



UNIVERSITÀ  
DEGLI STUDI  
DI PADOVA



## **UNIVERSITÀ DEGLI STUDI DI PADOVA**

DIPARTIMENTO DI SCIENZE STORICHE,  
GEOGRAFICHE E DELL'ANTICHITÀ

**LAUREA MAGISTRALE IN  
TECNICHE, PATRIMONIO, TERRITORI DELL'INDUSTRIA -  
TECHNIQUES, PATRIMOINE, TERRITOIRES DE  
L'INDUSTRIE**

MASTER ERASMUS MUNDUS TPTI

TESI DI LAUREA  
Mémoire de Master

The Industrial Heritage in Itabira:  
History, Memories and future perspectives

Le patrimoine industriel d'Itabira :  
Histoire, souvenirs et perspectives d'avenir

Relatore: Prof. Massimo Preite

Laureanda :Gabriela Procopio de Souza  
matricola: 1211368

Anno Accademico 2019/20









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UNIVERSIDADE  
DE ÉVORA

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ACITA	Itabira's Commercial, Industrial, Services and Agriculture Association
CFEM	Financial Compensation for the Exploration of Mineral Resources
CONAMA	Brazilian National Commission for the Environment
CVRD	Brazilian Mining Company
EFVM	Vitória-Minas Railway
GDP	Gross Domestic Product
IBA	<i>Internationale Bauausstellung</i>
IBGE	Brazilian Institute of Geography and Statistics
IPHAN	National Historical and Artistic Heritage Institute
ICOMOS	International Council on Monuments and Sites
METABASE	Itabira's Iron and Basic Metals Industry Workers Union
OBSI	Social Observatory of Itabira
PCTI	Scientific and Technological Park of Itabira
TICCIH	The International Committee for the Conservation of the Industrial Heritage
UNESCO	United Nations Educational, Scientific and Cultural Organization
UNIFEI	Federal University of Itajubá



## **ABSTRACT**

The city of Itabira, located in the southeastern region of Brazil, has one of the largest and most important mining areas in the country, dating from the mid-20th century and which remain active today, exerting a great impact in the region and in the country. In addition to economic development, the mining industry brought major changes to the territory and significantly affected the landscape, the city and the lives of the inhabitants, leaving a strong industrial legacy that includes mines, ore processing plants, tailings dams and other industrial structures, that make the city a great symbol of the mining history in Brazil and an exceptional testimony to the social and economic changes caused by the extractive industry. Currently, the city faces serious environmental and social issues caused by mineral exploration and, towards the possibility of depleting mining resources, this study proposes, through strategies, proposals and guidelines, the valorization of its industrial heritage as an economic alternative for the future, thus reducing the impact of the end of iron ore exploration, overcoming the dependence of the mining sector and allowing to maintain and promote its industrial culture.

**KEYWORDS:** industrial heritage, mining, rehabilitation

## **RÉSUMÉ**

La ville d'Itabira, située dans la région sud-est du Brésil, possède l'une des zones minières les plus grandes et les plus importantes du pays, datant du milieu du XXe siècle et qui reste active aujourd'hui, exerçant un grand impact dans la région et dans le pays. Outre le développement économique, l'industrie minière a apporté des changements majeurs au territoire et a considérablement affecté le paysage, la ville et la vie des habitants, laissant un héritage industriel fort qui comprend des mines, des usines de traitement du minerai, des digues de résidus et d'autres structures industrielles, qui font de la ville un grand symbole de l'histoire minière au Brésil et un témoignage exceptionnel des changements sociaux et économiques provoqués par l'industrie extractive. Actuellement, la ville est confrontée à de graves problèmes environnementaux et sociaux causés par l'exploration minière et, face à la possibilité d'épuiser les ressources minières, cette étude propose, à travers des stratégies, des propositions et des lignes directrices, la valorisation de son patrimoine industriel comme alternative économique pour l'avenir, ainsi réduire l'impact de la fin de l'exploration du minerai de fer, surmonter la dépendance du secteur minier et permettre de maintenir et de promouvoir sa culture industrielle.

**MOTS CLÉS:** patrimoine industriel, exploitation minière, réhabilitation

## 1. INTRODUCTION

- **Présentation du contexte**
- **Énoncé du problème:** La nécessité d'alternatives économiques à la ville et le fait que son patrimoine industriel n'est pas valorisé
- **Objectifs:** favoriser la valorisation du patrimoine industriel, atout pour la ville d'Itabira:
- Créer des stratégies d'action permettant de conserver l'identité industrielle de la ville et d'aider à sa promotion du patrimoine industriel
- Présenter des propositions pratiques, pour guider le début d'un processus de reconversion du complexe industriel de la ville
- Proposer des lignes directrices d'intervention.
- **Justification:** La vocation économique de la ville et la valeur exceptionnelle de son complexe industriel
- **Méthodologie:** les méthodes appliquées pour développer l'étude

### 1.1. PROBLEM STATEMENT

Itabira, is a brazilian city located in southeast Minas Gerais, 110 kilometers away from the state capital, Belo Horizonte, and 845 kilometers away from the federal capital, Brasília. It occupies an area of 1,253,704 km<sup>2</sup>, of which 12,4377 km<sup>2</sup> are in urban perimeter and it is currently the twenty-fourth largest municipalities in the state in terms of population, with 119,186 inhabitants in 2018. The city is known as the cradle of mining in Brazil due to its history marked by the strong presence of the extractive industry. It is one of the largest iron ore producing cities in the region and it was the birthplace of one of the largest mining companies in the world, Vale, founded in 1942.

The presence of industry in Itabira for almost eight decades has brought many impacts to the territory, to the economy and it has also significantly affected the life

of the community. Itabira's economy has become heavily dependent on Vale's operations and the activities arising therefrom: a large part of the city's revenue comes from the extractive industry, which is also the largest generator of direct and indirect jobs for the municipality. The urban site is interwoven and surrounded by mines, unlike other areas of mineral exploration, where extraction takes place outside the urban perimeter. The marks of the ore withdrawal in Itabira are visible from anywhere in the city, behind the gray mountains there are huge and deep craters excavated over the decades of iron exploration in the municipality. The economic development thanks to the mining activities also reflected in the population growth in Itabira: in 50 years, the number of inhabitants grew around four times, and the population flow has been changing since then, as the activity develops. What has been also changing is the population's perception of the industry in the city. In the first decades, Vale's presence enabled access the natural resources and part of the obtained income allowed the municipality to grow and, reinforced by the social values of the company, the industry was seen by the inhabitants as something positive, that was bringing development and quality of life. Later, from the 1972s onwards, a stage that consolidates Vale's expansionary dynamics, the population and especially the company's workers began to be dissatisfied with the work environment, with their salaries and, although the constitutional culture remained quite cohesive, a feeling of alienation ran through the social body and the soul of the workers' collective. More recently, these conflicting feelings became stronger due to environmental crimes carried out by the company and the fear that the mining activities would end soon.

The city is, therefore, in a very ambiguous context and Itabira's identity is forged with a blend of strong emotions, conflicts and pride. On one hand, the mining industry was one of the main responsible for the economic, social, cultural, and environmental changes in the city. On the other hand, a growth absents of effective criticism allowed the loss of symbolic heritage, environmental degradation, atmospheric pollution and also brought impacts to the health and quality of life of the population. Nowadays Itabira concentrates a large part of the mineral extraction of Brazil. The Itabira complex is comprised of seven mines, three processing mills, four tailings dams, and sixteen overburden piles. The ore is freighted over a 905 km railway to Vitória, Espírito Santo state. Close to the harbor, the company operates



eight pellet plants, many of which are joint ventures with foreign steel companies (Vale, 2016).

Currently, the city faces serious environmental and social issues, as well as structural difficulties in promoting policies for economic diversification and overcoming dependence on the mining sector and the imminent risk of exhaustion of the mining resources. The future and soon exhaustion of mines will not necessarily mean the end of mining in the city, but it would certainly represent the loss of one of its main resources and the loss of its main identity symbol. For those reasons and circumstances, it becomes essential to find alternatives that would decrease the impact of the end of the iron ore exploitation and would contribute to the city's development and would also allow to retain and promote its industrial identity.

## **1.2. OBJECTIVES**

In view of the need for economic diversification in the city of Itabira, the general objective of this study is to use the specific challenges and vocation of the industrial heritage of Itabira as an asset, that is, to encourage a change in the region to attract other activities and investments, through a viable solution, which takes place through the valorization of the city's industrial heritage. Concretely, the final objective of this study is to present (1) action strategies, which allow retaining its industrial identity and assisting in the promotion of industrial heritage; (2) practical proposals to assist in the beginning of a process of reconversion of the city's industrial complex and (3) intervention guidelines, which can guide future intervention policies, so that the various stakeholders (local administrations, industrial companies, non-profit organizations, pressure groups, and the population in general) are guided by a larger objective, which is to promote discussion on this subject and promote new ideas and projects in this direction.

### **1.3. JUSTIFICATION**

The Itabira industrial complex has an extension of elements that constitute an industrial heritage of exceptional value. This heritage includes its industrial facilities, the railway, its mining landscape and intangible social aspects of mining culture and local identity. Studying the potential of this municipality and valuing the industrial heritage as part of the cultural heritage of Itabira is necessary not only for its economic vocation in this sense and for the exceptional value of its complex, but also, in the future, to serve as a testimony of one of the most important processes in the history of that region, so that future generations can know how this prodigious transformation took place.

### **1.4. METODOLOGY AND SOURCES**

The steps followed to the development of this study consisted of four main phases: the first one being the definition of the problem and the unit of analysis, which in this case was the city of Itabira and the main problems that revolved around the presence of the mining industry in the city: the fact that this industrial legacy is not valued and the fact that the city lacks future economic alternatives, since the mineral resource will be depleted in the near future. The second phase was the preparation and data collection: bibliographic reviews and documentary research that reported the history of the city, the consequences that mining brought to the city and that showed other aspects, from a multidisciplinary point of view, of the mining industry in Itabira. Forms were also prepared for the collection of data that dealt with the perspectives of the inhabitants of Itabira on the subject in this study. In the third phase, the treatment and interpretation of these data was carried out and complementary interviews with the city's stakeholders, regarding the presence of the mining company and its prospects for the future of Itabira. Finally, the results were analyzed, proposals were presented, and the conclusion of this study was obtained. For the contextualization of the environment, bibliographic references such as books, studies and specialized journals were used that dealt with the subject.

## 2. CONTEXTUALIZATION

- Les progrès miniers au Brésil
- Le développement de l'industrie minière à Itabira
- L'histoire de l'entreprise Vale dans la ville

### 2.1. THE MINING PROGRESS IN BRAZIL

In Brazil, the mining activities begins in the 17th century, with expeditions that searched the interior of the territory in search of valuable metals (gold, silver, copper) and precious stones (diamonds, emeralds). In the beginning of the 18th century (between 1709 and 1720), these minerals were found in the regions that are now known as the state of Minas Gerais (*figure 1*), Goiás and Mato Grosso (L. FERNANDES 2015).



Figure 1: Minas Gerais state map, in the XVIII century, Caminhos Gerais Blog, accessed 12 Jun 2019, <<https://caminhosgeraisblog.wordpress.com/2016/06/>>

The mining activity of the so-called “Gold Economic Cycle”, a period in Brazilian history in which the extraction and exportation of gold dominated the economic dynamics of Colonial Brazil, was characterized by significant changes in those regions, by the predatory actions of the deposits, violent environment exploitation, unforeseen imbalance that caused shortages and, consequently, hunger cycles that punished mining pioneers (O. P. SILVA 2013). At this time, the colony's economy was affected by the decline of the sugar economy, which prompted the authorities to start looking for gold in the territory. With the discovery of the mines, people arrived from Portugal, southern Brazil, and other regions in search of this gold. Also, following the development of that region, the capital of Brazil was transferred from Bahia to Rio de Janeiro (ARAUJO s.d.).

Thus, the territorial occupation grew with a population influx coming from Portugal and other populated areas of the colony. The mines provided a relative diversification of services, such as traders, artisans, lawyers, doctors, master schools, among others. However, it was intensely enslaver process since that urban society was developed at the expense of the exploitation of slave labor. Mining also brought about an increase in the control of the slave trade in order to avoid the emptying of the farm labor force. It also promoted the creation of roads, the implantation of urban centers,



Figure 2: “Washing of gold ore, close to the Itacolomi mountain”, Johann Moritz Rugendas, watercolor on paper, 30 x 26 cm, 1835, blog: Teaching History - Joelza Ester Domingues, accessed 12 Jun 2019, <<https://ensinarhistoriajoelza.com.br/mineracao-sob-olhar-de-rugendas>>

the unification of the territory, the creation of its own administrative structure and, in consequence, interregional commercial relations were developed, creating an internal market and an essentially urban social life. Even with little knowledge of mining techniques, the success of the exploitation was compensated by the richness of the deposits and the ease of extraction of the metal, which was released and coarse. From 1700 to 1780, Minas produced about two thirds of the gold and most of the gems and diamonds mined in Brazil (ALVES 2008).

In the second half of the 18th century, the mining resources began to run out and the mining economy started to decline. The depletion of gold and diamond deposits led to the diaspora of the urban population, who moved to other regions of the state. The production, which reached 300 tons in the middle of the 18th century, was reduced to a third of this less than 100 years later. The population of Minas Gerais became then predominantly rural, and the gold cities became more and more empty, which had a great influence on the culture and politics of the province (A. MOURA 2013). However, there was still much wealth to be explored underground. The ores sought after were no longer gold and precious stones and thanks to the technical-scientific progress that marked the end of the 19th century, inaugurating what some historians called the Second Industrial Revolution, new possibilities were open, especially for the extraction and use of various others minerals. (VALE 2012).

The discovery of new processes for the transformation of iron into steel had immediate consequences. Steel, an alloy of iron and carbon more malleable than cast iron, was essential in the production of machines for new factories and beams for civil construction. Iron deposits hitherto abandoned because they are uneconomical began to be explored in Europe and the United States, and steel production registered extraordinary increases. Used in railroad tracks, in large-scale structures, in tunnels and bridges and in various machines, steel - the main product of the iron and steel transformation - became a basic industrial input. The improvement of stone coal extraction processes and techniques made it possible to take advantage of deeper veins and increase production. Other minerals, such as copper, lead, zinc, bauxite, and manganese, had their applications diversified and their production increased (TEIXEIRA 1993).

Also, in Brazil, the extractive industry started to have some elements favorable to its development. In several states, important advances have occurred in the area of research and geological recognition, which has enabled a significant increase in the number of discoveries of mineral occurrences. And it is in this new context - in which scientific research is increasingly tied to economic progress - the School of Mines of Ouro Preto appears. Conceived by the Emperor Dom Pedro II and founded by Claude Henri Gorceix on October 12, 1876, the School of Minas was a pioneer in geological, mineralogical, and metallurgical studies. At the time, the Emperor of Brazil asked the scientist Auguste Daubr e for a document with recommendations on the best way to conduct the discovery and exploration of mineral resources in Brazil. However, Daubr e had just been appointed Director of the Paris School of Mines and, for this reason, he refused Dom Pedro's request, promising to send a person he trusted: Claude Henri Gorceix. After a thorough study done here in Brazil, Gorceix concludes that it was a region of great geological wealth (MINAS s.d.).



*Figure 3: Scientists work at the Laboratory of Mineralogy and Geology at the Ouro Preto School of Minas Gerais (MG), on a 1925 record, Vale, Nossa Hist ria (2012).*

“In a very small area of land, you can follow the almost complete series of metamorphic rocks that make up a large part of the Brazilian territory, and all the surroundings of the city are suitable for useful and interesting mineralogical excursions.” Claude Henri Gorceix, founder of the Ouro Preto School of Mines, in a report sent to Emperor Dom Pedro II 1874 (MINAS s.d.).

In just over 30 years, the engineers trained by the School started to dictate the direction of mineral policy in the country. Laboratories seethed, students went out into the field looking for new deposits, the mining sector exchanged chance for strategic study.



Figure 4: The handwritten map made by the engineer João Victor Magalhães Gomes for the emperor d. Pedro II, in 1881, where it reveals an itinerary that indicates the gold and topaz mining, mineral deposits and iron factories located on the outskirts of Ouro Preto (Minas Gerais). Source: Vale, Nossa História (2012)

The evolution of interest in mineral reserves took shape in the creation, by Decree no 6.323, of January 1907, of the Geological and Mineralogical Service of Brazil (SGMB), which would give rise, in 1934, to the National Department of Mineral Production (DNPM). The institution would become the main instrument for studying the country's geological and mineralogical structure. The SGMB's research

focus, already in its first actions, was iron. The SGMB, still in 1907, was tasked with carrying out prospective and economic studies, mainly focused on iron ore. These studies resulted in two maps on the distribution of iron and manganese deposits in the region. More than anything, the study also revealed the existence of immense iron reserves, of exceptional quality, in Itabira. The small mining town was beginning to enter the geological and economic map of Brazil (VALE 2012).

## 2.2. ITABIRA AND VALE

The iron from the mountains of Minas Gerais can in a way be considered inexhaustible. (SAINT-HILAIRE, 1938[1817]: 249). For over a hundred years Itabira has been leaning over itself. To engage again in an economy geared to the export market, the exploitation of iron ore, Itabira poured itself some advantages, but mainly suffered the inconveniences of an economy dependent and ephemeral. This contingency disfigured its urban physiognomy, its economic and social organization, and its own cultural identity [...] (FRANÇA apud COSTA, B. 1988:11).

For Milton Santos: *“each place is defined by its own history, that is, by the sum of the accumulated influences, coming from the past and the results of those who maintain greater relations with the forces of the present.”* (SANTOS, 1998, p.83). In this way, this chapter seeks to historicize Itabira in the period before and after the installation of *Companhia Vale do Rio Doce*<sup>1</sup> through the brief presentation of its trajectory.

Itabira, the small settlement of colonial origin embedded in immense iron deposits, had a particularly important role in the history of mining in Brazil. In this small city in the interior of the state of Minas Gerais, tons of a precious and pure mineral, the iron ore, would be found and this discovery would not only transform the entire history of that territory but would also give rise to one of the largest mining companies in the world, Vale. This condition, which made it a target of international

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<sup>1</sup> Before 2009, the company Vale was officially named Companhia Vale do Rio Doce.



economic interest since the beginning of the 20th century, made the city a silent epicenter of a fierce dispute for the control of iron exploration, involving everything from the local reality to the national political scenario and the world iron ore market (WISNIK 2018). Unlike other mining cities that are born and consolidated with the extraction process, Itabira has a long previous history. Its perplexity at the arrival of Vale is perhaps due to the cultural refusal to allow himself to be transformed into a village without a past, in which the urban site merges with the mine, in addition to the clash of interests between the local power groups and the company that settles in. With the discovery of the iron ore reserves and with the establishment of Vale, Itabira would become a city where a company monopolizes jobs, organizes social life and is stronger than local political authorities. (MINAYO 2004).

Itabira is a word of Tupi<sup>2</sup> origin that means “*stone that shines*”. And it was precisely those shiny stones of a great mountain range, Pico do Cauê, that started the occupation and exploration of minerals in the region. This precious metal helps to tell part of the city's history - until the discovery of the first iron ore deposits (VALE, 2016). The city's history begins around 1720.

*“Were discovered, in 1698, the General Mines, those from Ouro Preto [...] from Ouro Branco, São Bartolomeu, Ribeirão do Carmo, Itacolomy, Itatiaia, Itabira”*, writes Rocha Pita, in her book “History of Portuguese America”, mentioned by Francisco Ignácio Ferreira, in his “Geographical Dictionary of Mines of Brazil”, 1885 edition. Despite the previous evidence, the local tradition gives the year 1720 as the starting point of its history, with the arrival of the Farias de Albernaz brothers, who came for an expedition from the Itambé do Mato Dentro region (IBGE 1959).

The two adventurers, from São Paulo, were mining in Itambé region when they saw, in the distance, a peak, and following in its direction they reached the mountain that they called Cauê (that in an African language, which means "brothers"). They explored the streams collecting gold, without knowing, however, for how long. It is certain, however, that checking the presence of alluvial gold, they

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<sup>2</sup> Tupi is an extinct language which was spoken by the native Tupi people of Brazil, mostly those who inhabited coastal regions in South and Southeast Brazil.

transferred their slaves and colonists to the place. The first streets were then defined and was registered, at the end of this century, the construction of the Church of the Rosary (1775), important historical heritage of the municipality with national registration by IPHAN (National Historical and Artistic Heritage Institute) (ITABIRA, 2019).

Over time, with the rampant exploitation of the product and the export for the enrichment of European colonizers, gold mining has declined, leaving the population exposed to economic decay and its working population in the most complete abandonment and desolation. (MINAYO, 2004). However, this did not dampen the initial impulse of the population, because, in the seductive glow of gold, a new mineral richness, less beautiful, but more useful, happened - iron.

At the turn of the 19th to the 20th century, the Cauê peak, the geographical landmark of Itabira, was mapped as the largest iron deposit in the world. The news took over the planet and, if the gold miners disappeared from the city, foreign miners began to appear. In 1867, 84 forges were already found in the regions of Itabira and Santa Bárbara. And since then, iron has been the mainstay of the city's economic life, never having stopped the extraction of ore on increasingly important scales. (IBGE 1959).

According to Minayo (2004), the discovery of large deposits by the international market takes place at the beginning of the 20th century. In 1907, when the engineers at the Ouro Preto School of Mines<sup>3</sup> went to Itabira to inventory the iron ore deposits, there they found foreigners performing the same survey unofficially. In 1910, at the XI International Geological Congress held in Stockholm, Sweden, it was revealed that in the center of the State of Minas Gerais were located the largest deposits of iron ore in the world and thus, the great capitalist countries became aware

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<sup>3</sup> Conceived by Dom Pedro II and founded by Claude Henri Gorceix on October 12, 1876, the Escola de Minas was created with the objective of researching the country's mineral wealth. It set the starting point for the study and exploration of iron ore deposits and for the implantation of the national steel industry. It was also essential for the industrial development of the state and in the country's economic policy, under the government of Getúlio Vargas. In 1969, it joined with the also centennial School of Pharmacy of Ouro Preto forming the Federal University of Ouro Preto. Currently, the institution functions as a higher education institution of engineering and architecture and in the original building there are still some of the classrooms and laboratories, the Permanent Archive of the Escola de Minas and the Science and Technique Museum.

of the ore reserves of Brazil. In this period, powerful English “syndicates” bought the iron deposits in the Itabira region identified by Brazilian technicians, taking advantage of the loopholes of the then Brazilian Constitution<sup>4</sup>. They then organize the Brazilian Hematite Syndicate, aiming to dominate the flow of exploration and export, the English group obtains the Itabira reserves delimited in an area of 76,000,000 m<sup>2</sup>, in addition to the majority of the actions and the control of, until then under construction, the Vitória-Minas railroad.

Succeeding the Brazilian Hematite Syndicate, the Itabira Iron Ore Company was created in June 1911, which, through the Federal Government concession, is authorized to explore and export iron ore from the Itabira deposits (ITABIRA. 2009). In 1910, Brazilian Hematite had already acquired the main deposits in Itabira, which, covering 76.8 million square meters and housing more than 1 billion tons of ore, constituted one of the largest iron reserves in the country. About the purchase of the mine in 1910, the author Wisnik (2018) highlights the feeling of the time:

It is a time that neither returns nor advances, going back, as we know to the year of purchase of the mine, which suggests an association between such facts and feelings: the purchase of the mine, the promise of wealth to the small town, the global dimension of this event, all hovering over this time. The beginning of the extractive operation will be fated to remain at long halting deadlocks. (WISNIK 2018)

During its existence, the company lived mainly with the discussion about the strategic importance of preserving mineral wealth, with opinions that wavered between the nationalist position and the opening to foreign capital. Whether because of the movement, which has since established itself in Minas and reaches the whole country, pressing against the unpunished delivery of the State's mineral wealth to foreign groups; either as a result of this dynamic, that is, the government of Minas Gerais has started to hinder, by legal provisions, the exploration of the deposits; or for the international conjunctures generated during the First World War and the post-

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<sup>4</sup> The Brazilian Constitution of 1891 - the first republican constitution - provided that the owner of the soil was also the owner of the land, whether foreign or Brazilian.

war period: such events brought numerous obstacles to the raising of funds for the enterprise, so that the Itabira Iron Company was never able to carry out the exploration of iron ore in Itabira .

In 1919, Itabira Iron Ore Co. changed hands: it was bought by American businessman Percival Farquhar, a former representative of the company in Brazil. Farquhar had arrived in Brazil 15 years earlier and specialized in business involving foreign companies and the government.

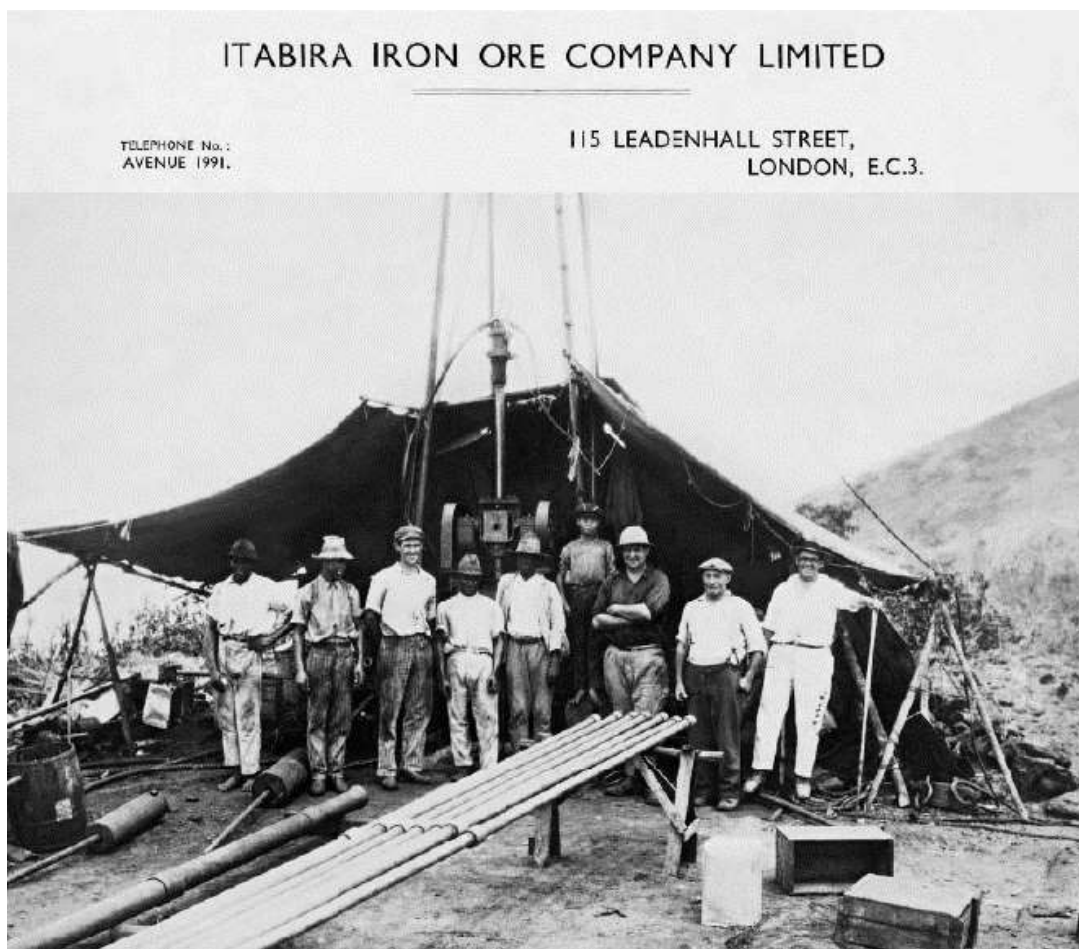


Figure 5: Workers in front of the rigs at the Cauê Mine, in 1920. Source: Vale, *Nossa História*, 2012.

The beginning of the 1940s, so troubled by the Second World War, is also the starting point in the history of the Brazilian company that is, today, one of the largest mining companies in the world, the CVRD - *Companhia Vale do Rio Doce*, today simply called Vale. Created as a mixed-capital corporation, from the merger of *Companhia Brasileira de Mineração e Siderurgia SA* and *Itabira de Mineração SA*,

it included, in the package of its foundation, the maintenance, operation and expansion of the Vitória-Minas Railway (EFVM). The company establishes itself within a national and international political context that favors and marks its immediate implantation and expansion, within the following characteristics: separation of the exploitation and industrialization of iron ore; and the marks of a mixed economy, forming the company whose majority shareholder is the National Treasury itself, holder of all its share capital. American capital only comes in the form of technical advice, equipment, and loans to be covered in the short term.

According to Minayo (2004), the city that Vale finds is rich in experiences and stories. But it is an economically decadent city, resembling the typical cities born from the gold cycle and living, particularly, from the primary sector. As in the other colonial cities of Minas Gerais, in the period before the creation of the Company, cultural life occupies a privileged space. The quality of teaching and the development of the arts - music, theater, sculpture, painting - were highly valued, which attracted several people from other neighboring cities since teaching was considered of higher quality there. The tradition of religious events closed this cultural life, where particularly the elite, coming from the rural oligarchy took advantage. The working class, however, presented the opposite situation, as is highlighted in the chronicles of Saint Hillaire (1974), where the French traveler describes the precariousness of the workers' homes and the lack of health care, which resulted in high mortality rates.

There was therefore an opposition of perspectives between the two social groups, the dominant groups, and the workers, regarding Vale's entry into the city. The author states that for the local elite, it was an invasion of space linked to the feeling of loss of power. For the poor population, the implantation of Vale meant “fixed employment”, social rights and a possibility for a better life.

Within the scope of local power, in Itabira, there is a diffuse fear caused by the macro-dimensions of central and authoritarian power that emanate from the federal government, in contrast to the fragility of the municipal power to propose protective and safeguard alternatives to the city and to the population. Itabira was one of the first victims of this policy aimed at profit at any price, for a policy much more directed at external interests, to the benefit of foreign companies, and the payment of the Brazilian external debt. This policy took a landscape, a history, a

culture. In the name of progress, the city was subject to the domination of the company, whose “economic hegemony is projected in the totality of social life” (A. ROSA 2000).



Figure 6: Cartoon reproduced in the newspaper O Cometa Itabirano, n.º 5 edition, of 1980, expressing a criticism regarding Vale's presence in the city of Itabira, its inconsequential exploration guided by the idea of progress. With the following sentence at the end: I sometimes think that Itabira sold his soul to Companhia Vale do Rio Doce ". Source: (A. ROSA 2000)

In this context, one of the figures that stands out in the local and national press is the writer Carlos Drummond de Andrade. In his poems he speaks plastically that deep sense of loss that plagues the ruling groups of the locality and that is represented in the rural oligarchy, as in the poem *The Assets and the blood*, 1951:

*Os bens e o sangue    The assets and the blood*

*Os urubus no telhado:    The vultures on the roof:*  
*E virá a companhia inglesa e por sua vez    And the English company will buy*  
*comprará tudo    everything*  
*e por sua vez perderá tudo e    and in turn will lose everything and*  
*tudo volverá a nada    everything will return to nothing*  
*e secado o ouro escorrerá ferro,    And dry, the gold will flow the iron,*  
*e secos morros de ferro    And dry iron hills will cover the sinister*  
*taparão o vale sinistro    valley*  
*onde não mais haverá privilégios,    Where there will be no more privileges,*  
*e se irão os últimos escravos,    And the last slaves will be gone,*  
*e virão os primeiros camaradas    And the first layers will come;*  
*e a besta Belisa renderá os arrogantes    The beautiful beast surrenders the arrogant*  
*corcéis da monarquia,    steeds of the monarchy,*  
*e a vaca Belisa dará leite no curral vazio    The bellisa cow will give milk in the empty*  
*para o menino doentio,    corral to the sick boy,*  
*e o menino crescerá sombrio,    The boy will grow up dark,*  
*e os antepassados no cemitério    The ancestors in the cemetery will laugh,*  
*se rirão se rirão porque os mortos não    They will laugh because the dead do not*  
*choram.    cry.*

The course of events echoes in several other poets' writings. Born in 1902, Carlos Drummond de Andrade's work is imbued with a Minas Gerais spirit that the author attributes to his childhood in Itabira. The writer's relationship with mining in his works pioneers a wound that is open until today: the degradation of the environment and life in the areas affected by mining blinds itself to its consequences. In another poem, *Itabirano's Confidence*, Drummond reveals that he took an iron

stone as a souvenir from his hometown, when he moved to Belo Horizonte first, and to Rio de Janeiro later.

**Confidência do Itabirano    Itabirano's Confidence**

Alguns anos vivi em Itabira.	For some years I lived in Itabira.
Principalmente nasci em Itabira.	Mostly I was born in Itabira.
Por isso sou triste, orgulhoso: de ferro.	That is why I am sad, proud: made of iron.
Noventa por cento de ferro nas calçadas.	Ninety percent iron on the sidewalks,
Oitenta por cento de ferro nas almas.	Eighty percent iron in the souls.
E esse alheamento do que na vida é porosidade e comunicação.	And this detachment from what in life is porosity and communication.
A vontade de amar, que me paralisa o trabalho,	The desire to love, which paralyzes the job,
vem de Itabira, de suas noites brancas, sem mulheres e sem horizontes.	comes from Itabira, from its white nights, without women and without horizons.
E o hábito de sofrer, que tanto me diverte, é doce herança itabirana.	And the habit of suffering, which amuses me so much, it is a sweet Itabiran heritage.
De Itabira trouxe prendas diversas que ora te ofereço:	He brought several gifts from Itabira I offer you:
esta pedra de ferro, futuro aço do Brasil,	This iron rock, future steel of Brazil,
este São Benedito do velho santeiro Alfredo Duval;	This Saint Benedict of the old saint Alfredo Duval;
este couro de anta, estendido no sofá da sala de visitas;	this tapir leather, stretched out on the sofa visiting room;
este orgulho, esta cabeça baixa...	this pride, this head down ...
Tive ouro, tive gado, tive fazendas.	I had gold, I had cattle, I had farms.
Hoje sou funcionário público.	Today I am a civil servant.
Itabira é apenas uma fotografia na parede.	Itabira is just a picture on the wall.
Mas como dói!	But how it hurts!

The 1940 poem Itabirano's Confidence presents a subject that is confused with the physical, social and cultural landscape of his hometown; someone who internalized their signifiers and carried their values; speaks of a subject who



recognizes himself as the son of Itabira and who knows the consequences of being born and living in Itabira. He shows himself as an individual aware of this identity, marked by this social and cultural world: “Ninety percent of iron on the sidewalks. / Eighty percent iron in souls” - reveals the poet. The occluded landscape between walls and tortuous slopes, the “white nights, without women, constituted the subject's way of being, whose suffering is a sweet Itabiran heritage”, or “the complex art of being unhappy”, as said Cornélio Penna, another almost Itabiran (A. ROSA 2000).

A curious story involves the two greatest symbols of Itabira: the iron and Carlos Drummond de Andrade. The white house known as Pontal farm, where the poet spent part of his childhood, was dismantled by Vale in 1973. The site was occupied by a dam built to wash ore. Three decades later, the company reassembled the house in a place close to the original, in honor of the artist. Currently, the farm is a tourist and cultural spot, but from the windows, the landscape is not at all poetic: the lake of waste from iron extraction (C. BRASIL s.d.).

Regarding Vale's production process in the city of Itabira, the company divides into three stages: the so-called first technological wave of ore in Itabira, from 1942 to 1972 and consists of the period in which Vale gave priority to the commercialization of hematite, a high iron ore that does not require industrial processes. The second wave lasts from 1972 to 2013, the implementation of the Cauê and Conceição I mines marks the beginning of the processing of friable itabirite for the production of sinter and pellet feed. Ore separation processes were introduced by magnetic, gravity and physical-chemical (flotation) methods. The third wave, starting in 2013 (VALE 2016).

From the point of view of the trajectory of the miners in Itabira, making a counterpoint with the trajectory of the institutionalization of Vale, the author Minayo (2004) highlights three remarkable moments that institute changes in the social relations of ore production and its identity. The first stage, from 1942 to 1951, which is part of the so-called “manual labor era”, where the work force is subject, at the same time that it is an object (merchandise), and where the company begins to create a profile of its hand - labor, through a social organization of industrial work such as hierarchical distribution, regulation of time and production pace and the development of a code of discipline. From this stage the author highlights the following aspects:

(1) the origin, recruitment, and selection of workers as an important social fact, where there is, at the same time, a convergence of interests between the company and the workers and where, at the same time, class opposition is established and becomes visible; (2) the work process as a form of technical and social organization, where traditions are intensified according to the major object of capital, valuation. During this period, the creation of the Metabase Union in Itabira in 1945 stands out, four years after the creation of Vale, which even today operates and represents the workers of Itabira in defense of their rights. However, the form of organization of the miners in the Union could be called induced unionism, since historically it corresponds much more to the strategic interests of the Company to prevent and contain autonomous movements of workers' rebellion than to defend the rights of employees. (DUTRA, apud MINAYO 2004).



*Figure 7: First headquarters of the Metabase Union in Itabira. 1945, accessed 05 Jul 2019, <[https://www.metabase.com.br/pgaberto.php?id\\_cat=1&&id=1](https://www.metabase.com.br/pgaberto.php?id_cat=1&&id=1)>*

The second stage, which goes from 1952 to 1972, covers the change from manual extraction to the completion of the iron ore industrial extraction process and its significance for miners. In this period, there are continuous ruptures both in relation to the first stage and in relation to the next period, that of modernization. According to the author, this stage is considered as a transition that brings profound

meanings to the configuration of the worker segment whose identity is in the process of construction. This is the moment for the technical and social organization of industrial production itself, where the company gained dynamism and efficiency in the mining sector, in addition to recognition and competitiveness in the foreign market. It is from this period that the company starts to gain more notoriety and that social relations of work become more complex. *"In the memory of workers, this was the time of abundance and optimism and, for Itabira, the time of economic effervescence, the boom in civil construction and the real estate market, which transformed the city into a dynamic pole for industrial employment and for the municipal collection"*, says the author.

In the third stage, which runs until the end of the 1980s, the company consolidates an expansionary dynamic in which workers feel a loss of control over the dimensions of the company that they themselves saw born and helped to build. Competition is also intensified within the production units and workers begin to show a high degree of dissatisfaction with the work environment, with their salaries. Although the institutional culture remained very cohesive as in the previous stage, a feeling of alienation ran through the social body and the soul of the workers' collective.

For the workers, direct actors in the destruction of the Itabira landscape, motivated by the extraction of the ore, the miracle of the transformation remains unraveled: they know, but they do not participate. They are aware that the mountain turns into dollars and their sweat into wealth, but who gives and who receives? Who loses and who wins? [...]

With the advancement of mining, Vale also introduced outsourced labor and, as a consequence, a low-income population multiplied in Itabira. The collective feeling of dissatisfaction multiplies and marks the end of the time when the national developmentalist ideology still managed to manipulate the feelings of workers. This discontent will be expressed in a remarkable strike, in 1989, where union leaders and workers mobilized demanding the wage readjustment and maintenance of social achievements (MARQUES 2005). In addition to the practically total adhesion of Vale workers, the strike also counted on the participation of road and railroad workers, who also joined the strike, and with the support of the population of Itabira, who no longer saw the mining company with the branch eyes of before. It was the

second and biggest strike launched by the miners of the then state company Vale do Rio Doce and lasted for five days. The agreement signed with Vale's management guaranteed the strikers not to be dismissed for a period of 100 days, as well as the payment of the days stopped. The shift surcharge has been increased from 20% to 22%. As for salaries, although the category claimed 83% of readjustment (it was time of rampant inflation), the employer's counterproposal prevailed, being granted 60.1%, with a real gain of 39.15%. This movement preceded a period of fear and uncertainty for workers (CRUZ 2019).

In the 1990s, it was defined by the author as the era of insecurity and uncertainty and is marked by the process of privatization and the implementation of the productive restructuring that follows the moment of crisis marked at the end of the previous stage. Crisis for workers, as Vale, meanwhile, became a company symbol of competitiveness and success. During this period, Vale promoted several voluntary dismissal plans, which were carried out through retirement incentive plans for retired workers. This process of reducing the workforce brought great ambiguity to workers. On the one hand, the program was presented as an option that offered a number of advantages and, on the other hand, the imminent possibility that people who did not join could be fired against their will was discussed. This incentive together with technological and organizational changes caused the collective directly linked to the company to gradually decrease, from 5150 employees in 1979 to 1638, in 2004 (MINAYO 2004).

Until 1997, the company had the status of a state-owned company. Although legally linked to the state, a radical organizational change is beginning to take place in the company, aimed at effecting the privatization that actually occurs in 1997. As mentioned, in the first stage, Vale was a mixed capital company, whose largest shareholder was the National Treasury itself. The federal government held 90.91% of its shares and it was under the jurisdiction of the Ministry of Mines and Energy (CVRD, 1982 apud MINAYO, 2004). The privatization of the company determined the direction of the changes with the change of the "owner" of the company. The state, the previous owner, hypothetically representing national interests, was replaced by a group of owners, whose relevance is symbolized in the word "profit" as opposed to the expression "social sense" ideologically inoculated as one of Vale's purposes as a state company (MINAYO 2004).

Vale's privatization was a very controversial process because although it had always operated with a positive balance, breaking production, and sales records, it was sold “at a bargain price”, as those who oppose the company's privatization say. At the time, Vale was sold for R \$ 3.3 billion, when only its mineral reserves were estimated at more than R \$ 100 billion at the time. Farias apud Rocha, Oliveira and Nolasco (2019) argues that the privatization process at Vale did not take place with transparency, since its auction was marked by inconsistencies in the public notice. Supporters of privatization claimed that the measure was beneficial, since today it generates more jobs for the country and more taxes for the Federal Government than when it was still state-owned. (PRAGMATISMO POLITICO 2019).



Figure 8: Protests against the sale of Vale do Rio Doce. In the Poster the writing: Vale is not for sale; it belongs to the people. Author: Ricardo Stuckert, Memorial da Democracia

After privatization, the company continued to show a significant increase in its profitability, becoming one of the largest mining companies in the world. But, at the same time, labor conflicts within it also intensified and the perception of the company by workers and inhabitants of Itabira was becoming increasingly negative (CARVALHO 2013). The discourse created in the construction process of Vale undergoes a reformulation in this period. The moment the company is put up for sale, the identity “Vale is ours” is undone. A rupture in this discursive identity of property is promoted: “the company will no longer be ours” (ADAO 2006).

Vale is currently the largest producer of iron ore and nickel in the world and also operates in other mineral segments through investment in technology and logistics. With headquartered in Brazil and operating in about 30 countries, the company employs approximately 125,000 employees, including its own and permanent third parties (VALE s.d.).

### 3. THE MINING AND ITS CONSEQUENCES

- **L'impact économique**
- **Les conflits environnementaux**
- **Identité de la ville basée sur la culture minière**

#### 3.1. THE ECONOMIC IMPACT

In Brazil, the mining industry, along with agribusiness, is considered one of the most important items of the Brazilian trade balance. Mineral exploration is treated as an activity of great public interest, in view of the economic return it provides. This activity is a great source of income for the country and balances the national growth indices to a significant degree. Currently, mining accounts for almost 5% of the national Gross Domestic Product (VALE 2017) and is capable of attracting various investments and offering products that are widely used in various industries, such as metallurgy, fertilizers, steel and petrochemicals. In addition, mining contributes to the creation of numerous direct and indirect jobs, precisely because it offers raw material for various types of industry. According to the Brazilian Mining Institute, Brazilian mineral production was US \$ 34 billion in 2018 and this same industry employed, until January 2019, approximately 195 thousand workers directly, according to data from the Ministry of Economy's Labor Secretariat (IBRAM 2019).

Mining as an economic activity is not recent in Brazilian history. Historically, it begins in the 17th century, with expeditions that searched the interior of the territory in search of valuable metals (gold, silver, copper) and precious stones (diamonds, emeralds). At that time, the extraction of ores was responsible for a large part of the occupation of the territory of the region of the current state of Minas Gerais and, mainly, for the economic balance and the generation of wealth. Since then, the southeast region, and especially the state of Minas Gerais, has not stopped receiving population contingents from other regions and outside the country, due to mineral exploration (FERNANDES, ALAMINO e ARAUJO 2014). The demographic

increase around deposits was exponential during the 18th century: the colonial population of Brazil grew 11 times at that time, from 300 thousand inhabitants to 3.3 million, giving rise to cities such as Vila Rica, now Ouro Preto, Sabará and Mariana (BLOG DA HISTÓRIA, s.d.).



*Figure 9: The Doce River, which bathes the state of Minas Gerais, in 1815, depicted in an engraving by the German prince Maximilian Alexander Philipp Wied-Neuwied. Vale, Nossa História. 2012*

Currently, Minas Gerais remains the largest mining state in Brazil. With mining activity in more than 250 municipalities, and more than 300 mines in operation, the state has 40 of the 100 largest mines in Brazil. In addition, of the 10 largest mining municipalities, seven are in Minas Gerais. The state is also responsible for approximately 53% of the Brazilian production of metallic minerals and 29% of the total minerals, in addition to extracting more than 160 million tons / year of iron ore (IBRAM, 2013 apud (FERNANDES e ARAUJO 2016) Minas Gerais also has the largest variety of explored and commercialized substances (16 metallic and 29 non-metallic substances) and in reserves (28 metallic and 33 non-metallic) in Brazil, in



addition to being the second most important state in terms of collecting the CFEM - Financial Compensation for the Exploration of Mineral Resources <sup>5</sup> (figure 10).

PERCENTAGE OF THE VOLUME OF RESOURCES COLLECTED BY CFEM IN BRAZILIAN STATES, 2019

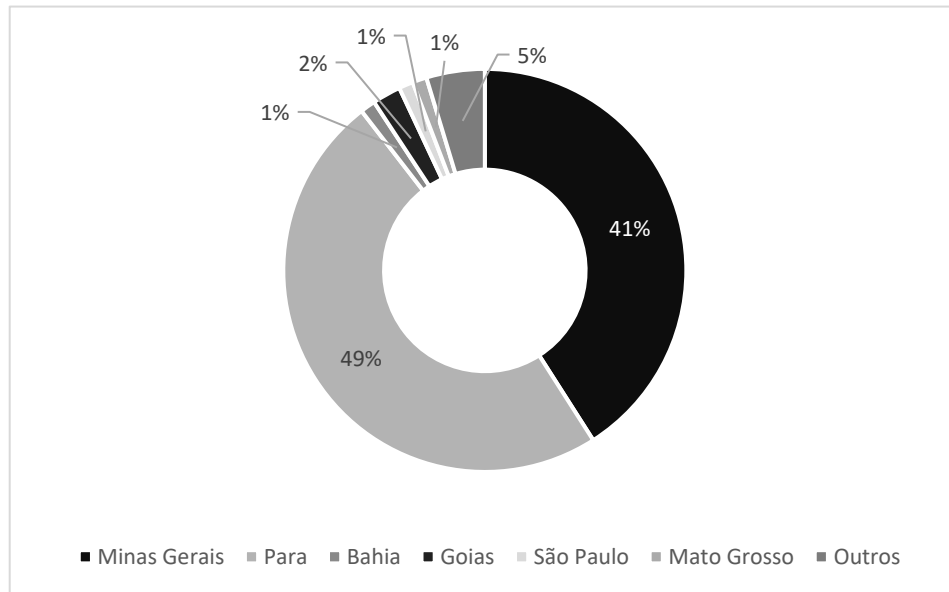


Figure 10: The percentage of the volume of resources collected by CFEM in Brazilian states in 2019. Source: DNPM (2020)

In this scenario, the city of Itabira stands out for its significant role in the development of the region's extractive industry. For decades Itabira has been one of the cities that most collects with mining activity in the state, as shown by the report of the National Mining Agency, where in 2019 alone, the city collected more than 6 billion reais from this industry (figure 11). In 2016, according to a survey conducted by the João Pinheiro Foundation, Itabira was the city where the extractive industry represented the highest gross added value, compared to other municipalities in the state of Minas Gerais (figure 12).

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<sup>5</sup> Established by the 1988 Constitution, the Financial Compensation for the Exploration of Mineral Resources (CFEM) is a consideration for the economic use of mineral resources in their respective territories, that is, it is a counterpart of the exploiting company to the municipalities, states and the Union for the exploration of minerals. This Financial Compensation is calculated on the value of the net revenue obtained when the mineral product is sold and is distributed as follows: 12% for the Federal Government; 23% for the state where the mineral substance is extracted and 65% for the producing municipality (CNM 2012).

LARGEST IRON ORE FUNDERS IN THE STATE OF MINAS GERAIS IN 2019

Funder (City)	Quantity of Titles	Value		
		Operation Value	CFEM Received Rate	% CFEM Received Rate
1 Congonhas	5	R\$ 8.324.531.044,22	R\$ 284.157.465,30	3,41%
<b>2 Itabira</b>	<b>1</b>	<b>R\$ 6.956.062.448,13</b>	<b>R\$ 240.484.242,10</b>	<b>3,45%</b>
3 Nova Lima	7	R\$ 5.449.081.095,30	R\$ 197.676.999,60	3,62%
4 Conceição do Mato Dentro	2	R\$ 5.168.630.440,60	R\$ 180.908.066,95	3,50%
5 São Gonçalo do Rio Abaixo	5	R\$ 4.526.848.438,88	R\$ 159.735.455,10	3,52%
6 Itabirito	11	R\$ 2.941.195.301,22	R\$ 106.670.692,50	3,62%
7 Mariana	7	R\$ 2.328.430.597,66	R\$ 83.058.924,13	3,56%
8 Brumadinho	18	R\$ 2.107.347.348,81	R\$ 72.394.429,75	3,43%
9 Belo Vale	6	R\$ 1.712.471.021,99	R\$ 58.739.589,42	3,43%
10 Itatiaiuçu	8	R\$ 1.734.025.685,06	R\$ 57.879.666,07	3,33%

Figure 11: Largest CFEM funders in the state of Minas Gerais, 2019. Source: Agencia Nacional de Mineração, 2020.

CITY WHERE THE EXTRACTIVE INDUSTRY WAS THE HIGHEST ADDED GROSS VALUE ACTIVITY IN 2016 - MINAS GERAIS

City	Territory	Population (number of inhabitants)	GDP per capita (R\$)	GDP per capita in relation to the state of Minas Gerais (%)
<b>Itabira</b>	<b>Metropolitan</b>	<b>118.481</b>	<b>30.167</b>	<b>116</b>
Nova Lima	Metropolitan	91.069	82.145	317
Ouro Preto	Metropolitan	74.356	39.002	150
Mariana	Metropolitan	59.343	35.860	138
Congonhas	Hillside	53.348	50.722	196
Itabirito	Metropolitan	50.305	52.884	204
Brumadinho	Metropolitan	38.373	40.100	155
Conceição do Mato Dentro	Metropolitan	18.160	43.714	169
Rio Piracicaba	Metropolitan	14.613	24.813	96
Itatiaiuçu	Metropolitan	10.882	66.981	258
São Gonçalo do Rio Abaixo	Metropolitan	10.683	179.339	69
Riacho dos Machados	North	9.665	16.173	62
Conceição do Pará	West	5.488	43.314	167
Catas Altas	Metropolitan	5.274	48.747	188
Tapira	South Triangle	4.598	119.080	459

Figure 12: Source: João Pinheiro Foundation (FIP), Directorate of Statistics and Information (DIREI), 2016

The extractive industry also has a great influence on the employment rate in the city, since Vale <sup>6</sup> is the company that covers almost the entire market and that the other services are developed indirectly due to the mining company. According to 2010 statistics, 10.65% of Itabira's workers were employed in the extractive industrial sector and 6.42% in the manufacturing industry<sup>7</sup>, while 11.65% of the employed population was employed in the construction sector, 1.47% in the public utility sectors, 14.18% in commerce and 43.64% in the services sector (PNUD 2013).

The generation of jobs caused by the extractive industry was also responsible for the exponential population growth in the city. In 1940, the Census gave the municipality 11,492 inhabitants, of which only 4,685 were residents of the city, a statistic that represented practically the same demographic profile of the population in the previous three decades. With the establishment of the Vale company in the city in 1942, and with the expansion of mining activities, Itabira went from 11,492 inhabitants to an estimated population of 117,634 in 2015 (IBGE, 2016). At the same time that the extractive industry was gaining prominence, other activities were losing space for mining (Presas, 2012). According to the data of the General Census, from 1950, the municipal population was distributed according to the branches of activity presented in the *figure 13* (IBGE 1959). Currently, the scenario in which Itabira finds itself is different from that time: industry is now the most relevant sector for the municipality's economy, followed by the services sector, leaving livestock and agriculture as the least representative sector in Itabira's economy. (*figure 14*).

Today, Vale extracts about 41 million tons of iron ore in Itabira - 11% of its production of this metal. The company accounts for 30% of Itabira's revenue and, directly and indirectly, moves 70% of the local economy, as stated by the city hall (BBC 2019).

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<sup>6</sup> Although there are other companies in the extractive industry sector in Itabira, Vale's participation was considered in isolation, as this company encompasses almost the entire age of the city's mineral activity.

<sup>7</sup> According to the National Classification Commission (CONCLA), the Transformation Industries comprise the activities that involve the physical, chemical and biological transformation of materials, substances and components in order to obtain new products. The transformed materials, substances and components are inputs produced in agricultural, forestry, mining, fishing and products from other industrial activities. This industry is, therefore, directly related to the extractive industry and consequently with the company Vale (CNM 2012).

Branches of Activity	Present population 10 years and over			
	Men	Women	Total	
			Absolute numbers	% over grand total
Agriculture, livestock and poultry	3931	1.934.129	4.129	23,03
Extractive industry	1277	1.310	1.310	7,30
Manufacturing industry	654	864	864	4,81
Trade in goods	224	244	244	1,36
Trade in real estate and securities, c	50	53	53	0,29
Services provision	250	857	857	4,77
Transport, communication and stor	177	185	185	1,03
Liberal professions	19	21	21	0,11
Social activities	36	242	242	1,34
Public administration, legislative an	53	67	67	0,37
Public security	9	9	9	0,05
Unpaid domestic activities	739	8.156	8.156	45,49
Inactive conditions	1083	1.801	1.801	10,05
<b>Total</b>	<b>8502</b>	<b>17.938</b>	<b>17.938</b>	<b>100,00</b>

Figure 14: The most relevant sectors for Itabira's economy in 1950 (adapted). Source: IBGE 1959

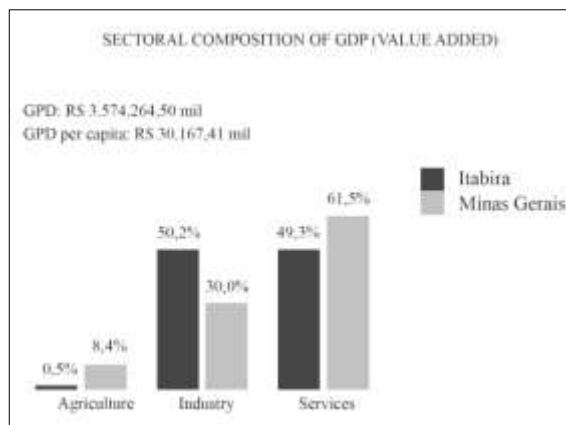


Figure 13: Sectoral composition of the gross domestic product in the state of Minas Gerais and Itabira, 2016. Source: IBGE (2016)

But despite the economic determination of the mono-industry, because of the hegemonic power of the iron ore industry, Minayo (2004) states that Itabira cannot be configured as a company town<sup>8</sup>, because, despite having an autonomous life prior to the presence of the iron mining mono-industry, Itabira, especially from the 1950s

<sup>8</sup> Company towns are built as a logistical strategy and therefore become mere extensions of the sphere of production. The company's rules permeate all the collective equipment and activities carried out by its inhabitants. The coexistence in closed spaces accentuates this, creating mechanisms of control of the group over itself, and intergroups, in such a way that different behaviors that are diluted in larger cities attack and disturb more. Relationships tend to be more superficial, for fear of invasion of privacy. They are usually built and maintained within a logic of provisionality. They must end when the enterprise ceases (in the case of mining, for example) and more commonly, they pass the hands of the municipality (PIQUET 1998).

onwards, becomes a typical case of socio-space appropriation by a dominant economic activity, putting it transform into what the author considers, a "city of work" because almost everything in the sphere of social reproduction still mostly revolves around Vale's projects, times and culture.

This occurs within a specific dynamic of relations between the sphere of economic power of the company and the sphere of local political power, and between the world of production and social life. A peculiar culture of dependency is created, configuring a *modus vivendi* that is perpetuated in the daily dynamics of relations between company and municipality (MINAYO 2004).

And although the presence of the mineral sector in the city has brought great development to the city, extractive activity has also not guaranteed balanced growth, on the contrary, it is characterized by a cyclical gap between supply and demand. Due to the scale of operation, increases in production and other setbacks, large jumps occur at certain times. This dynamic creates periodic imbalances in the relationship between supply and demand, causing great variation in the economy of the municipality and the country. (GUIMARÃES e MILANEZ 2017).

Until the 1980s, a cycle of stability prevailed in the city, which was interrupted due to a drastic reduction in the price of iron ore on the world market at that time. This process was associated with the oil crisis, still in 1973, and the economic recession of the USA, which led to a decrease in the consumption of commodities, which put - for the first time - the Itabira economy at risk. The period of instability continued during the 1990s, and was only overcome in the early 2000s, due to the growing demand for ores from China, accompanied by an unprecedented increase in the price of iron ore.

China's demand for ore seemed inexhaustible and the new price level allowed Vale to continue exploring the old mines in Itabira, even though quality ore was not as abundant and operating costs were higher (GUIMARÃES e MILANEZ 2017)

This scenario, however, was modified again with the financial crisis of 2008, when a momentary fall in the price of iron ore brought back the idea of

unemployment and the absence of *royalties*<sup>9</sup> hovered over the city. That year, the municipality, which collected R \$ 49.6 million from CFEM, only obtained R \$ 33.2 million. Thus, the City needed to work with the possibility of reducing the collection by 70% in the face of this situation. In addition, Vale laid off a significant number of people (Saraiva & Carrieri, 2012 apud Guimarães e Milanez, 2017). As of 2009, prices resumed, the crisis was noticed and new projects were resumed. However, the end of the commodities boom, starting in 2011, proved that dependence on mining exposed the city of Itabira to great risks. This time, the impact took place in a structural way, reaching municipal revenue, employment, and economic dynamics. For example, between 2013 and 2014, the collection of CFEM increased from R \$ 125 million to R \$ 60 million. And again, a reduction in the number of jobs was recorded (GUIMARÃES e MILANEZ 2017).

In recent years, more events have occurred that have further shaken the state of the mining industry in Minas Gerais. In November 2015, a mining tailings dam called "Fundão", controlled by *Samarco Mineração S.A.*, a joint venture of the largest mining companies in the world, the Brazilian Vale S.A., and the Anglo-Australian BHP Billiton, broke down. A total volume of mining waste of 62 million cubic meters devastated the district, leaving 18 dead and 1 missing (SCHREIBER 2015). The embargo on activities had a negative impact on the city's economy, with a 60% drop in trade and losses of R \$ 5 million in revenue.

On January 25, 2019, the country again witnessed a tragedy produced by mining activity. A dam of mining waste, in the city of Brumadinho (170km from Itabira), broke due to the activities of Vale, causing extensive environmental, socioeconomic, and human devastation. The Vale disaster caused 248 deaths and 11 missing persons (G1 2019), mostly company workers or outsourced workers. As a result, an important economic effect for the state's economy has been added to the enormous human tragedy that has been observed (DOMINGUES, et al. 2019).

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<sup>9</sup>The Federal Constitution, in its article 20, defines that mineral resources are assets of the Union. Therefore, companies that explore ores are obliged to pay royalties as compensation for the extraction of such resources.

At the national level, the gross domestic product (GDP) of the Brazilian extractive industry was significantly affected by the performance of the general industry in Brazil. The rupture of Vale's dam in Brumadinho drastically reduced production, and technical problems delayed the start-up of new oil platforms, hampering the expected production growth for 2019. The GDP result in the 2nd quarter of 2019 for the industry came out positive despite the fall of the extractive industry, which fell by 3.8% in comparison with the 1st quarter of the same year (figure 15). (D. ALVARENGA 2019). In addition, Vale's Production and Sales report in 2Q19, released by Vale S / A, points to a 33.8% drop in iron ore production in the second

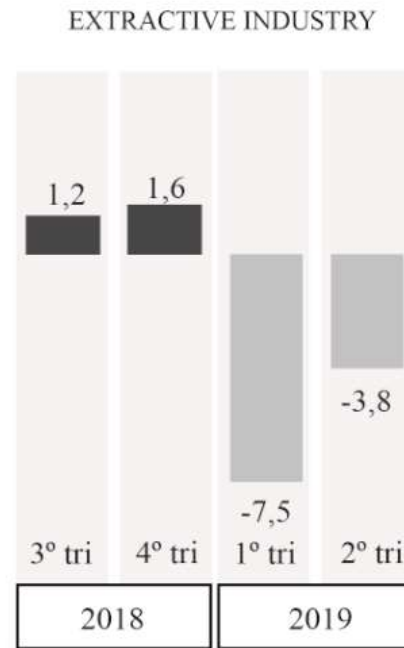


Figure 15: Variation in the GDP of the extractive industry in Brazil (in% over the previous semester). Source: IBGE (2019)

quarter of 2019, compared to the same period in 2018. (VALE 2019). The collection of CFEM in the state of Minas Gerais reached R \$ 112.3 million in the first month of 2019, representing a 10% decrease compared to the collection of mining royalties in January 2018 (R \$ 124.9 million ) (N. BRASIL 2020).

Other consequences of accidents in the region were layoffs in the mining sector, which seriously affected the economy and daily life of mining cities. In 2015, more than 2.5 thousand people lost their jobs in Itabira. According to the Itabira City Hall, in the first three months of the same year, the municipality stopped collecting R \$ 19 million from mining taxes (G1 2015).

“The person who works at Vale, she creates jobs at her house, in civil construction. She is going to consume in commerce, she works in the bakery, in a store. For every one person fired in the Vale area, we estimate that a couple more people will be fired here,” said the president of the Chamber of Shopkeepers (CDL) of Itabira, Maurício Martins in an interview with the G1 newspaper, in May of 2015 (G1 2015)

The rupture of the two dams also left the inhabitants of Itabira in a constant state of tension, after all Vale has 15 dams in the municipality, of which five are close to the urban perimeter. The five dams closest to the city center store 423 million m<sup>3</sup> of tailings, according to data from 2019, from the National Mining Agency, a volume equivalent to 33 times what was in the first dam that broke in Brumadinho (BARIFOUSE 2019).

In addition, another worsening of the mining situation in Itabira is the fact that ore reserves may eventually be depleted. According to the 20F report, destined for the international market and published by the company in 2017, the forecast is that the mines still active in Itabira will be exhausted in approximately ten years. (figure 16). According to Vale, the exhaustion forecast may change according to advances in technology and the demand of the international market, but what is known for certain is that the resource is finite (PIMENTEL 2018).

“Will this end one day? Hopefully so. It is not infinite. Today we work with the ten-year mine horizon, so we will operate the Itabira deposit for another ten years with current technology, with the current plants and after that we keep the plants working with the possibility of processing any ore from the iron quadrilateral, ”said Rodrigo Chaves, executive manager of Itabira da Vale mine.

#### INTEGRATED IRON ORE OPERATIONS

SOUTHEAST SYSTEM	Type	Operating since	Expected exhaustion date (1)	Vale's Participation (%)
<b>Itabira</b>	<b>Open sky</b>	<b>1957</b>	<b>2028</b>	<b>100,0</b>
Minas Gerais	Open sky	1994	2056	100,0
Mariana	Open sky	1976	2105	100,0
<b>SOUTH SYSTEM</b>				
Itabirito Mines	Open sky	1942	2118	100,0
Vargem Grande	Open sky	1993	2054	100,0
Paraopeba	Open sky	2001	2034	100,0
<b>NORTH SYSTEM</b>				
North Montain	Open sky	1984	2040	100,0
South Montain	Open sky	2016	2046	100,0
East Montain	Open sky	2014	2060	100,0

(1) Indicates the useful life of the operational mine, with the longest planned exhaustion date in the complex

Figure 16: Vale's 20-F report in 2017. Source: Annual Reports, Vale. Accessed in 25 Aug 2018  
 <<http://www.vale.com/brasil/pt/investors/information-market/annual-reports/20f/paginas/default.aspx>>

Even with the Itabiran ore reserve being depleted in a decade, the manager guaranteed that the iron ore quadrilateral should be processed in the city's plants. “We



*will continue to invest in technology and who knows, increasing the reserve, but it is important to look at the whole, no matter if Itabira will have 15, 20 or 50 years of mining, the important thing is that we need to think about the future of the city. Itabira is still very dependent on mining. When this exhaustion happens, the city will lose at least half of the revenue”,* said the mayor of Itabira in 2018, Ronaldo Magalhães.

As it can be seen, the contributions of the mineral activity are the main sources of resources of the Itabira City Hall, which represents, according to Alvarenga (2006), a great dependence on mining activity not only in relation to the public budget, but also to the number of jobs. In his analysis, Alvarenga affirms that the mineral activity does not generate a pole of development, but an economic enclave. This enclave is characterized by the absence of chain links between the main activity (in this case, mining) and the other economic sectors in the region in which the company operates. A region that is configured as an economic enclave, as in the case of Itabira, does not enjoy a self-sustainable, diversified, and independent development of its main activity. The author concludes by stating that the economic enclave does not presuppose underdevelopment, only dependence.

All indicators that were developed to quantify Itabira's economic vulnerability in relation to mineral activity were unanimous in indicating significant economic dependence, which validates the theories that model the development of mining municipalities. In addition to showing great economic vulnerability, no indicator analyzed showed in its historical evolution signs of decreasing or increasing economic vulnerability in the last five years (C. ALVARENGA 2006).

For the municipality, the future exhaustion of mines would not exactly mean Vale's departure from the city, but it would certainly represent the loss of one of its main sources of collection, which creates the need to find economic alternatives that would reduce the impact of the end of exploration iron ore and would contribute to improving the local social development (CUNHA e GUEDES 2017), making so-called intergenerational equity possible to ensure that future generations develop (ENRÍQUEZ e DRUMMOND, 2007).

### 3.2. ENVIRONMENTAL CHANGES AND CITY DEVELOPMENT



*Figure 17: Above, Pico do Cauê, in Itabira, where mining started. Source: Vale, Nossa História, 2012. Below, on the left, the Caue's Peak in 1942. On the right: The peak after the exploitation, 2007. Source: Drummond 30 anos, accessed in 26 nov 2019, </https://drummond30anos.wixsite.com/30anossemdrummond/itabira-minerio>*

According to the National Environment Council (Conama), the environmental impact is defined in Article 1 of Resolution Conama-001 as: “[...] any change in the physical, chemical and biological properties of the environment,

*caused by any form of matter or energy resulting from human activities that, directly or indirectly, affect the well-being and health of the population; socioeconomic activities; the biota; the aesthetic and sanitary conditions of the environment; and the quality of environmental resources”.*

As highlighted previously, the almost 500 years of mining in Brazilian territory have left great environmental liabilities, involving thousands of mines and mines. The extractive industry brings different types of socio-environmental conflicts in the territory involving populations affected by the installation of mining megaprojects, as is the case of Itabira, which are affected by the contamination resulting from mineral extraction, in addition to becoming a scenario for conflicts arising from the opposition of interests and the divergent view on what development is, especially in areas of great natural wealth and with tourist potential and areas of population concentration (FERNANDES e ARAUJO 2016).

One of the main environmental impacts pointed out in the mining regions is related to water, air, and damage to the local ecosystem. The silting of rivers, the inadequate disposal of tailings and soil pollution are also pointed out. In addition, reports on groundwater pollution, impacts on the landscape and the extinction of plant / animal species are highlighted. Deforestation, rupture of dams, performance in areas of environmental preservation, inadequate use of tailings and illegal extraction of native wood are less frequently reported, but they are still present (FERNANDES, ALAMINO e ARAUJO 2014).

In Itabira, mining was the foundation of the process of occupation of geographic space and the formation of the city and brought significant impacts to the territory, in contrast to the economic growth promoted by this industry. According to Penna (2009), under open skies or underground, mining intensely changes the local landscape, both in the extraction and in the deposition of its waste and tailings. This was the case of the well-known Cauê's Peak<sup>10</sup>, a mountain range located in Itabira that represents a milestone in the history of the area because it was where the city's history and mining began. Around 1720, when the region was still unoccupied, the peak was already a reference for travelers passing by. This was the case for the two

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<sup>10</sup> African dialectal word meaning brothers.

brothers, Francisco de Faria Albernaz and Salvador de Faria Albernaz, who traveled in search of gold in the region and were attracted by the sheen of the mountains. But, contrary to what the adventurers supposed, what made the mountain shine was not gold, but its enormous amount of iron. It was a reddish iron, which spread its color across the relief, the clay bites and the surrounding rivers (*figure 17*) (VALE 2012).

With the arrival of the Vale company in 1942, and the growing demand for iron ore, explorations at the site increased progressively and the peak, which previously rose to 1385 meters above sea level, gradually decreased, remaining in its place only one pit, surrounded by one by a slope of exploited land (GUIMARÃES e MILANEZ 2017). The exploration of this peak gave rise to what is now called Cauê's Plant, inaugurated in the 1970s together with a second plant, Conceição. As of 2013, a third plant, Conceição II, also started to operate. Meanwhile, the Cauê and Conceição I plants underwent adjustments to make use of the compact itabirite with low iron content (VALE 2012).

Today, the Itabira complex is made up of seven large mines: the largest Conceição I and II and the Cauê mine - this last has already been exhausted and, according to Vale, is in the process of environmental recovery - and the Minas do Meio, composed by the Periquito mine, Dois Córregos, Onça, Camarinha and Chacrinha (*figure 18*). In addition to the mines themselves, the construction of these complexes also involved the implementation of tailings dams, which contain the product left over from the iron ore processing process. Vale has a total of 15 dams in the municipality, of which five are close to the urban perimeter - among them, the two largest, Pontal and Itabiruçu (*figure 19*). In some neighborhoods, houses end where the iron ore tailings dam begins. The five dams closest to the city center store 423 million m<sup>3</sup> of tailings, according to data from January 2019 from the National Mining Agency (BARIFOUSE 2019).

From January to September 2018, according to the most recent report released by Vale, 30.465 million tons of iron ore were removed from the Itabira complex, 10.8% more than in the same period in 2017 (VIEIRA, 2019). The text below - Itabira, Environmental Vulnerability: socio-environmental impacts and risks arising from mining in urban areas, by Maria das Graças Souza e Silva and Maria do Rosário Guimarães de Souza, FUNCESI / FACHI, clearly describes the level of degradation that mining activity causes to a city, its people and even its history:



*Figure 18: The existing mines in Itabira. N.D. Author: Esdras Vinícius*



*Figure 19: Itabiruçu dam with 222,8 milions of m cubic of mining waste. N.D. Accesed in 12 feb 2020. <<https://pbs.twimg.com/media/Dx20GllWwAgv74d.jpg>>*

[...] The embankments and embankments resulting from the mineral extraction process make the landscape sad, aggressive, and threatening for the Itabirans. The result of the destruction is the formation of what is commonly called the "lunar landscape". Some pits serve as the tailings deposition site and in the future, it is not known how they will be used. The valleys downstream from mining are silted up, making them unsuitable for agriculture. Another profound intervention in the landscape is associated with the waste deposits subject to the action of the weather. The concussions caused by the detonation of explosives in the vicinity of the residential neighborhoods threaten the structure of the houses and the residents' peace, especially in the village of Paciência, Pará and Campestre. Today, some neighborhoods are less than a hundred meters away from mines, making the population increasingly vulnerable to the external effects of mining. The environmental problem in Itabira is aggravated because, with the mining process, not only the elements of the biotic and social environment are changed, but also the city landscape itself. These changes assume an irreversibility and risk situation for the Itabiran population. Hence to assert that society Itabira is configured as a "risk society". "The concept of risk society seeks to designate a stage of modernity in which the threats produced by the pace of industrial society come to predominate" (Beck, apud Torres (2000: 58). For Beck, apud Torres, (2000: 59), "the growing importance of the environmental issue is itself an evidence of the emergence of the issue of risks as a central problem in contemporary societies". Environmental degradation in the city has been present since the beginning of mineral exploration by Vale. However, at that time, there was no concern to reconcile economic activity with environmental quality. In general, nature was seen by mining companies as a source of inexhaustible resources. Therefore, there was no concern about predatory exploitation and the effects of this way of looking at nature for the natural heritage and for the populations of the regions impacted by mineral exploitation. The population of mining areas, such as itabirana, often feels like "dwarfs" in the face of the miners' gigantisms and without the strength to face them [...].

In addition to the installation of power plants and the creation of tailings dams, another element that changed the landscape considerably was the Vitória-Minas Railway, built in 1904. There are 905 kilometers of railway (*figure 20*), which leaves Itabira, to pass through neighboring cities, including the capital of the state of Minas Gerais, Belo Horizonte, and goes to the capital of the state of Espírito Santo, to the port of Tubarão. The train was - and continues to be - essential for the integration of the entire Vale do Rio Doce region and everything that is produced there. Initially created for the transportation of iron ore, today it is also the largest passenger branch in the country (*figure 21*) (VALE 2012).



*Figure 20: Vitória-Minas Railway over its 905km of length, which connect the iron ore operation points in the interior of Minas Gerais to the Port of Tubarão, in the state of Espírito Santo. Accessed in 24 mar 2020 <>www.vale.com.br*

The landscape in Itabira has also undergone major changes due to the consolidation and expansion of the urban area. First with the creation of workers' villages (and eventually with the destruction of several of these neighborhoods for the expansion of the company itself) and, later, with the natural growth of the city due to the presence of Vale (*figure 22*).

In 1942, when Vale had just established itself, the city had no housing structure capable of accommodating the immigrant crowd and, in turn, the first miners lacked resources to face rents based on their salaries. Rustic campsites were then built that served the first moments of welcoming workers who arrived and left, in a movement of intense labor rotation (MINAYO 2004). Vale's first camp was in the neighborhood called Campestre, still in 1942, which lasted until 1943, when the

first village was built for employees in the Sagrado Coração de Jesus neighborhood, better known as Explosivos (VALE 2016).



*Figure 21: Above, ore loading in 1944. Below, on the left the locomotive on the Vitória a Minas Railroad (EFVM). Right: First shipment of iron ore at the Port of Victoria (ES) on the Greek ship Modesta, June 1940. Source: Vale, Nossa História. 2012*

As soon as the company's expansion projects in the 1950s took off, the leaders began to abandon the term workers 'village and began to invest in the construction of the so-called neighborhoods or popular villages, specific for the workers' housing



and for the technical staff. Across the country, the use of the word “village” is widespread to name sets of houses, which are generally identical, arranged along streets or streets and which often did not have the character of a public street. According to Correia (2001), the renouncement of the term “workers 'village” shows the wear and tear of a model presented at the beginning of the century as capable of contributing decisively to the solution of the issue of workers' reproduction, in terms of improving health, moral reform and strengthening family ties.



*Figure 22: Itabira in the 1930s before mining. Source. Arquivo Público Mineiro. Accessed in 23 mar 2020*

According to the author, this disrepute is also evident in the elimination of the word "worker" from the name of some villages. In 1952, these first houses were delivered to workers (*figure 23*). Until 1967, the company granted, in exchange for a symbolic rent, 900 houses that constitute neighborhoods close to the mines in operation (CVRD, 1967 apud MINAYO, 2004). They were planned houses and spaces, and whose alignment and uniformity are the symbol of the desired alignment and uniformity of employees' behavior. The houses, according to the author, showed the distance between the workers and the administrative staff and both in relation to the engineers, which crystallized the distinction that the company wanted to mark among the different groups of its employees. While the working-class neighborhoods

were located close to the mines, west of the city, close to the center, there were the spacious residences of the middle ranks of the company.



*Figure 23: View of the Vale workers' village; in the foreground, a football field. Source: Arquivo Mineiro, iconographic collection.*

Some sets of houses built by Vale in Itabira were Vila Piedade, Vila América and, in the 1960s, Vila Paciência and Vila Coração de Jesus. One of the most emblematic cases in relation to urban occupation was the destruction of Vila Paciência. This mine originally belonged to Acesita; as it was a secondary asset, of low exploitation, it did not impact the city considerably. With the purchase by Vale, in the 1990s, there was an intensification of operations and expansion of the mine towards the city, up to a distance of less than 50 meters. As a result, the problems experienced by the residents of Vila Paciência were accentuated. Among these, the most common were, in addition to particulate matter, noise and vibration which, according to reports, led to the appearance of cracks, broken glass and damage to buildings. As a consequence, there was a significant devaluation of the properties. To resolve the impasse, the process of buying the properties by Vale began. However, many residents questioned the values offered by the mining company, opting to extend the negotiation, in an attempt to achieve fairer proposals. In addition, the emptying of the neighborhood led to a reduction in public services, such as transportation and security. Thus, a new dispute front emerged for the residents, this time against the City Hall, in order to guarantee the quality of life in the neighborhood.

As a result, there was a strong movement against the expansion of Vale in the neighborhood. The residents of Vila Paciência, in general, were unable to obtain support from the municipal public agencies, nor from the population in general (figure 24). After the company offered to buy the property, they stopped receiving solidarity from the population (SOUZA 2007 apud GUIMARÃES e MILANEZ 2017).



Figure 24: Report in the newspaper *O Cometa* disclosing the situation of abandonment of the residents of Vila Paciência. January, 1988. Title: *Vila Paciência: bitter nightmare. Iron ore wins another, ends an entire neighborhood and puts its population in despair.* Excerpt: “Mining continues to advance over the city. Now it is the turn of the despair of the residents of Vila Paciência, in which it has become unbearable to live, due to the Serra do Esmeril mine. The neighborhood is being deactivated by Companhia Vale do Rio Doce. But the community revolted against the unjust compensation, which does not buy another house or on the periphery. What is worse is that the advance of mining over the city is increasingly striking. (...)”. Source: *Vila de Utopia*. Accessed in 10 apr 2020 <<http://www.viladeutopia.com.br/>>

Over the decades, mining has caused the city of Itabira to develop urbanely (table below) and, due to the establishment of Vale, other demands have been generated, resulting in the development of trade, the provision of services and other autonomous activities in relation to the company as higher education, provision of health services, tourism, etc.; what solidified the local economy (C. ALVARENGA 2006) e and transformed the city into an urban hierarchical level of a medium level city <sup>11</sup>, which currently leads an urban agglomeration to which João Monlevade,

<sup>11</sup> According to Filho, Rigotti and Campos (2007), medium-sized cities of higher education are those that, when it comes to classifications that cover all cities in the State, are seen as medium, but within their own regions, are viewed by the population regionally like big cities. They have a sustained demographic dynamism and have developed, alongside industry, dynamic sectors of commerce and services. Thus, these

Nova Era, São Gonçalo do Rio Below and Bela Vista de Minas also belong (figure 25) (CONFI, et al. 2017).

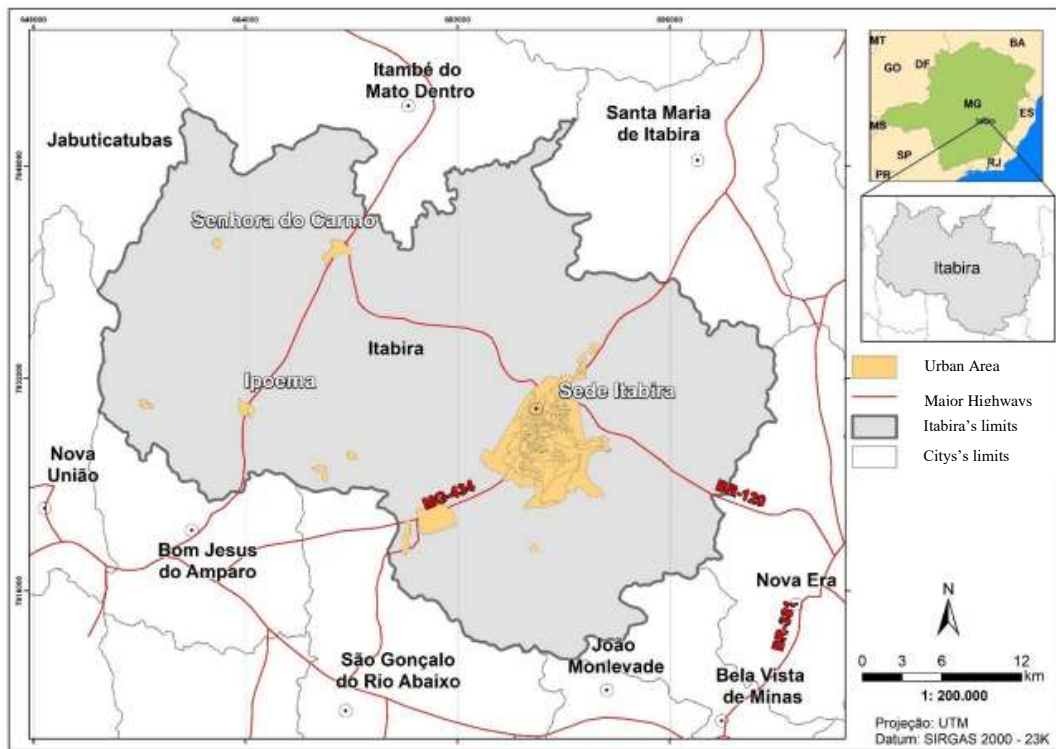


Figure 26: Limits of the municipality of urban areas of Itabira. Source: IBGE, 2010

RESIDENT POPULATION BY HOUSEHOLD SITUATION,  
ITABIRA - 1980, 1991, 2000 AND 2007

YEAR/ HOME SITUATION	1980	1991	$\Delta$ % 1980 - 1991	2000	$\Delta$ % 1991 - 2000	2007	$\Delta$ % 1991 - 1991
Total population	71.114	85.606	1,70	98.322	1,27	105.159	0,96
Urban	58.675	72.954	2,00	89.703	3,43	97.564	1,21
Rural	12.439	12.652	0,15	8.619	1,90	7.595	-1,79
Degree of urbanization (%)	82,51	85,22	-	91,23	-	92,78	-

Figure 25: Resident population by household situation in Itabira, 1980, 1991, 2000 and 2007. Source: IBGE, demographic census (1980, 1991, 2000)

cities, in addition to strengthening their position and their links in the regional domain, extend these links to points located beyond these domains.

In view of its current level of economic development, its geographical position, always on the main axes or junctions of the communication routes, and its important relations with larger centers, Itabira is currently considered a center for providing services to the region, standing out whether opportunities in the area of education and health (C. ALVARENGA 2006) but that, at the same time, continues to maintain intense, constant and direct relations with the micro-regional space connected to them and with other cities like Belo Horizonte, the capital of the state of Minas Gerais (FILHO, RIGOTTI e CAMPOS 2007).

To illustrate the development of the city, the growth of the urban network of Itabira, the evolution of mining activity and the degradation of the city over the decades of mining, images of the city were produced at different times through the integration of Quantum GIS technology (which allows the integration of recent orbital images, available in the Google Earth system) and also a table is presented with the evolution of the household situation of Itabira from 1984 to 2007.



*Figure 27: Itabira in 1984. Source: Google Earth*



*Figure 29: Itabira in 1994. Source: Google Earth*



*Figure 28: Itabira in 2007. Source: Google Earth.*



*Figure 30: Itabira in 2019. Source: Google Earth*

Another impact linked to mining activity in the territory is atmospheric pollution, mainly associated with the emission of particulate matter, generated by the mechanical dismantling of ore and soil. As a consequence, Itabira presents, in certain periods, a scenario covered with reddish dust clouds (*figure 31*).



*Figure 31: The dust cloud could be seen all over the city when an explosion occurs in the mines.*

*Source: Itabira Online, accessed in 07 ago 2019*

*<<https://www.itabiraonline.com.br/2019/07/05/itabira-recebeu-muita-poeira-da-vale-nesta-sexta-feira/>>*

The relief of the municipality, surrounded by hills, makes it difficult to disperse particulate material, aggravating the situation (Braga et al., 2007). In the specific case of Itabira, there is a perception that low air quality increases the number of cases of respiratory diseases, especially in children and adolescents, and cardiovascular diseases in the elderly. In another study, Braga et al. (2007) concluded that air pollution in Itabira was comparable to that of large urban centers. The radical subversion of the landscape as a consequence of mining exploitation also appears very strongly in the lyric of the poet Carlos Drummond de Andrade, as previously mentioned. At the period that the poet lived in the city, he mentions the time when the mineral "destiny" was recognized there ("*a mineral destiny, of a hard and ineluctable geometry, stuck you, Itabira, to the tired back of the mountain*"). This real, hard and inescapable destiny, appears spasmodically in his poetry, from the allusions to the primordial edges of the peak of Cauê to the common valley of "The pulverized mountain", which emerges as a clear nightmare in the late mining of Boitempo, "crushed in billions of chips "and carried by the" largest train in the world".

#### **A montanha pulverizada    The pulverized mountain**

Chego à sacada e vejo a minha serra,	I reach the balcony and see my saw,
a serra de meu pai e meu avô,	My father and grandfather's saw,
de todos os Andrades que passaram	Of all the Andrades that passed
e passarão, a serra que	And they will pass the mountain that does
não passa.	not pass.

Era coisa de índios e a tomamos	It was Indian stuff and we took it
para enfeitar e presidir a vida	to decorate and preside over life
neste vale soturno onde a riqueza	in this gloomy valley where wealth
maior é a sua vista a contemplá-la.	greater is your view and contemplate it

De longe nos revela o	From a distance, it reveals the serious
perfil grave.	profile.

A cada volta de caminho aponta	Every turn of the path
uma forma de ser, em ferro, eterna,	A way of being, in iron, eternal,



e sopra eternidade na fluência.	And it blows eternity in the fluency.
Esta manhã acordo e	This morning I wake up and
não a encontro,	I cannot find it.
britada em bilhões de lascas,	Crushed into millions of splinters
deslizando em correia transportadora	Sliding on conveyor belt
entupindo 150 vagões,	Clogging 150 wagons
no trem-monstro de 5 locomotivas	On the 5-locomotive monster train
- trem maior do mundo, tomem	- the biggest train in the world, take
nota -	Note -
foge minha serra vai,	Run away my saw, go
deixando no meu corpo a paisagem	Leaving on my body and
mísero pó de ferro, e este	Landscape, wretched iron dust, and this
não passa.	does not pass

In addition, the poet composed many other poems about mining and the radical subversion of the landscape due to this exploration (WISNIK 2018). The purchase processes of the mines in Itabira, the vision of the mining machine installed in the mining landscape and the implementation of the mining project, by Vale, are well anchored in his poems, even if at times latent and almost invisible. Today, his works are symbols of that time that exercise enormous power over the sense of identity and belonging to the community.

As you can see, the mining process in Itabira brought several consequences for the territory and its surroundings. The company Vale became “[...] *important modeling agent of the urban space of Itabira, planning and building neighborhoods, industrial facilities, roads, airstrip, offices, hospital and clubs*” (SILVA, 2004. p. 96 apud FERREIRA, CASTRO e BRUSADIN, 2019). Mineral extraction has a direct relationship with the expansion of the urban area, both because of the proximity of the mine to the built area and because of the history that is related to the economic exploitation of this asset. Some pits serve as the tailings deposition site and in the future, it is not known how they will be used. The valleys downstream from mining are silted up, making them unsuitable for agriculture. Another profound intervention in the landscape is associated with the waste deposits subject to the action of the weather (SILVA e SOUZA 2002). The mining process in Itabira causes changes not only in the elements of the biotic and social environment, but also in the city's

landscape itself. The embankments and embankments resulting from the mineral extraction process make the landscape sad, aggressive, and threatening for the Itabirans. These changes assume an irreversibility character and often put the population at risk, as is the case with tailings dams built in the urban perimeter.

The environmental issue in Itabira is becoming more and more serious as, today, mines are approaching neighborhoods and ore veins are becoming deeper. The mineral extraction process removes more sterile material, which increases the emission of suspended particles in the atmosphere, generating increasingly serious effects for the environment and making the local society more and more vulnerable (SILVA e SOUZA 2002).

### 3.3. IDENTITY AND MINING CULTURE IN ITABIRA

Since the company Vale was settled in Itabira, in 1942, mining has brought several changes to the city, affecting not only the economy and the environment, but also the lives of the population. The city, which used to live mainly on agriculture and livestock, came to depend mainly on the extractive industry and soon the citizens began to live in a city where a single company monopolized the jobs, organized the social life and dominated the local political instances. Given this context, the perception of the citizens of Itabira regarding the mining and the presence of industry in the city was being shaped and a collective identity was being built based, in large part, on the mining industry and work. (MINAYO 2004).

By addressing the issue of identity in this study, it is possible to understand how the identity construction took place in Itabira amid constant socio-cultural and economic changes caused by the presence of industry. To understand the influence of mining in the city and in the lives of its citizens, it is necessary to highlight the changes in people's perspective in relation to the mining industry during all these years, to understand how these residents face the current scenario and to know their perspectives in relation to the future of the city, especially from 2016, after accidents involving tailings dams owned by the company in neighboring cities. This analysis was conducted based on participant observation, data research on the internet and on the bibliography of the author Maria Cecília Minayo, who analyzes the

transformations of the worker segment in Itabira over the years of the company in the city. Also, to analyze the speeches of citizens and how these subjects identify and position themselves in relation to the presence of industry in the city, support was sought in theoretical approaches that also took into account the social aspects associated with spatiality, which was done through concepts of identity and memory.

According to Moser (2003) apud Cavalcante (2006), the study of the identity associated with a physical and social space is part of the theoretical field of Environmental Psychology<sup>12</sup> and aims to identify the processes that regulate and mediate the relationship of man with his surroundings, highlighting the perceptions, attitudes, assessments, environmental representations and also the subject's behaviors. In this sense, an essential process for someone to feel identified or belonging to an environment is what is meant by appropriation. The author states that in the appropriation the subject interacts dialectically with the surroundings, which results in a mutual transformation. It is through so-called appropriation, that the subject feels that he is connected to a place in some way, and that it belongs to him, even if he does not have legal possession of it. The relationship becomes reciprocal, as it also belongs to the place.

In the man / environment relationship, there is a spatial practice that takes place through conducts that modify space and insert human beings into the environment. This insertion is not, however, one-sided. The subject acts on the environment, modifies it and, in this process, leaves its mark and is equally marked by it. This happens to the extent that the changes in the environment by man are the result of subjective needs, emotions, expectations, in short, experiences that are part of the subject's personal history. (Fischer, 1981 apud Cavalcante, 2006, p. 145).

As stated by Proshansky et al. (1983) apud Cavalcante (2006), place identity is a substructure of a person's deep identity and consists of cognitions about the physical world, relating to the variety and complexity of the places in which he lives and satisfies. These cognitions are formed by memories, ideas, feelings, attitudes, values, preferences, and meanings related to a certain environment. The author

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<sup>12</sup> According to Moser (2003), "Environmental Psychology is the study of the interrelationships between the individual and his physical and social environment, within his spatial and temporal dimensions"

Delgado (2006) apud Bastos (2008), highlights the issue of memory, stating that it is the basis for constructing identities and solidifying individual and collective consciences and that a group bases its process of appropriation on aspects related to its collective memory. That is, memory and identity would reinforce each other.

The study of the relations of the various residents of Itabira with their living space points to the construction of an appropriation process shaped by the presence of mining in the city, where the feelings of the population and the memory of these social actors are related in some way to the mining industry, and it thus constitutes an important clarifying principle of the city's identity and mining culture. In other words, the group of residents bases its appropriation process on aspects related to their collective memory. In the case of this study, residents report their personal history lived and related to a place and a specific context: Itabira and mining. History that has left its mark, which was and continues to be built by those who live in this context and experience similar experiences. According to Halbwachs (1990) apud Cavalcante (2006), such a story would be more properly called collective memory, since, in some way, it still lives in the consciousness of the group. The author highlights the fact that memory is not only an individual phenomenon: *“memory must also be understood, or, above all, as a collective and social phenomenon, that is, as a phenomenon built collectively and subjected to fluctuations, transformations, constant changes”*. (HALBWACHS apud POLLAK, 1992)

It is also found in Pollak (1992), considerations that refer to the relationship between memory and social identity. Two statements in particular are suitable for this study: a) memory as a phenomenon constructed by selectively arranging what should remain in the group memory e b) memory as a contribution to the formation of an identity in the sense of the image of oneself, for oneself and for others. As specify by sociologist, there is a close relationship between memory and identity, which them, jointly, contribute to the social setting:

When memory and identity are sufficiently established, sufficiently established, sufficiently tied, the questions inquiries by groups outside the organization, the problems posed by others, not enough to cause the need to carry out reorganizations, or at the level of collective identity, nor at the level of individual identity (Pollak, 1992, p.207).

These perspectives admit that memory and identity are socially constructed, in the relationships between different groups and in the relationships that individuals or groups establish with their material and symbolic environment, and are, therefore, subject to change, as a result of negotiations, adjustments, forgetfulness, resistance and adhesions. Canclini (1999), apud Ferreira, Castro and Brusadin (2019), also state that the construction of identity depends on a social context in which relationships are evident and are liable to be changed over time. In other words, identity is culturally elaborated and often remade, becoming a “co-production”, as it comprises diverse actors and powers and is formed in heterogeneous conditions among them.

According to Minayo (2004), in the case of Itabira, from the perspective of the major changes in the economic, environmental and social contexts, already mentioned; there have been various meanings and reformulations over time. Since the formation of the city, passing through the installation of the industry and continuing in the period of operation of the mining company, it has been possible to identify these different phases of constitution of identity and also the actors and powers involved in this process, which are constituted mainly by the community and by the company Vale. As claimed by the author, Vale's strength and influence ended up involving workers and their families, configuring a peculiar culture, charged with the values of domination. Due to this fact, Itabira's identity formation process has been elaborated along the lines of a symbolic imposition of economic interest on urban culture and the different conjunctures of this context have aroused different feelings in the population, whether they accept or reject mining culture.

The memory of these “*Itabirans*” and their perceptions regarding the presence of industry in the city reflects to important facts and events that can help to understand the formation of the Itabira’s identity and the reinterpretations of mining culture from the period when the industry arrived in the city until nowadays. Based on the analysis of this author, the testimonies collected by her and the perception of the community on this subject, obtained for this study through a questionnaire, the categories of presented the results summarized in figure below.

Minayo (2004) states that, before Vale's installation in Itabira, the idea of building a company catalyzed production forces and made people from the

countryside and urban workers welcome the company's arrival with great euphoria, considering it “a mother”, “ the salvation ”, "a promoter of progress ". The author stresses that this era was also a stage in which ideological manipulation, used through a nationalist discourse, played a very important role in the relationship between workers and the company: developmental discourses were passed on to workers, and the general perception was that that the construction of the new era of the country depended on entrepreneurs and workers, in a collaborative process.

I used to go to work at night and explain to the workers: we had to produce, so when the end of the year comes, if they want an increase, they will get it, but they had to show production. Vale was ours [...] we had to make our part, for the good of the company and of Brazil.

Later, when large machines began to emerge and replace manual means of extracting ore, new relationships between men and machines were established. According to the same author, it was a period of transition, which brought profound meanings to the configuration of the workers' segment whose identity was in the process of being built and was being forged in the iron of emotions, conflicts and pride of belonging to the family of this “Mother Vale”, which provided well-being for workers, but also created a situation of comfort and dependence. At this moment, when the company was still state-owned and, through a peculiar conception of nation, it had, intensely linked, an ideology of “common good” and equality. In the narratives collected by the author, the first miners overvalue Vale's origin period, in the sense that their physical strength accounts for the company's success.

The expressions “the company started with difficulty, poor just like us”, followed by “with our effort, with our muscles, she grew up” [...] The words register several elements “the company was poor” and we remain poor, externalizing consciousness exploitation and little recognition. When is said “she grew up with our muscle”, they praise the protagonism that leaves marks on the broken body and, at the same time, the feeling of belonging to a victorious collective construction (MINAYO 2004).

As Vale's expansionary dynamics are being established, the workers started to feel a loss of control over the dimensions that the company would gain and they started to demonstrate a high degree of dissatisfaction with the work environment

and their wages. Although the spirit of the body and the institutional culture remained very cohesive, as in the previous era, a feeling of alienation permeates the social body and the soul of the Itabira workers' collective, as shown by the testimonies of workers who worked during this time:

The level of satisfaction is not going well. In fact, if we go deeper, there are no reasons for dissatisfaction, compared to other companies: Vale gives a better salary than the market; provides a uniform that equates everyone, from the worker to the superintendent; it provides a better standard of living than other companies; gives you a balanced meal [...] Where is the source of dissatisfaction?? (MINAYO 2004)

When all companies stopped raising the salary, Vale's salary was frozen, but it didn't fire anyone. The salary is Always up to date, did not fire anyone, the bonus comes up to date. I mean, there is that dissatisfaction, but the man is drinking, he is eating, and he is not finding better conditions out there. All you see is unemployment. Why fight?

The author affirms that the “patriotic conscience” incorporated in the work is still present, but it does not have the same enthusiasm as in the early days, to guarantee the personal rejoicing of “being a worker at Vale”, in the same way that the former were proud of. This transformation was consolidated in 1997 with the privatization of the company. As a result of deepening neoliberal policies in the country, Vale underwent a restructuring process, seeking to increase productivity and reduce costs. This impacted Itabira directly, with the reduction of investments in the city, and indirectly, with job cuts, voluntary dismissal programs and increased outsourcing. The authors Guimarães and Milanez (2017) claim that this deepening of the management model, based on “efficiency”, has shaken the community's relationship with the company; from then on, the mother became known as “Stepmother Vale” (Enríquez, 2007 and Presas, 2012 apud Guimarães and Milanez, 2017). The change from the “Mother” scenario to the “Stepmother” scenario was felt both by the mining company's employees and by the community in general.

Since the preparation for the privatization process and in the period following this initiative, the expressions of workers' social life have changed profoundly. In the privatized Vale stage, other elements such as the legitimacy of profit, the idea of

international competitiveness and the winning company were replacing the old concepts and forming another type of worker mentality. This establishes a more critical view of the industry's presence in the city and also a symbolic relationship between Vale and Itabira, in which there is a kind of “social debt” of the city to the company, which requires “thanks, that have the power to maintain and reproduce dependency”, as an illusory representation of reality, “in fact, what the company gives to the city is just a crumb of what the city gives to the company, in terms of expropriation of its non-renewable natural resources and the production of workers” (MINAYO 2004).

The negative sentiment towards the form that is given to mining exploration in Itabira is strengthened over the years and is getting more and more of this speech of residents: *Vale is like a carnivorous flower. It is devouring the citizens of Itabira, without them noticing it. People think Vale is very good, they think it is a very safe institution. But it slowly devours Itabira. Itabira has almost nothing left.* (GONZALES CRUZ, 1980:74 apud FERREIRA (2015)). The admiration for mining and the economic benefits it brings is overshadowed by the repudiation of the impacts it has brought to the environment, fear and insecurity about the future, especially after two incidents caused by the same mining company that operates in Itabira, involving tailings dams in neighboring cities, in 2016, in Bento Rodrigues (110km from Itabira), and 2018, in Brumadinho (160km from Itabira). The rupture of these mining tailings dams has caused enormous damage to both cities, with the latest event being considered the biggest environmental disaster ever recorded in Brazil, also from a humanitarian point of view. From that moment on, the company Vale went through a series of negative events, such as the fall of its shares in the international market, as shown previously, but it also had its image tarnished with the public. Given this scenario, the inhabitants of Itabira, which is surrounded by 15 dams, had to learn to live with the uncertainty over the possibility of an incalculable environmental disaster, an issue that was not seriously debated in the city, either by the company or by the government. These facts reaffirmed the contradictory positioning in relation to mining activity and the presence of the industry in Itabira and this ambiguity of feelings was reflected in the comments of the residents in the research carried out for this study. This data collection played a fundamental role in the quality and timing of this study as it offered valuable contextual information and



reaffirmed the fact that these constant changes caused by the presence of the industry remain alive in the memory of the inhabitants and articulate the feeling of belonging and identification of residents with the mining culture.

The research was carried out through a qualitative approach and aimed to understand the existing relationships between the mining industry, the city and the group in question and had the specific objectives: a) to identify the group's perception of the role of mining in the city's history; b) to understand the opinion and feelings of the group about the presence of the mining industry and Vale company, and the impact of their actions on the city and on the life of the population; c) to identify the favorable and unfavorable aspects of mining in the city, in the group's perception; d) to understand the citizens perception about the legacy that mining leaves in the city and ideas about industrial heritage and at last; e) to identify the group's expectations regarding the future of the city;

The data were collected during the month of April 2020, and the collection strategy used was the online questionnaire, developed on the Google Forms virtual platform. This virtual questionnaire had as its unit of analysis those born in Itabira (who lived or not in the city) and those who were not born in Itabira, but who have some link (social, employment or affective) with the city. It was sought to obtain the response of people of different ages and genders, to see if there are variations of perception on the subject. The questionnaire was disseminated in virtual environments frequented by the citizens of Itabira and on social medias such as Facebook, Instagram, and WhatsApp.

The type of research chosen was the semi-structured interview, with structured questionnaires, which included equal questions for all respondents, so that it is possible to establish uniformity and comparison between responses, but also with spaces that allowed the interviewer to include another set of responses, not initially planned. The types of questionnaire used for the survey were: (1) multiple choice questions to identify preferences of the interviewed group and facilitate both the answers and the subsequent tabulation of the data, with the inclusion of a blank gap for eventual filling if the suggestions presented did not represent the interviewee's opinion; (2) open questions, leaving the interviewee free to state, in their own words, their opinion; (3) evaluation scale, with assignments from 1 to 10. The questionnaire

created contained twenty questions and over the thirty days of research, 365 questionnaires were completed completely filled out. The questionnaire was divided into five sessions, the first of which was about general information about the participants such as age, gender, and the type of link with the city and the mining industry. On the second session, the questions were directed to the history of the city. The third session was related to Vale's presence in Itabira. The fourth session had as its theme the future of the city and the fifth and last, on the issue of industrial heritage.

The results of the first session (*figure 32*) of the questionnaire showed that participation in this research covered participants with a very varied age: 37.4% of the participants were between 45 and 60 years old, 18,1% were over 60 years old, 17% were people from 35 to 45 years old, 17% were between 25 and 35 years old and 10.2% between 18 and 25 years old. 0.4% of participants less than 18 years old. Of the 365 responses obtained, 56.6% of the participants were from the female gender, 42,6% male from the gender and 0.8% declared other genders. The results showed that most participants were born and still live in the city of Itabira (60%) and / or have, in some way, a link with mining, whether working at Vale (55,8%), having a member of the family who worked or still work at the company (21,9%), or working

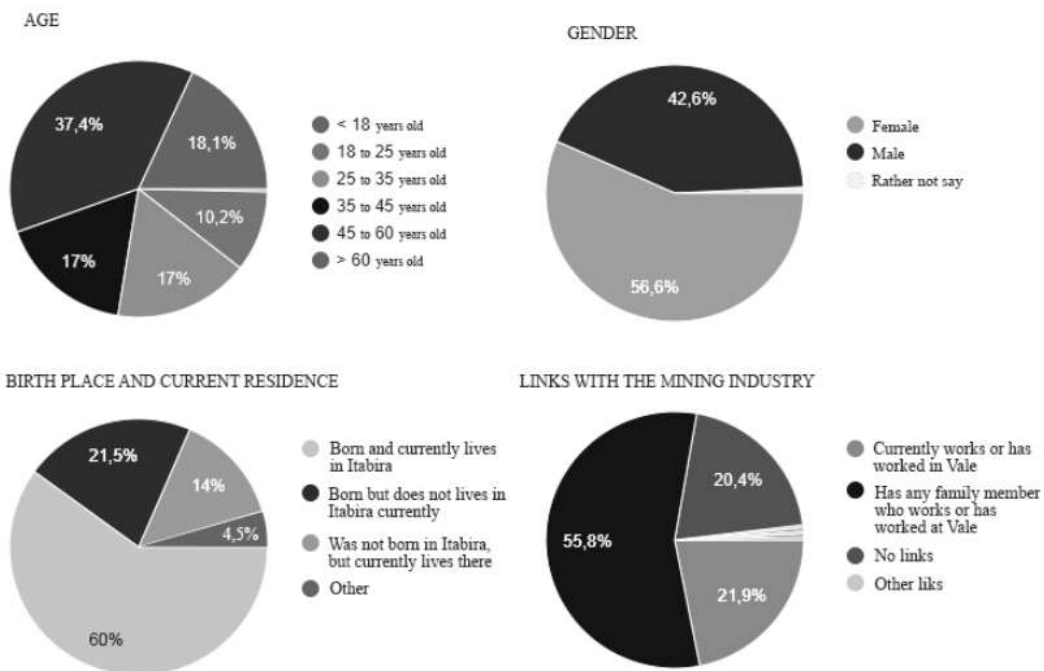


Figure 32: Illustrative graphics with the answers obtained through the question. Elaborated by the author.

indirectly with mining, as in companies that provide services to the mining company (1,9%).

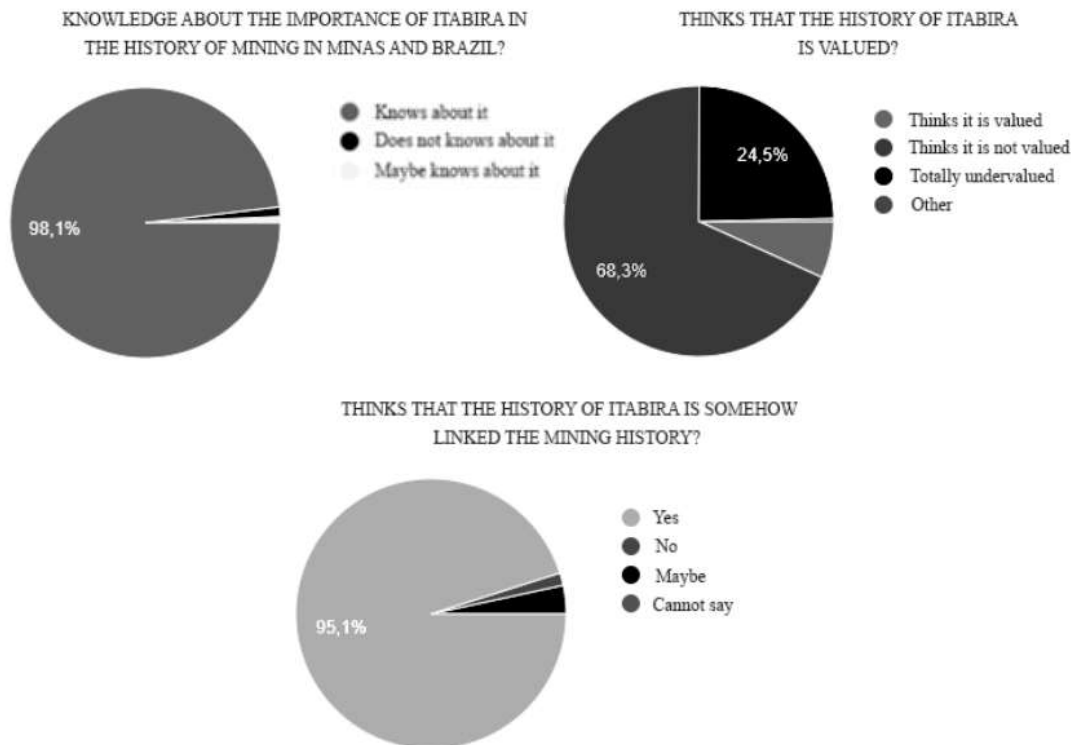
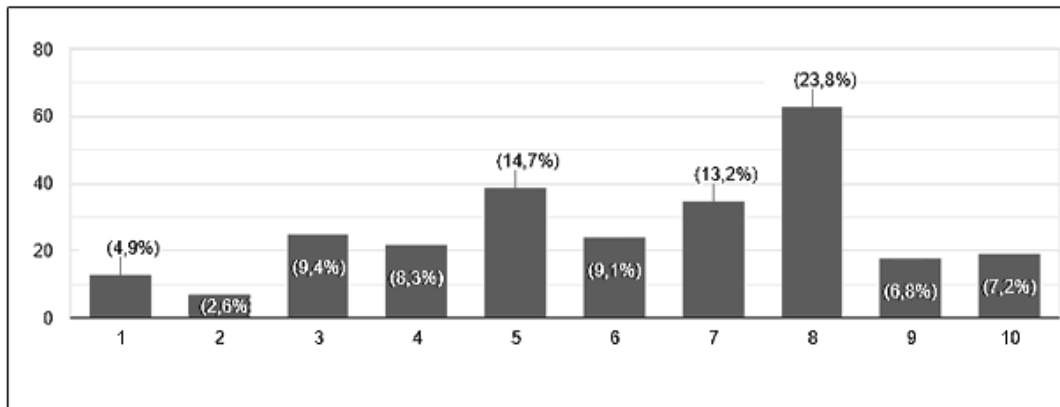


Figure 33: Illustrative graphics with the answers obtained through the question. Elaborated by the author.

On the second session (*figure 33*) a short text was provided, showing the importance of Itabira in the context of national mining. Soon after, it was asked if the participant had knowledge about the importance of the city in the history of mining in the state of Minas Gerais and in Brazil, if he thought if the history of Itabira was linked to mining and if in his opinion this history is valued. According to the results obtained, the vast majority (98.1%) were aware of the importance of Itabira in the history of mining in the state and in Brazil, but they thought this history was little (68.3%) or totally devalued (24, 5%). Only 6,8% of the participants considered that the history of Itabira was valued. Some comments related to the history of the city show the opinion of the participants in relation to the need to recognize and make the population aware of this issue, such as: *“Other means must be sought to use the legacy and heritage to continue the story of Itabira”*; *“Itabira must be known and recognized for its beauty and history”*; *“The city's history is not limited to extractive activity. Itabira brought Vale to life, not the other way around”*; *“intensive*

*awareness work is lacking among the people, as they are unable to understand and value the history and culture of our city”; “it (Vale) does have a history. Over the years, the city has lived for Vale and if it has any assets, I would like someone to show me, in addition to the stories I know, how it emerged, how it evolved and, of course, how the company destroyed Itabira.”*

ON A SCALE OF 1 TO 10 (1 BEING TERRIBLE AND 10 BEING EXCELLENT),  
HOW DO YOU ASSESS VALE'S IMPACT ON THE CITY?



ON A SCALE OF 1 TO 10 (1 BEING TERRIBLE AND 10 BEING EXCELLENT),  
HOW DO YOU ASSESS VALE'S IMPACT ON THE POPULATION?

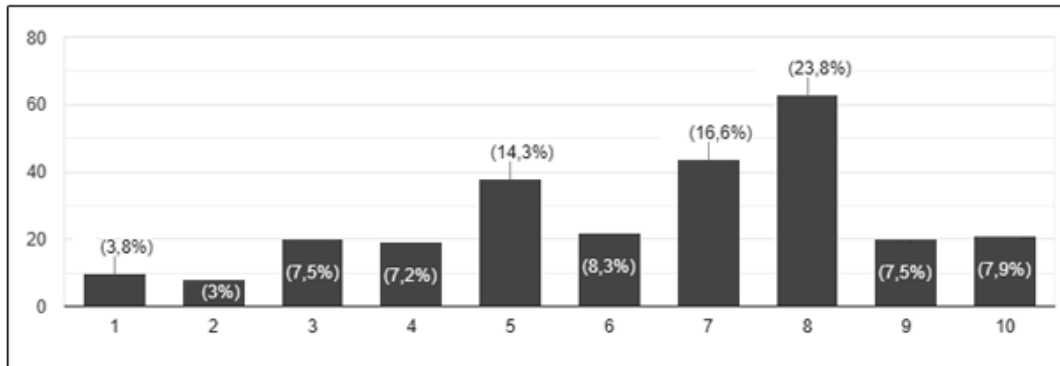


Figure 34: Illustrative graphics with the answers obtained through the question. Elaborated by the author

In the third session (*figure 34*), about Vale's presence in Itabira, participants were asked to describe Vale's presence in Itabira in one word. The words sent had both positive and negative connotations. This ambiguous result reflects the feeling of citizens towards the company, which brought development and destruction, which was a mother for the citizens, but which now brings a sense of abandonment and fear. The most mentioned word to describe Vale's actions was the word "exploitation", followed by the words "employment", "development", "important", "development",

"dependency" and "necessary". Some described the company through positive adjectives such as "encouraging", "mother", "good" and "employer", but a large part used negative adjectives to describe it as "parasite", "stepmother", "damn" and "trash". In the last two questions, it was asked to evaluate, on a scale of 1 to 10 (1 being terrible and 10 being excellent), Vale's impact on the city and, despite the negative and critical adjectives to the company, the evaluations were more positive than negative, resulting in an average of 6.1 in assessing the impact of the valley to the city and 6.3 in assessing the impact of the company on the life of the population. Still within this theme, economic development, the generation of jobs and income and the improvement of lifestyle (such as improved wages and health plans) are among the main advantages that the company brought to Itabira. Among the listed disadvantages are environmental destruction, economic dependence, and the limitations that this brings to the future of the city and damage to the citizen's quality of life (mainly due to health problems caused by environmental pollution).

In the fourth section, which deals with the future of Itabira, the vast majority (94,7%) most responded that he cared about the city's future. Of the 365 participants, 43.9% said that they do not see a good future for Itabira, 34% said that they see a good future and the rest, 22.1% said that the future can be promising but depends on mobilizations, political actions, investments and other initiatives to make this a reality. Some comments reflect this thought: *"There is still time to work for diversification. However, in order to create a better future, a study of the region's vocation and a change in the residents' behavior is necessary. Unfortunately, I do not see administrators and citizens doing anything to change this situation. Very few are the initiatives aimed at the future without Vale"*. Another participant says: *"Local authorities have the power to make speeches, but they are not really able to offer satisfactory answers to the municipality. Vale does not feel committed or responsible for seeking economic alternatives. The population watches everything, remains inert and reproduces old patterns of dependence"*. Another comment highlights the city's dependence on Vale and how it can be harmful in the future: *"Itabira has not yet emancipated itself from Vale. It made Vale its safe haven and did not redirect its expansion to other activities. Soon, Itabira will be a ghost town if we don't wake up now"*. The need for investments in other sectors is also often mentioned: *"Vale and the city government should have*

*faster initiatives in investments in other sectors; because the valley profits a lot and the city has a good collection”.*

The fifth and final session was devoted to the issue of the legacy that the industry brought to the city and the industrial heritage. To contextualize the theme, a definition of what industrial heritage is was provided and then it was asked if the participant had already heard about the concept. 57.1% said yes, while 37.1% said they did not and 5.7% said they may have heard. When asked if the history and legacy of the industry in Itabira could constitute an industrial heritage, 67.3% said yes, 15.1% said they did not, and 17.6% did not know how to say or answered that they might. Some comments demonstrate that maybe the concept of heritage and especially industrial heritage are still little widespread. *“Itabira has no industrial heritage because only provides raw material”.* *“Our industrial heritage = the fabric factory in the Gabiroba neighborhood - Ferro-Gusa”.* *“In addition to the industrial heritage, Itabira has a significant cultural heritage that could transform it into a tourist product”.*

The mixed feelings about the industry were reflected mainly in open comments. Environmental issues and the feeling of fear and insecurity after the collapse of dams in neighboring cities was a very recurring subject in the comments obtained.

“Vale was part of my life because I had access to countless educational opportunities encouraged by it (music group, museums, Drummondian paths ...). However, it is necessary to say that the company did not "more than its obligation", although it runs the risk of being considered ungrateful. I do not think anything that is private sector constitutes a heritage for the people. Heritage for the people is what is theirs: what is public. And without a doubt, since Vale has been privatized its only and main interest is the production of capital for its owners and the rest (production of jobs, incentives for culture are bureaucratic obligations). Vale will leave the city and the only thing left will be destroyed landscapes, fear (nobody talks about the dams) and ghosts?”

“[...] it (Vale) thinks that building a memorial, a monument, will help somehow, but what’s the use of doing so if it will keep us up every day in fear of a dam, or several of them, breaking down and killing the people? We don't even sleep anymore. After that, does anyone want to think about industrial heritage? The company was good only for its first employees ... today one works for 3 and receives for half”.

“Dams are not 100% safe and there is one across Itabira”

“Due to the economic dependence around Vale and the existence of dams that put the population at risk and also prevent the development of other areas.”

“In addition to the environmental destruction of mining activities and damage to health, the population wakes up to the danger of the proximity of the dams and has begun to better understand their vulnerability. The asymmetrical power relationship historically experienced, which imposes the silence and submission of the population and its representatives, now becomes more frightening and dramatic. Every wealth has its price”.

As can be seen, the mining industry in Itabira is intricately linked to the space in which it is inserted, and it has a strong relationship with its inhabitants. In addition to the physical proximity between open pit mines and the city, Itabira has a history directly connected with this industry since 1942, which makes mining and the company Vale deeply embedded in the city. Furthermore, it was in Itabira that the legacy of the Brazilian mining industry began: the iron ore deposits found there contributed to the development of the mining sector on a national and even international scale. The Itabira mines were primarily responsible for the economic development of the Minas Gerais region and still represent today a large part of the profits of the extractive industry in Brazil, thus constituting an important industrial historical heritage in Brazil. In addition to the historical and economic aspects already mentioned, this incorporation also involves social and intangible aspects, as the city has strong cultural and identity ties with this industry, which occupies a special place in the collective memory of the inhabitants. As demonstrated in this chapter, in Itabira, the relationship between the community and the mining company has changed a lot over the years and this social aspect has been reframed throughout history, as the industry brought changes to the city that affected not only the economy and the environment, but also the lives of the entire population. Also, the population's discontent with the way mining is conducted in the city has been gaining more and more visibility and reinforcing the contradictory feelings towards the mining industry. The testimonies and opinions expressed by community members

demonstrate what the authors Milanez and Santos affirm (2019), that an ambiguous relationship emerged between Itabira and Vale. On the one hand, there is pride, respect, fascination, and expectations. On the other hand, there was frustration, resentment, and bitterness. And this mixture of feelings towards the company is crucial for understanding its embeddedness in the local societal fabric.

According to C. L. ROSA (2011), industrial sites are often at the heart of territorial and community development and, thus, are strong symbols of identity and memory for the communities born in their surroundings, be they locations with large industries, cities, companies, working-class neighborhoods, etc.; This is clear in Itabira, where mining spills over the mine gates. The culture created around mining is part of the identity and composes the feeling of a percentage of the population, who *“have a little piece of iron in their hearts”*, as shown by a Vale worker, in a statement by the author Minayo (2004): *“I don't live here, I've only lived here for three and a half years, because of my job at Vale. But today I consider myself an Itabiran. I have a little piece of iron in my heart. I have a very strong relationship with the city, I see the people of Itabira as my people. So all the things I do are strongly linked to Itabira. I live here, shop here, I spend here and my whole life is directed on the Itabira market”, reports the mining equipment technician. This mining culture is, therefore, another important constituent element of the heritage of this city because it plays a social and symbolic role as mediator between memory and history, between past and present.*

According to T. O. Cordeiro (2017), the enhancement of the history of this industry and this culture would enable a broader interaction between society and the locality with its specificities, which would favor the relationship of approximation and construction of local identities by stimulating the constitution of a belonging network. The author states that preserving and valuing the mining culture is also essential so that the notions of belonging and identity of the population are safeguarded. In the case of Itabira, since the city cannot see itself without this industry and its inhabitants are so present in their lives, the “rescue” of this culture and the appreciation of this heritage, especially in this period of fear and uncertainty, could help in the emergence of a sense, of an objective in the search for an identity around which the local population can unite and articulate.



#### 4. FUTURE PERSPECTIVES

- Le point de vue des parties prenantes sur l'avenir d'Itabira
- Discussion sur leurs perspectives

The research carried out for this study, with the citizens of Itabira, and the recurring comments on social media and media have shown that there is a great concern regarding the future of Itabira. Especially in recent years, a discussion about mine depletion has been a recurring issue in the city, due to the report released by Vale in 2018, in which the company estimates that 2028 will be the year of depletion of the mines in Itabira, which lives, therefore, the last years of mining exploration (VALE 2018). This news was published in the mainstream media and the uncertainty about the future was mixed with the fear of the rupture of the ore tailings dams and alleviated the feelings of insecurity and fear of the population, which were reflected in the results in the questionnaire carried out for this study..

“Itabira is currently financially dependent on Vale. And nothing concrete has yet been done to create options for the city in this regard. So, if Vale leaves Itabira, in this context, I see a bad future”, says a resident of Itabira when asked about the future of the city.

However, as noted in the previous Form-20 reports, which is the name of the document presented annually in the United States, the exhaustion forecast for the Itabira mines has changed over the years, according to available resources and reserves already detailed in the mining company's strategic planning. The first Form-20 report released in 2001 predicted the depletion of the Itabira mines for 2014, whereas in the following year's report the forecast was more optimistic: the exhaustion would occur in 2021. In 2003, the exhaustion horizon increases by one year, with the exhaustion forecast for the Conceição and Minas do Meio mines for 2022 - and Cauê in 2004, as in fact occurred. The constant change in these projections may indicate that the company may extend the horizon for the exhaustion of mines in the Itabira complex beyond 2030, but they do not exclude the fact that this finite resource and that the base that sustains the city's economy will soon become extinct. As mentioned earlier, with the imminence of mine depletion, the municipality is in a great degree of economic vulnerability, as the local coffers would no longer receive

most of the revenue it now receives and would be left with only a percentage of 15% dedicated to cities impacted by mining (ANDRADE 2020). This possibility of exhaustion and the future and probable scarcity of resources brought several discussions about the future of the city, especially in the social and political sphere.

According to Kooiman (2002), when it comes to dealing with the diversity, dynamics and complexity of the transformations that can occur in a city, interactions between the various stakeholders are extremely important to increase the degree of interaction with social actors, so that bridges of understanding can be built and “To face an environment of turbulence and uncertainty”, as is the case in the city of Itabira. Therefore, when it comes to perceptions and actions for the future of the city, it is necessary to better understand the perceptions, expectations and plans of the so-called stakeholders, as they are called, have specific interests involved and that directly or indirectly affect the city's decisions. The debate of these issues with these actors also contributes to increase the practicality of the research, since they perceive on a daily basis the magnitude of the municipality's economic dependence in relation to mineral activity. In the case of Itabira, these stakeholders include business, political, union and community leaders, who have a complex set of relationships between groups with different rights, objectives, expectations and responsibilities in the city. For this study, the perspectives of André Viana, president of the Union of Workers in the Extractive Iron and Basic Metals Industry (Metabase); Jenisse Lanza, president of the Itabira Social Observatory (OSBI), a non-profit organization that acts as a voluntary network focused on contributing and supervising public management actions; by the ex-president of the Itabira Commercial, Industrial, Services and Agriculture Association (Acita), Reginaldo Calixto. The current mayor of Itabira, Ronaldo Magalhães, was also wanted for an interview, but due to his unavailability at the moment, his recent statements to the local media were extracted. The director responsible for Vale's institutional relations, communication and sustainability was also contacted, but there was no answer.

Based on a form with eight open questions, the interviewees spoke about the impacts of mining in the areas of the economy and the environment and the consequences of this activity for the local community. The issue of the municipality's economic vulnerability in relation to mineral activity and the participation of the community, the government and Vale itself in this process were also discussed. Still in relation to the city's future, it was questioned what concrete has been thought or done to overcome this

economic dependence in relation to mineral activity, that is, what possible alternatives for autonomous economic development to mining have been considered, such as tourism and the transformation of Itabira into a service center for the region, highlighting the opportunities in the area of education and health. These local leaders showed different perspectives in relation to expectations for the future and about the municipality's economic vulnerability. A subject that was highly emphasized in the interviews was the question of community participation and the relationship of the inhabitants with the Vale company. According to the authors Sánchez, Castillo, Kunze e Araya (2001) apud (C. ALVARENGA 2006), mining companies, even the most modern ones, do not have a history of credibility with the community. That is why it is normal for the community to view the attitudes of these companies with suspicion, seeing hidden interests in all their decisions.

“Traditionally, a good relationship with the local population is not an important part of the mining culture. For this reason, the local community tends to see the mining company as something isolated and totally oriented towards profit. The community is apprehensive about being excluded from the benefits generated by the mining company and demands information about the company's conditions and objectives”

In Itabira, this lack of credibility between the company and the local community was highlighted by the interviewees, who stated that this is a factor that makes communication between both parties difficult. It was also highlighted that the community's lack of interest in participating more actively in the municipality's decisions prevents it from demanding more productive compensation and a more social posture from the company. The Itabiran community, despite the advances, was described as accommodated, with no interest in knowing their rights, thus failing to explore their capacity for action and consequently not demanding concrete actions from the company or the City Hall.

## 4.1. THE STAKEHOLDERS OPINION

### 4.1.1. ITABIRA CITY HALL

- The new economic investments of the city hall
- The investment in education as an economic vector to the city

According to the Itabira's City Hall, several initiatives by the municipal government have been considered in order to foster the local economy. The then mayor, Ronaldo Magalhães, says that the economy has developed a lot in recent years, and that diversification has made the city less vulnerable to Vale's activities. One of the paths that has been followed, as an alternative for economic development, is the strengthening of higher education institutions, which generate autonomous demand in relation to Vale and solidify the local economy. With support from the city hall and Vale, an advanced campus at the Federal University of Itajubá (UNIFEI) was opened in 2008 with higher engineering courses (PRESAS, 2012; GUIMARÃES e MILANEZ, 2017). Segundo Couto (2018), in addition to the relevant role that the university plays in teaching and research, the entry of UNIFEI in Itabira brought the beginning of a new phase of city development, generating a particularly important impact on the city's economy. The establishment of the university campus promoted a positive variation in the civil construction sector due to the heating caused by real estate speculation about the new incoming flow in the municipality. In addition, the increase in the movement of capital from student consumption has heated up several other sectors, such as services and trade, contributing to the development of the local economy. "Itabira is transforming a mining-based economy into a knowledge-based economy", said the municipal executive in a note to the newspaper Sul de Minas. In 2019, the Municipality of Itabira announced a project to expand the university's local campus. An investment that has the support of Vale and that would increase the capacity of students by approximately 4 times and that would stimulate the expenses of the university community in the city's service chain, however, a year later, nothing concrete has yet been

accomplished. Another educational institution recently opened in 2019 was the UNA University, which offers undergraduate courses in important areas of knowledge such as veterinary medicine, agronomy, physiotherapy, biomedicine, pharmacy, and electrical, mechanical, and civil engineering.

“Una is in Itabira with the commitment to add knowledge and, through it, assist the municipality in the search for economic diversification and strengthening of fundamental sectors for its development, such as commerce, service provision, agribusiness, creative economy and technology”, he comments Vinícius Costa, Business Director at UNA Itabira (LEMOS 2019).

Another project recently released was the construction of the Scientific and Technological Park of Itabira (PCTI), a structure that would include buildings for business incubators and technological modules, improving the region to attract new investments, in addition to the construction of a cargo terminal for both supply operations and production outlets and eventually for passengers. But, concretely, these projects have not yet started to develop, which leaves the paths for economic diversification still very uncertain. In addition, different proposals have always produced results that are less than planned, which calls into question the municipality's ability to effectively promote the diversification of its activities and become independent from mineral extraction. (RODRIGUES 2019).

#### 4.1.2. ANDRE VIANA, FROM THE UNION OF WORKERS IN THE EXTRACTIVE IRON AND BASIC METALS INDUSTRY

- Critique to the vulnerability of the city's economy
- The lack of investments in economic alternatives
- The good investments on the educational sector

In an interview with André Viana, current president of the Itabira's Iron and Basic Metals Industry Workers Union (Metabase Union), an association of workers in the mining and processing industry of the city, he says that the discussion about the future of Itabira is still short-sighted and that the consequences will be serious if diversification projects do not advance. According to Viana, Itabira is totally dependent on mining and is not taking any impact measures to guarantee its economic sustainability for the post-mineral phase. He also highlights the installation of the Federal University of Itajubá (UNIFEI) as a step towards economic diversification in the city, but states that this institution alone will not be able to guarantee the city's economic future and that it should not focus on just one project, but also in other alternatives. The then president of the Metabase Union also stated to the local media that, in addition to financial resources, Vale should contribute to knowledge management to bring technology, propose ideas and advances for the municipality.

“I think the economic future of Itabira is being irresponsibly thrown on the back of a federal institution, which has difficulties, problems, and will not be able to save Itabira alone. We need much more progress. And for that, we could use not only the money, but also Vale's know-how, which can bring experiences to Itabira. UNIFEI (Federal University of Itajubá) does not have support to guarantee the future of Itabira [...] is it important? Yes. But it cannot be seen as the only point for salvation or economic diversification in Itabira”, states councilor André Viana, in 2020, for the local newspaper of Itabira, Defato.

#### 4.1.3. REGINALDO CALIXTO, FROM THE ITABIRA'S COMMERCIAL, INDUSTRIAL, SERVICES AND AGRICULTURE ASSOCIATION

- The lack of dialog between government, Company, and population
- The absence of a concrete plan for the city's future
- The good investments in the health and education sector

According to the former president of the Itabira's Commercial, Industrial, Services and Agriculture Association (Acita), Reginaldo Calixto, the presence of mining in Itabira for so many years brought jobs and development to the city but, at the same time, caused a great economic dependence , as it was not able to develop much other activity sectors independent of mineral activity. It also highlights the major environmental consequences that the activity has brought to the city. As examples, he cites air pollution, groundwater damage, noise pollution generated by the locomotives that transport the ore, traveling through the city, and visual pollution, since the company completely mischaracterized the landscape. The former president of ACITA is optimistic about the future of the city but criticizes the delay in relation to the impact measures to ensure its economic sustainability for the post-mineral phase. According to him, the municipality should already have an action plan for the more concrete future, combining several economic areas, such as culture, health, education, and tourism; in favor of economic diversity. "Itabira lacks a municipality project, a long-term vision, a strategic plan that stipulates achievable goals in its various areas of public interest", says Calixto. However, what would make the creation and development of this plan more difficult would be the question of discontinuity of projects due to political-party alternation. Calixto affirms that this interruption of initiatives, projects and the shelving of future plans leads to the waste of public resources, the loss of memory, the discouragement of the teams involved and an increase in tension and animosity between stable

technicians and managers who come and go with the elections. It is for this reason that he believes that Vale itself is the one who should be at the center of these projects for the future, after all it is the company that remains constant and independent of the political and administrative changes in the city. As for the participation of the community in this process, he believes that the contradictory feelings of citizens in relation to mining hinder communication between the company, the government, and the community. On the one hand, those who see mining as something positive for the city have a hard time charging the results in a concrete way and, on the other hand, those who see Vale's presence as something negative for the city, have a lot of difficulty in establishing a dialogue. On the one hand, those who see mining as something positive for the city have a hard time charging the results in a concrete way and, on the other hand, those who see Vale's presence as something negative for the city, have a lot of difficulty in establishing a dialogue. Regarding investments in education, like André Viana, he highlights the creation of UNIFEI, which brought not only the development of teaching and research, but also moved a significant amount of financial resources, collaborating to stimulate local economic activity. The health sector also stands out: in 2009, the municipality had 63 health establishments including hospitals, emergency rooms, health posts and dental services, with the medical-hospital system circulating around two main hospitals. The health system of Itabira also receives patients from other 12 neighboring municipalities, representing in general numbers, 116 thousand local inhabitants and 130 thousand from other cities (DEFATO 2015). As an example, he cites the countless residents of the region who come to consult with doctors from Itabira and the growing number of students from other cities who are so enrolled in existing universities.



#### 4.1.4. JENISSE LANZA, FROM THE SOCIAL OBSERVATORY OF ITABIRA

- The disinterest and lack of participation of the population about the community affairs
- The changes in the perspectives after the environmental accidents in neighboring cities
- The lack of concrete measures by the local government

In order to understand how public management and the population have positioned themselves in relation to the future of the city, Jenisse Lanza, president of the Social Observatory of Itabira (OSBI), was also interviewed. This non-profit and non-partisan organization has existed since 2016 and is made up of local entities, individuals and companies, which work in favor of transparency and the good and correct application of public resources through the monitoring of public spending, aiming to contribute to the efficiency of public management. In Itabira, OBSI represents twenty-six institutions, twenty-one companies, in addition to having twenty-three individual taxpayers and thirty-eight voluntary individuals. In an interview, Lanza limits herself to commenting only on issues related to community participation and the use of public resources. She highlights the importance of a mature and proactive stance by the company and the community, in order to lay the foundation for future socioeconomic development and affirms that her experience at OBSI has shown that the Itabiran community is not very interested in participating and supervising actions of the municipality. However, she points out that, after the Vale incidents, in the cities of Bento Rodrigues and Brumadinho, in 2016 and 2018 respectively, a certain movement started in the city and the inhabitants began to question what mining has done to the city and at what cost. What, until then, was an abstract problem and far from the daily life of the population, has materialized through fear and uncertainty about their own futures. But even so, the interest on these issues is still small and

there are few who actively participate in the inspection of public actions in the city and control demand local government decisions.

The Itabiran community, despite the advances, is still very accommodated, does not know its rights or its capacity for action, and it is up to the leaders to encourage and raise awareness among community organizations to act in order to collect greater compensation for mineral exploitation in the municipality..

When it comes to the actions of public resources, Lanza says that, since 2016, there have been few concrete measures by the government that sought economic diversity or control of the company's activities in the city. She says that in the last few years, the only measure taken that covered this issue was the creation of a law that obliges the mining company to account for the exhaustion forecast for the Itabira mines, which is already done annually by the company, through the Form-20 report, previously mentioned.

#### 4.1.5. VALE

- The investments that are being made to support the city's future
- The responsibility of the city when defining its post-mining future

Vale's Institutional Relations director was also contacted for an interview, but no response was obtained. Therefore, his recent statements to the press were collected, which was the subject discussed in this research. In 2019, Luiz Eduardo Osório spoke to the local newspaper Defato about the mining company's role in Itabira in the post-mining scenario. The executive assured that the company will not shy away from the responsibility of helping the municipality to achieve its new vocation, based on technological development, saying that "Vale will not shirk the

responsibility of helping the municipality on this journey". Osório replied that he has had meetings with the government of Itabira, through Mayor Ronaldo Magalhães, and that all Vale actions will be guided by the choices of the municipality itself. According to him, it is only up to the city to define its post-mining profile.

“The municipality's economic vocation after mining, who has to say it is the municipality itself. We, as a company, have no competence to say what this vocation is. From wiretaps that we have From wiretaps that we have done with society and with the Public Power, led by Mayor Ronaldo, we seek to develop the municipality of Itabira as a technological pole, to attract other technology companies and other colleges as well this focus ”, affirms the Institutional Relations director (Osório 2019).



## 5. PROPOSAL OF VALORIZATION

- Le concept de patrimoine industriel
- Le réaménagement des zones post-industrielles comme potentiel
- L'utilisation du patrimoine industriel comme vecteur d'une alternative de l'avenir économique à Itabira
- Les atouts du patrimoine industriel d'Itabira et sa valeur exceptionnelle
- Stratégies pour l'initié
- Propositions pratiques
- Lignes directrices pour la conservation et le maintien de l'authenticité du patrimoine

In view of this context, the debate on overcoming the model based on mineral extraction in the city becomes essential. Other possibilities must be considered to encourage a change in the city, so that new channels can be built and attract activities and investments to the region, thus avoiding the effects of stagnation that will possibly be caused as the progressive reduction of industry activities. A way to diversify Itabira's economy and enhance the city's industrial legacy. Not just as an alternative, but also as a vector. The enhancement of this legacy may come to enable a wider interaction between society and the locality with its specificities, which favors the relationship of approximation and construction of local identities by stimulating the constitution of networks of belonging. The following enhancement proposals are born from the perspectives brought by the interviews with stakeholders and with the population, and from the analysis of an international case, which have a similar context to Itabira.

### 5.1. THE INDUSTRIAL HERITAGE

The concepts of preservation and conservation related to industrial heritage, according to the International Committee for the Conservation of the Industrial

Heritage (TICCIH) Nizhny Tagil Charter, become necessary to develop interventions that have, as main concern, the preservation of the functional integrity of buildings. The construction of this concept was carried out through the reframing and re-appropriation of the traces of industrial production so that these, previously seen as unimportant traces of economic activities, came to be endowed with the value of “heritage”. In this document, from which the concept originates, it is said that:

“Industrial heritage consists of the remains of industrial culture which are of historical, technological, social, architectural or scientific value. These remains consist of buildings and machinery, workshops, mills and factories, mines and sites for processing and refining, warehouses and stores, places where energy is generated, transmitted and used, transport and all its infrastructure, as well as places used for social activities related to industry such as housing, religious worship or education (ICOMOS 2003)”.

As the charter emphasizes, the adaptation of an industrial site to a new use, as a way of ensuring its conservation is generally acceptable, except in the case of sites of particular historical importance. New uses must respect the specific materials, as well as the original circulation and production schemes, and must be compatible, as much as possible, with their original use. An adaptation that evokes your original activity is recommended (ICOMOS 2003).

Industrial heritage is not just another heritage typology but has an intrinsic relationship with contemporary society. According to Cizler, Pizzera and Fischer (2014), the significance of industrial heritage and its reuse is multiple, but one of the main issues is connected with its social and cultural value. Nowadays, the industrial heritage is a memory about the life of not only workers in those factories but also many other people. The factories were everyday surroundings for generations of workers and symbols of progress and pride for the local community.

The valorization of the industrial heritage has been concentrated both in old-industrialized and de-industrialized areas in Europe, and to a much lesser extent in North America. The properties valorized are mostly large-scale and spectacular properties (e.g. mines, textile plants, blast furnaces, etc. mainly dating from the late nineteenth to early twentieth century). Besides preservation for their historical

values, these projects are often conducted to diversify the range of tourism products available in order to (re)generate economic activities and employment in post-industrial places that are in decline. Issues of identity and/or image building have also become important facets in these endeavors (LEUNG e SOYEZ 2009).

In Brazil, according to Azevedo (2010), the study and investigation of industrial heritage began before the spread of the discipline of industrial archeology in the country, which occurred during the 1970s. It can be said, however, that research and the preservation of industrial heritage in Brazil are still incipient, and its theoretical, methodological, and practical field for knowledge about industrial heritage is still dispersed in isolated and little-spread efforts. As claimed by E. R. Oliveira (2017), the industrial heritage should be considered as an integral part of cultural heritage in general, but it has only recently been recognized in national heritage bodies - not least because it is not recognizable in its traditional architectural modalities.. Due to the incipient way in which the value of the architectural heritage resulting from the industrialization process is recognized in Brazil, there are few examples of industrial installations listed in the federal sphere.

Propositions built for defining concepts about preservation and conservation of industrial heritage have provided an expansion of its comprehension. Current experiences include examples of reconversions and reuse of their architectural structures and range from a traditional design for their use to the most diverse innovations. They emerge from mainly European experiences which seek to broaden the understanding of the relationship of these elements with cultural and social life, from their conservation and preservation to the revitalization (R. A. SILVA, *Perspectivas para reutilização, reconversão e recuperação de patrimônio industrial no Brasil* 2013).

## 5.2. INDUSTRIAL HERITAGE AS A POTENTIAL FOR REDEVELOPMENT OF POST-INDUSTRIAL AREAS

Nowadays, many former and now redundant mining areas are undergoing rehabilitation and turned into industrial heritage sites for regional revitalization. Though perception of post-industrial landscapes is sometimes negative, they are

often positively connotated and considered to have a potential. The versatility offered by the industrial heritage in terms of its reuse, is also an additional factor that favors the adoption of this type of solution. (J. M. CORDEIRO 2011). Cultural potentials related to industrial heritage are man-made relicts such as technical structures, buildings, and infrastructure, as well as intangible potentials such as tradition of miners, mining customs and identity. These potentials can be turned into cultural facilities, events, museums, industrial routes, and tourist paths (CIZLER, PIZZERA e FISCHER 2014).

These ideas for reconversion of industrial heritage elements are related to the possibilities of “maintaining” the original characteristics of the spaces, in addition to allowing a perpetuation of their uses and objectives. A global analysis of the need for conservation of industrial buildings is presented by Tagliaferri (2006) apud R. A. Silva (2013), in which:

“One of the most important benefits in the conversion of an old building is the conservation of the “previous energy”, or, in other words, of the energy involved in all the processes associated with its construction (the transport, the choice and the manufacture of the construction material , or the equipment) ... In social terms, the adaptation of vacant buildings creates dynamism, small urban rehabilitation centers and a desirable attractive visual diversity. Reuse a historic building increases the quality of life in the neighborhood and at the same time, keeps alive the city's collective memory”. (Tagliaferri, 2006, p. 9 apud R. A. Silva, 2013).

In the justifications for including these monuments of industrial society, it is consensus to cite their recognized exceptionality, both in terms of the technical development associated with the good, as well as the activity developed in a significant period of human history, without forgetting the architectural exceptionality (DEZEN-KEMPTER 2011).

Among many others, several significant examples may be cited, such as the Völklingen Ironworks and the Zollverein Coal Mine Industrial Complex, both in Germany; the Sewell Mining Town, in Chile; the Saltaire, the Engelsberg Ironworks, in Sweden, the Blaenavon Industrial Landscape and the Cornish and West Devon Mining Landscape, all located in the United Kingdom; the New Lanark, in Sotland; the Mining Historical Heritage, in Spain, the Lousal Mine in Portugal, They all reflect



the recognition of the symbolic and social meaning that marks these industrial monuments as cultural heritage.

Post-mining areas and post-industrial facilities are also part of the national cultural heritage associated with the period of industrialization, which should be subject to promotion (educational paths, tourist trails). However, the transformation process of derelict, degraded mining landscapes, into areas of interest for tourism is, by any means, a major challenge for authorities, technicians, tourism managers, stakeholders, and the local population, but that process may generate several direct and indirect benefits to the local society and region (I. MENDES 2013).

Mining rehabilitation plans - or strategies - for the appreciation of heritage, whether for tourism and recreation of cultural heritage are likely to generate a series of environmental, cultural, economic and social impacts (I. MENDES 2013). According to Fagiewicz and Mekarski (2018), those initiatives, which includes the process of reclamation and management in the context of the socio-ecological system, should include the relations in the management system, that occur between the main stakeholders (internal relations) and the ecological, economic and socio-cultural conditions of the environment (external relations). The authors highlight that post-mining areas and post-industrial facilities are also part of the national cultural heritage associated with the period of industrialization, which should be subject to promotion (educational paths, tourist trails). They also claim that those areas should be seen as an opportunity for the development and must be associated with the development of the resource and use potential of post-mining areas. In the process of reclamation and management of these mining areas, relations between the management system of postmining areas and its surroundings should be created, and the ecological, economic, and socio-cultural conditions should also be considered. The authors declare that the modern post-mining management process is in the phase of transition to a participative system, based on co-creative and consensual model of reclamation of post-mining areas; and that the implementation of this model for reclamation practices should be based on building and strengthening internal and external relations on two levels (*figure 35*).

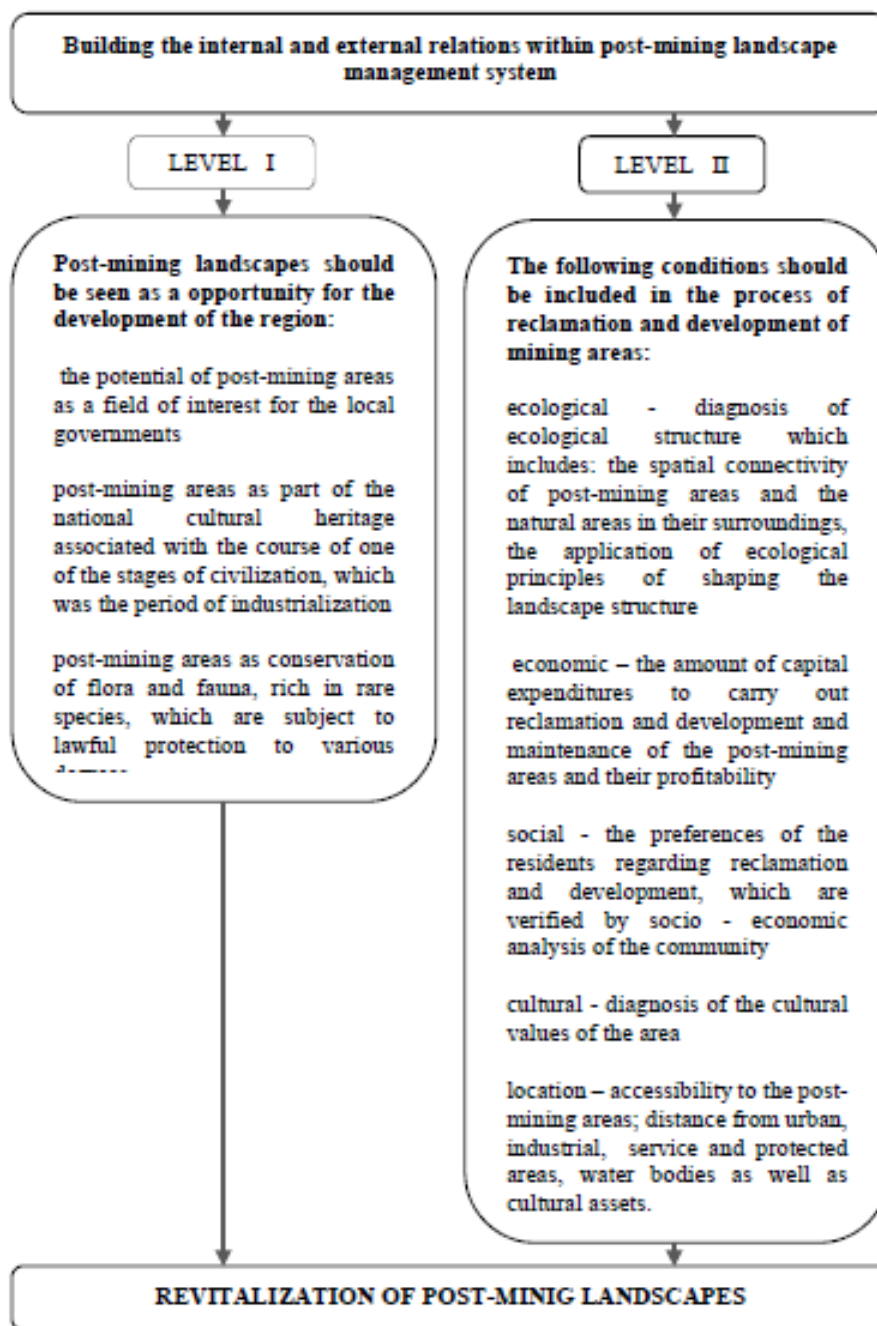


Figure 35: The change in approach to post-mining landscape management. Source: Fagiewicz and Mekarski (2018)

As seen, cities or urban spaces from different countries, with different histories, economies and cultures, are sharing the same conception of reconstructing certain spaces, especially through the diffusion of “requalification” models, which guide intervention policies (BEZERRA 2015). According to I. Mendes (2013), the benefits of the rehabilitation plan for large areas damaged by early mining are widely dispersed in terms of where they accumulate (for example, local / regional; short /

long term; the respective economic sector - agriculture, industry, tourism - benefiting) and for whom they benefit (for example, people in general; entrepreneurs; landowners; associations; politicians). One means of contributing to the success of industrial heritage tourism plans is by estimating the economic, environmental, cultural, and social effects that such structural plans generate in monetary terms. The appreciation of heritage through rehabilitation plans can be a way to restore the economy and build a new image for the city, associated with leisure and tourism (BEZERRA 2015). The requalification of degraded spaces, the improvement of the visual, landscape and environmental impact on mining municipalities and the development and proposition of new uses for these areas are reflections that deserve to be better established. Such questions must necessarily consider the endogenous characteristics of the place and aspirations of the communities involved, aiming at improving environmental and urban quality (CARSALADE, et al. 2012).

### 5.3. VALUING THE INDUSTRIAL HERITAGE IN ITABIRA



*Figure 36: Partial view of in 2017. Photo: Josue Marinho*

According to E. R. Oliveira (2017), industrialization has produced, and still produces, marks in today's societies that have taken shape in architecture, in objects, in souvenirs or even in the territory. This statement very clearly exemplifies the situation in the city of Itabira, whose different forms of manifestation of material and immaterial culture are related to the industrial legacy. These events are testimony to

activities related to mineral extraction, which had and still have profound consequences for the place: since the industry was installed in the city, the economy of Itabira depends heavily on the operations of the mining industry and the activities resulting therefrom. The urban site of the city is interwoven and surrounded by mines, unlike other areas of mineral exploration, where extraction takes place outside the urban perimeter. Mining is also a strong symbolic reference, constituting the city's identity. As demonstrated in the previous chapters, Itabira has an extension of elements that constitute its industrial heritage. In short, this heritage includes the mining landscape, industrial facilities, the Vitória a Minas railroad and the intangible social aspects of mining culture.

### 5.3.1. THE MINING LANDSCAPE



*Figure 37: Itabira's Mining Complex, with its three main mines and its urban area. Source: Google Earth, 2017*

One of the most visible impacts in Itabira is the change in the landscape, particularly in relation to the extraction of the peak of Cauê. The city is now a reflection of the mining activity. As already mentioned, the change in the landscape was not limited to the natural aspect, but also to the urban infrastructure, which developed due to the mines.



*Figure 38: Above: Periquito's Mine. N.D. Photo: Esdras Vinicius. Below: Cauê's Mine in Itabira. N.D. Photo: Esdras Vinicius.*

### 5.3.2. THE INDUSTRIAL FACILITIES (PLANTS, MINES AND DAMS)



*Figure 39: Above: Part of the Itabira's Mining Complex. Source: Flickr, WATERLAT  
GOBACIT – JEC. March 2014  
The Cauê's Mine Industrial Plant*

Vale's operations allowed the implantation of a steelmaking park that directly connects the city. Today, the complex in Itabira is formed by seven mines, the main ones, Conceição I and II, and the Cauê mine - which has already been exhausted and is in the process of environmental recovery - Minas do Meio, composed of the Periquito mine, Dois Córregos, Onça, Camarinha and

Chacrinha. In addition to the mines themselves, the construction of these complexes involved the implantation of power plants and the construction of tailings dams, which contain the product left over from the iron ore beneficiation process.

### 5.3.3. VITÓRIA A MINAS RAILWAY



Figure 40: The route of the railroad Vitória Minas, crossing the states of Minas Gerais and Vitória.  
Source: OpenStreetMaps. 2018

The railway connects the capital of the state of Minas Gerais, Belo Horizonte, to the ports of Vitória and Tubarão, in the state of Espírito Santo. Its location began at the end of the 19th century and its initial objective was to transport passengers by rail and transport coffee production from Vale do Rio Doce and Espírito Santo. However, its focus was changed in 1908, starting to target Itabira and transport iron ore mined in the municipality to the port complexes in the state of Espírito Santo. The Vitória a Minas Railway gained momentum after 1942 - the year in which Vale was created. The industrial growth of the region was only possible due to the existence of the railway, which started to serve as a way of transporting the production of the local industries. The route of the railway reached the city of Itabira between the 30s and 40s (VALE 2014).

Symbol of the importance of the railway, Itabira has a square, which has already been declared a historic heritage site in the city, where it is exposed to “Maria Smoke”, which was one of the last steam locomotives used by VALE in the 1940s. The Mikado locomotive No. 185 (*figure 41*), manufactured by Baldwin Locomotives Works in Philadelphia, United States, in August 1945, is one of the last steam engines acquired by Vale in the 1940s. It has the capacity to pull up to 22 wagons loaded with iron ore to a speed of 25 km / h, being originally operated by a driver, a stoker (who feeds the furnace and the boiler) and a grease fitter. The steam locomotives on the Vitória a Minas Railway were gradually replaced by diesel-electric ones between the 1950s and 1970s. Last restored in the first half of 1997 at the wagon workshop at the Tubarão da Vale Complex, in Vitória, Espírito Santo Santo, by a group of retired people from the old João Neiva workshop, Maria Fumaça is in normal working condition. The existing place was designed and built in 2005 specially to house the composition of Maria Fumaça (locomotive, passenger car and freight wagon), protecting it from the weather (VALE 2014).



*Figure 41: Areão Square and the famous locomotive, in Itabira. N.D. Photo: Esdras Vinícius*



#### 5.3.4. THE INTANGIBLE SOCIAL ASPECTS OF MINING CULTURE

The significance of industrial heritage and its reuse is multiple, but one of the main issues is connected with its social and cultural value. Industrial heritage is nowadays a memory about the life of not only workers in those factories but also many other people (CIZLER, PIZZERA e FISCHER 2014). As demonstrated in chapter 3.3, mining is invested in the social value of Itabira, it is part of the life record of men and women and, as such, it also gives them an important identity feeling associated with this economic activity. The industrial heritage, in this context, can then be understood as a collective heritage of Itabira, a producer of a certain collective memory, who carries symbols capable of developing the feeling of belonging of the community to this city. In addition, industrial sites are often at the heart of territorial and community development and, thus, are strong symbols of identity and memory for the communities born in their surroundings, be they sites with large industries, cities, companies, working class neighborhoods, etc. Therefore, the safeguarding of industrial heritage is closely linked to the “The resurgence of identarian feelings, of wanting to belong to a history, culture, region or district is symptomatic of the human need to know oneself and for one’s identity to be acknowledged.” (UNESCO 2008, 20-21)

#### 5.3.5. THE JUSTIFICATION OF ITS EXCEPCIONAL VALUE

The reasons that justify the protection and enhancement of this industrial heritage are essentially due to the exceptional value of its characteristics. To demonstrate the potential of Itabira as a site of extraordinary value, UNESCO’s selection of World Heritage criteria was used as a reference. Itabira's industrial legacy can meet three of the ten criteria:

**(II) To exhibit an important interchange of human values, over a span of time or within a cultural area of the world, on developments in architecture or technology, monumental arts, town-planning or landscape design:** The Itabira industrial complex forms an industrial monument where several important technological innovations in the extraction and processing of iron ore have been

developed and improved and are now in universal use worldwide. Also, mineral extraction at that location led to the evolution of an industrialized community, the transformation of the landscape caused by extraction, the creation of railroads and the urban development of the city of Itabira. Also, the way in which the city and industry have developed, intrinsically in each other, is an excellent and unique example of the role played by the mining industry in the development of a city. The industry in Itabira also had a profound impact on the growth of industrialization in the region of Minas Gerais, in Brazil and, consequently, on industrialized mining worldwide.

**(IV) To be an outstanding example of a type of building, architectural or technological ensemble or landscape which illustrates (a) significant stage(s) in human history:** The mining sites in Itabira are a testimony of the continual history of precious metal extraction from the twenty century until nowadays. The history and landscape of Itabira illustrate, in an exceptional way, the social and economic structure generated by this economic activity. Also, the technological and other structures of the Itabira industrial complex are representative of a crucial period in the development of the extractive industry in Brazil and represent techniques that are still alive and tangible which, if not preserved and valued, may be forgotten.

**(V) to be an outstanding example of a traditional human settlement, land-use, or sea-use which is representative of a culture (or cultures), or human interaction with the environment especially when it has become vulnerable under the impact of irreversible change:** The industrial heritage in Itabira is an excellent example of land use for mineral extraction, where this activity has shaped a cultural landscape that provides a unique image of how mines and the mining city functioned as a complex and vulnerable system. The legacy that the mining industry leaves in Itabira is constituted by the memories of territorial development, of the transformation of the landscape and workers, carries diverse patrimonial values, among them the value of historical testimony of the development of human activities, being the materialization of these experiences and the social value as a record of the experiences of industrial work and workers. In addition, this industrial complex is not only imposed by its importance as material heritage, but also as a contender of the meanings it started

to have after the transformations and consequences left by unrestrained mineral extraction.

As demonstrated, the legacy left by the industry in Itabira makes the city have a great vocation to be valued as an industrial heritage. The process of "requalification" in search of this valorization, is essential in a city like Itabira, not only for the exceptional value of its complex but also to serve as a testimony of one of the most important processes in the history of mankind, so that future generations can know how this prodigious transformation took place. Its preservation can also play an important role in the economic regeneration of depressed or declining regions (CORDEIRO 2011). Based on the realization that Itabira has great potential, as far as its industrial heritage is concerned, the following strategies, proposals and guidelines are presented, which can guide future intervention policies and assist in the promotion of this heritage, as a way to enhance culture and the history of Itabira but also as one of the possible paths for an economic alternative for the municipality, in a scenario of exhaustion of extractive activity. Its specific objectives are related to the areas of urban, social, cultural, and ecological development, considered as basic sectors to drive and direct changes in an old industrial region undergoing a transformation process.

#### 5.3.6. STRATEGIES

When assessing the various forms of expression of industrial heritage, one must consider the existence of a group of instruments that guarantee the expansion of its applicability - be it private or collective actions, private or state initiatives - and which allow to envision the aggregation of the vision of culture, memory and history to a heritage based on science and technology (BRUNO, 1997 apud R. A. SILVA 2013). It is about combining initiatives aimed at the local community with projects of great impact and significance, capable of mobilizing governments, companies and awakening the general interest. Interventions with strong symbolic connotations, highlighting the landmarks of the past and illuminating the signs of the future.

In this sense, due to similar circumstances, *The Internationale Bauausstellung Emscher Park* (IBA Emscher Park) can be used as a reference for

the case of Itabira. It was a program for structural changes in the so-called German Ruhr region from 1989 to 1999 in order to show new concepts in terms of social, cultural and ecologic ideas. As in Itabira, the Ruhr region, with coal and steel, has become one of the most formidable industrial regions in the world. The price to pay for this was that of high environmental pollution and economic dependency concentrated exclusively in one sector. The changes were not long in coming. Coal started to be replaced by oil, natural gas and, more recently, imported coal, which ends up costing less than if it were extracted on site. As a result, the region went into decline, facing successive crises, leading to a high unemployment rate of 20% in recent years.

The intention of the IBA Emscher Park was to develop in parallel structural changes covering the whole area and to initiate lighthouse projects that work as local stimulation and attract attention. The region was suffering from its image as rust belt for more than a hundred years and even though a lot of green spaces and landscape existed this was not highlighted before and made the region – a misgiving of the government – not attractive for investments or long-term improvements. The time stretch of 10 years (1989-1999) was chosen to create changes that do not only present single solutions on buildings but to enable public partners to activate complex interdisciplinary planning processes that work in the long run. Moreover, the processes partly were organized in a way that projects like the restoration of the Emscher system were scheduled to last up to the year 2025. The initiators of the IBA were aiming at changes to become deeply rooted in regional planning culture (IBA 1989). One of the Exhibition's principle features was that restructuring should take an holistic view rather than simply trying to attract inward investment and jobs (SHAW 2002). The strategies presented below propose a schedule of actions, which, complemented with practical proposals and intervention guidelines, could guide future intervention policies and assist in the promotion of this heritage, uniting several organizations (local administrations, industrial companies, non-profit organizations, pressure groups, and the population in general), in a greater objective of promoting new ideas and projects.

- To elaborate an environmental plan and natural resources, with recovery of degraded areas and promotion of environmental education;

- To enhance the city's identity and its industrial heritage;
- To establish the industrial heritage in the tourism next;
- To direct actions for the valuation of industrial heritage;
- To incentive to projects and ideas through active participation a community effort to preserve the story of the region's industrial past;
- To incentive to heritage education actions.

### 5.3.7. PROPOSALS

In the case of Itabira, these proposals are about encouraging a change or alternative for the city's economic future in the direction of enhancing its industrial heritage. Projects that rescue the history of mining and that promote the reuse of equipment that will be demobilized. Also, that mark the beginning of the conversion of the Itabira mining complex into a large technological, cultural, tourist and leisure complex, along the lines of those existing in old mining and steel areas in Europe and the USA.

#### 5.3.7.1. ENVIRONMENTAL RECOVERY

Due to human interventions and changes in the environmental characteristics of the region so that mineral extraction is carried out, the mining undertaking results in the appearance of degraded areas during and at the end of exploration, since the ore extracted from nature does not return to its place of source. Degraded areas are considered natural extensions that have lost the capacity for natural recovery after suffering disturbances (MOREIRA, 2004 apud D. MOURA, 2015)

Degradation is a process induced by man or by a natural accident that reduces the current and future productive capacity of the ecosystem. According to Belensiefer (1998) degraded areas are those that have lost their production capacity, making it difficult to return to economic use. The term degrade as Ferreira (1986) can be interpreted as: spoiling,

deteriorating, wearing out, attenuating, or gradually decreasing (MOREIRA, 2004 apud D. MOURA, 2015)

In the extractive process, the restoration of the area is something impossible to happen, because restoring implies the exact reproduction of the conditions of the place before the alteration suffered. Rehabilitation, which according to Kopezinski (2000) apud D. Moura (2015) seems to be the closest proposal to reality, is linked to the use and occupation of the land, that is, a reuse of the mined site as a leisure, residential, commercial, industrial area, among others. The techniques used to ensure the proper use of the soil are numerous, but in general all comprise the following steps: deforestation, removal and storage of the soil cover, final remodeling of the area and revegetation (*figure 42*).

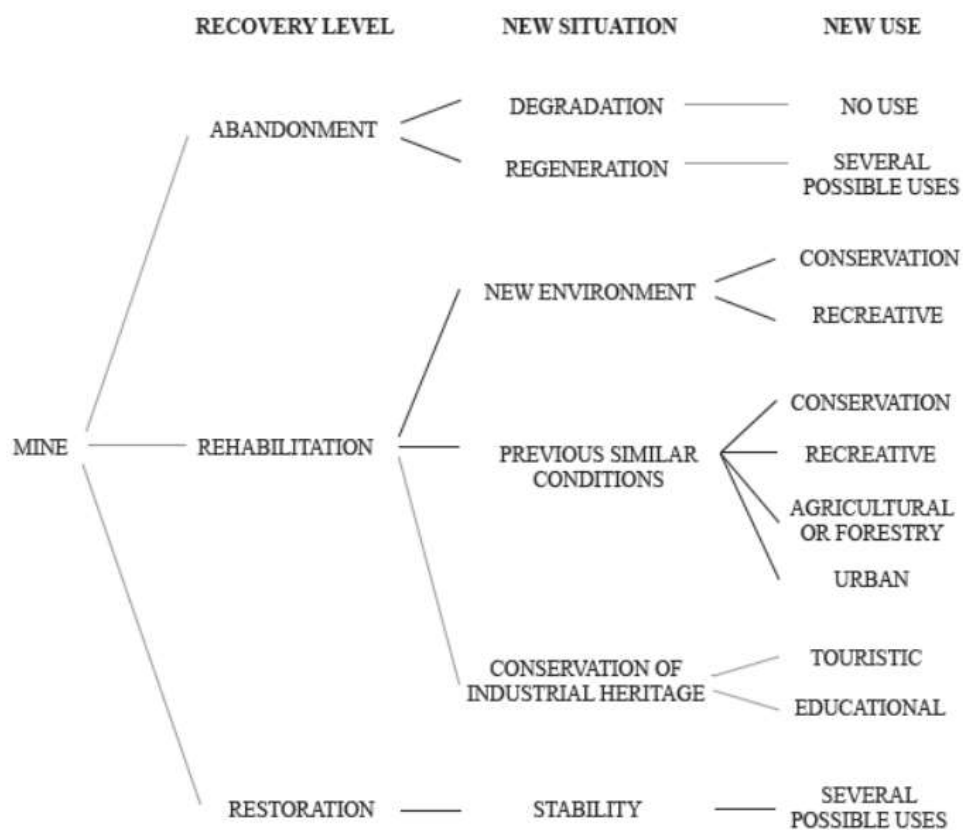


Figure 42: Recovery stages of degraded areas Source: Sánchez (2005) apud D. Moura (2015)

Understandably, in a region so mistreated in environmental terms as Itabira, sustainability is vigorously pursued. Considering the intrinsic exhaustible nature of the mineral resource, so that mining can be considered a sustainable activity, according to Enriquez (2009), it needs to promote intra and intergenerational equity. Thus, from the perspective of the current generation, mining can only be considered sustainable if it minimizes its environmental impacts and maintains certain levels of ecological protection and environmental quality standards. From an intergenerational perspective, ensuring the well-being of future generations is the precondition; which, in Itabira, can be done from the sustained use of the income that mining has provided.



*Figure 43: The rehabilitation of a mining site. Source: Mining Technology, 2003, accessed in 10 ago 2020 <<https://www.mining-technology.com/wp-content/uploads/sites/8/2017/10/mine-water-l.jpg>>*

The recovery of areas degraded by mining usually involves activities aimed at restoring vegetation (ALMEIDA e SÁNCHEZ 2005). When mining operations are complete, the change in topography and stripping of vegetation can lead to significant soil erosion – not only washing precious nutrients away and clogging up waterways with run-off, but also creating unsightly and unusable heaps of dirt. This is why rehabilitation of mining sites is so

important: to establish new growth as quickly as possible and to allow any land destroyed by mining to be put to better use for forestry or grazing purposes. (MINING TECHNOLOGY 2013).

The environmental recovery in Itabira, should aim to return the degraded site to a form of use, according to a pre-established plan for the use of the soil, aiming at obtaining an environmental stability. According to Brun et al (2000) apud D. Moura (2015), in order to be able to obtain new use of the area, it is necessary that it be in conditions of physical stability (hill, embankment, land depression) and chemical stability (the area should not be subject to chemical reactions that can generate problems harmful to human health and the ecosystem, acid drains from waste batteries or tailings). Depending on the post-mining use, the requirements for geological stability (areas used for the purpose of environmental conservation) can be added. In the case of the mining enterprise, man's participation must start when planning the mine and end when the fauna, flora and soil relations are in balance and in conditions of sustainability. The techniques used to ensure the proper use of the soil are numerous, but in general all comprise the following steps: deforestation, removal and storage of soil cover, final remodeling of the area and revegetation.

#### 5.3.7.2. REUSE OF THE INDUSTRIAL DEACTIVATING FACILITIES

The requalification of former industrial and mining facilities for cultural and tourist purposes is now common practice in the United States and Europe. Art, tourism, and design are changing the appearance of old industrial complexes. Former deactivated coal mines and steel mills have been converted into centers of technological innovation and cultural centers. Adapting and continuing to use industrial buildings preserves the physiognomy and urban characteristics of a given city area, while avoiding unnecessary expenses with demolition and subsequent construction, also contributing to sustained economic development (J. M. CORDEIRO 2011).





*Figure 44: The Zollverein Complex. Source: Moose around the World, accessed in 15 jul 2020 <[https://www.moosearoundtheworld.de/blog/wp-content/uploads/2017/01/Zollverein\\_Kokerei\\_02-1170x780.jpg](https://www.moosearoundtheworld.de/blog/wp-content/uploads/2017/01/Zollverein_Kokerei_02-1170x780.jpg)>*

In a context remarkably similar to that of Itabira, one can mention the Zollverein Coal Mine Industrial Complex in Essen, Germany, where the industrial ruins of this industrial center were used as converted cultural centers. These industrial monuments came to be conceptually conceived as transmitters of a cultural message, that is, seen as signs in a landscape that emptied itself of guiding landmarks, and in which they started to represent the symbolic role of the presence of a regional identity.

Comparably to Itabira, the Ruhr region was one of the most formidable industrial regions in the world. While Itabira's raw material is iron ore, the complex worked with steel and also coal. The price to pay for the years of exploitation was that of high environmental pollution and economic dependency concentrated exclusively in one sector, the same problems that Itabira is facing right now. In that complex, the changes were not long in coming. Coal started to be replaced by oil, natural gas and, more recently, imported coal, which ends up costing less than if it were extracted on site. As a result, the region went into decline, facing successive crises, causing a high unemployment rate of 20% in recent years. In addition to natural deterioration, urban environments have also declined, and, at the same time,

brownfields have appeared, numerous and bleak. This was the context in which IBA Emscher Park was established in 1989 (CASTELLO 2003).

As mentioned, the installation of the Zollverein Mine (Zeche Zollverein) in Essen dates from the first half of the 19th century and most of its installations, which were active until the 1980s, were carried out in the beginning of the 19th century. XX, with the restructuring and modernization of its machinery and equipment when it was acquired by Vereinigte Stahlwerke AG. The design of most of the buildings in that period was carried out by architects Fritz Schupp and Martin Kremmer according to principles advocated by the Modern Movement (CASTRO 2014). After the demolition request made by the then owners of the complex in 1986, which had the approval of the municipality of Essen, the State of North Rhine-Westphalia declared the entire area of interest for preservation. During this period, the dominant tendencies were to propose the demolition of the entire complex and the realization of new developments, which changed with the institution of IBA Emscher Park in 1989. From then on, a process of articulation between public and private actors began for the innovative development of several projects in the area, combining preservation requirements with new projects focused on design, the arts and culture, occupying the old facilities. Declared a World Heritage Site by UNESCO in 2001, Zollverein became the main site of the Industrial Culture Route in Germany (*Route Industriekultur*) (ZOLLVEREIN 2020).

Very similarly to Itabira, all region's wealth was generated on top of the massive massifs that have grown over the years of industrialization. As witnesses to the strength of a past full of remarkable developments, the industrial facilities represent valuable relics. As in Itabira, the Ruhrgebiet, the past does not pass. The remaining relics do not hesitate to become volunteers to diligently narrate the history of the region. And not only the urban and cultural history, but the history of the region's own life, of the social formation of an entire population, of the subjectivity etched in the minds of these people.

In the case of Itabira, it is a question of finding new uses for industrial structures that will in the future be deactivated, which should be

understood as historical and architectural monuments. Contemporary uses should be sought that also allow them to retain their industrial identity. It is also possible to establish cooperation programs with international projects aimed at the conversion of industrial areas and technological and cultural innovation, aiming at exchanging procedures and strategies.



*Figure 45: Zollverein Coal Mine Industrial Complex. Source: Visit World Heritage, accessed in 09 ago 2020 < <https://visitworldheritage.com/en/eu/zollverein-coal-mine-industrial-complex-germany/>>*

### 5.3.7.3. CREATION OF A MINING MUSEUM

According to R. A. Silva (2014), the musicological character applied to the industrial heritage allows the construction of a social memory and history in which the importance and relevance of the organizational history and its influences on the social, cultural, political and economic life are perceived. An adequate “organizational synthesis”, pluralistic and complex from the musicological point of view, allows a different perception of how to describe and perpetuate organizational histories from the perspective of museology. In Itabira, appreciation and appreciation for the cultural past itself, that is, for the unique local industrial culture, only strengthens the region's self-esteem. Thus, in this perspective of expansion, a museum that

values the industrial history of the city could provide a revitalization of the memory and socioeconomic history of Itabira and of the identity developed from the links between man and work, company and community, city and industry.

As international examples there are concepts of Eco museums or retrofits of industrial areas, such as the Völklingen Steel Complex and the museum that seek to expand the relationship between industrial heritage and cultural and social life, from its conservation to revitalization. Also, as an example of a museum with a mining theme, we can mention The German Mining Museum in Bochum, Germany, where above-ground exhibitions, and a faithfully reconstructed show mine below the museum terrain give visitors insights into the world of mining. This museum is also a prestigious research institution in the history of mining. Still in Germany, the Ruhr Museum is a diverse natural history and cultural history museum for the Ruhrgebiet in Essen, Germany.



*Figure 46: The Ruhr Museum, in Germany. Source: Ruhr Museum, accessed in 03 ago 2020 <<https://www.ruhrmuseum.de/en/visiting/hours-and-admission/>>*

The museum, which understands itself as a memory and showcase of the Ruhr area, documents in its permanent exhibition nature, culture, and history of the Ruhr area and thus the development of the largest

agglomeration in Europe. A diverse range of attractions that portray aspects of the industrial past could be applied in Itabira. But this museum would not only be an industrial museum, but it would also present art, culture, and history. In addition, it could inspire a connection with the community through heritage education, providing spaces for lectures, practical workshops for adults and for children and school classes.

#### 5.3.7.4. NEW OPTIONS FOR SOCIAL AND CULTURAL ACTIVITIES



*Figure 47: Library created in a train station, in the city in Mariana, Minas Gerais, Brazil. N.D. Source: Trem da Vale, accessed in 02 ago 2020 <<https://tremdavale.santarosacultural.com.br/noticias/bibliotecas-das-estacoes-do-trem-da-vale-promovero-circuito-de-leitura-especial---culinaria-mineira>>*

In order to enhance the railway heritage of Itabira, it is proposed to create programs that promote social and cultural activities in the city, as well as heritage education programs. created by Vale. The Vale's Railway Heritage Education Program, which from 2006 to 2015, offered residents of local communities training workshops in photographic and audiovisual language at the stations in the cities of Ouro Preto and Mariana. Within the scope of reading incentive activities carried out in the libraries of the Stations,

such as reading circuits, cultural workshops, soirees, and short story sessions. In this program, circuits were made for the community and the school public. The circuits consisted of a free round trip on the train, guided visit to the education and culture equipment installed at the stations and participation in workshops. During the train journey, the program monitors passed on information about natural occurrences of the stretch, spreading knowledge in relation to the region in which they live. (VALE s.d.).

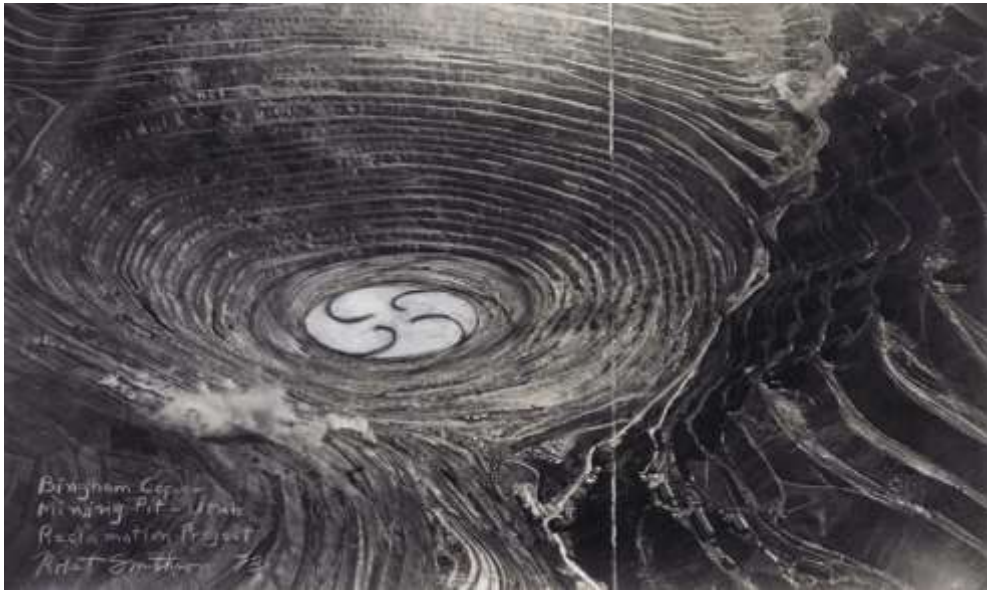
#### 5.3.7.5. ART FOR INDUSTRIAL LANDSCAPE



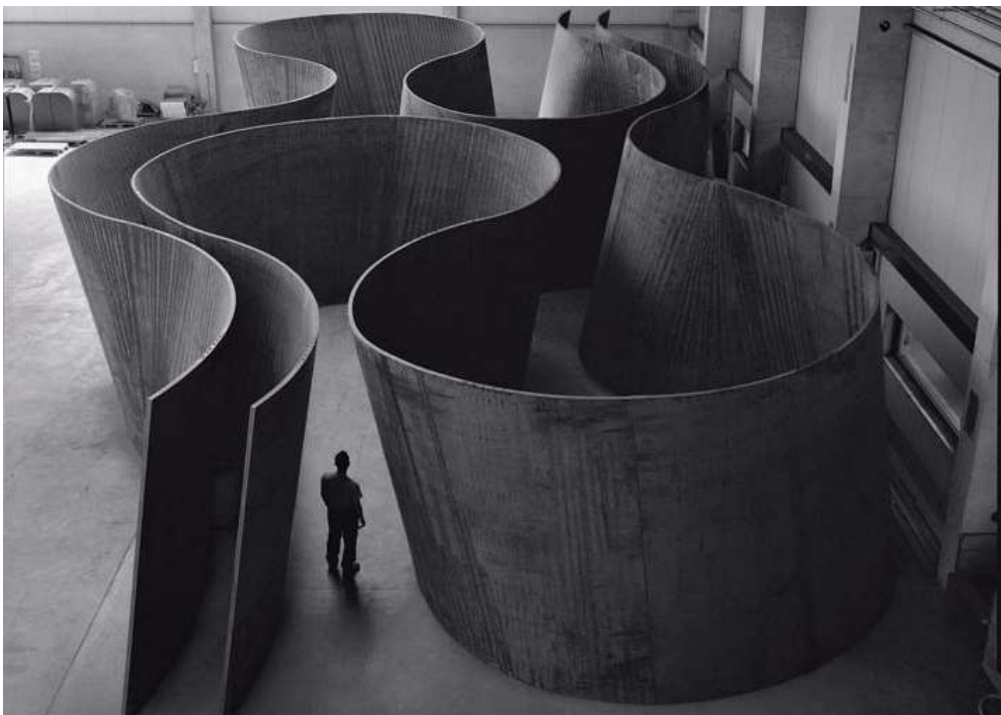
*Figure 48: Proposed site for Nancy Holt Sky Mound, 1986. 57 acres, height 100 ft. Meadowlands landfill in Hackensack, New Jersey. Photo by the artist. <<https://nmr.collinsandgoto.com/weblinks/frost/FrostTop.html>>*

Large scale works of art and environmental projects for the industrial landscape, as proposed by the author Brisaac (2006), in one of his proposals for the valorization of industrial culture in Itabira. According to the author, these interventions would reinforce the cultural attractiveness of the city and the region, in addition to highlighting its technological research and design centers to a wide audience. As references, he cites the program “Art for a specific place”, an artistic strategy created from the 1960s, by American artists who focused on large and complex spatial configurations, developing

ways of apprehending and intervening in landscapes and urban areas affected by industrial activities and large infrastructures. Another reference cited are the works of the artist Robert Smithson, who laid the foundations for this strategy. Their interventions took place in places in the process of disruption, related to erosion and industrial degradation. His works sought to confront the observer with the complexity and instability of these large-scale configurations.



*Figure 50: Project for copper mine Bingham -Utah Reclamation Project, 1973 Robert Smithson. Source: Notations About Drawing, accessed in 01 ago 2020 <<http://notations.aboutdrawing.org/robert-smithson/>>*



*Figure 49: Richard Serra piece of art. S.D. Source: Art Tribune, accessed in <https://www.tribune.com/report/2014/02/la-scultura-nuova-di-richard-serra/>*

In this context, one can also quote the artist Richard Serra. His works - large volumes in steel - restructure the landscape and problematize the look. Several Brazilian artists have works in this line, such as Nelson Felix, José Resende, Vic Muniz, Nuno Ramos, José Wagner Garcia and Carmela Gros (BRISAAC 2006).

#### 5.3.8. GUIDELINES

With regard to the valorization of industrial heritage, the construction of the revitalization process, in a future post-mining context in Itabira, and as to what future interventions in this area are concerned, the preservation of its functional integrity and the interventions carried out on this site must, both as possible, aim at maintaining its integrity (AZEVEDO 2010). As Fagiewicz and Mekarski (2018) recommends, ecological, economic, surrounding and socio-cultural factors must be considered because only such an approach could give an opportunity for a new quality on this kind of area.

Based on these arguments, the following guidelines are presented, that can highlight the beginning of this process, in order to maintain the integrity and authenticity of the site, so that, as industrial activities are suspended, the preservation and conservation of values and meanings is guaranteed of industrial heritage in this city, which were described earlier in this study. The guidelines were listed by areas of action, in order to facilitate the general understanding and the desired objectives. Pointing out that these guidelines are initial guides, and therefore others can be listed and those of practical and operational nature should be discussed, selected and implemented by the stakeholders directly involved with the city. Those involved should seek through their mutual gains actions all social actors involved with the site in question.



## **- ECOLOGICAL**

According to Fagiewicz and Mekarski (2018), the diagnosis of the ecological structure must include: the spatial connectivity of the post-mining areas and the natural areas around them and the application of ecological principles to shape the landscape structure. The formation of ecological connections must allow the communication between the post-mining geo-networks (external waste banks, internal waste banks, final wells) to be maintained and the systems systems that constitute the environment. The authors also highlight the strengthening of the ecological structure of post-mining geological systems. For example, through the introduction of wood seedlings and shrubs, the counters of large-scale internal waste banks are recovered in the agricultural direction or strengthen the biological stabilization of watercourses, newly built channels or water reservoirs. In the case of Itabira, additional measures can be included, such as risk management, so that mining in the vicinity of protected areas must be strictly supervised, to prevent environmental disasters; and, regarding safety and risk of disruptions, existing dams in Itabira and its surroundings should receive improvements, reinforcements and monitoring must be maintained.

## **- ECONOMIC**

To Fagiewicz and Mekarski (2018), the economic point of view regards an amount of capital expenditures to carry out reclamation and development and maintenance of the post-mining areas and their profitability. Economic factors must take into account the dynamics of the commune's development, the structure of the local economy and the demand for new investment areas, as well as the financial possibilities in the area of post-mining land management and its subsequent maintenance. Regarding the continuation of mining activities in Itabira: Research should be encouraged for new mining and recovery techniques in the areas explored; and the Mining in the sorroudings must be strictly monitored in order to prevent further disasters.

## **- SURROUNDINGS**

According to Fagiewicz and Mekarski (2018), the surroundings regard the accessibility to the postmining areas; distance from urban, industrial, service and protected areas, water bodies as well as cultural assets. In this area is also important to take into account location factors - transport and infrastructure links, access to post-mining areas, distances from industrial, service or tourist-recreational areas (water reservoirs, cultural facilities).

## **- SOCIOCULTURAL**

This area covers the preferences of the residents regarding reclamation and development, which are verified by socio – economic analysis of the community and also the diagnosis of the cultural values of the area. The regeneration of industrial areas needs the inclusion of local groups, in order to preserve the place identity and to initiate a beneficial re-use of the heritage site (CIZLER, PIZZERA e FISCHER 2014). After all, the local community, as a future user, should be able to determine its preferences regarding the selection of the reclamation and development of post-mining areas (FAGIEWICZ e MEKARSKI 2018). In the case of Itabira, the idea of recovering the image and identity of the region may prevail in the works, through initiatives that ensure the permanence of the subjectivity that the population maintains regarding their habitat and that regenerate faded self-esteem.

Initiatives that encourage research and information can also be considered, such as: (1) the creation of an incentive fund (maintained through the fund from compensatory measures from mining) for research involving the recovery of the affected areas, the reuse of tailings and improvements in mining processes. (2) mapping and cataloging of research involving Itabira and the mining theme that should be freely and easily accessible.

## 6. CONCLUSION

From this study, it can be concluded that, historically, the occupation of the urban space of Itabira has particularities peculiar to mining cities that generate socio-spatial processes marked by the different phases of the development of political, economic, and social relations. In the case of Itabira, all of them are linked to the existence of large and rich mineral deposits located around the urban site, which constitute a great value for the city. Unlike other mono-industrial cities where the urban core is installed close to the industries, it was the mining industry of Vale, which installed itself next to the urban site of Itabira and expanded in its direction, building, destroying, transforming and reconfiguring the urban space , over time.

The history and landscape of Itabira illustrate, in an exceptional way, the greatness of the social and economic structure generated by this industry. The exploitation of these riches represented a great economic development for the city, but brought, at the same time, great socio-political and environmental conflicts. In addition to representing the main source of revenue in the municipality, the extractive industry contributed to the generation of numerous direct and indirect jobs, offering raw materials for various types of industry. The industry in Itabira also had a profound impact on the growth of industrialization in the region of Minas Gerais, in Brazil and, consequently, on industrialized mining worldwide. In addition to the historical and economic aspects, its industrial legacy also involves social and intangible aspects, as the city has strong cultural and identity ties with this industry, which occupies a special place in the collective memory of the inhabitants. As demonstrated, the relationship between the community and the mining company has changed a lot over the years and this social aspect has been reframed throughout history, as the industry brought changes to the city that affected not only the economy and the environment, but also the lives of the entire population.

The way in which the city and the industry were developed, intrinsically in each other, constitute, therefore, an excellent and singular example of the role played by the mining industry in the development of a city and compose an industrial heritage of exceptional value. Its industrial complex forms an industrial monument where several important technological innovations in the extraction and processing of iron ore have been developed and improved and are now in universal use worldwide. In addition to the

industrial facilities, this heritage includes the mining landscape, the railway, and various intangible social aspects of the mining culture, which bear symbols capable of developing the community's sense of belonging to this city and mining.

Today, the city faces serious environmental and social issues, as well as structural difficulties in promoting policies for economic diversification and overcoming dependence on the mining sector and the imminent risk of exhaustion of the mining resources. The future possibility of depleting the mines would not exactly mean the mining company leaves the city, but it would certainly represent the loss of one of its main collection sources. The proximity of the end of a cycle shows the need for a strategy of transition to a new economic, social and cultural cycle, based on the search for economic alternatives that would reduce the impact of the end of iron ore exploration in order to contribute to the improvement the social development of the locality, making possible the so-called intergenerational equity to ensure that future generations develop.

In this sense, the valorization of the city's industrial heritage appears as one of the possibilities for consolidating this new economic base, outlined by strategies, proposals, and guidelines, based on ecological, economic, socio-cultural factors and their surroundings. These proposals should be enhanced by other projects that reinforce the mining identity of Itabira with vectors related to research, experimentation, and innovation. It is believed that the characteristics of the Itabira industrial landscape should be seen as an asset and that the contributions of this study can be useful in the formulation of developmental policies for the municipality of Itabira, both for today and for a future post-mining phase.

## 7. ANNEXES

### ANNEX 1: Questionnaire applied to the community via Google Forms:

# The Industrial Heritage in Itabira, Minas Gerais

This questionnaire is intended for residents and / or born in Itabira - MG, and was created with the aim of collecting an analysis sample for a survey of the Master in Management and Valorisation of Cultural Heritage at the Paris-Sorbonne University, in France. All responses are anonymous and will be used for academic purposes only.

**\*Obrigatório**

#### 1. Age \*

*Marcar apenas uma oval.*

- < 18 years old
- 18 to 25 years old
- 25 to 35 years old
- 35 to 45 years old
- 45 to 60 years old
- > 60 years old

#### 2. Gender \*

*Marcar apenas uma oval.*

- Feminino
- Masculino
- Outro

#### 3. Do you currently live in Itabira? \*

*Marcar apenas uma oval.*

- I was born and live in Itabira
- I was born, but I don't live in Itabira
- I was not born in Itabira, but I live here
- Other

4. Do you have any links with the mining sector? \*

*Marcar apenas uma oval.*

- I work or have worked at Vale
- Some member of my family works or has worked at Vale
- No
- Other

**Itabira  
and  
Mining**

Itabira is of great importance for the mining history of Minas Gerais and Brazil. The wealth of its deposits transformed the city into one of the largest producers of iron ore. It is also one of the ones that most collects from mining in the state and was also the birthplace of one of the largest mining companies in the world, Vale.

5. Read above and answer: did you know the importance of Itabira in the history of mining in Minas and Brazil? \*

*Marcar apenas uma oval.*

- Yes
- No
- Maybe

6. Do you think the history of Itabira is linked to mining? \*

*Marcar apenas uma oval.*

- Yes
- No
- Maybe
- Can't say

7. Do you think the history of Itabira is valued? \*

*Marcar apenas uma oval.*

- Valued
- Little valued
- Totally devalued
- Other

12. What are the disadvantages the company brought / still brings to Itabira? \*

*Marque todas que se aplicam.*

- Environmental Destruction
- Economic dependence
- Not a good company to work for
- Affects lifestyle (ex: poor working environment)
- It affects the quality of life (ex: it brings health problems)
- Limits the future options for the city
- Affects population health
- Other

#### Itabira's Future

13. Do you care about Itabira's future? \*

*Marcar apenas uma oval.*

- Yes
- No
- A little
- Can't say

14. Do you see a good future for Itabira? \*

*Marcar apenas uma oval.*

- I see a good future
  - I see a bad future
  - I never thought about it
  - I do not care about it
  - Other
- 
- Ensures the future of the city
  - Other

15. Justify your answer above

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Industrial  
Heritage in  
Itabira

Industrial Heritage is related to the vestiges left by an industry that have great historical and symbolic value for a region and that, due to this importance, acquire a unique value for society.

16. Read the definition above and answer: had you heard of Industrial Heritage? \*

*Marcar apenas uma oval.*

- Yes  
 No  
 Maybe

17. Do you think Itabira can be considered a city that has industrial heritage? \*

*Marcar apenas uma oval.*

- Yes  
 No  
 Maybe  
 Can't say

18. Do you think that valuing the industrial heritage of Itabira could be an alternative for the future? \*

*Marcar apenas uma oval.*

- Yes  
 No  
 Maybe

Additional comments



19. Use this space if you want to make any additional comments on this subject.

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Este conteúdo não foi criado nem aprovado pelo Google.

Google Formulários

**ANNEX 2:** Questionnaire applied to political, economic, community and union leadership in Itabira.



**EVALUATION OF SOCIOECONOMIC, ENVIRONMENTAL CONDITIONS AND FUTURE PERSPECTIVES OF THE CITY OF ITABIRA, MINAS GERAIS, BRAZIL.**

- 1) 1) In your opinion, what is the impact that mining activity in Itabira has brought to the following areas:
  - a. To the economy
  - b. To the community
  - c. To the environment
  
- 2) Thinking about the future of Itabira and the possible depletion of mines, what measures should be taken so that the city's economy is not harmed?
  
- 3) How do you see community participation in this process?
  
- 4) What about the participation of the municipal government?
  
- 5) And Vale's participation?
  
- 6) Thinking about the future of the city, do you think that something concrete has already been done?
  
- 7) How do you think the community perceives Vale's performance in the city?
  
- 8) Other considerations that you consider pertinent

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## 1. INTRODUCTION

The tutored project is an interdisciplinary collective work, foreseen in the TPTI master's program, whose objective is to intertwine the students' specialties to produce a research on a specific topic, contributing to the exchange of knowledge, developing personal and collective skills of those who are participants.

The theme chosen by the group during this TPTI promotion was the coastal dunes. The discussion on this subject is pertinent not only because it is a unique landscape and a natural heritage to be preserved, but also because the dunes are a complex and delicate natural system, that perform extremely important environmental functions and that are being threatened due to climatic changes and anthropic actions. Also, the three countries that were part of the students' student path during these years (France, Italy and Portugal) have interesting aspects on this theme and several projects and studies involving the coastal dunes.

Tutored by the project manager and forestry history researcher, Professor Dr. Ignacio Pereda Garcia, the team members were the architects Daniele Pasinetti, Gabriela Procopio and Joseph Tannous, the archivist Jean Paul and the historian Khady Sarr. Due to the different areas of knowledge of each one and the different cultures, it was possible to analyze the issue of dunes from different perspectives, resulting in a multidisciplinary research and in the production of a website on the subject.

The chosen cases for the project were the coastal dunes of Costa da Caparica, in Portugal and the dune system of the lagoon of Venice, in Italy. In each case, the geomorphological characteristics of each region were analyzed, as well as their evolution, the history of the region's development, the main problems involving the dunes and, finally, the projects, interventions and protective measures that have been applied for their preservation.

At the end of the research, as a final product of the project, a website was created to not only summarize and disseminate all the research produced during these two years of study, but also to promote the awareness of the problems related to the dunes and to enable access to this kind of information in a wider scale.

## 2. THE COLLECTIVE PROJECT: THE COSTAL DUNES



*Figure 1: Costa da Caparica dunes, with a sign saying "protect the dunes". Image by Carlos Costa/Global Imagens.*

The dunes are a natural heritage and unique landscape. These hills of white and fine sands, which have the brilliance revealed by the sun and the shape shaped by the winds, represent a complex ecosystem that, through the interaction between nature and humans, shape this natural landscape in a unique way.

In addition to representing reservoirs of natural sediments that feed the beaches, the dunes are the environment for countless species of plants and animals that are of great importance for the environment. This set of elements generates a complex system where the interaction between wind, sand and vegetation makes the dunes gain distinct contours, which are defined through differentiations closely related to the direction of the dominant wind, to the conformation of the surface traversed by sediments from their availability, the action of winds on the beach and the location of these dunes within the coastal segment. (PINHEIRO, 2009).



## 2.1. OBJECTIVES AND JUSTIFICATION

Coastal dunes have important environmental functions: they stabilize the coastline, protect the groundwater, and also constitute a natural barrier against the ocean waves.

They are considered important ecosystems because they have a unique biological diversity, composed of a flora rich in species and a fauna consisting of insects, reptiles, amphibians, small mammals and some species of sea birds that use the dunes to build their nests. (Moura 2009).

Besides the importance already mentioned, the unique beauty of the dunes also make them a very strong tourist attraction. Coastal regions are very popular destinations, especially in the summer, for visitors motivated by the pursuit of leisure, scenic diversity and by contact with nature. Because it is a fragile and dynamic system, dunes and beaches are susceptible to several changes in their morphological dynamics, which can be caused by both natural phenomena, such as fluctuations in the relative sea level and climate changes, as well as by human intervention, such as erosion due to the construction of fixed structures in the front dunes caused by the urbanization of the shore and occupation by the real estate sector, which obstruct the natural movement of replacement and transport of sand by wind and sea (PIANNA n.d.).

Making the preservation of the dune system and its biodiversity compatible with climate change, with the needs of urban areas and the use of the beaches on our coast is a challenge for the preservation of this natural heritage and many projects and participatory actions have been carried out with this aim, defining policies and strategies to solve these types of problems.

This project therefore aims to enhance this natural heritage, understanding its importance for the environment and society, in addition to forming a discussion on the subject in the hope of creating a collective conscience, so that academics, professionals and managers, together with the community, can be sensitized and aware of this heritage so important for environmental balance.

## **2.2. WORK ORGANIZATION**

In order to become better acquainted with the theme, the first semester in Paris focused mainly on a general understanding of the context of coastal dunes and on the various types of possible research approaches. That semester, the objective was to concentrate mainly on visiting the Paris libraries in order to find bibliographical references on the subject, to help better delimit the theme and choose the case studies.

Based on the references found and the group discussions, it was decided that the cases to be studied should be located in the countries where we would spend the next two semesters, that is Italy and Portugal, and also in the vicinity of the cities in which we would be living for so that it was possible to visit these dunes in person and also meet projects and people involved in the cause of the environmental protection of this heritage. In addition, two members of the group had Portuguese and Italian as their native language, and this would greatly facilitate access to information and expand the range of bibliographic references, thus contributing to the enrichment of the project.

Finally, it was determined that our project would mainly deal with exploratory research, which would involve gathering information about the dunes and understanding the problems involved in their preservation, in order to increase familiarity with the subject and formulate more precise problems and hypotheses. Throughout the research process, all results and findings would be shared with the entire group so that all participants could have a global understanding of the subject.

From these premises, the following case studies were chosen for the development of the research: the dune systems of the Venice lagoon, in the Veneto region, in Italy; and the coastal dunes of Costa da Caparica, in the Setúbal region, in Portugal. The research structure was divided into three main topics: the morphogenic and historical characteristics of each dune, the problems faced in each case and, finally, the projects that were created or are being carried out to safeguard this heritage. All the results obtained would serve as a fundamental basis for the development of a website, which would be the final product of this project to enhance coastal dunes.

From this, the organization of the work, the determination of the research content, the instruments of data collection and analysis and the final product of the project were determined based on the training, interests and inclinations of each participant, and also based on in the language spoken by each student. Together, always with the help of tutor Ignacio, everyone dedicated themselves to familiarize themselves with the theme, which until then was little known by the participants. It was researched how the dune system is formed, how it is organized, the environmental functions that the dunes exercise, the particularities that may exist in each case and what are the main problems faced when it comes to the preservation of this ecosystem.

Soon after this general contextualization, students dedicated themselves to studying more specific things, according to their particular interests and inclinations. Those who were interested in historical research were dedicated to understanding the history of the dunes, their functioning, the natural dynamics of this ecosystem and the changes, problems and challenges that exist when it comes to preserving this ecosystem. Those who were more interested in the social aspect, dedicated themselves to understanding the anthropic interaction that exists in this environment and how it influences the preservation of the dunes. For example, how the cultural valorization of these spaces has been an important vector of occupation and accelerated urbanization, how does their interaction with the environment work, etc. Others dedicated themselves to the study of actions and projects to safeguard the dunes and what has been done to preserve these fragile structures. In addition, those who had specific digital skills decided to enrich the project by applying them to this research. To understand the evolution of the dunes over the centuries, for example, the potential of the geographic information system (GIS) was explored, which allowed observing the changes that occurred in these territories and making a richer environmental diagnosis, through historical images and satellite images. Another specific digital skill used in this project was the programming language, which was used to develop the project's final product, a website, which had transmitted, in a dynamic and democratic way, all the research carried out during these two years.

### 2.3. METHODOLOGY AND BIBLIOGRAPHY

In addition to defining the type of research and its universe, it was also very important to address the main methodologies for the production of the project, to provide a better understanding of the objectives set and thus be able to assist our study and improve the productivity and quality of research that would be carried out. It was then determined that the most suitable research methods for the development of this project would be the bibliographic and documentary research for each particular case study, to obtain information about the topic from different bibliographic materials already published, from old maps and others documents, putting different authors and data in dialogue; and all information would be complemented with field visits and other activities that add to the development of the project.

Another important aspect for the development of the study was the search of several bibliographic sources to bring more credibility to the study. Various types of articles and theses were found on the subject of coastal dunes and in several languages. As it is a polyglot group, it was very enriching. Bibliographic research allows the recognition and contribution of other writers and researchers to the project.

During the semester in Italy, with the fortnightly monitoring of the tutor via skype, the study of the dunes in Venice was based mainly on the search of bibliographic references in libraries in the region, such as the Biblioteca Centrale di Agripolis «Pietro Arduino», located in the city of Padova and the Ateneo library system, in the collection of satellite images, in the research of old maps that showed the evolution of the dunes over the centuries, in projects that aim to maintain the ecological integrity of these habitats, as is the case of the Life ReDune project, coordinated by the Universidad Cà Foscari di Venezia, and also in other bibliographic references and studies on dune protection.

During the semester in Portugal, the research took place in a similar way. Fortnightly meetings were held with the professor, in Évora or Lisbon, searches for bibliographic references, and discussions of the results found, always shared in groups. The chosen case study was the dunes of the city of Costa da Caparica, in the Setubal region. During the semester, in addition to the bibliographic references and

projects found, it was possible to meet other researchers who study these and other cases. It was also possible to attend conferences on the history of peri-urban forests in Portugal, in addition to a field visit to the dunes of Costa da Caparica.

### 3. THE INDIVIDUAL PROJECT: THE CASE OF COSTA DA CAPARICA



*Figure 2: Costa da Caparica, in Portugal, 2009. Photo by Vitor Oliveira. Source: <https://flic.kr/p/2gSAqiE>*

#### 3.1. GENERAL CHARACTERISTICS

Located in the small municipality of Almada, on the coast of Portugal, the parish Costa de Caparica occupies an area of 10.74 km<sup>2</sup> between the sea and the escarpment. Stretched, narrow and with a diversity of physical and landscape characteristics, it is the largest continuous beach in the country, with an extension of approximately 30 km, between the left bank of the Tagus River and the Albufeira Lagoon (TRYP 2018). Costa da Caparica is popularly known for its beaches and is easily accessible from Lisbon, which makes the region a holiday destination for many

tourists, although the problem of the disorder of the territory and the sharp retreat of the coastline be a topic discussed constantly (OLIVEIRA 2015).

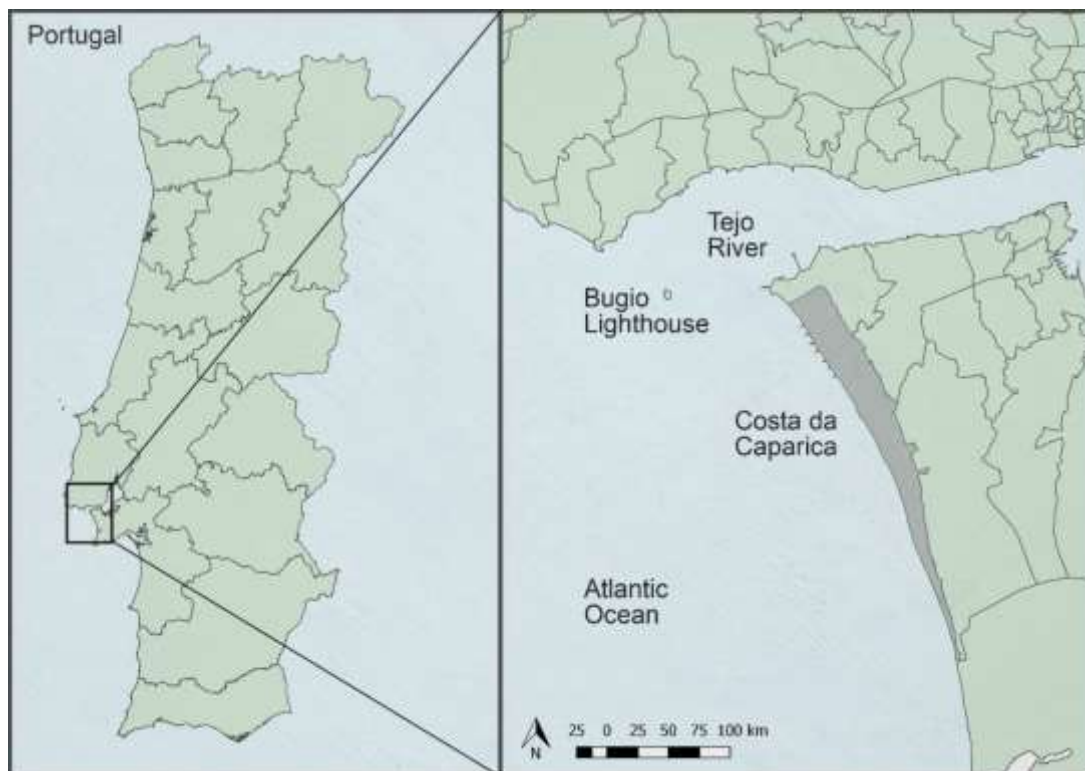


Figure 3: Location Map of Costa da Caparica (Author: Gabriela Procópio).

Some of the beaches that compose Costa da Caparica are: *São João de Caparica*: it is the northernmost location of Costa de Caparica, just after the mouth of the Tagus which offers views of Lisbon and the mouth of the river; *San João de Caparica Sur*: It is the continuation of the beach mentioned above, very frequented by those who stay in the campsites of the region; *the Vila da Costa beach*: close to the urban center, with many neighboring bars and restaurants, it is a small beach, very popular for surfing; *Terras da Costa Sul and Acacias Norte beaches*: more familiar beaches, with many children and with possibilities to practice sports like beach volleyball. *Acacias and Acacias Sur beaches*: which are beaches that attract a younger audience, with an environment where there are many bars and nightlife venues. *Playa dos Medos and Playa dos Medos Sur*: which have a party and fun atmosphere from the neighboring northern beach, but which also brings together those who come to practice kitesurfing in Costa de Caparica; and *Fonte da Telha beach*: It is the end of the beach line known as Costa de Caparica and the gate of Serra da Arrábida. Familiar and accessible by public transport and car, with very blue waters and a wide strip of

sand. (VOYALISBOA 2019). Very familiar and accessible by public transport and car, with very blue waters and a wide strip of sand. (VOYALISBOA 2019).

Historically, this parish has a strong connection to the sea, since it is a land built by fishermen, inculcated by a strong culture and tradition of fishing roots that give it its unique identity. But alongside the sea, also its agricultural land, they are fertile and, equally, they play a major role in the Metropolitan Area of Lisbon (CAPARICA 2020).

According to Fernandes (2012) and Oliveira (2015), it was around 1770 that the first fishermen from Ílhavo settled on a strip of sand that stretched between the ocean and an old cliff that reaches 70 to 100 meters at the highest points. Some started by settling in the place, always in humble wooden and thatched huts, later joining Algarve fishermen and another part came just for fishing during the summer. This first population that settled in the Costa saw the fishing for their survival, but to overcome the winters of storms and little fish, agriculture also emerged as a complete activity.



*Figure 4: Costa de Caparica and its beaches. S.D. Source: <https://lisbonlisboaportugal.com/images/costa-da-caparica/costa-da-caparica-summer-2.jpg>. Accessed in 12/2019*



Figure 5: The Trafaria and the Caparica Coast area. From *El Atlas del Rey Planeta* (detail), Pedro Teixeira, 1634. Source: <https://almada-virtual-museum.blogspot.com/>



Figure 6: Housing centers in Costa de Caparica, Military Charter of 1816. Source: <http://fronteirasurbanas.ie.ul.pt/>



Above, in *figure 5*, you can clearly see the growth of the sand in the area of Trafaria and Costa da Caparica. Also, in a military map of the Setúbal Peninsula dated 1816 (*figure 6*), two separate housing groups can already be seen, one to the north (Medo Inglês), with four masonry constructions and as many tents and one to the south (Cabanas da Costa), with only half a dozen boats.

According to Oliveira (2015), it was after a big fire in 1886 that fishermen stopped living in tents and started to live in new masonry constructions. From then on, new blocks emerged and began to extend from the current Costa Pinto neighborhood to Pescadores Street. But then quickly, Costa de Caparica is no longer just a village of humble fishermen. In the 20th century, in the 20s, Costa de Caparica is classified as a tourist resort, attracting tourists who sought the sun and the sea.

Currently, Costa de Caparica continues to be the holiday destination of many tourists for its beaches and sun, especially after 1966, with the construction of the 25 de Abril Bridge. Also, from the 1960s onwards, urban pressure accelerated, with the construction of second homes skyrocketing exponentially. In 1986 Costa de Caparica was elevated to Vila and in 2004 elevated to Cidade. The growth of the region brought several problems related to the disordered growth of the territory and the sharp retreat of the coastline, themes that are now widely discussed.



*Figure 7 and 8: On the left, Caparica's Coast around 1962 and on the right, in the 80's. Source : Oliveira, 2015.*



Figure 9,10,11: On the top left : Postcard from the « Sunset beach » in Costa da Caparica during the summer season (Photo by Dinis, n.d. apud Silva, 2012). On the top right : « Sunset beach », in Costa da Caparica n.d.(Source:<https://retratosdeportugal.blogspot.com/2015/08/costa-da-caparica-praia-do-sol.html>) and below, the same « sunset beach » recently, s.d (Source : <https://www.tripadvisor.es/>).

### 3.2. THE EVOLUTION OF THE COAST

The components that define a landscape are deeply dynamic and are constantly changing, due to natural or man-made causes. In the case of Costa da Caparica, there were several changes in its coastline as well as interactions of tectonic movements and sea level oscillations (M. N. OLIVEIRA 2015). In the study area, the main changes in the coastline mainly cover the mouth of the Tagus River, or Bugio sandbank, that is, a sandbar that connects the and Cova do Vapor. This goal was not always closed, as you can see in figure 10 and 11, and its closing / opening is responsible for important changes in the sand of Costa de Caparica and Cova do Vapo



Figure 12: Bugio Lighthouse and Cova do Vapor. Robert de Vaugondy, Gies, 1751. Source: Oliveira (2015)



Figure 13: Boat Channel (a golada), The environs and harbour of Lisbon, Laurie & James Whittle, 1812. Source: Lisbon Nacional Library

According to Oliveira (2015), in 1845 there was the beginning of a retreat of about 750 m from the free tip of the Cova do Vapor sandbank towards the Bugio lighthouse. Between 1879 and 1893 this retreat is accentuated and the tip of the sandbank advances 400m towards the lighthouse. In the second half of the 19th century, the sandbank of Bugio suffered a sharp retreat, causing its opening. From the century onwards, the sandbank advances towards the Bugio Lighthouse, promoting its closure. Despite a slight reversal of the Costa line in 1929, it remained stable.

According to Rocha (2011), between 1929 and 1957 the sand tongue retreated about 3 km (figure 12), and during the 1940s the Tagus' goal broke. The free end of the sandbank (Golada do Tejo) advances 750 m towards the Bugio Lighthosue and retreats about 200 m on the riverbank west of Trafaria. From the opening of this natural barrier, the retreat of the coastline was evident and forced the execution of coastal defense works (spurs and walls). From 1940 on, an erosion process and a sharp reduction in the sandbank that connected the Cova do Vapor to the Bugio began, making it possible to pass only at low tide. This reduction is a consequence of dredging carried out in this area and in which the destination of the dredged materials remains unknown. (M. N. OLIVEIRA 2015).



Figure 14 : The evolution of the Costa line between 1870 and 1972, based on a satellite image from Google Earth 2015. Adapted from (Gomes, Costa da caparica Artificial Sand Nourishment and Costal Dynamics 2009, 679).

According to Pinto et al. (2012) and Oliveira (2015), from 1959, the evolution of Costa de Caparica is based on the following events:

- **From 1959 to 1963:** There was a retreat of the 150m beach line. Construction of 3 spurs and adherent work at Cova do Vapor;

- **From 1964 to 1972:** In 1964 the Fóssil cliff was artificially cut for the passage of the road that connected Costa de Caparica to the center of Almada, currently IC20 (COSTA, 2007 apud Oliveira, 2015). There was also the construction of the adherent work (1969) and 7 spurs (1971) in Costa da Caparica. In 1971, the first reference is made to the artificial feeding of beaches in Costa de Caparica (PINTO et al., 2007 apud Oliveira, 2015).

- **From 1995 to 2007:** Until 1995 the situation was stabilized, although with progressive loss of width and volumetry of the beach. Since 1996, erosion has intensified in SJC (> 30m) (reduction of the beach width; retreat of the dune cord; destruction of beach supports, episodes of overflow / flooding). Between 1999 and

2002 the coast line retreated on average about 14.6 m (PINTO et al., 2007 apud Oliveira, 2015).

- **From 2007 to 2009:** Beginning of works for the Costa Polis program, namely the artificial feeding of beaches with 2.5 Mm<sup>3</sup> of dredged sand from the navigation channel of the Port of Lisbon;



Figure 15: Intervention performed for the repair of spurs and adherent longitudinal work (2004 to 2006)



Figure 16 : Artificial nourishment in 2007 (0.5 Mm<sup>3</sup>), 2008 (1 Mm<sup>3</sup>), 2009 (1 Mm<sup>3</sup>). Source: PINTO, 2012

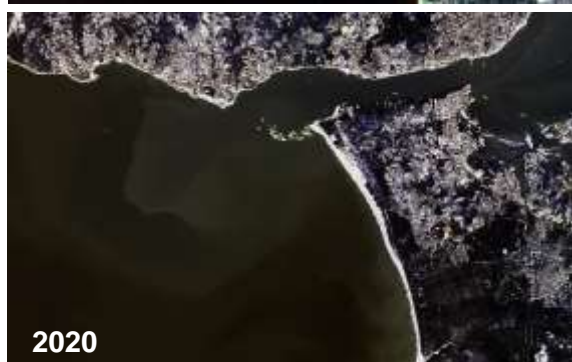
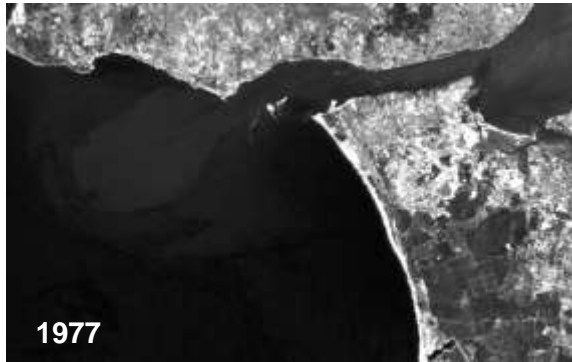
- **From 2013 to 2014:** numerous reports of intense erosion due to violent sea overflows, partial destruction of beach supports on the urban front of Costa de Caparica; artificial feeding of beaches with 1 Mm<sup>3</sup> of dredged sand in the navigation channel of the Port of Lisbon (started in July 2014).



Figure 17: Views of the Costa da Caparica beach deprived of sand in 2006 (A; courtesy of Alveirinho Dias) and the beach and its marginal strip after the last major intervention in 2014 (B). This arrangement has remained substantially constant since 2010, with only some interventions in the support structures and the replacement of small amounts of sand that are lost annually (a few hundred thousand cubic metres per year from approximately 2 km of beach).

Complementing the authors' information, the following images show, from the same point of view, the various changes that have occurred in the Costa da Caparica region over the past centuries. These images were produced by integrating Quantum GIS technology (which allows the integration of recent orbital images, available in the Google Earth system) to historical or ancient maps of the region. For the realization of these images (figure 16) were used the map of *Laurie & James Whittle (1812)*, available in the Lisbon Nacional Library ; the chorographic map of Lisbon's surroundings, made by *Gúerin Delamotte (1821)*, made available by the Harvard Library map collection; the chorographic map of Portugal, containing the administrative division by municipality, by *José A. F. de Madureira Beça (1901)*, available in the Lisbon Nacional Library; and images from the Landsat 2,5,7 and 8 satellites obtained through the Earth Explorer Portal database, from USGS, of the years of 1977, 1989, 2000, 2007, 2011, 2012 e 2020.

Through these images obtained it is possible to see, for example, the growth of urban areas, the marine dynamics caused by the proximity of the Tagus River and the Atlantic Ocean in addition to the sharp retreat of the region's coastline.



### 3.3. PROBLEMS AND POSSIBLE CAUSES

Dunes, even when stabilized, are very fragile systems that, due to various factors, are subject to actions that can unbalance the entire structure. According to Oliveira (2015), the main problems reported in Costa da Caparica are mainly related to the rehabilitation of the coastline, the dismantling of the territory and the erosion process. But all these factors are not isolated facts, they can be a consequence of each other, where each problem triggers or aggravates the other.

Regarding the erosion process, there are three incompatible phenomena on the coast that, together or separately, contributed to this problem in Costa de Caparica: human occupation, the strong reduction in sedimentary supply and the eustatic rise in sea water levels (M. N. OLIVEIRA 2015).

Concerning the retreat of the coastline, the Tagus river, for example, has a fundamental role in retaining the sands that prevent the sea from advancing. Despite the fact that the goal was not stable over the centuries - as confirmed by the cartography already presented, that in different periods of history the goal was open and in others it was closed, with variation of the coastline - it is known today that the break this is also due in large part to human action (M. A. ROCHA 2011).

After erosion and the retreat of the coastline, the disorder of the territory is the most serious problem that affects the study area and has been dragging on for decades. In Costa da Caparica, the disorder of the territory is characterized by a strong urban pressure that, since the 30s of the 20th century, with a strongly consolidated urban area and close to the sea.

Irregular housing, campsites, housing in protected and extremely sensitive areas (foothills and platform above the fossil cliff), poorly located beach supports (over the dunes), the non-preservation of water lines, poor soil management and its increasing waterproofing, the massification of urban agglomerations, among others, are the main problems that characterize the study area (M. N. OLIVEIRA 2015)



### 3.4. SAFEGUARD PLANS AND PROJECTS

The complexity of coastal areas makes them extremely sensitive and vulnerable systems and, in order to mitigate the damage and guide their uses and / or management, several protection and replacement measures have been taken over the years for the beaches of Costa de Caparica. In the 20th century, two projects for the city stand out: the utopian plan of Cassino Branco, from 1930, where the architect proposed a transformation of Praia do Sol into an exuberant bathing complex (figure 17) and the Urbanization Plan by architect Faria da Costa , from 1946, which was only partially executed and served as a basis for the consolidated urban core of Costa de Caparica (figure 18) (M. N. OLIVEIRA 2015).



Figure 18 and 19: on the left, the Costa da Caparica Urbanization Plan, 1930, by the architect Cassiano Branco. Where there's the beach complex with ample spaces for activities, as well as an artificial canal that extends parallel to the sea and separates the beach from the tourist complex. And on the right, the Faria Costa project, which proposed displacement of the population, works for satellite agglomerations, urbanization of the area adjacent to the beach and afforestation in neighborhoods and boulevards. Source : Oliveira, 2015.

With the erosion and retreat of the coastline becoming more and more constant, several coastal engineering works were carried out over the years to remedy the situation. According to Oliveira (2015), in 1959, the E1 spur was built and in 1962 and 1963, the E2 and E3 spurs were created, which would be extended later, in addition, there was the construction of the first adherent longitudinal defense (wall) between these spurs. Finally, in 1969, the spurs EC1 to EC7 were created (figure 20).



Figure 20: Spurs built in Costa da Caparica and Cova do Vapor. Image: Google Earth, 2015.

Among the most recent projects for protection from the beaches of Costa da Caparica, stand out:

The **Coastal Zone Management Plan (POOC)**, a plan capable of hierarchically superimposing itself on the Municipal Plans, which establishes a programmatic basis for an intervention for the requalification of beaches along the Costa da Caparica and which was created in order to control construction and urban growth, attract private entities in the tourism sector and hoteliers for the area, preserve protected areas and encourage agricultural practice (R. MENDES 2013).

The Polis Program, which, through a strategic action plan, aimed to promote interventions in the urban and environmental aspects, for urban requalification and the environmental enhancement of this parish in the municipality of Almada. (ALMADA 2009). In this program, the first works began in 2006, with the construction of Jardim Urbano, opened on June 1, 2008 and the program extended until 2013. But the Costa Polis ended without the proposed interventions initially having been completed in totality (OLIVEIRA 2015).

The Polis Program for Costa de Caparica started with very good intentions and was very well accepted by the population that was anxious to see their city free from that disorder, but over the years, what little has been done has turned out to be a real failure, either due to the lack of study of the intervention area and its natural and historical-social characteristics, or due to the inadequacy of materials and pavements

used, the mischaracterization of the coastal front with the demolition of some haystacks and the construction of new beach supports. (OLIVEIRA 2015)

Descata is also the Intervention **Project of the Portuguese Environmental Agency (APA)**, beginning in August 2019, which consisted of artificial feeding the urban beaches of Costa de Caparica and S. João de Caparica with 1 million cubic meters. The total investment, carried out in partnership with APL, is around 5.8 million euros and was financed by community funds from POSEUR - Operational Program Sustainability and Efficiency in the Use of Resources (APA s.d.).

Created by APA, the **Reduna Project** - Ecological Restoration and Restoration of the Dunar System of S. João da Caparica - aimed at implementing a set of integrated coastal protection actions, promoting ecological restoration and structuring the dune cord in front of the beaches of S. João da Caparica. Actions were taken such as the installation of access conditioning and trampling control structures, the placement of information signs and palisades, and the dune population with plants adapted to these ecosystems. Wicker palisades have been installed over a length of 1 km, which have the function of retaining the sand carried by the wind. At the same time, dune species adapted to these ecosystems were planted, such as the reversal, the thistle, the clove, and the shrimp, essential for fixing the sands and stimulating local biodiversity. At the same time, new accesses were defined and installed, with specific structures for this purpose, in order to limit trampling and circulation through the dunes. The entire ecological dune restoration process is regularly monitored, in partnership with Research Centers and Universities. (REDUNA s.d.).



Figure 21 : Images of the interventions carried out by the project on the beach of São João da Caparica. S.d. Source: Almada City Council - Reduna Project. Available at: <http://www.m-almada.pt>.

In addition, there was also an academic research project, such as the Change Project, developed at the Social Sciences Institute of the University of Lisbon, in collaboration with a research team from the Faculty of Sciences of the same university. That ran until 2013 and was funded by the Foundation for Science and Technology. (CHANGE s.d.).

#### 4. PROCESSES AND RESULTS

The presented study was the result of intense and rewarding research, which was not always easy, direct, and conclusive. During the process, some difficulties were encountered. The first was to reconcile the project's research with the other mandatory activities required of the master's. The amount of external commitments to the project and the physical distance between the tutor and the group participants made it difficult for

some students to discipline and commit to the project, but the tutor's work methodology, the consistency of meetings despite the distance, and the methodology that was established was bringing a more constant and systemic work rhythm and, little by little, it was possible to better organize the research routine and proceed with the studies in a satisfactory manner. In Portugal, with the physical presence of the teacher and also familiarity with the topic, the research could proceed more dynamically.



*Figure 22: Visit to Costa da Caparica in November/2019. Photo: Ignacio Garcia*

Also, during the two years of development of this study, the research and construction of the project brought great contribution to all who participated, not only a scientific contribution, but also a personal gain. It was primarily an important advance in relation to an area of knowledge that until then was unknown. Through the study of coastal dunes, it was possible to understand the importance of these ecosystems for the functioning and balance of the environment and also understand how significant and pertinent it is to discuss ways to preserve this environment and seek a balance between society and use rational use of these natural means.

It was also possible to learn how to do a research in a consistent and careful way, after all, the act of researching with all its variables, consists in the act of defending an idea, grounding it with bibliographies and data extracted from the real world and the results through questionnaires, deductions, implications, proofs, people related at the

same time to show graphs the analyzes and interpretations of the results obtained with the research. It is to seek new information from existing ones and cross knowledge.



*Figure 23: Above: the environment of the Venice lagoon valley, photo by Fulvio Roiter. Below: the environment of Costa da Caparica in 2016, photo by Thibault Poriel.*

The case studies of this project have many differences. Each has unique characteristics due to the nature of the sites, from the historical and geographic /

morphological point of view, but they are also different in relation to the complexity and succession of human interventions involved in the evolution of each region.

From the morphological point of view, for example, the two cases are quite different. The area studied in Venice, is an interdunal coastal lagoon, which is produced by the interaction of water courses and the sea and which is losing its original shape due to erosive phenomena and rising sea levels and soil subsidence. The case of Costa da Caparica, on the other hand, is a coastal dune that has direct contact with the sea, without this intermediate zone, but which have also been suffering similar problems of erosion and retreat of the dune cord, as shown above .

Despite their singularities, the results of the research showed that in both cases there were major changes, which mainly involve human intervention in these areas. In Venice, for example, the tendency of human action to dig deeper into the lagoon's entrance channels led to a greater generalized depth of the seabed and canceled the ancient hydrodynamic role of the lagoon channels in controlling the spread of the tide, changing radically the sea regime. currents from almost the entire lagoon. In Costa da Caparica, the construction of fixed structures in the front dunes caused by the urbanization of the coast and occupation by the real estate sector brought about several changes in the dune coasts.

The study also showed that there are several safeguard projects and several people involved in the protection of this heritage, but that there is still a need for greater awareness on the part of the population about the subject and that is why the idea of creating the site is so necessary for that these studies are not restricted only to the academic field but that they are democratized and that the general population has access to this type of information and that it is an incentive for other countries and regions to encourage research on this subject and promote the preservation of this natural heritage.

The result of the project was, in addition to the research, the creation of a public website, which allowed the dissemination of these two years of research. On the website, educational contents are shared, such as information on coastal dunes, studies carried out during these two years of research, in addition to other references dealing with the subject. The site also has more tourist content available, where you can find information about the dunes in general.

## 5. CONCLUSION

In general terms, the process that led to this study provided very enriching experiences in terms of academic research, in the sense of making those who research more oriented to details and creating good research habits. In addition, the research act enabled qualification in relation to the ability to identify trends and patterns and to gather good bibliographic references. The collective work was also useful as a social experience, when working in different professional contexts and cultures.

Regarding the chosen theme, the coastal dunes, the research allowed to understand the ecological importance of this fragile ecosystem. The dunes are an extremely important community heritage that have important environmental functions: they stabilize the coastline, protect the water table, constitute a natural barrier against sea surfs and are habitat for different species of fauna and flora. It was also possible to understand how this ecosystem has been affected by several factors and what are the consequences as a result of these environmental changes.

In the individual research, it was possible to see the natural and man-made events that have contributed over the years to the evolution of this section of the Portuguese coast have been chronologically presented. With the use of images, cartography, and constant descriptions of varied documentation, we present the evolution of this coastal section, which from the 1940s onwards entered a marked process of erosion. The anthropic evolution of this coast has been rapid, having in its origin the occupation by fishermen and that, from the 30s of the twentieth century, has become the most popular seaside resort on the south bank of the Tagus. The main consequences are the disorder of the territory; worsening of the natural risks to which it is subject; increasing artificialization of the coastline; emerging coastal defense works; industrialization; progressive retreat from the coastline.



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