA
Amanda Kethlyne da Silva	EETEPA-Paragominas	Karin Thainne Silva de Sousa	IFPA
Amanda Suany Marinho	UFOPA	Karolina dos Santos Moraes	UFRA
Ana Carla da Silva Maia	UFOPA	Keid Nolan Silva Sousa	UFOPA
Ana Carolina da Silva	EETEPA-Paragominas	Keila Daniellen Pantoja Paiva Caldas	UFOPA
Ana Carolina Garcia	IFPA	Keilianede Lima Bandeira	UFOPA
Ana Fabia Novares de Oliveira	EETEPA-Paragominas	Larissa dos Santos Vieira	IFPA
Ana Lúcia Veras dos Santos	IFPA	Larissa Lima Santos Sousa	UFOPA
Ana Márcia dos Anjos	UFOPA	Lázaro João Santana da Silva	UFOPA
Ana Paula Botelho de Carvalho	EETEPA-Paragominas	Leonardo Ney Barros de Holanda	UFOPA
Ana Paula de Oliveira Bicalho	UFOPA	Leony Negrão	UEPA
Angela Batista da Luz	IFPA	Lina Borges Ha rada	UEPA
Angélica Lucélia da Silva Mose	EETEPA-Paragominas	Livaldo Santos	UFOPA
Angelo Tiago Campos Rego Filho	UFOPA	Liz Carmem Silva Pereira	IFPA
Antônia de Jesus	EETEPA-Paragominas	Luan Alexandre Martins de Sousa	UFOPA
António José dos Santos	IFPA	Luan Silva dos Santos	IESPES
António Rodrigues Fernandes	UFRA	Luana Ferreira da Silva	UFOPA
Arthur Iven Tavares Fonseca	UFOPA	Luana Vitória Silva Araújo	IFPA
Auriane Cardoso Pimentel	UFOPA	Lucivania Maia Silva	EETEPA-Paragominas
Barbara Tharyni Rodrigues Sousa	UFOPA	Luís Jeferson dos Santos Guedes	EETEPA-Paragominas
Benedito Cruz	UEPA	Luiz Carlos Silva Mota	UFOPA
Bernard Peregovich	UFOPA	Maíza Richele Almeida Ribeiro	IFPA
NAME	ACADEMIES OF EDUCATION	NAME	ACADEMIES OF

			EDUCATION
Bianca Ferreira Couto	IFPA	Manoel Carneiro de Sousa Filho	EETEPA-Paragominas
Brenna Costa Façanha	EETEPA-Paragominas	Manoel do Nascimento Miranda	UFOPA
Bruna Couto Nicretta	UFOPA	Marcela Teixeira Pinto	FIT
Bruna Luiza da Silva Barbosa	IFPA	Marcelo Erick Batista Dezincourt	UFOPA
Bruno dos Santos Neves	IFPA	Marcelo Machado da Silva	IFPA
Camila da Costa Lopes	UFOPA	Márcio Roberto do Carmo Pereira	PCT-Guamá
Camila Silva de Sousa	FIT	Marcos António Viana	EETEPA-Paragominas
Carine Oliveira Galvão	EETEPA-Paragominas	Marcos Queiroz de Matos	IFPA
Carlos Eduardo Guerra	UFOPA	Marcos Ramires	IFPA
Carlos Manoel Rocha Melo	UFOPA	Marcos Rodrigo Gomes Machado	IFPA
Carlos Mateus Oliveira de Sousa	EETEPA-Paragominas	Marcos Vinicius da Silva Mose	EETEPA-Paragominas
Carolina Serique Feitosa	IFPA	Maria Aparecida Silva	EETEPA-Paragominas
Caroline Rocha Monteiro	IFPA	Maria Leilane Silva Santos	EETEPA-Paragominas
Cedriana Teixeira de Araújo	IFPA	Maria Monique Monteiro de Sousa	IFPA
Celia Jane dos Santos	IFPA	Mariana Araújo Cordeiro	EETEPA-Paragominas
Cezimardos Santos de Souza	UNAM A	Marilia Emília de L. Tostes	UFPA/CEAMAZON
Charles Moraudimi Silveira de Matos	UFRA	Marina Reis	EETEPA-Paragominas
Cláudio Scliar	UFOPA	Marinete Ferreira Pereira	UFOPA
Cleberson da Silva Vieira	UFOPA	Marlon de Sousa Mota	UFOPA
Daiane Xavier Monteies	UFOPA	Mateus Ruiz Pantoja	IFPA
Dalvani Medina de Almeida	EETEPA-Paragominas	Michael Andrey Pereira	UFOPA
Damião Pedro Vieira Filho	IFPA	Michel Batista Pinto	UFOPA
Daniel Lucas Moraes	EETEPA-Paragominas	Monalisa Galvão Aguiar	UFOPA
Danilo do Carmo Guimarães	EETEPA-Paragominas	Mylleni Rego Silva	IFPA
Danny Castro	UFOPA	Naira Cecília de Sousa Coelho	IFPA
Darlisson Fernandes Bento	UFOPA	Naíra Silva das Chagas	EETEPA-Paragominas
David Silva Gonçalves	EETEPA-Paragominas	Najmat Celene Nasser M. Branco	CEAMAZON -
Diogo Pessiana Barbosa	EETEPA-Paragominas	Nataline Coutinho Lopes	EETEPA-Paragominas
Ediclei da Costa Maciel	IFPA	Nayara Moraes	EETEPA-Paragominas
Edinilza da Silva	EETEPA-Paragominas	Nielton Diego Pantoja	UFOPA
Edith Sara Rego de Sousa	IFPA	Nilton Dias Pantoja	UFOPA
Edklilton Silva Nascimento	EETEPA-Paragominas	Nita Pereira de Oliveira	EETEPA-Paragominas
Edson Fabiano Melo dos Santos	UFPA	Norma Cruz Dias	Escola Francisco Xavier
Eduardo de Magalhães Braga	UFPA	Patick Araújo dos Santos	EETEPA-Paragominas
Eduardo Francisco da Silva	UFOPA	Patrícia Oliveira	UFOPA
Edwan Almeida Assunção	UFOPA	Patrick Pereira Souza	UFOPA
Eliana Guimarães Xavier	UFOPA	PatrickVasques Araújo	EETEPA-Paragominas
Elielton Oliveira Bentes	IFPA	Paula Renata Nunes da Silva	UFOPA
Elimar Nascimento	UnB	Paulo de Souza Mendes	EETEPA-Paragominas
Elineide Silva Santos	FACESP	Paulo Ricardo Soares	IFPA
Elisângela Carvalho de Sousa	FIT	Paulo Roberto Tavares da Silva Junior	IFPA
Eliude Sousa Ferreira	UFOPA	Paulo Wendhausen	UFSC
Elivângela Carvalho de Sousa	FIT	Pedro Baia Júnior	UFPA
Emanuel Viana do Vale Filho	IFPA	Pedro Lima Farias	UFRA
Emanuel Vitor de Sousa Andrade	IFPA	Pedro Mota Santos Neto	IFPA
Emelyn Souza Matos	EETEPA-Paragominas	Priscila Camacho Xavier	IFPA
Emerson Lima Matos	IFPA	Rafael Corrêa Muniz	UFOPA
Eny Mota Cardoso	UFOPA	Rafael Pimentel de Oliveira	UFRA
Erick Jhan nascimento Coelho	EETEPA-Paragominas	Raimunda F. Silva Maia	ITEC/ UFPA
Evelin Gabriele Moreira Rezende	EETEPA-Paragominas	Raissa Coelho Almeida	UFOPA
Evelin Teixeira do Espírito Santo	EETEPA-Paragominas	Raiza D'áquinoPrintes	UFOPA
Fabio Gois da Mota	UFOPA	Raniere Carvalho Junior	EETEPA-Paragominas
Felipe Carneiro Salgado	IFPA	Ranieri Gonçalves Eleotirio	IFPA
Felipe da Silva	EETEPA-Paragominas	Reilane de Cássia Costa de Araújo	IFPA
Felipe Rodrigues Ferreira	EETEPA-Paragominas	Renata Guimarães Cabral Lima	UFOPA
Fernanda Guedes Rabelo	FIT	Rildson Oliveira Silva	UFOPA
NAME	**ACADEMIES OF EDUCATION**	**NAME**	**ACADEMIES OF EDUCATION**
Fernanda Kelly dos Santos Sousa	EETEPA-Paragominas	Roberto Célio Limão de Oliveira	UFPA/ITEC
Fernando Teixeira da Silva	EETEPA-Paragominas	Rodrigo Augusto Sobral Santos	UFPA / ITCPES
Francisca Raniely Cordeiro	EETEPA-Paragominas	Rodrigo Carneiro de Aguiar	IFPA

Francisco Matos	UFPA	Rogério Amaral Farias	EETEPA-Paragominas
Francisco Gerlan Moura Teixeira	UFOPA	Ronnie Batista Estumano	IFPA
Gabriel Lucas de Souza	EETEPA-Paragominas	Rosândela Oliveira Barbosa	UFPA
Gabriel Oliveira Torres	IFPA	Rosangela Paz	IFPA
Gabriela de Cassia Santos	UFOPA	Rosângela Carvalho Rego Mafra	UFOPA
Geovanna Renata Santos Moraes	UFOPA	Rosemira Lima Ramos	EETEPA-Paragominas
Gisele Tavares Maués	UFPA	Rosiane do Socorro Sousa Gomes	UFOPA
Gilvana Barbosa Soares	IFPA	Rosiela Ferreira da Silva	UFOPA
Giovana Renata Santos Moraes	UFOPA	Rosielce Ferreira Silva	UFOPA
Gleiciane Franco Tavares	UFOPA	Sabrina Socorro Batista	IFPA
Gleicy Assunção Rodrigues	IFPA	Sandra Oliveira Feitosa	EETEPA-Paragominas
Gleison Carvalho dos Santos	IFPA	Sandy Santos Silva	UFOPA
Gustavo Ruffeil	UFRA	Sávio Batista Gomes	IFPA
Harley Silva Cardoso	EETEPA-Paragominas	Savio Ricardo Santos	EETEPA-Paragominas
Hedileno Monteiro	UFPA	Sidclay Furtado	IFPA
Helen Mayara Simplício Viana	UFOPA	Simone Beatriz Oliveira	EETEPA-Paragominas
Hellen Cristina Soares Ney	CTEPMA	Simone Viegas de Souza	UFOPA
Helvio Moreira Arruda	FIT	Solano Pereira Santos	EETEPA-Paragominas
Hevila de Nazaré da Costa	UFPA	Suelen Carvalho Fernandes	IFPA
Hugo Leonardo Brito Monteiro	UFOPA	Sulsiene Machado de Souza	UFPA
Humberto Soares de Sousa Junior	FIT	Talita Godinho Bezerra	UFOPA
Hyago Elias Nascimento Souza	UEPA	Tamires Alves	EETEPA-Paragominas
Iandra Carolina Chaves	EETEPA-Paragominas	Tássio Aderaldo Valente	UFOPA
Isabela Pantoja Garcia	UFOPA	Tatiana Rocha de Azevedo	IFPA
ítalo Tavares Timóteo	EETEPA-Paragominas	Tereza Cristina de Oliveira Martins	IFPA
Ivan Zevalhos	UFOPA	Thamires Caroline Lima Matos	EETEPA-Paragominas
Iverson Costa Moya da Silva	UFOPA	Thayrimme Suellen do A. Rodrigues	UFOPA
Izabela Cristina Lopes Carvalho	UFOPA	Thiago Almeida Vieira	UFOPA
Jaciara da Silva Saraiva	IFPA	Ubiratan Bezerra	UFPA
Jamille Soares Batista	EETEPA-Paragominas	Valdemir de Sousa Farias	UFOPA
Jandreane Ramos	UFOPA	Victor Eduardo Pereira de Freitas	IFPA
Janice Paiva de Sousa	UFOPA	Victória Ananda Martins Bastos	UFOPA
Jarlan Carvalho Pinto	UFOPA	Wagner Figueiredo Serrão	UFOPA
Jeise Caroline do Nascimento Silva	IFPA	Wanderlany Fialho de Abreu	UFOPA
Jéssica Naiane da Silva Miranda	IFPA	Wellington dos Santos	EETEPA-Paragominas
Jhonathan Lopes Pereira	EETEPA-Paragominas	Werlyson de Sousa Alves	IFPA
Jhuliana Gomes Santos	EETEPA-Paragominas	Xirle dos Santos da Silva	EETEPA-Paragominas
Jo Oliveira Maia	IFPA	Yuri Bertolo Macedo	EETEPA-Paragominas

NAME	CIVIL SOCIETY	NAME	CIVIL SOCIETY
Aldenice Vanessa da Silva	AMIPARNA	José Antunes	AMOT
Aldina Chaves Sousa	ADELISP	José Nazareno Santos	Written Independent Press
Alenilson Ferreira Aguiar	Partido Verde	José Vieira Barros	COOGAM
Aliccia Ferreira	AMAT	José Waldemiro Souza Brito	Cooperative Agriculture
Almi José da Cruz Arantes	COOMPRO	José Waterloo Lopes Leal	APGAM
Anderson Cabido	AMIB	Jubal Cabral Filho	AMOT
Angela Lúcia	Ass. de Moradores/ Parauapebas	Keila Cristina Lopes	COOPEMVAT
António José Tavares	COOMIDEC	Larissa Anne Stoner	IFT
Aristheu Pereira de Mattos Neto	Associação Comunitária de Suruacá	Lilian Rose Nogueira	3rd Sector
Camila Amaral	AJEPA	Manoel Rosa de Oliveira	COOPERSERRADO
Carlos Henrique A. Melo	OCB/SESCOOP/PA	Maria de Nazaré da Silva	Autonomous
Carmem Oliveira	AMUCAN	Maria Rosilene Pereira Trindade	COSAPA
Cinthia Cristina Hosana de Souza	COARTI	Mario Vinícius Imbira Herketh	Autonomous
Cleverson Carvalho	Autónomo	Marlison da Silva	AMAT
Darlindo Oliveira	FACAPA	Maurílio Cortez Ribeiro	ISGB
Dilson Jones Meneses Trindade	COSAPA	Moniely Ribas Fidalgo	UMAMP
Dinair Paiva dos Santos	COMIP	Nilza Maria Sena de Alcântara	ARTEPAM
Elinelza BANDEIRA Cardoso	Pastoral da Criança	Pastor Reinaldo	Assembly of God
Elis de Araújo	IMAZON	Polyane Amaral Feio	Amaparaense Institute
Etevaldo da Cruz Arantes	COOMPRO	Raimundo Benigo Moreira	SINGASP
Fernando Marculino	ISGB	Raimundo Ferreira de Sousa	Community Association Suruacá
Francisco Canindé	SINTICLEPEMP	Raimundo Leandro da Silva	Residents Association
Francisco Lima	Associação Agape	Raimundo Lopes Carvalho	COOMIC
Gilberto Gomes do Amaral	COOMGRIF	Raimundo Lucio Teixeira	APPD
Ieva Lazareviciute	PNUD	Regis H. da Silva	Autónomo
Joanir Oliveira Moreira	Comunidade Tamanara/ Itaituba	Rosa Helena Nascimento Neves	IGAMA
João Batista de Jesus	SIGANP	Sineia Pereira Hosana de Sousa	COART
João de Souza Botelho	Ass. de moradores/ Paragominas	Thiago Bezerra Vianna	IGAMA
João Raimundo de Barros Feijão	Garimpeiro	Thiago de Albuquerque	IGAMA
Josberto Girão	AGAM		

GLOSSARY

Construction aggregates - A term used to identify the segment that produces mining mineral raw materials or gross benefit of immediate employment in the construction industry.

Agrominerals - Ores containing phosphorus, among other things, used for the manufacture of fertilizers; limestone used as a corrective of soil acidity; minerals that can be used as remineralizadores soil. **Flood** - Deposit of organic and inorganic materials left by the water. And formed of pebbles, gravel, sand and silt. **Charter** - Document issued by the Director General of DNPM, authorizing the holder of the mining right to search the mineral substance for authorization system. In the proposed replacement design draftsman, preliminary version, the Permit will be issued for both conducting mineral exploration and for exploitation of mineral resources, for the mining, encompassing the ancient PLG 's, RLM' if ERs.

APL - Local Productive Arrangement - significant cluster of projects in a given territory and individuals who work around a dominant productive activity, perceived forms that share some mechanism for cooperation and governance.

Drainage Basin - Area where a major river along with its tributaries drain water and other sediment to an exit point.

Tailings Basin - Management and disposal of tailings held in an artificial pond.

Biodiversity - Diversity of plant and animal communities that are interrelated and coexist in an ecosystem or biome.

Horizontal chain - Growth strategy based on the acquisition of two or more business corporations the same level of the production chain.

Production chain - Sequence of operations, along which the various inputs undergo some kind of transformation, until the constitution of a final product and its distribution.

Vertical chain - The same corporate group or company takes several successive stages of the total production process. This procedure is adopted in order to reduce costs, risks and facilitate the coordination of actions.

Human Capital - Set of knowledge, skills and personality attributes that favor the realization of work to produzirvaloreconômico. Are the attributes acquired by a worker through education, skills and experience.

Red ceramic - Tiles, bricks, ceramics and building blocks, channels and similar products produced in factories with clay or pottery.

CFEM - Financial Compensation for Exploiting Mineral Resources - compensation due to the extraction of minerals.

Colluvium - Soil from the hillsides, consisting of a thin layer of debris stemmed from on high. **Commodity** - Merchandise unprocessed or basic product of commercial importance, as some minerals and metals (Sn, Au, Cu, Zn etc..), Whose price is commonly controlled by international grants.

Mining Concession - Titles that guarantee the right to extract the minerals from the subsoil

Mineral deposit - Concentration of a metallic or non-metallic mineral well, providing geological attributes of potential economic interest.

Sustainable development - And the development that does not exhaust the resources for the future. According to the Brundtland Report (1987), is "development that meets present needs without compromising the ability of future generations to meet their own needs."

El uvião - Proceeds from the decomposition of rocks, which remains in the same place. The eluvial deposits are distinguished from deposits transported by the waters and called alluvium.

Anchor company - Companies that play the leading role in a group of small and medium-sized companies supplying products and services for her.

Direct jobs - Jobs created in direct activity.

Indirect jobs - Additional jobs arising from the direct jobs, because the means of production, inputs for the formation of the final good (direct).

Induced jobs - Jobs created by the income provided by the direct activities.

Related companies - Companies that operate in activities that directly or indirectly complement the activities of the company anchors.

Productive specialization - Determined region has expertise in the local structures of production in a particular industry.

Garimpeira sparking - Demand for gold in rivers or on the sands that sparkle in the sunlight, in bicames wood, bringing the water to the auriferous sands decanters.

FOB - Free On Board - Contractual Form in which the exporter is responsible for the costs of transport and insurance of the goods until it is inside the ship for transportation at the port indicated by the buyer.

Mining front - Mina open, active or not, and future projections or forward opening mine, within four years.

Castings - Products of the casting of metals and alloys castings in process

Governance - Systemic set of actions that determines institutional relations, directs actors acting to confer legitimacy to face the problems of a territory.

Mineral processing industry - Industry quetransforma raw material into final or intermediate product, as examples of mineral processing industries, we have: metallurgical industry, steel, fertilizers etc..

Institutions - Formal recognition.

Field - Local Concentration of substances on the surface or inside the Earth, which have economic value.

World-class deposit - Mines high grade and / or large size that allows a low unit cost of production. **Scale mining** - Scheme for extraction of mineral substances with immediate utilization of the mineral deposit is located that, by its nature, especially its small volume and uneven distribution of mineral commodity, not justify, many times, investment in research.

Law Kandir - Complementary Law No. 87/1996.

Critical Mass - Design of a group in relation to a particular matter necessary and sufficient in quantity and quality, establish and sustain certain action, relationship or behavior.

World-class Mines - Mines high grade and / or large size that allows a low unit cost of production. **NPK** S Igla appointing Nitrogen, Phosphorus and Potassium, the three nutrients most commonly used to manufacture fertilizers.

Troy ounce - English measurement unit mass. 1 troy ounce equals 31.1035 grams.

Permission Mining prospectors - Applies to the immediate utilization of mineral deposit is located that, by its nature, size, location and economic use, can be transcribed independently of previous exploration work, according to criteria set

by DNPM. Article 1 of Decree No. 98,812, of January 9, 1990.

Busy people - Includes individuals who have a boss or more, exploiting an economic activity or exercise a profession or trade.

Metal Product - Product from metal ores and is used by industry as metal or alloy. Examples: aluminum and steel.

Non-metallic product - Proceeds derived from non-metallic minerals such as cement, ceramics and fertilizers. **Reuse of waste** - Reuse of waste that aim to minimize the environmental problem is the disposal of these materials.

Mineral resource - Concentrations of ore formed in the earth's crust, whose characteristics make its extraction has the possibility of sertécnica and economically viable.

Electrolytic reduction - Procedure conducted to obtain metallic aluminum by continuous passage of electrical current in electrolytic cells coated with carbon.

Mining income - Yield advantages accruing from a project in the mineral sector can provide and that does not depend on the technical and managerial capacity of its owners, operators or controllers.

Mineable reserves - Corresponds to the technical reserves and economically usable, consider this recovery of plowing, sterile / ore ratio and the dilution resulting from the mining method.

Royalty - Nomenclature designating the percentage paid to the holder or owner or a territory, product, brand, patent product or production process rights of exploitation, use, distribution or commercialization of such product or technology. CFEM is a kind of royalty.

Regional Innovation System - According Lastres and Cassiolato (., 2005, p 21), the innovation system is: "[...] The set of organizations that contribute to the development of innovative capacity of a country, region, sector, or location." **Truckless System** - Production in which no presence of off-road trucks, with the ore being transported by conveyor belts, reducing greenhouse gas emissions, reduce consumption of diesel and electricity.

Smelter - Term for a productive unit of primary aluminum by electrolytic reduction of alumina. **Sustainability** - Usual disclaimer that defines human actions that aim to meet current human needs without compromising the future of the next generations. Sustainability is related to economic and material development without harming the environment by using natural resources wisely so that they remain in the future. **Vertical integration of production** - A strategy in which a company seeks to manufacture all their equipment and benefit from its products at all stages of production.

Mining Rule - Document issued by the Minister of Mines and Energy, granting the holder of the mining right to plow mineral substance on a concession basis. In the proposed replacement design draftsman, preliminary version, the concession scheme will allow both research as plowing, to be granted after the adoption of the Final Research Report or bidding process.

Permission Mining prospectors - Document issued by DiretorGeral DNPM authorizing otitulardo mining rights plowing mineral substance by the regime Permission Mining prospectors, housed in the Law 7.805, of 18/07/89.

Extraction Ordinance - Document issued by the Director General of DNPM, empowering bodies of direct and autonomous administration of the Union, States, Federal District and Municipalities, the extraction of minerals for immediate use in construction, DNPM discriminated by Ordinance No. 23, 03/02 / 00, for exclusive use in public works executed by them directly, sealed their marketing.

Registry of Mineral Licensing - Document issued by DNPM that records the license issued by the municipal administration, authorizing the holder of the mining right to plow mineral substance by the Licensing system, housed in the Special Law No. 6.567, of 09/24/78.

(*) Refers to minerals refractories for use in construction shall not. Source: SEICOM, 2013.

1st MINING PLAN OF THE PARÁ STATE

SEICOM

Secretária de Estado de Indústria, Comércio e Mineração

Travessa Curuçá, No. 555 – Bairro Telégrafo

CEP 66050-080. Belém - Pará - Brasil

Phone: (91) 3110-2550

www.seicom.pa.gov.br

email: mineracao@seicom.pa.gov.br

Ministério de Minas e Energia

GOVERNO FEDERAL BRASIL PAÍS RICO É PAÍS SEM POBREZA

Secretaria de Estado de Indústria, Comércio e Mineração

Secretária Especial de Desenvolvimento Econômico e Incentivo a Produção

GOVERNO DO PARÁ

www.pa.gov.br