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AN OVERVIEW OF MINING ROYALTY REVENUES IN THE BRAZILIAN AMAZON AND REFLECTIONS ON SOCIOECONOMIC INDICATORS

UM PANORAMA DAS RECEITAS DE DIREITOS DE MINERAÇÃO NA AMAZÔNIA BRASILEIRA E REFLEXÕES SOBRE INDICADORES SOCIOECONÔMICOS

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Abstract

Mining contributes to the economic growth of many countries where this activity is developed. In Brazil, mining is one of the primary sectors of the economy and plays an important role in the country's trade balance. Financial Compensation for Exploration of Mineral Resources (CFEM) is an important means of public revenue within the mineral sector, which should be employed for the benefit of the local community through investments in infrastructure, health, education and environmental quality. We analyzed the collection of CFEM from 2011 to 2018 in states of the Brazilian Amazon that correspond to the Northern Region of Brazil (Acre, Amapá, Amazonas, Pará, Rondônia, Roraima and Tocantins), and verified whether revenues have a reflection on socioeconomic indicators. To this end, we use data from the National Mining Agency (NMA), the Municipal Human Development Index (MHDI) and the FIRJAN Municipal Development Index (FMDI). This study showed that, among the states, Pará had the highest revenue from CFEM in the period analyzed, but also the lowest human development indices in the Northern Region. Furthermore, the main mining municipality - Parauapebas - had moderate development rates, lower than expected for a state that receives the largest amount of mining royalties, which come mainly from iron ore exploration. Therefore, this study confirms an ineffective public management in the country regarding the use of revenues from CFEM in the Brazilian Amazon, with insignificant contribution to its development, calling attention to the need to discuss possible solutions to this problem.

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Resumo

A mineração contribui para o crescimento econômico de muitos países onde esta atividade é desenvolvida. No Brasil, a mineração é um dos principais setores da economia e desempenha um papel importante na balança comercial do país. A Compensação Financeira pela Exploração de Recursos Minerais (CFEM) é um importante meio de receita pública dentro do setor mineral, que deve ser empregado em benefício da comunidade local por meio de investimentos em infraestrutura, saúde, educação e qualidade ambiental. Analisamos a arrecadação do CFEM de 2011 a 2018 nos estados da Amazônia Legal que correspondem à Região Norte do Brasil (Acre, Amapá, Amazonas, Pará, Rondônia, Roraima e Tocantins) e verificamos se as receitas têm reflexo nos indicadores socioeconômicos. Para tanto, utilizamos dados da Agência Nacional de Mineração (NMA), do Índice de Desenvolvimento Humano Municipal (IDHM) e do Índice de Desenvolvimento Municipal da FIRJAN (FMDI). Este estudo mostrou que, entre os estados, o Pará teve a maior receita da CFEM no período analisado, mas também os menores índices de desenvolvimento humano da Região Norte. Além disso, o principal município minerador - Parauapebas - apresentou taxas de desenvolvimento moderadas, abaixo do esperado para um estado que recebe a maior quantidade de royalties de mineração, que vêm principalmente da exploração de minério de ferro. Portanto, este estudo confirma uma gestão pública ineficaz no país quanto à utilização das receitas do CFEM na Amazônia brasileira, com contribuição insignificante para o seu desenvolvimento, chamando a atenção para a necessidade de discutir possíveis soluções para este problema.

Palavras-chave: Mineração. Royalties. Desenvolvimento socioeconômico. Amazônia brasileira.

Introduction

The mineral sector stands out for being a base industry that drives the growth of Gross Domestic Product (GDP) and favors the economic development of countries (HOWARD, 2019). The mineral products generated in this activity become raw materials for various industries and are very necessary in housing, sanitation, energy, mobility, infrastructure projects, among others (IBRAM, 2018).

In Latin America, the exploitation of mineral resources is prominent in many national economies (SOUSSAN, 2019). Therefore, there are several debates focused on the idea that mining can contribute to the improvement of the quality of life of the population living around the mining enterprises (BARBARA; SLUDER, 2019). In Brazil, the mineral sector has been growing and is one of the main activities that contribute to national economy, being linked to its history since the colonial period (LOUREIRO et al., 2019).

In the Brazilian territory, the Amazon Region stands out for having a great availability of mineral resources, with reserves of iron ore, bauxite, manganese, copper, nickel, chromium, tin, zinc and zirconite among the metals, in addition to kaolin, limestone for use in the cement industry and also for soil correction, gypsum, phosphate rocks, aggregates used in construction (sand, clay, grit and gravel), and ornamental rocks (NMA, 2018).

The mineral sector has been one of the main growth engines of the Northern Region of Brazil (SANTOS, 2017), especially in the state of Pará, where the most exported products are iron ore, copper, manganese, bauxite, nickel, kaolin, gold and silicon. The main destinations for these exports are China, Malaysia, Japan, South Korea, Canada, Germany, the Netherlands, and the Philippines (SIMINERAL, 2019).

Despite the great importance of mining for society, in Brazil there is a need for public policies that value its high mineral potential, mainly as a means of contributing to the socioeconomic development of the country (WEAVER, 2018). Thus, the objective of this study was to analyze whether the mining royalty revenues from 2011 to 2018 in the Brazilian Amazon reflect on human development indices of the region at both state and municipal levels, and thus verify whether these royalties are being used as an instrument to improve the quality of life of the local population.

Mining royalties in Brazil

The exploration of mineral resources in Brazil involves the payment of the Financial Compensation for Exploration of Mineral Resources (CFEM), the so-called mining royalties. Law 13,540 of December 18, 2017, brought changes in the percentages of distribution of the financial compensation, taxation of mineral substances, and calculation basis of CFEM.

The National Mining Agency (NMA) collects CFEM and distributes it according to current legislation: 60% for the Federal District and the municipalities where the production occurs; 15% for the Federal District and Municipalities if they are affected by the mining activity and production does not occur in their territories; 15% for the Federal District and the states where production occurs; 7% for the agency responsible for the regulation of the mineral sector (NMA); 1.8% for the Mineral Technology Center (CETEM); 1% to the National Fund for Scientific and Technological Development (FNDCT); 0.2% for the Brazilian Institute of Environment and Renewable Natural Resources (IBAMA) (BRAZIL, 2017).

CFEM's rate varies according to the minerals mined and concerns their gross revenue. The rate is 3.5% for iron, and may be reduced to up to 2% upon duly justified demand from NMA; 3% for bauxite, manganese, niobium and rock salt; 2% for diamonds, precious stones, cut-and-polished colored stones, carbonates and noble metals; 1.5% for gold; and 1% for rocks, sands, grit, gravel and other mineral substances when intended for immediate use in construction, ornamental rocks, mineral and thermal waters (BRAZIL, 2017).

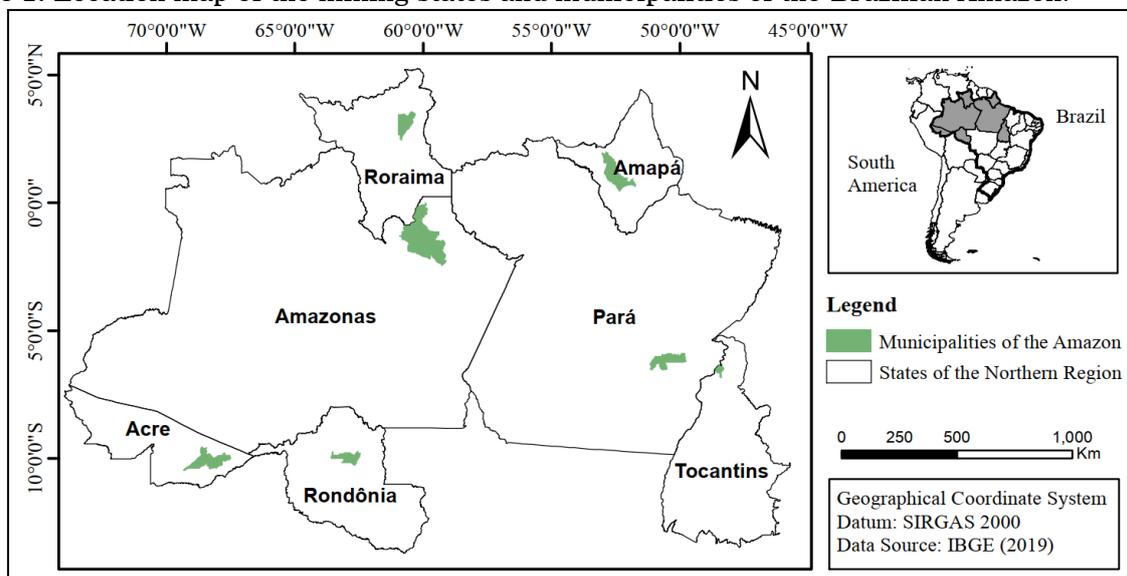
Materials and methods

Study area

The Legal Amazon is present in nine Brazilian states: Acre (AC), Amapá (AP), Amazonas (AM), Maranhão (MA), Mato Grosso (MT), Pará (PA), Rondonia (RO), Roraima (RR), and Tocantins (TO). In this study the states of the Northern Region of the country were analyzed, and thus Maranhão and Mato Grosso were not included. The Northern Region has an estimated population of 18,430,980 people, the state of Pará being the largest in terms of population (8,602,865), followed by Amazonas (4,144,597), Rondônia (1,777,225), Tocantins (1,572,866), Acre (881,935), Amapá (845,731) and Roraima (605,761) (IBGE, 2019).

The largest percentage of revenues from CFEM is given to the mining municipalities (60%). Thus, the municipality of each state of Northern Brazil that collected the largest share of mining royalties from 2011 to 2018, according to NMA data, was selected for a more thorough analysis, namely: Parauapebas (Pará), Pedra Branca do Amapari (Amapá), Presidente Figueiredo (Amazonas), Ariquemes (Rondônia), Xambioá (Tocantins), Boa Vista (Roraima) and Rio Branco (Acre) (Figure 1).

Figure 1: Location map of the mining states and municipalities of the Brazilian Amazon.



Source: Authors, 2019.

Data collection and analysis

In this study we used data from the NMA, the Atlas of Human Development in Brazil, the FIRJAN Municipal Development Index, the Brazilian Legislation, as well as mineral production data available in publications from the Brazilian Mining Institute (IBRAM) and the Mineral Industries Union, in the state of Pará (SIMINERAL).

Reports of CFEM revenues per Substance, Region, State, Municipality, and Company from 2004 onwards are available on the NMA website. These values are updated daily, in the official currency of Brazil (Brazilian Real), the conversion to US dollars was based on the quotation on June 21, 2019, where 1 dollar corresponded to 3.83 reais, and therefore 1 real was \$ 0.26.

The human development indices were provided by the Municipal Human Development Index (MHDI) Radar, created in 2011 to meet the need of public managers, researchers and citizens to have a more up-to-date analysis of the socioeconomic indicators in their regions, since before that, this information was analyzed every 10 years through the censuses carried out by the IBGE, of which the last one was carried out in 2010.

The MHDI has three sub-indices: Education, Longevity and Income, with data available from 2011 to 2017 for federative units, nine metropolitan regions and the Federal District. This index has the following ranges of human development: Very low (0.000-0.499), low (0.500-0.599), medium (0.6000-0.699), high (0.700-0.799), and very high (0.800-1000). The MHDI methodology supports the work of managers, researchers and academics dedicated to assessing the impact of public policies in Brazil.

The FIRJAN Municipal Development Index (FMDI) is a study of the FIRJAN System that monitors the socioeconomic development of Brazilian municipalities on a yearly basis in three areas: Employment & Income, Education, and Health. Created in 2008, this index is calculated exclusively with official public statistics (FIRJAN, 2019). The FMDI is available on the FIRJAN website (<https://www.firjan.com.br/ifdm/>). At present, the information provided in the website includes data until 2016, and for this reason this study analyzes the evolution of the socioeconomic indicators of the mining municipalities from 2011 to 2016.

The FMDI has a simple reading, ranging from 0 to 1 point (maximum), with analysis as follows: Low development: < 0.4; Regular development: from 0.4 to 0.6; Moderate development: between 0.6 and 0.8; High development: > 0.8. The FMDI methodology makes it possible to determine precisely whether the relative improvement in a given municipality is due to the adoption of specific policies.

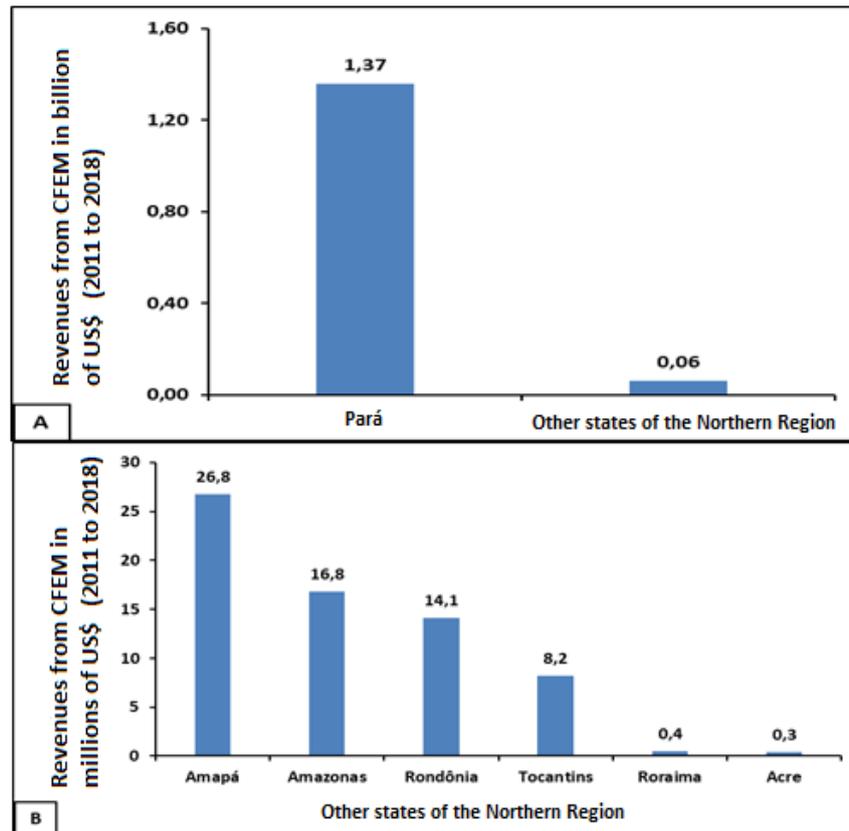
After data collection, graphs and tables were prepared in Excel software to verify if there was a relationship between the collection of royalties from mining and the development indices in the Brazilian Amazon during the analyzed period.

Results and Discussion

Revenues from CFEM in the states of the Brazilian Amazon

The state of Pará alone collected in eight years (2011 to 2018) the total amount of approximately 1.37 billion dollars, much more than the sum of the amounts collected by the other states of the Northern Region of Brazil (Figure 2.A). Amapá presented the second largest collection of CFEM during the analyzed period, followed by the states of Amazonas, Rondônia, Tocantins, Roraima and Acre (Figure 2.B).

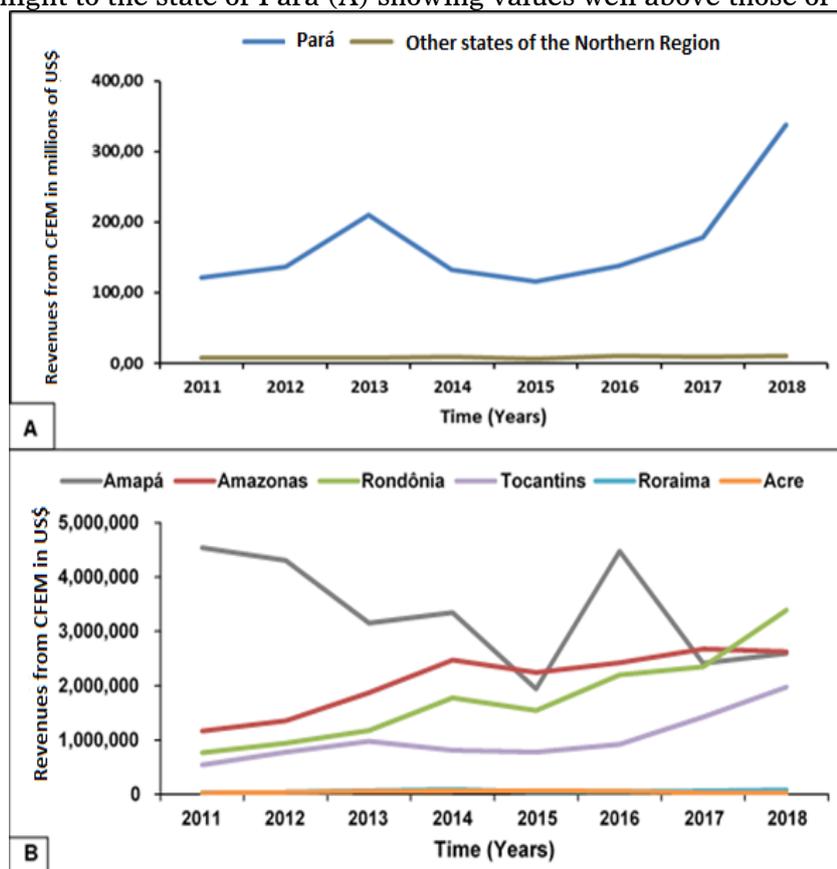
Figure 2: Revenues from CFEM in the period from 2011 to 2018 in the state of Pará (A) and in the other states of the Northern Region of Brazil (B).



Source: Authors, adapted from NMA (2019).

The state of Pará receives the largest share of revenues generated from CFEM in the period from 2011 to 2018, more than one billion reais in the year 2018 as a result of the change in CFEM legislation at the end of 2017, which increased the rates of minerals, a step important in improving the collection mechanism; however, the amount collected is still much lower compared to the profit made by mining companies in Brazil. The amounts collected from CFEM in Pará exceed those of other states in the Northern Region in all the years analyzed (Figure 3). Thus, Pará is currently consolidated as the state that collects the largest amount of mining royalties in the country.

Figure 3: Revenues from CFEM in the period from 2011 to 2018 in states of the Northern Region of Brazil, with highlight to the state of Pará (A) showing values well above those of other states (B).



Source: Authors, adapted from NMA (2019).

Amapá, the second state that most collected CFEM in the period analyzed, had a decrease in revenues from 2011, being surpassed in some years by the states of Rondônia and Amazonas. The later ranked third in revenues from CFEM, and maintained a growing trend over the years.

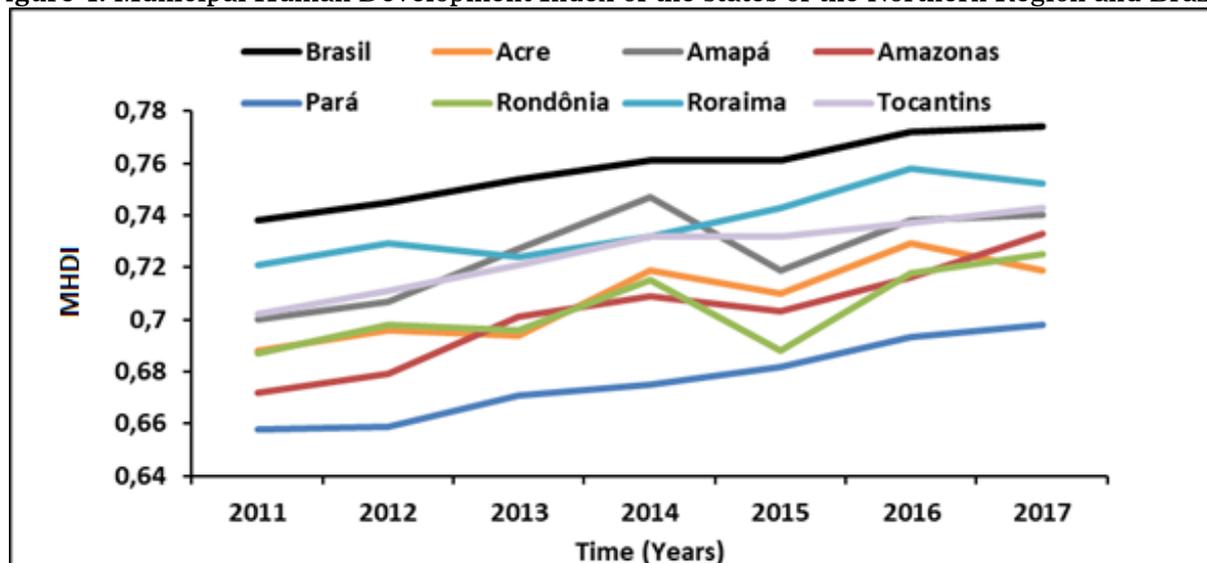
The state of Rondônia is the fourth in the ranking in the Amazon, also showing a growing trend during the period studied, mainly due to the increase in tin ore exploration. The state had a decrease only in 2015, and it was the second that most received royalties in 2018. The state of Tocantins was the fifth largest collector, followed by Roraima and Acre, where there is less mining activity, and, therefore, less significant revenues from CFEM.

Socioeconomic indicators of the states of the Northern Region

Regarding the MHDI, all states in the Northern Region of Brazil were below the national average. It was observed that Pará had the lowest rates among the states from 2011 to 2017 (Figure 4), which is not consistent with the large amounts of mining royalties received during this period. This finding demonstrates that despite the fact that this state stands out on the world stage for its mineral wealth, no improvement is seen in the life of the population.

The state of Roraima presented the best evolution in the period from 2011 to 2017, although unrelated to the increase in mining royalties, for the state had the second lowest revenues in the Northern Region. Other economic sectors contributed to the growth of these socioeconomic indicators in the state. Tocantins presented a regular growth in terms of MHDI as well as in the collection of CFEM during this period.

Amapá presented a growing MHDI until 2014, where there was a decrease until 2015, and from this year on, the index started to grow again, setting a similar pattern to that of revenues from CFEM. The states of Acre and Rondônia showed an alternate pattern of growth and decrease in MHDI over the years, and the state of Amazonas had one of the lowest indices, above only the state of Pará.

Figure 4: Municipal Human Development Index of the states of the Northern Region and Brazil.

Source: Authors, adapted from ATLAS OF HUMAN DEVELOPMENT IN BRAZIL (2019).

Collection of CFEM in municipalities of the Brazilian Amazon

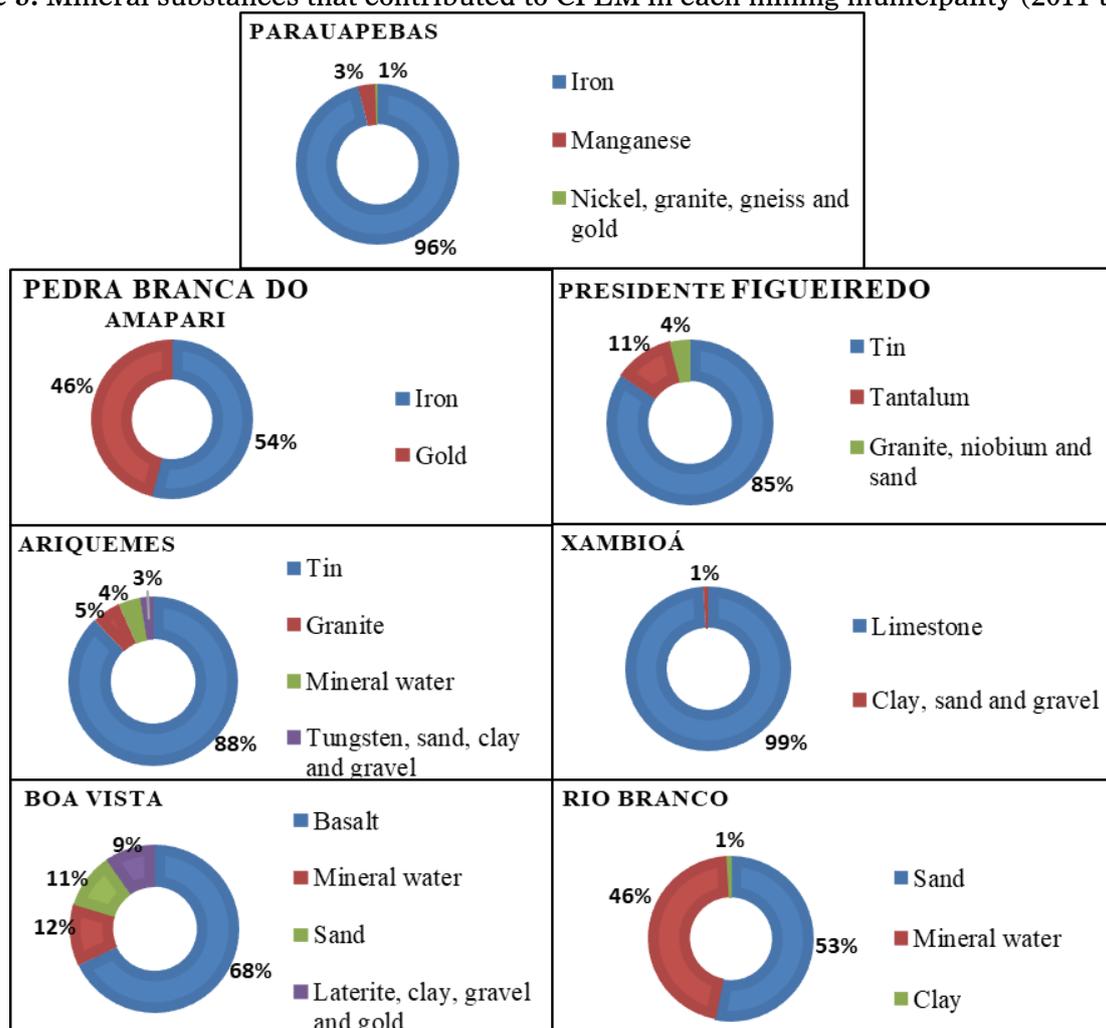
The mining municipalities that contributed most from 2011 to 2018 to CFEM collection in each state are presented in Table 1.

Table 1: Revenues from CFEM in the Northern Region of Brazil (2011 to 2018).

Revenues from CFEM in the states	Municipality that collected the largest amount of revenues from CFEM	Mineral substances exploited in mining municipalities during this period
Pará US\$ 1,371,156,435.91	Parauapebas US\$1,089,819,691.12	Iron ore, manganese ore, nickel ore, granite, gneiss, and gold ore.
Amapá US\$ 26,822,134.71	Pedra Branca do Amapari US\$ 17,493,853.43	Iron ore and gold ore.
Amazonas US\$ 16,865,868.65	Presidente Figueiredo US\$ 13,709,831.71	Tin ore, tantalum ore, granite, niobium ore and sand
Rondônia US\$ 14,155,914.47	Ariquemes US\$ 3,497,522.20	Tin ore, granite, mineral water, tungsten ore, sand, clay and gravel.
Tocantins US\$ 8,228,451.86	Xambioá US\$ 1,695,902.55	Dolomitic limestone, clay, sand and grit.
Roraima US\$ 461,269.24	Boa Vista US\$ 376,679.87	Basalt, mineral water, sand, laterite, clay, gold ore and gravel.
Acre US\$ 364,694.19	Rio Branco US\$ 176,868.21	Sand, mineral water and clay.

Source: Authors, adapted from NMA (2019).

The collection of CFEM in the municipality of Parauapebas in the analyzed period was approximately 79.5% of the total collected in the state of Pará. The percentage collected of each mineral substance in this municipality is presented in Figure 5, showing a prominent position of iron ore as the main mining royalty generator in Pará.

Figure 5: Mineral substances that contributed to CFEM in each mining municipality (2011 to 2018).

Source: Authors, adapted from NMA (2019).

In the municipality of Pedra Branca do Amapari, revenues from CFEM corresponds to 65.22% of the total in state of Amapá, and the minerals that contributed to this collection were iron ore and gold ore. Then, the municipality of Presidente Figueiredo accounted for 81.29% of the total collection in the state of Amazonas, mainly due to exploration of tin ore.

The municipality of Ariquemes collected 24.71% of the total CFEM in the state of Rondônia, where tin ore exploration stood out. The municipality of Xambioá received 20.61% of the revenues in the state of Tocantins, mainly from limestone exploration. These two municipalities do not stand out at the state level as the others, because there is a greater distribution of mining enterprises in their states.

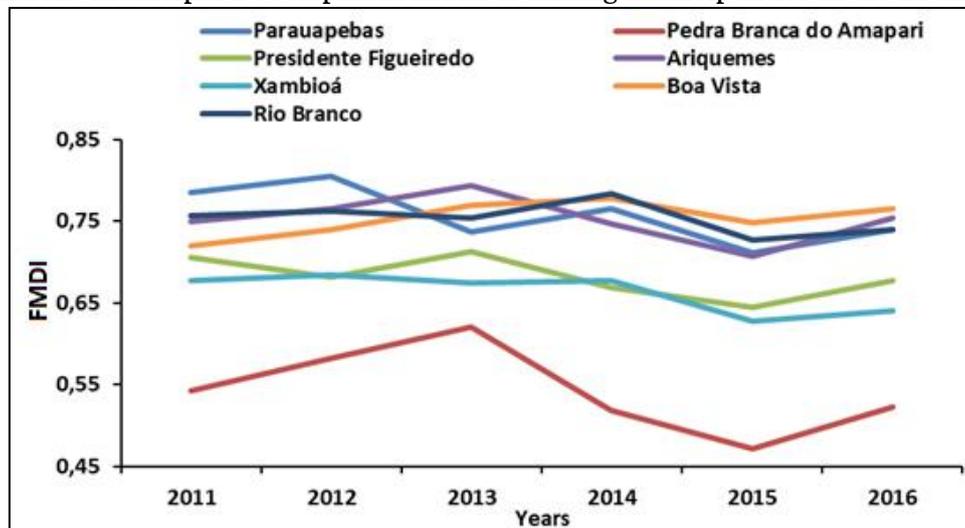
The revenues in the municipality of Boa Vista corresponded to 81.66% of the total of the state of Roraima, with prominence of basalt exploration. The municipality of Rio Branco had 48.50% of the total collected from CFEM in the state of Acre, where the minerals explored are sand and clay to supply the local construction market, and mineral water for human consumption.

Reflection on the socioeconomic indicators of the mining municipalities

Although the municipality of Parauapebas, in the state of Pará, had a much higher collection of CFEM than the other municipalities studied, no positive reflections on socioeconomic indicators were noticed. The state presented FMDI lower than that of the Rio Branco and Boa Vista in some years (Figure 6). This can be explained by the fact that these municipalities are the capitals of their states, where other economic activities are developed. This demonstrates that dependence on the mineral sector may be one of the causes that hinder the socioeconomic development of many mining municipalities. It is necessary to invest and boost the local economy of these municipalities.

Pedra Branca do Amapari in the state of Amapá presented the lowest development indices among all the analyzed municipalities (Figure 6). From 2013 on, its FMDI decreased as a result of the low employment and income rates, because the country was experiencing an economic crisis that strongly influenced the labor market (FIRJAN, 2019). This crisis disrupted the trajectory of socioeconomic development of many mining municipalities, which showed growth in the FMDI from 2015 onwards.

Figure 6: FIRJAN Municipal Development Index of mining municipalities in the Brazilian Amazon.



Source: Authors, adapted from FIRJAN (2019).

The valorization of mineral reserves located in the Amazon, especially through the expansion of CFEM, is of fundamental importance because the amount of taxes collected from these activities is insignificant compared to the volumes invoiced and profit of mining companies operating in the region. Currently, the control of mineral resources is the responsibility of the federal government; however, public policy decisions in the mineral sector should have a greater participation of state and municipal governments, for it is upon these levels that the social and environmental impacts of mining activities fall.

More efficient management of mineral resources is sorely needed, with prioritization of projects that stimulate the valorization of mineral reserves in the Brazilian Amazon and the economic diversification of mining municipalities, as for example the creation of mineral transformation industries. This is due to the fact that most of the mineral reserves explored in the region benefit the foreign market, as companies export raw material to the various industries in foreign countries. Thus, vertical distribution of mineral production, i.e. the transformation of raw and processed ore into final product, is necessary in the Northern Region of the country, especially in the state of Pará. This would generate more sources of employment and income and ultimately contribute to the socioeconomic development of the country.

Conclusion

This research demonstrated, through the analysis of socioeconomic indicators, that the increase in mining royalties does not imply the socioeconomic development of the Amazon Region. The results indicate that the analyzed states present MHDI below the national average. This brings to light the inadequate public management of this region, where governments do not effectively internalize resources derived from CFEM and do not invest in boosting other economic sectors. In addition, no evidence was found that mineral activity contributes significantly to improving the quality of life in the region.

Therefore, it is necessary to deepen the reflections on the possibility of converting royalties arising from mining activity in the region into vectors of socioeconomic development. The goal is a more efficient management of these resources, prioritizing projects that stimulate the valorization of mineral reserves in the Brazilian Amazon and the economic diversification of the mining municipalities, in order to provide the population with quality education and health, access to the labor market, increase of jobs, and better income distribution. This is especially true for the state of

Pará, bearing in mind that this state has a promising potential in terms of revenues from CFEM, given the geological, market and logistics characteristics of the region.

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