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POTENTIAL OF MINERAL ROYALTIES IN PROMOTING SOCIO-ECONOMIC DEVELOPMENT IN MUNICIPALITIES OF THE STATE OF PARÁ, BRAZIL

POTENCIAL DOS ROYALTIES MINERAIS NA PROMOÇÃO DO DESENVOLVIMENTO SOCIOECONÔMICO DE MUNICÍPIOS DO ESTADO DO PARÁ, BRASIL

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Abstract

The purpose of this article was to analyze the potential of CFEM (Financial Compensation for Mineral Exploration), mineral royalties, in promoting the socio-economic development of the following municipalities in the state of Pará: Parauapebas and Canaã dos Carajás. The justification for this study lies in the need for greater efficiency in the application of CFEM to minimize the local impacts of mining, and in the implementation of economic alternatives in mining municipalities in view of the possible depletion of mineral reserves. The methodology involves secondary data analysis (CFEM, socioeconomic and sanitation indicators, municipal revenues, and expenses). The Pará municipalities analyzed in the years 2005 and 2016, showed an increase in the development indexes in health and education. However, there was a decrease in employment and income indicators, which affirms the importance of the economic diversification of these municipalities that depend heavily on mining. The sanitation indicators of Parauapebas and Canaã dos Carajás are above the other municipalities in Pará, however, below the expected for municipalities that receive the largest amounts of CFEM in the country. The results indicate that mineral royalties have made little contribution to the socio-economic development of the municipalities analyzed, in view of their mineral wealth, therefore, it is necessary to create public policies that promote the efficient use of resources from CFEM by public managers, who must prioritize the sectors of health, education, basic sanitation, and especially the attraction of new economic sectors to increase the employment rate and local income.

Keywords: Mining. Socioeconomic Impacts. Mineral Royalties. Local Development. Public Policy.

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Resumo

O objetivo deste artigo foi analisar o potencial da CFEM (Compensação Financeira pela Exploração Mineral), os royalties minerais, na promoção do desenvolvimento socioeconômico dos municípios do estado do Pará que mais arrecadam essas receitas: Parauapebas e Canaã dos Carajás. A justificativa deste estudo reside na necessidade de uma maior eficiência na aplicação da CFEM para minimizar os impactos locais da mineração, e na implantação de alternativas econômicas nos municípios mineradores tendo em vista o eventual esgotamento das reservas minerais. A metodologia envolve análise de dados secundários (CFEM, indicadores socioeconômicos e de saneamento, receitas e despesas municipais). Os municípios paraenses analisados apresentaram aumento nos índices de desenvolvimento na área da saúde e educação nos anos de 2005 e de 2016. Entretanto, houve diminuição nos indicadores de emprego e renda, o que afirma a importância da diversificação econômica desses municípios que dependem fortemente da mineração. Os indicadores de saneamento de Parauapebas e Canaã dos Carajás encontram-se acima dos demais municípios paraenses, entretanto, abaixo do esperado para municípios que recebem os maiores montantes da CFEM no país. Os resultados indicam que os royalties minerais pouco têm contribuído no desenvolvimento socioeconômico dos municípios analisados, tendo em vista a sua riqueza mineral, portanto, torna-se necessário a criação de políticas públicas que promovam o uso eficiente dos recursos oriundos da CFEM pelos gestores públicos, que devem priorizar a área da saúde, educação, saneamento básico, e principalmente a atração de novos setores econômicos para aumento da geração de emprego e renda local.

Palavras-chave: Mineração. Impactos Socioeconômicos. Royalties Minerais. Desenvolvimento Local. Políticas Públicas.

Introduction

In Brazil, the exploitation of mineral resources involves the payment of financial compensation to the Union, the States, the Federal District, and the Municipalities. The Financial Compensation for the Exploration of Mineral Resources (CFEM), mineral royalties, is a consideration given by mining companies for the economic use of a mineral substance in the country, which aims to repair and minimize the socio-economic and environmental impacts resulting from mining and provide economic alternatives for the moment of depletion and closure of mines, within the concept of sustainable development (IBRAM, 2018).

The mineral sector has been one of the main drivers of economic growth in the Northern Region of Brazil, due to the great availability of mineral resources, particularly in the state of Pará, where the main ores exported are iron ore, copper, manganese, bauxite, nickel, kaolin, gold, and silicon (SIMINERAL, 2019). In recent years, Pará has consolidated itself as the state that collects the most mineral royalties in the country, however, despite its mineral wealth, it continues to present the lowest development rates among the states of the Northern Region of Brazil (MOTA; BARCELOS, 2018).

Data on mineral production in the country indicates an increasing trend in mining activities in the state of Pará, especially in the Mineral Province of Carajás, where the municipalities that collect the most CFEM in Brazil are located: Parauapebas and Canaã dos Carajás (ANM, 2020). Therefore, it is necessary to analyze whether these resources are being applied strategically in these municipalities, considering the local impacts related to mining during its installation and operation, the future exhaustion of mines, and the ultimate closure of these activities in the region. Therefore, the following question arises: has mining activity, through its royalties, contributed to the development of the main mining municipalities in the state of Pará?

This study aims to analyze the potential of mineral royalties in promoting the socio-economic development of municipalities in the state of Pará. First, a bibliographic survey and an analysis of Brazilian legislation on mineral royalties charged in Brazil were carried out. Then, an analysis of the socioeconomic and sanitation indicators of the main municipalities collecting CFEM in the state was made. Finally, the potential of applying these royalties to improve the quality of life of the local

population was verified, in addition to discussing the main challenges for these municipalities to better use their mineral resources in a sustainable way.

Financial Compensation for the Exploration of Mineral Resources (CFEM)

The Brazilian Federal Constitution of 1988 granted the Union the right to own mineral resources, including those in the subsoil, and ensured their exploitation to others through the payment of financial compensation to the Union, the States, the Federal District, and the Municipalities. The Financial Compensation for the Exploration of Mineral Resources (CFEM) was established by Law No. 7,990, of December 28, 1989, and regulated by Decree No. 01, of January 11, 1991, monthly payment must be made by the holder of the mining right to the Union, which deposits in specific accounts held at Banco do Brasil S.A., until the last business day of the second month following the triggering event, which may be the sale of the mineral product, its industrial transformation or even its consumption by the miner.

Law No. 8001, of March 13, 1990, specified the definition of the basis of CFEM calculation. Factors such as the value of net sales, allowing the deduction of taxes levied on sales and other operating expenses such as transportation and insurance, determined the rate to be charged per mineral substance extracted and the distribution among federative entities. This law was amended by Law No. 13,540 of December 2017, which brought important changes to CFEM, its calculation base became gross sales revenue, where only deductions of taxes levied on sales are allowed, and there were also changes in the percentage rates of mineral substances (Table 1). Therefore, from 2018 onwards, there was a significant increase in the collection of mineral royalties in the country, compared to previous years (IBRAM, 2018).

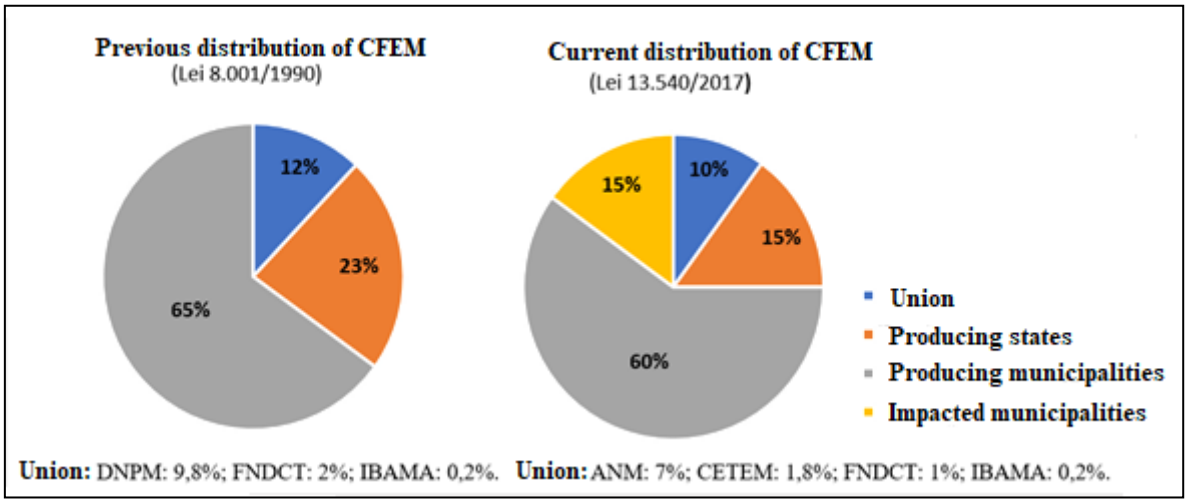
Table 1: Changes in the rates of mineral substances for the purpose of levying the CFEM.

Previous Tax Rate (Law No. 8001/1990)	Current Tax Rate (Law No. 13,540/2017)
2% - Iron, rate defined based on the international price of the product. 3% - Bauxite, manganese, diamond, niobium, potassium, and rock salt. 2% - Gold and other mineral substances. 0.2% - Gold and diamonds, when extracted under the mining permit regime, other precious stones and cut colored stones. 1.5% - Rocks, sand, gravel, and other mineral substances intended for immediate use in civil construction.	3.5% - Iron, upon duly justified demand, it is possible to reduce the rate by up to 2%. 3% - Bauxite, manganese, niobium, and rock salt. 2% Diamond and other mineral substances. 1.5% - Gold. 1% Rocks, sand, gravel, and other mineral substances intended for immediate use in civil construction; ornamental rocks; mineral and thermal waters.

Source: BRAZIL (1990); BRAZIL (2017).

Law No. 13,540/2017 also changed the distribution of CFEM between the Union, states, and municipalities (Figure 1).

Figure 1: CFEM distribution percentages before and after Law 13,540, of December 18, 2017.



Source: BRASIL (1990); BRASIL (2017).

An important change was the determination that 15% of the collection would be granted to non-producing municipalities that are affected by mining activity, such as by the presence of infrastructure used for the rail or pipeline transport of mineral substances, port structures and operations, and loading and unloading of ores, and the location of waste rock piles, tailings dams and mineral processing facilities in their territories. The distribution criteria among the municipalities impacted by mining are presented in Decree No. 9,407, of June 12, 2018.

The federal agency in charge of inspecting and collecting the CFEM from mining companies is the National Mining Agency (ANM), the former National Department of Mineral Production (DNPM), which is also responsible for distributing it to the relative states and municipalities. As the mineral production data for calculating the CFEM is provided by the companies, it is up to the ANM to inspect the projects and apply fines in cases of administrative infractions, such as failure to submit documents requested by the inspection, or if there is contradictory information in the documentation provided, and CFEM calculation lower than due (BRASIL, 2017).

The legislation does not specify where CFEM revenues should be applied, only prohibits their use in the payment of debt and expenses with permanent staff, in the sense of preventing a finite resource from being committed to permanent expenses. However, Law No. 12,858, of September 9, 2013, allowed its use in the payment of debts to the Union and other federative entities, and also in the cost of expenses with maintenance and development of education, especially in public basic education in full-time, including those related to the payment of salaries and other amounts of a remunerative nature to teaching professionals in effective exercise in the public network (BRASIL, 2013).

The former DNPM recommended the application of CFEM revenues in projects that, directly or indirectly, benefit the local community, in the form of improving infrastructure, health, education, and environmental quality. Law 13,540/2017 guides states and municipalities to allocate at least 20% of CFEM revenues to activities related to economic diversification, sustainable mineral development, and scientific and technological development. In addition, this law established that information regarding the application of CFEM installments by federative entities will be made public annually, for absolute transparency in the management of CFEM resources as determined by the Access to Information Law (BRASIL, 2017).

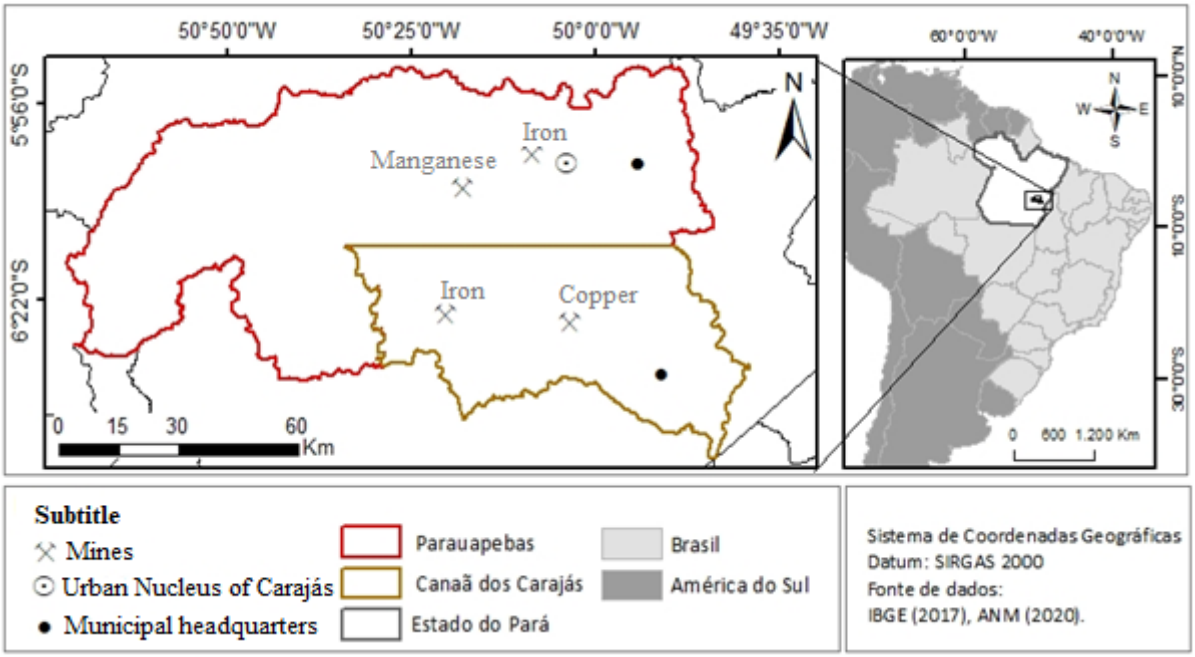
Materials and Methods

Area of Study

The state of Pará stands out in the national and international scenario for its mining activity. The main mining municipalities of Pará are Parauapebas and Canaã de Carajás, located in southeastern Pará (Figure 2), within the mineral province of Carajás, the geologically richest province on the planet, mainly in iron, manganese, copper, gold, and nickel distributed in an area of

40,000 km² (MATLABA et al., 2019). Currently, these municipalities are the ones that collect the most mineral royalties in the country, due to the presence of large mining ventures of the company Vale S.A. in the region, which produces high-quality and pure iron ore, manganese, copper, and nickel, with most of its production destined for the international market (SILVA; LIMA, 2017).

Figure 2: Location map of the municipalities of Parauapebas and Canaã dos Carajás and the mining ventures of the company Vale S.A. in each.



Source: Authors (2020).

In the municipality of Parauapebas, Vale S.A. has been operating since the 1980s in the iron mines of the Carajás Complex, and in the manganese mine in Azul. In Canaã dos Carajás, this company has been operating in the Sossego copper mine since 2004, and in the S11D Iron Project implemented in 2016, the largest mining project on the planet, which uses innovative technological solutions in the extraction of iron ore, with greater efficiency and reduced impacts on the environment and communities (MATLABA et al., 2019).

Data collection and analysis

In this study, CFEM data found on the National Mining Agency (ANM) portal was used, in collection and distribution reports from 2004 onwards, which inform the values of mineral royalties collected and received monthly by each entity of the federation. (Union, states, and municipalities).

To analyze the socio-economic development of the municipalities, the FIRJAN Index of Municipal Development (IFDM) was used, which uses official public statistics from three areas: Employment & Income, Education and Health, to verify the relative improvement that occurred in a given municipality, from the historical series started in 2005 to 2016 (FIRJAN, 2018).

This index varies from 0 to 1, and the closer to 1, the greater the development of the locality: Municipalities with IFDM between 0.0 and 0.4 indicates a low stage of development; IFDM between 0.4 and 0.6 indicates regular development; IFDM between 0.6 and 0.8 indicates moderate development; and IFDM between 0.8 and 1.0 indicates high stage of development.

To analyze the basic sanitation of mining municipalities, the most recent data from the Ranking of the Brazilian Association of Sanitary and Environmental Engineering (ABES) of the Universalization of Sanitation, from the year 2018 was used. This study presents the percentage of the population of Brazilian cities with access to water supply, sewage collection, and solid waste services, in addition to assessing how much sewage is treated and whether solid waste is properly disposed of, based on data obtained from the National Sanitation Information System (SNIS).

In this ranking, the Brazilian municipalities that reported the data necessary for the study in the SNIS, are divided into two population groups: small and medium-sized (up to 100 thousand inhabitants) and large (above 100 thousand), which makes the comparison more balanced.

Municipalities are classified into four categories, according to the total score obtained, which can reach up to 500 points: Below 200.00 (First steps towards universalization); From 200.00 - 449.99 (Commitment to universalization); From 450.00 - 489.00 (Commitment to universalization); Above 489.00 (Towards universalization).

Due to the intrinsic relationship between sanitation and health, the ABES Ranking also presents the hospitalization rate for Diseases Related to Inadequate Environmental Sanitation (DRSAI) in each municipality, obtained from the DATASUS of the Ministry of Health, which considers fecal-transmitted diseases -oral (diarrhea, enteric fevers, hepatitis A) (ABES, 2020). This study also informs whether the municipalities have a Municipal Sanitation Plan.

The Total Revenue of the municipalities, as well as the Expenses by Function in the years 2005 and 2016, were obtained through data from the National Treasury Secretariat (STN), available on the COMPARA BRASIL website, in order to analyze how much was spent by the public administration in the areas of health, education, sanitation, among other areas aimed at the socio-economic development of the analyzed municipalities.

After obtaining the data, Excel 2016 software was used to process the data and prepare graphs and tables. In addition, thematic maps were prepared using the ArcMap 10.5 software, for better visualization and discussion of the results.

Results and Discussions

Of the total of 144 municipalities belonging to the state of Pará, 65 municipalities contributed to the state collection of CFEM in 2019, due to the exploitation of mineral resources in their territories (Table 1).

Table 1: Main municipalities collecting CFEM in the state of Pará in 2019.

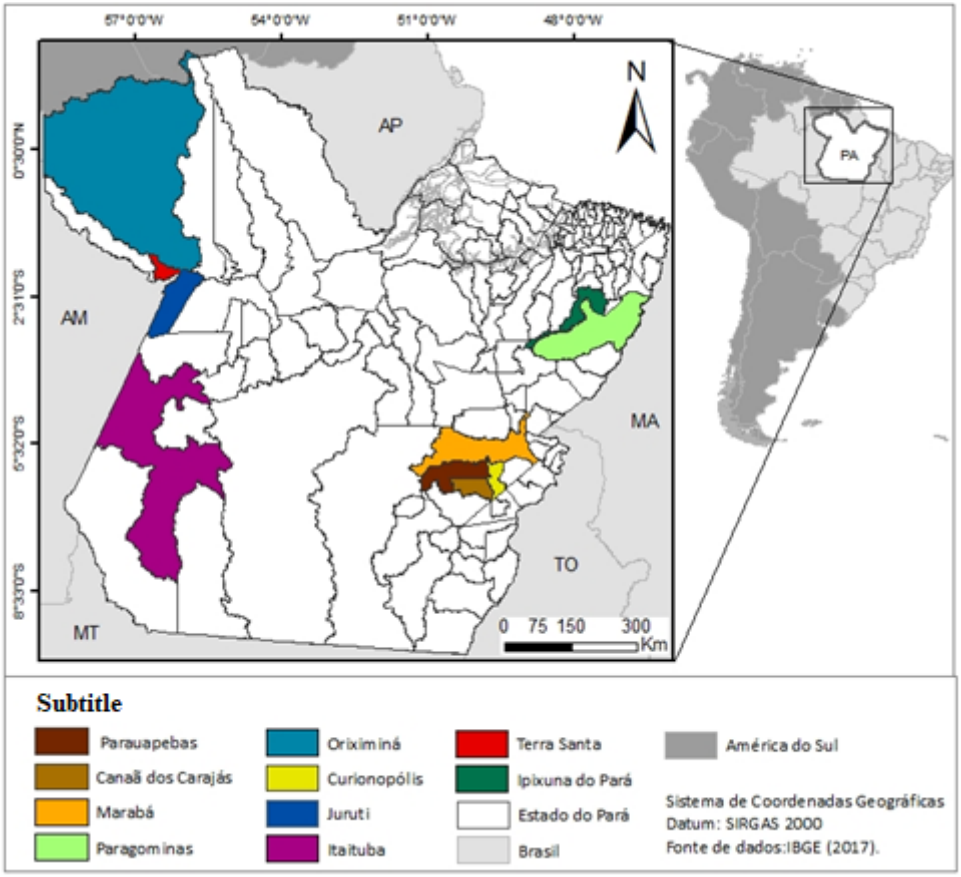
COUNTIES	CFEM (R$)	(%)	EXPLORED MINERAL SUBSTANCES
Parauapebas	1.156.139.681,25	52,73	Iron ore, manganese, nickel, granite, and gneiss.
Canaan of Carajás	706.068.474,12	32,20	Iron and copper ore.
Maraba	134.098.280,77	6,12	Copper and manganese ore, sand, gravel, mineral water, clay, and gravel.
Paragominas	38.887.372,91	1,77	Aluminum ore, clay, and sand.
Oriximiná	36.742.143,10	1,68	Aluminum ore and sand.
Curionópolis	36.350.079,07	1,66	Iron ore, copper, gold, and sylvanite.
Juruti	24.061.452,26	1,10	Aluminum ore.
Itaituba	20.271.651,03	0,92	Gold, tin, niobium, copper, sylvanite, granite, clay, sand, diamond conglomerate, and gravel ore.
Holly Land	17.550.519,39	0,80	Aluminum ore.
Ipixuna do Pará	10.732.754,36	0,49	Kaolin and clay.
Other Municipalities	11.541.840,16	0,53	-
TOTAL	2.192.444.248,42	100,00	-

Source: ANM (2020).

The municipalities of Parauapebas and Canaã dos Carajás were the municipalities that collected the most CFEM this year, concentrating approximately 85% of the total collection in Pará. Among the mineral substances exploited, iron ore stands out, responsible for about 84% of the total extracted in the state due to the large volumes produced, and which, due to its importance in the world market, has the highest rate of CFEM in Brazil (3.5 %). Vale S.A. was responsible for about 87% of the total collected this year.

Figure 3 shows the geographic distribution of the main municipalities collecting CFEM in the state of Pará in 2019.

Figure 3: Map of the location of the municipalities in Pará that collected the most mineral royalties in 2019



Source: Prepared by the authors (2020).

Mining has been the main factor of population attraction in the southeast of Pará, most people arrive in search of work opportunities in mining projects. Accompanied by the population increase, many social problems come to this region, such as the increase in demand for public services, mainly in the area of health and education, higher costs in local infrastructure, such as the road network and basic sanitation, conflicts over land, the increase in unemployment rates and the resulting violence, which the local government is responsible for managing (RIBEIRO, 2019).

Table 2 shows the significant population increase in the main municipalities collecting CFEM in the state of Pará.

Table 2: Population growth of the main mining municipalities in Pará

County	Area	Population (2000)	Population (2010)	Estimated Population (2019)
Parauapebas	6.886 km²	71.568	153.908	208.273
Canaã dos Carajás	3.147 km²	10.922	26.716	37.085

Source: Demographic Censuses; Population Estimate of IBGE (2019).

The application of CFEM mainly influences the socio-economic development of the municipalities that produce minerals, as they must receive 60% of the amount collected by the Union (IBRAM, 2018). Therefore, it is of fundamental importance that government officials have qualifications and training to strategically apply these revenues, in the recovery of the environment and in actions that promote local development, such as the attraction of new economic activities in mining municipalities, in order to minimize the impacts and socioeconomic dependence on mining activity.

Analysis of the FIRJAN Municipal Development Index (IFDM)

Next, we will analyze the changes that occurred in the socio-economic indicators of Parauapebas and Canaã dos Carajás in the years 2005 and 2016 (Table 3).

Table 3: Variation of CFEM and IFDM revenues of Pará municipalities from 2005 to 2016.

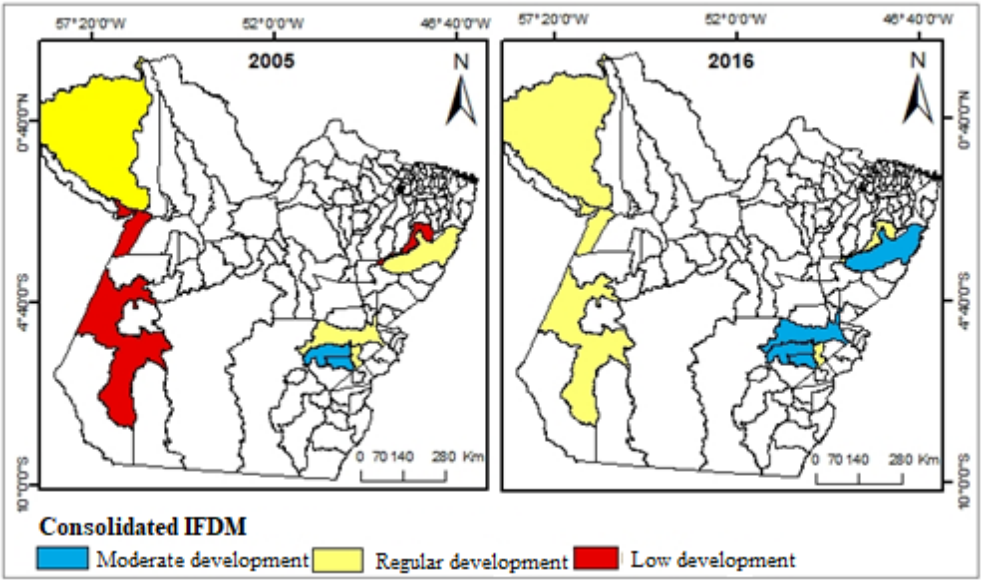
Municipalities of Pará	Year	CFEM (R$) Grant	IFDM Consolidated	IFDM Health	IFDM Education	IFDM Employment
Parauapebas	2016	186.616.604,74	0.7402	0.8453	0.7505	0.6248
	2005	41.805.523,82	0.6580	0.5592	0.6108	0.8039
Canaã dos Carajás	2016	19.407.050,35	0.6834	0.6662	0.7708	0.6132
	2005	10.296.323,57	0.6032	0.4822	0.5476	0.7797

Source: ANM (2020); FIRJAN (2018).

The CFEM values passed on to the municipalities were higher in 2016, mainly in the municipality of Parauapebas, which led to the state ranking of the Consolidated IFDM (Health, Education and Employment & Income) in the two years analyzed. In Canaã dos Carajás, only the Sossego copper mine, which has been in operation since 2004, contributed to the collection of mineral royalties in the years analyzed (ANM, 2020). The significant increase in CFEM in this municipality occurred from 2017 onwards due to the beginning of the sale of iron ore by Vale S/A.

Figure 4 shows the Consolidated IFDM (Health, Education, and Employment & Income) of the mining municipalities in the state of Pará in 2005 and 2016, which showed a positive evolution in their socio-economic indicators. However, none of them showed a high stage of development (IFDM between 0.8 to 1.00), and the largest CFEM collectors, Parauapebas and Canaã dos Carajás, remained in the moderate development range (IFDM between 0.6 and 0.8), followed by the municipalities of Marabá and Paragominas, the other municipalities presented regular development in 2016.

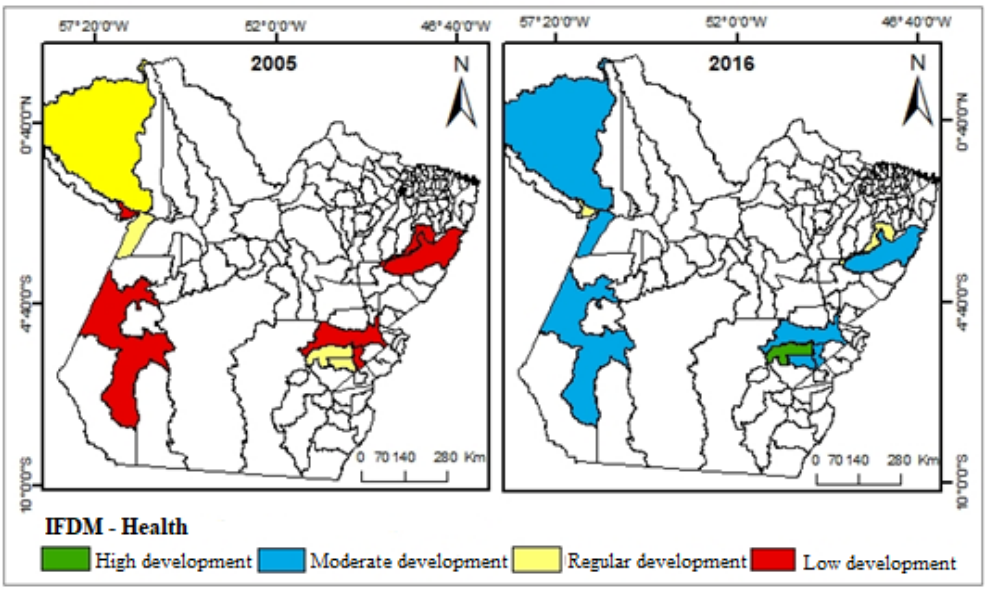
Figure 4: Consolidated IFDM of mining municipalities in the state of Pará in 2005 and 2016.



Source: Authors, adapted from FIRJAN (2018).

The health IFDM of all mining municipalities showed growth, among them, the municipality of Parauapebas stands out, which reached a high stage of development in the area of health (Figure 5). The municipalities of Terra Santa and Ipixuna do Pará, less expressive in terms of CFEM collection, showed regular development in 2016.

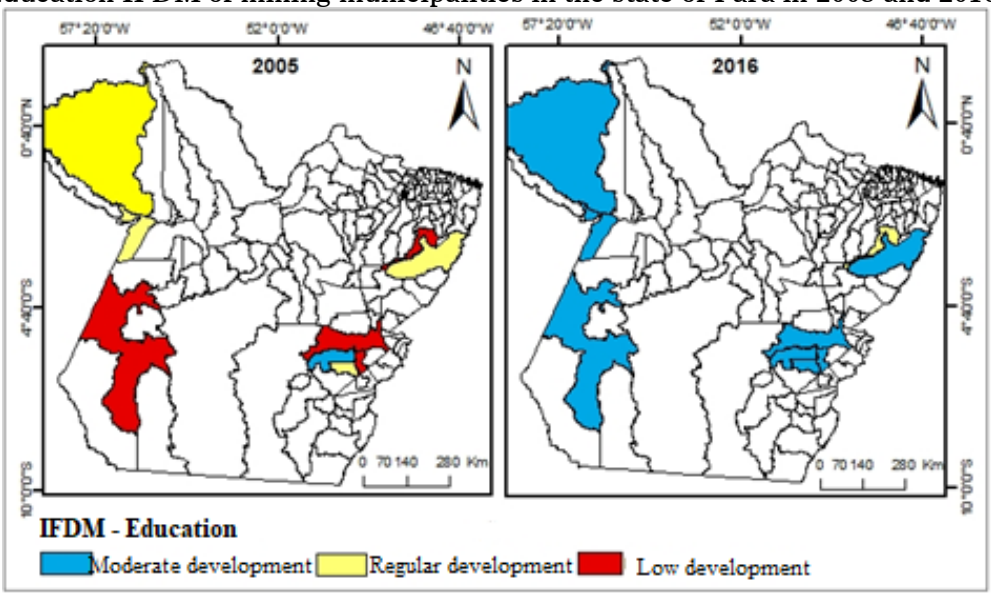
Figure 5: Health IFDM of mining municipalities in the state of Pará in 2005 and 2016.



Source: Authors, adapted from FIRJAN (2018).

Regarding the education IFDM, all municipalities showed moderate development in 2016 (Figure 6), except for Ipixuna do Pará, which was in the range of regular development.

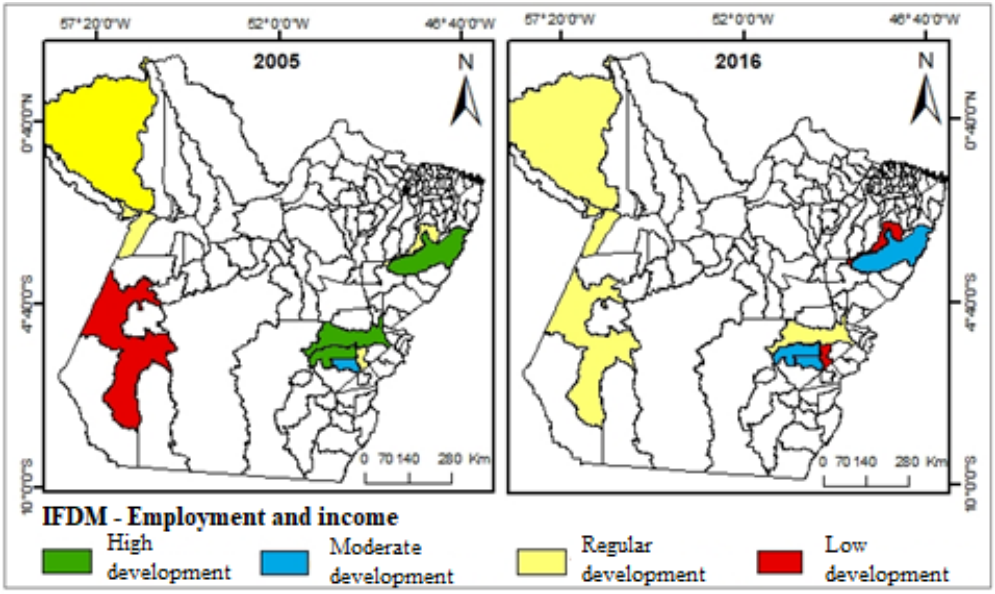
Figure 6: Education IFDM of mining municipalities in the state of Pará in 2005 and 2016.



Source: Authors, adapted from FIRJAN (2018).

The Employment and Income IFDM of the analyzed municipalities decreased in 2016, except for Itaituba (Figure 7). Parauapebas dropped to moderate development, while Canaã dos Carajás continued with moderate development.

Figure 7: Employment and Income IFDM of mining municipalities in the state of Pará in 2005 and 2016.



Source: Authors, adapted from IFDM (2018).

Given the above, it is possible to infer that the collection of CFEM is related to the socio-economic development of the mining municipalities of Pará, the biggest challenge for these municipalities is to reach a high stage of development in all areas, especially in the area of Employment and Income. The municipality of Parauapebas led the state ranking of the consolidated IFDM in the two years analyzed, but not even this municipality achieved a high stage of development, except only in the area of health, which demonstrates that the wealth brought by mineral resources has not significantly contributed to the improvement the quality of life of the local population compared to other mining municipalities such as Nova Lima in Minas Gerais, which have higher development rates (MOTA; BARCELOS, 2018).

Silva and Lima (2017) believe that the presence of other economic sectors is necessary to boost socio-economic development and reduce dependence on mining activities of the company Vale S.A. in the southeastern region of Pará. Therefore, it is essential to apply these revenues in the promotion of public policies for the economic diversification of these municipalities, which are in a situation of strong socio-economic vulnerability, in cases of interruption, reduction, or termination of mining activity in their territories (RIBEIRO, 2019).

Analysis of basic sanitation

For the analysis of basic sanitation in the municipalities of Parauapebas and Canaã dos Carajás, data from the ABES Ranking of Universal Sanitation (Table 4) were used.

Table 4: Sanitation data in municipalities in Pará in the reference year of 2018.

Municipalities	Parauapebas	Canaã dos Carajás
Water supply	89,90	98,97
Sewage collection	15,91	55,41
Sewage treatment	27,74	41,60
Solid waste collection	95,00	77,58
Proper destination	0,00	0,00
Total score	228,55	273,56
Admission rate	73,9	66,6
Sanitation Plan	No	No

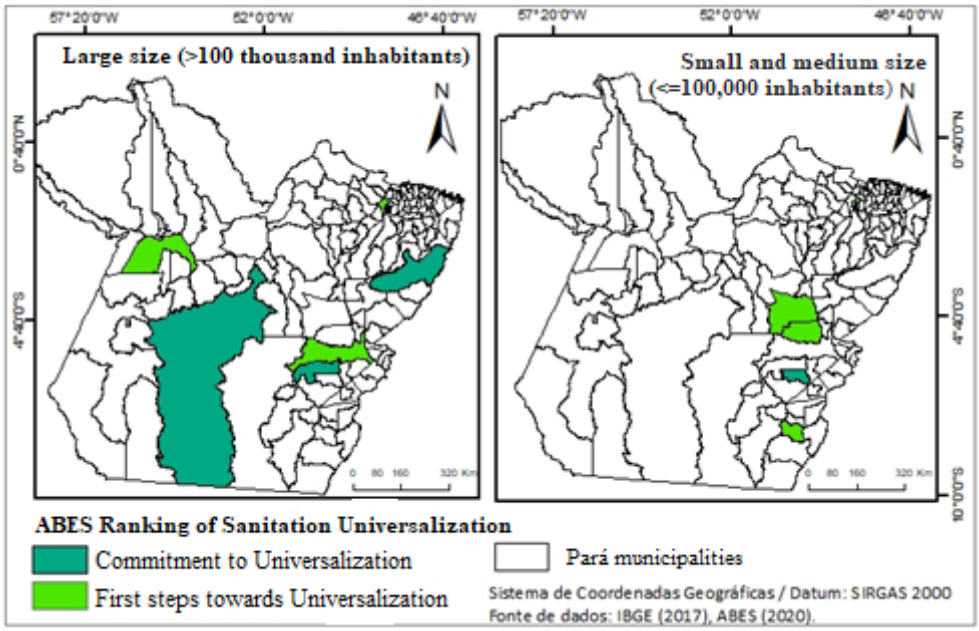
Source: ABES (2020).

In Parauapebas, the percentage of the population, urban and rural, effectively served by water supply and solid waste collection services is relatively good, while sewage collection and treatment services are not satisfactory. Both municipalities scored zero in terms of solid waste

disposal, which indicates that their waste is being wrongly disposed of in controlled landfills, dumps, or burned in ovens. The rate of hospitalizations for Diseases Related to Inadequate Environmental Sanitation (DRSAI) is significant in both municipalities, therefore, the lack of adequate sanitation has affected the health of the local population.

In addition, both municipalities do not have a Basic Sanitation Plan, a fundamental instrument for public sanitation policies in the country and a condition for obtaining Union resources for these services from 2023 onwards, according to Decree No. 10,203/2020 (ABES, 2020). Figure 8 presents the classification of municipalities in Pará in the ABES Ranking, and among them the mining municipalities of Parauapebas, Canaã dos Carajás, Marabá and Paragominas.

Figure 8: Classification of municipalities in Pará in the ABES Ranking of Universal Sanitation (2018).



Source: Authors, adapted from ABES (2020).

Among the large municipalities, Altamira had the highest score in the ranking, this is the municipality in Brazil that receives the most revenue from the Financial Compensation for the Use of Water Resources (CMPFRH), royalties for the use of water, due to the operation of the Belo Monte hydroelectric plant. The municipalities of Parauapebas and Paragominas, are classified in the category of Commitment to Universalization (total score 200.00 - 449.99), while Marabá, Belém, Marituba, Santarém, and Ananindeua are in the category of First steps towards universalization (below 200.00).

The municipality of Canaã dos Carajás had the highest rates among the small and medium-sized municipalities in the ranking, such as Redenção, Itupiranga, Novo Repartimento, and Santa Bárbara do Pará, being the only one classified in the category of Commitment to Universalization. However, these rates are lower than expected for the municipalities that receive the most mineral royalties in the country. Therefore, greater investments in basic sanitation projects are necessary, especially in Parauapebas, where demand is greater due to the number of inhabitants.

Analysis of the application of CFEM resources

To verify the CFEM values in the analyzed years, a consultation was carried out on the transparency portal of the municipalities of Parauapebas and Canaã dos Carajás. In this consultation, the amounts received from the Quota-Part of the Financial Compensation of Mineral Resources - CFEM were identified, however, it was not possible to identify where these revenues were applied. According to Silva (1998), the CFEM resources are diluted in the municipal funds, which does not make it possible to verify where these values appear in the municipal expenses, therefore, the resources end up being used for purposes that are not intended.

Therefore, it is essential to create an accountability mechanism so that CFEM revenues receive the destination provided for in the legislation, such as the creation of a CFEM Transparency

Portal, where data can be accessed with greater clarity by the civil society, thus allowing the social control of this resource, which, as its expenditure is not linked to a specific policy, the political factor prevails in its verification. In view of the above, we will analyze the percentage of CFEM in Total Revenue and Expenses by Function of each analyzed municipality to determine the highest expenses of municipalities in 2016 (Table 5).

Table 5: Budget data for the municipalities of Parauapebas and Canaã dos Carajás in 2016.

Municípalities	Parauapebas	(%)	Canaã dos Carajás	(%)
Share of CFEM (R$)	186.616.604,74	20,77	19.407.050,35	5,97
Total Revenue (R$)	898.686.717,01	100,00	325.147.733,82	100,00
Expense by Function:				
Management	106.405.524,48	11,45	53.747.761,72	16,60
Social assistance	23.039.835,71	2,48	14.202.242,09	4,39
Health	186.668.109,22	20,10	82.289.732,93	25,42
Education	242.619.595,19	26,12	95.973.499,32	29,65
Urbanism	87.462.334,89	9,42	32.676.483,60	10,09
Housing	20.947.783,44	2,26	5.308.503,88	1,64
Sanitation	59.549.816,40	6,41	19.164.966,22	5,92
Environmental management	6.420.922,43	0,69	0,00	0,00
Science and technology	0,00	0,00	0,00	0,00
Agriculture	17.138.808,11	1,85	279.365,51	0,09
Industry	376.531,15	0,04	0,00	0,00
Trade and Services	2.635.502,40	0,28	12.937,50	0,00
Other Functions	175.642.131,38	18,91	20.048.675,64	6,19
Total Expense (R$)	928.906.894,80	100,00	323.704.168,41	100,00

Source: COMPARA BRASIL (2020).

The value of the CFEM share in the Total Revenue of the municipality of Parauapebas is more expressive compared to that of Canaã dos Carajás in 2016, which demonstrates a greater dependence on these revenues. The largest expenses in these municipalities in the year analyzed were in the area of education and health, with a large part of the expenses in education coming from resources transferred by the federal government from the Fund for Maintenance and Development of Basic Education and for the Valorization of Education Professionals (FUNDEB), which has exclusive application in basic education.

Housing and sanitation expenses were higher in the municipality of Parauapebas, where demand is higher due to the number of inhabitants. Expenditures on environmental management, science and technology, agriculture, industry, commerce and services were low in the year analyzed, mainly in Canaã dos Carajás. This fact demonstrates the lack of greater investments in other sectors for economic diversification, as well as in environmental management, and the absence of investments in the area of science and technology in these municipalities during 2016.

The mining municipalities presented some initiatives in terms of the allocation of CFEM resources. The municipality of Parauapebas, foresaw the creation of its own fund in its project to amend the Municipal Organic Law, where CFEM resources should be used to generate alternatives for economic diversification for when mining is exhausted, in addition to the priority destination for health, education, social assistance, and infrastructure. It also determined the creation of a permanent commission in order to supervise the collection of CFEM together with the ANM in mining companies (PARAUAPEBAS, 2009).

The municipality of Parauapebas approved the creation of the Higher Education Actions Incentive Fund, which will receive 1.7% of CFEM's revenues. Currently, the municipality already has a campus of the Federal Rural University (UFRA), and a campus of the University of the State of Pará (UEPA) is being built, where undergraduate and master's courses will be offered, enabling residents to access higher education. , who previously resorted to nearby cities such as Marabá to study.

In Canaã dos Carajás, the Municipal Sustainable Development Fund (FMDS) was created by Municipal Law n° 753/2016, where 5% of the CFEM value is destined for investments in businesses in different areas such as agriculture and commerce, with lower interest rates and less bureaucracy. Thus, the available values can be used in the implementation, expansion, modernization, and diversification of economic activities in the municipality, which allows for a lesser dependence on mining activity and contributes to the increase in the generation of employment and local income. In addition, 20% of FMDS resources must finance projects in the area of Technical and Higher Education (CANAÃ DOS CARAJÁS, 2018).

These initiatives are few considering the high amounts of mineral royalties collected by these municipalities. Law 13,540/2017 guides states and municipalities to allocate at least 20% of CFEM revenues to activities related to economic diversification, sustainable mineral development, and scientific and technological development in order to reduce dependence on mining, therefore, it is necessary to formulate state and municipal laws that allocate part of CFEM's revenues to actions aimed at local development.

Project Law 01/2020 of the government of the state of Pará provides for the allocation of 20% of CFEM's revenues to the development of science and technology in the state, prioritizing technical courses and higher education and research institutions that meet the demand of the economic activities of municipalities in Pará. According to Matabla et al. (2019), the formal mining sector requires workers with relatively higher levels of education, and it is necessary to provide formal education, including technical training, to the local population.

One of the ways to promote the socio-economic development of mining municipalities in Pará would be through the creation of specific municipal funds that finance projects within the mineral sector or other sectors such as agriculture and family farming, the creation of an industrial district, which can generate new jobs and a permanent future income when the mining activity ends, and an educational center that presents a Science and Technology Fund aimed at financing research projects and training human resources in these municipalities.

In addition, it is necessary to create a Municipal Environment Fund, so that part of the CFEM resources are destined to protect the environment by a municipal council, which monitors the actions carried out by mining companies aimed at reducing or compensating for the negative environmental impacts arising from the mining activity, and that also analyzes the proposals for alternatives for the future use of the mining areas, the environmental recovery and restoration projects, for example, the projects of the company Vale S.A. for the Sossego copper mine in Canaã dos Carajás, which is in the final stages of exploration, with an estimated useful life for the year 2024.

Conclusion

The municipalities of Pará, strongly linked to the mining economy, face the effects of large-scale mining projects in their territories. Mining royalties have contributed reasonably to minimizing the impacts of this activity, the main challenge is to improve the quality of public services and diversify local economic activities since mineral reserves are finite. The results of this study demonstrate the potential of mineral royalties in promoting the socio-economic development of municipalities in Pará, however, this depends mainly on the ability of governments to be able to apply these revenues efficiently, a fact that is difficult to verify in the analyzed years since there is no transparency of the use of CFEM revenues by municipal governments.

Therefore, it is necessary to create public policies that promote an adequate application of the CFEM, through long-term strategic planning by the government, in the economic diversification of mining municipalities that contribute to the increase in the generation of employment and that generates a permanent local income, through the creation of laws that aim at the verification and greater transparency in the use of these resources, thus enabling the social control of the revenues from the CFEM in the state of Pará. In addition, ways should be considered to expand the potential of mineral royalties in promoting regional development to combat socioeconomic inequalities.

In this way, it is suggested to carry out other studies that can continue and bring new discussions to the subject, such as through the expansion of the CFEM legislation in the country, which does not have a specific destination for these resources, in addition, mineral rates are still low compared to other countries, and do not take into account the characteristics of mineral deposits, such as the quantity and quality of iron ore from the Carajás Mineral Province, considered the best on the planet because it has high purity and average content of 67.7% of iron ore, however, the rate is only 3.5%, the same as the lower quality iron ore produced in the state of Minas Gerais.

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