

O MERCADO DE TRABALHO PARA UM ENGENHEIRO DE MINAS: UMA PESQUISA COM OS EMPREGADOS FORMALMENTE CONTRATADOS NO BRASIL

G.R. PIRILLO¹, M.G. BERGERMAN², K. MENEGHINI³, E. MONMA⁴, H. LA SERNA⁵

Universidade de São Paulo (USP)^{1, 2, 3}, Agência Nacional de Mineração^{4, 5}

ORCID ID: <https://orcid.org/0000-0002-9112-6703>¹

gabrielpirillo@usp.br¹

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RESUMO

O número de cursos de Engenharia de Minas tem crescido no Brasil desde 2004, resultando em um significativo aumento do número de graduados. Entretanto, tal crescimento não foi seguido pelo número equivalente no pedido de registros profissionais como Engenheiro de Minas no Conselho Regional de Engenharia e Agronomia (CREA/CONFEA), o que pode indicar uma diminuição de oportunidades profissionais no mercado de trabalho. Este trabalho aborda o cenário atual do mercado de trabalho para engenheiros de minas no Brasil, tomando como base duas fontes de dados

formais de emprego: os sistemas de cadastro de empregados CAGED e RAIS do Ministério do Trabalho. Constatou-se que há uma significativa assimetria entre o número de formados e o de engenheiros de minas formalmente registrados no país nos últimos anos. Além disso, o número de demissões de engenheiros de mineração ultrapassa os números de contratação de 2012 a 2018, em contraste com as previsões de expansão anteriores neste setor, elaboradas em 2010 e 2014, com base nas quais foram abertos novos cursos de Engenharia de Minas.

PALAVRAS-CHAVE: engenharia de minas; mercado de trabalho; emprego formal

THE LABOR MARKET FOR A MINING ENGINEER: A SURVEY OF FORMALLY HIRED EMPLOYEES IN BRAZIL

ABSTRACT

The number of Mining Engineering courses has increased in Brazil since 2004, resulting in a significant rise in the number of graduates. However, such growth was not followed by an equivalent rise in the number of applications for professional registration as a Mining Engineer with the Regional Engineering Councils, which might indicate a shortage of professional opportunities in the marketplace. This paper addresses the current labor market scenario for mining engineers in Brazil, taking sources of formal employment data as a basis: the Labor

Ministry's CAGED and RAIS employee data systems. It was found that there has been a significant asymmetry between the number of graduates and the number of mining engineers formally registered in the country in recent years. Moreover, the number of mining engineers' dismissals exceeds the hiring figures as of 2012, in contrast with the previous expansion forecasts in this industry, elaborated in 2010 and 2014, based on which new Mining Engineering courses had been opened.

KEYWORDS: mining engineering; labor market; formal employment

1. Introduction

Up to 2003, the Mining Engineering course was offered by only seven Brazilian educational institutions, all of them public universities. According to Sanches, Bergerman and Roveri (2016), by 2008, approximately 100 mining engineers were graduated annually. Based on this data, the University of Ouro Preto (UFOP) had an eminent representation of approximately 44.8% of those graduates, according to the UFOP's open database in 2008 (UFOP,2020). There has been a significant expansion in the number of higher education institutions offering the Mining Engineering course over the past ten years and, as a result, in the number of graduates as well.

According to the Statistical Overview of Higher Education – 2019, elaborated by the National Institute of Educational Studies and Research Anísio Teixeira (INEP), there are currently 30 active Mining Engineering courses in Brazil, distributed between public (19) and private (11) universities, totaling 1,387 on-site vacancies (INEP, 2019). Another database organized by the National Register of Courses and Institutions of Higher Education (EMEC) points out that there are 34 Mining Engineering courses in Brazil. This minor deviation is associated with the requests for authorization to regularly open – some courses may have requested authorization and not formally opened. Another reason might be related to those universities in which the course was closed throughout the year – especially in private ones.

Such growth could be attributed to the following factors: (1) The creation of two Programs by the Brazilian Federal Government: the University for All Program (Act No. 11.096 of January 13, 2005) and the Federal University Expansion and Restructuring Plan (Decree No. 6.096 of April 24, 2007); (2) the expansion of the Brazilian mineral production during the 2000-2010 period (IBRAM, 2018), and (3) the optimistic projections of the future demand for professionals – Souza and Domingues (2014) estimated that the country would need 5,661 mining engineers by 2023. Furthermore, in 2010, Brazil's Mining and Energy Ministry (MME,2010) estimated that 13,801 professionals would be needed by 2022.

In order to work as a mining engineer, the professional must be actively registered with the Regional Council of Engineering and Agronomy (CREA), the responsible institution for regulating the engineering profession in Brazil. As each country has its own mineral legislation, it would be interesting to perform a future comparative analysis of the variation in the legislation, as approached by Silva, El Hajj and Rusilo (2020), and the effects of their singularities on mining engineers practicing their profession.

Considering the number of graduates and the application number of professional registrations as Mining Engineer, it can be noticed that, after an initial rise in the number of applications for professional registration, this figure plateaued at a much lower level than the expected number of graduates in 2010. According to the 2019 database, Brazil currently has, approximately, 5,200 mining engineers with a valid CREA registration (CONFEA, 2019). Figure 1 illustrates the evolution in the number of graduates and registration applications.

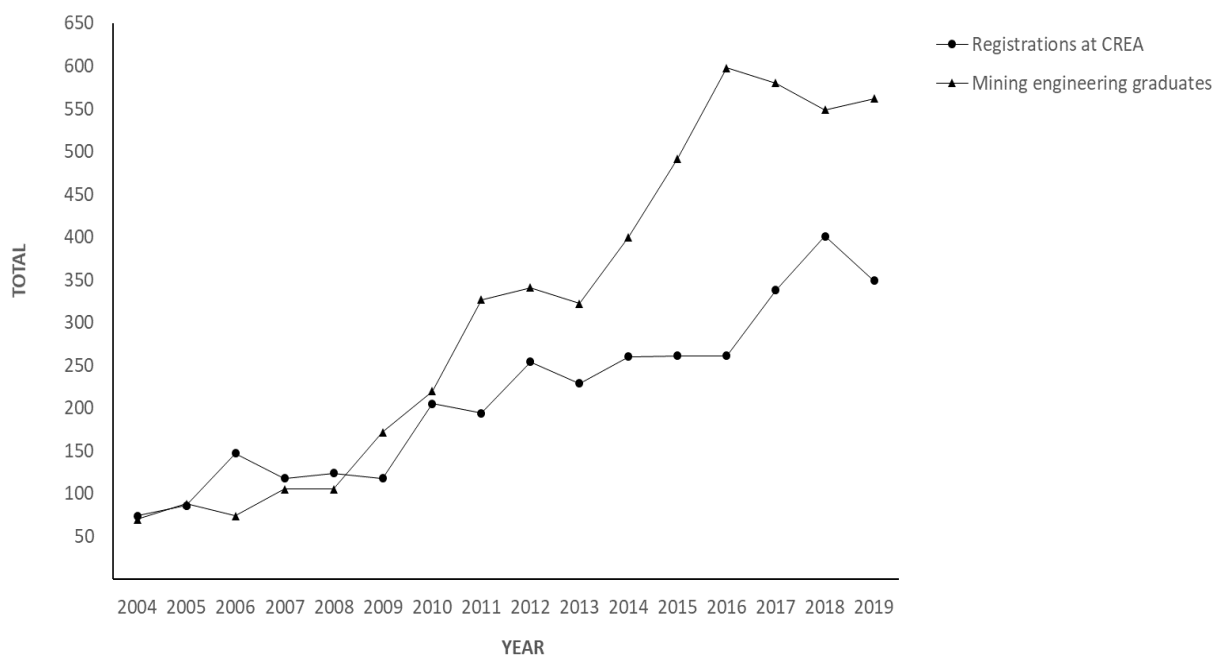


Figure 1: Graduates in Mining Engineering and applications for professional registration as mining engineer with the Regional Engineering Councils. Source: Adapted from MENEGHINI et al (2018).

The chart above shows that many graduates are not registering with CREA in the same proportion. The area is a comprehensive labor market, which may be broken down into different sectors and legal forms of work. In practical terms, mining engineers may be employed to work either in their specific area or in other departments that do not require legal registration as a mining engineer. Besides, a mining engineer can take different paths in the industry, where having an educational engineering background is much valued (e.g. banks, business corporations, professors and professionals who work outside their country of origin). As to the legal forms of work, a mining engineer may be either a hired employee or a professional freelancer. The main purpose of this paper is to focus on formally hired mining engineers, specifically those with a formal employment contract.

Considering the diverse ways of professional engagement, it is difficult to accurately establish how many mining engineers are currently working in the mining industry. This paper intends to contribute to the discussion by assessing the number of professionals hired as employees in Brazil and determining a correlation between this indicator and the growth of mineral output value in Brazil.

2. Data and methods

Two databases were used in this survey: The Labor Ministry’s database RAIS (Annual Social Information Report) and CAGED (General Employment and Unemployment Registry), which contains labor-related information for the entire country. Both sources are related with the Brazilian Institute of Geography and Statistics (IBGE).



The RAIS and CAGED databases include such information as the number of formal jobs nationwide, number of hires and dismissals, and more. Such data are broken down by geographical location, job characteristics (based on the Brazilian Job Classification of 1994 and 2002), and industry, including individual information such as age, education level, gender, nationality, years of service, salary, and the number of work hours (RAIS & CAGED, 2019). The RAIS database was used to analyze the number of mining engineers hired as employees from 2003 through 2019 under code 2147-05 (Mining Engineer) of the CBO- 2002 Brazilian Job Classification.

This search also included the corresponding nominal remuneration. The number of hires and dismissals of mining engineers registered under the same code, from January 2004 to December 2019, was searched in the CAGED database. Brazil's mineral production numbers were obtained from annual reports published by Brazilian Mining Institute (IBRAM, 2018).

3. Results and discussions

Based on the RAIS data (MTE, 2019), the number of mining engineers hired as employees was determined for the survey period, as shown in Figure 2.

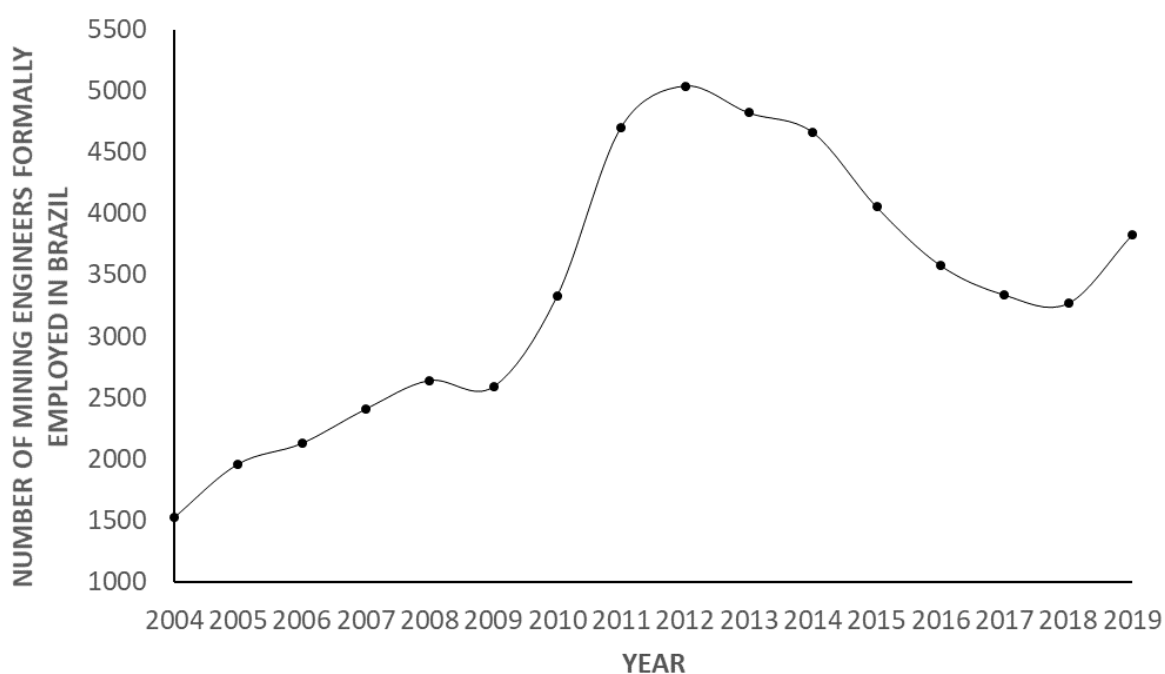


Figure 2: Mining engineers formally employed in Brazil. Source: RAIS (MTE, 2019)

In addition, the CAGED data (MTE, 2019) made it possible to quantify how many mining engineers were hired and dismissed, as shown in Figure 3.

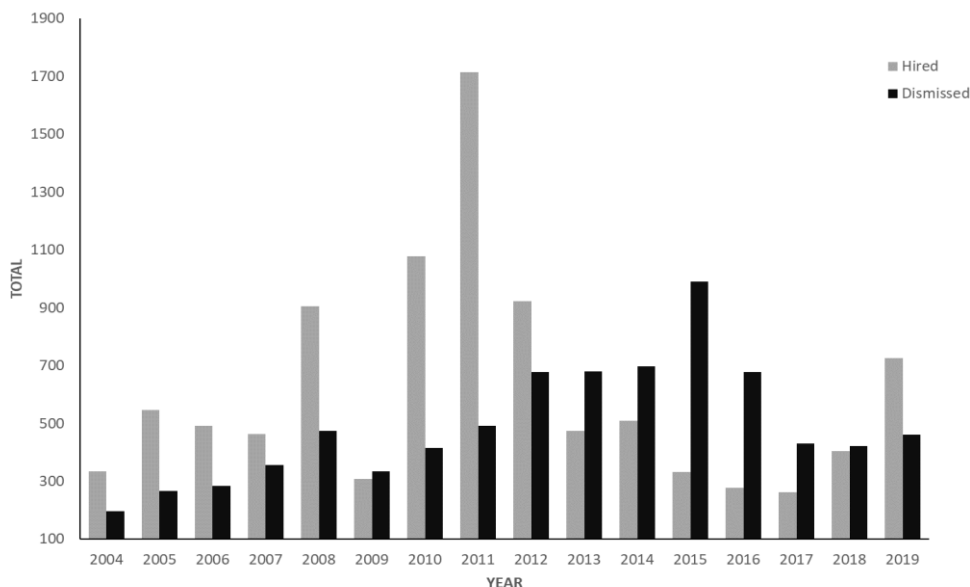


Figure 3: Hired and dismissed mining engineers in Brazil. Source: CAGED (MTE, 2019)

The number of mining engineers employed in Brazil peaked in 2011, when the average commodity price boomed, especially iron ore, whose yearly average price reached US\$ 166 per ton in 2011 and US\$ 128 in 2012 (Yiqun, 2013). From 2013 to 2018, a decrease in the number of hired mining engineers was noticed, as shown in Figure 2, and dismissals outstripped hires, as shown in Figure 3. The largest number of dismissals in the period under study occurred in 2015, which was confirmed by Souza (Souza, 2017). Figure 4 illustrates the correlation between Brazilian mineral output and the number of formally hired mining engineers, for the 2003 – 2018 period.

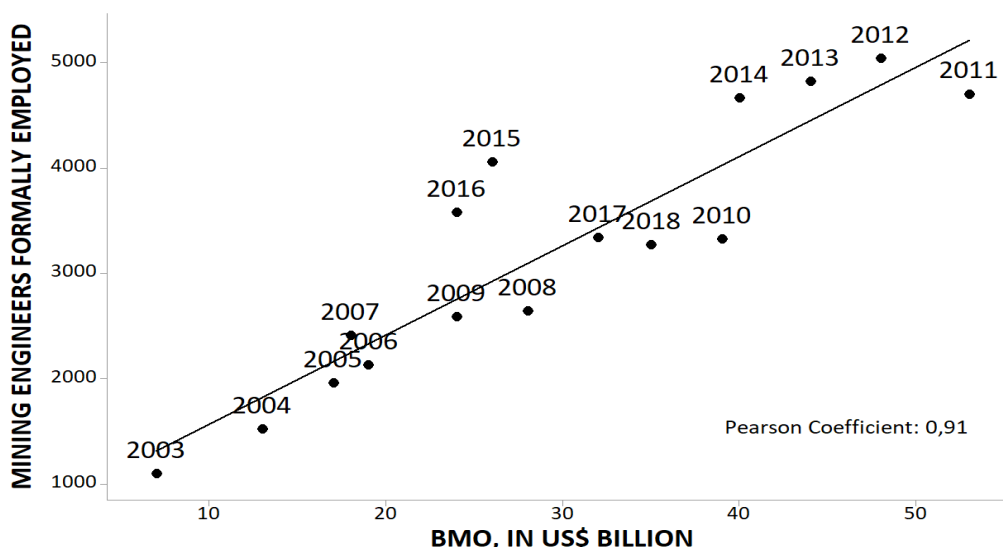


Figure 4: Correlation between Brazilian mineral output (BMO) and the number of mining engineers in the marketplace, between 2003 and 2018. Source: RAIS (2018) and IBRAM (2018)



The BMO data in Figure 4 refers solely to the Extractive Mineral Industry, excluding Oil & Gas. The BMO is the aggregate of all mineral goods produced in the country and calculated in billions of dollars according to IBRAM’s method (IBRAM, 2018).

In consonance with IBRAM’s data, the BMO peaked in 2011 (US\$ 53 billion), followed by a significant decline up to 2016, when it amounted to US\$ 24 billion. Minor variations were seen in 2017 and 2018. As can be seen in Figure 4, there is a strong correlation between the BMO and the number of mining engineers hired as employees, which is confirmed by the Pearson coefficient of 0.91. Figure 5 shows the salary curve for mining engineers in Brazil.

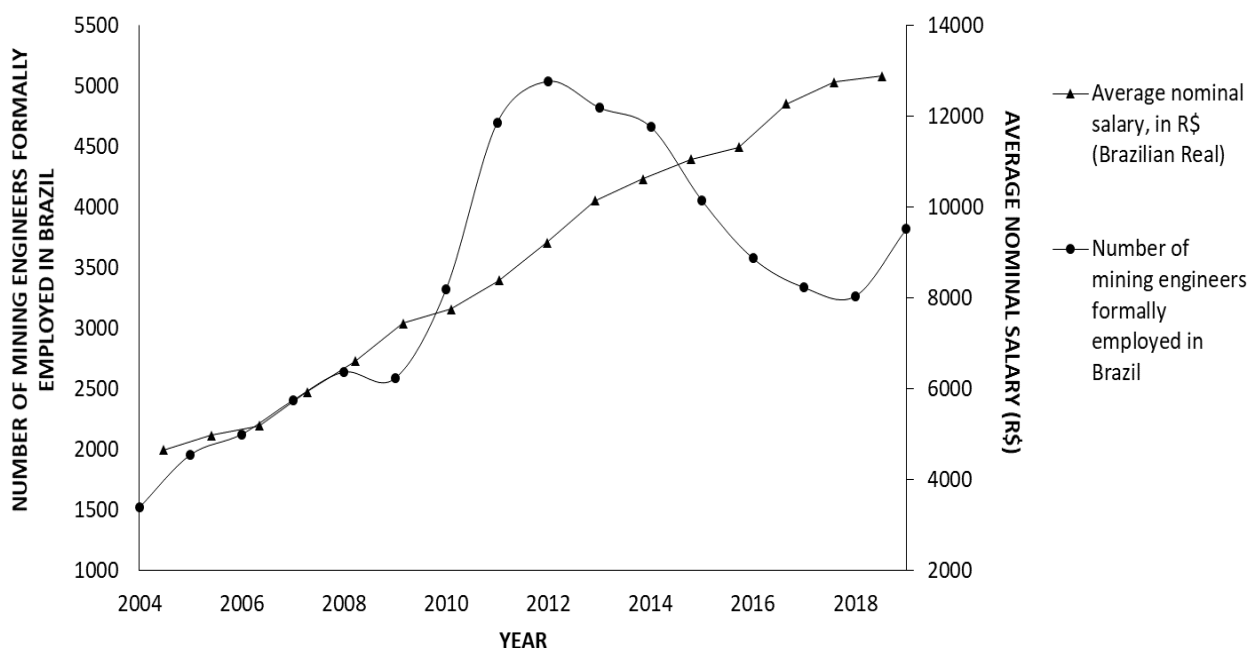


Figure 5: Evolution of the annual average nominal salary for mining engineers (adjusted by the IPCA inflation index as of December 2019) compared with the number of professionals with a job. Source: RAIS (2020)

Figure 5 shows that even with a significant dismissal of mining engineers in the market after 2012, the salary continued to rise annually. Figure 6 is a comparison of the 2019 average salaries for different engineering fields.



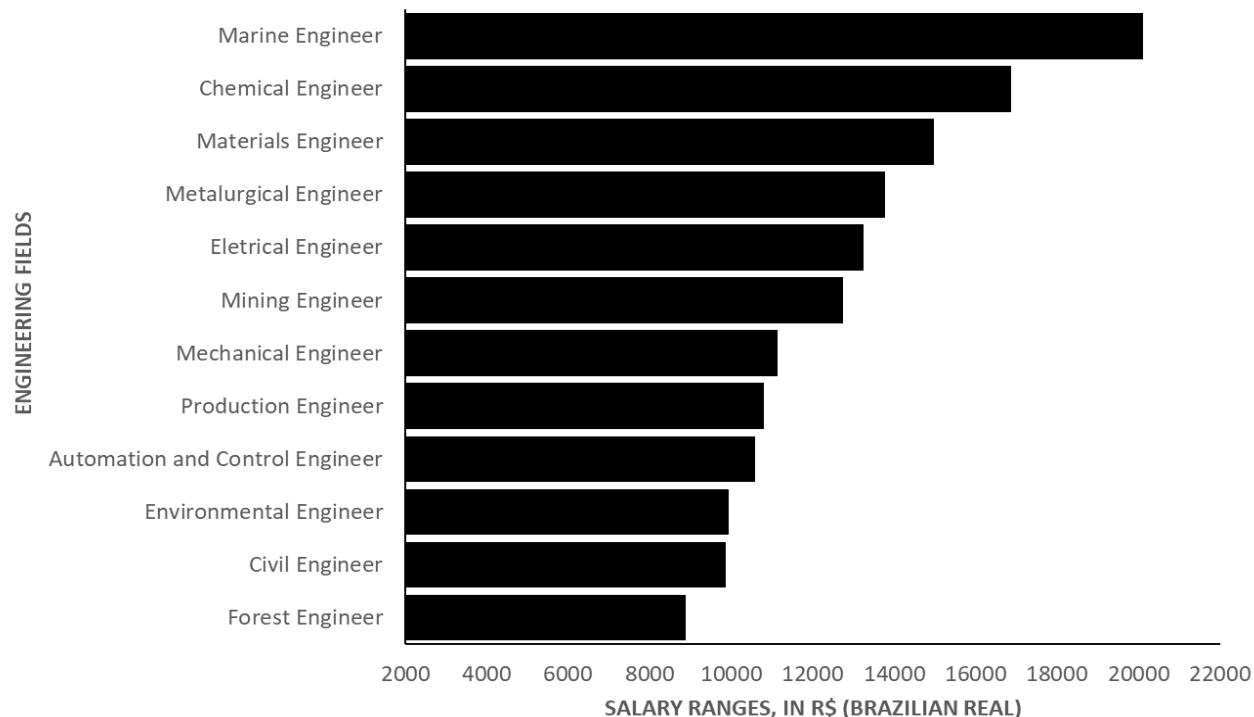


Figure 6: Salary ranges for Brazilian engineers, in 2019. Source: RAIS (2020)

According to the RAIS data, and as shown in Figure 6, mining engineers ranked sixth among the 12 categories of engineering with the highest salaries. This is evidence that the average salary was kept at a relatively high level when compared to other engineering field, notwithstanding the dismissals in the past few years (Meneghini, Bergerman and La Serna, 2018). The salary was based on the general category of mining engineering, not a specific working area, such as planning or mineral processing.

4. Conclusion

The result of this study points to a strong correlation between the demand for mining engineers as employees and the BMO. There was a significant reduction in the number of mining engineers hired as employees in the wake of a slackening Brazilian economy over the past few years and a bearish demand for commodities worldwide, which frustrated industry forecasts conducted in 2010 and 2014. The data presented in this paper make it clear that the labor market for mining engineers in Brazil is going through a difficult period. Out of the almost 5,000 mining engineers employed in 2012 (the best moment of the period under consideration), only 3,338 professionals were currently engaged as employees.

Considering that there are approximately 5,230 mining engineers currently registered with the CREA (CONFEA, 2020), it is estimated that a significant number of mining engineers, in addition to the 3,338 currently employed, are working as self-employed engineers, for instance, as service providers and outsourced technicians. Regardless of the significant drop in jobs as an employee, the average salary was kept at a relatively high level when compared with other engineering field



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SOBRE OS AUTORES

G.R. PIRILLO

Mining Engineer (UNIFAL-MG). Master's Degree Student (USP).

E-mail: gabrielrpirillo@usp.br

ORCID ID: <https://orcid.org/0000-0002-9112-6703>

M.G. BERGERMAN

Department of Mining and Petroleum Engineering (USP)

E-mail: mbergerman@usp.br

ORCID ID: <https://orcid.org/0000-0002-6843-3051>

K. MENEGHINI

Astronomy undergraduate student at the Institute of Astronomy, Geophysics and Atmospheric Sciences (USP)

E-mail: kayleighmeneghini@gmail.com

ORCID ID: <https://orcid.org/0000-0001-5801-6759>

E. MONMA

Mining Engineer (USP).

E-mail: eduardo.monma@anm.gov.br

ORCID ID: <https://orcid.org/0000-0002-7244-2786>



LA SERNA

Economist (USP). Master in Economy (UNESP).

E-mail: humberto.serna@anm.gov.br

ORCID ID: <https://orcid.org/0000-0002-5177-0596>

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