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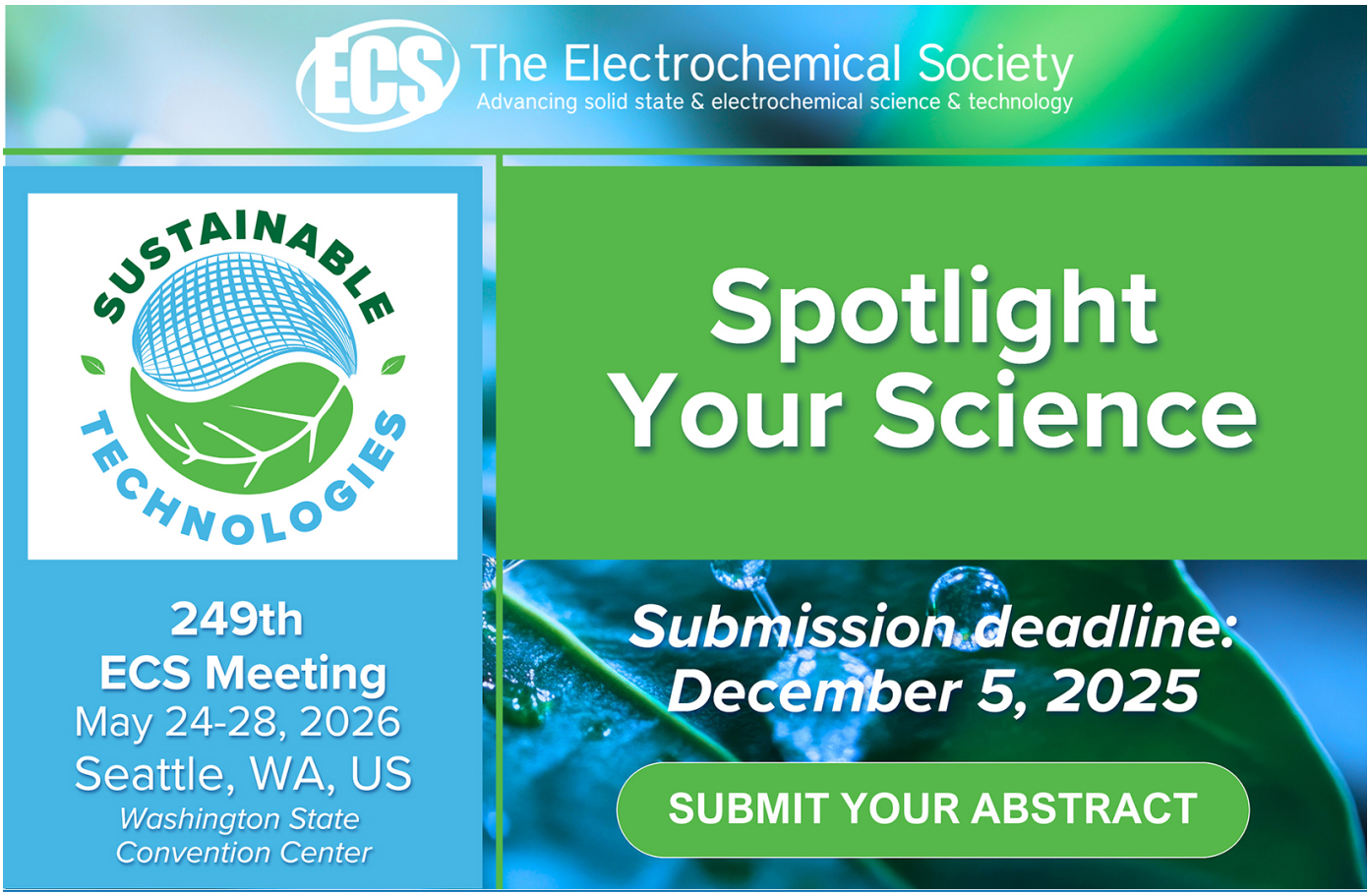

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Nickel ore export prohibition and mapping the business performance of nickel mining companies in Indonesia

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Abstract. As part of its efforts towards establishing the green energy value chain internationally, Indonesia has banned the export of raw nickel since 2020. The export ban is also aimed at adding value to the nickel supply chain for the sake of nickel mining sustainability in the country. The nickel ore export prohibition has caused the European Union to file a lawsuit against the Indonesian government in violation of the World Trade Organization agreement. Instead of discussing the dispute, this study will focus on whether the export ban will impact the business performance of the nickel mining industry. Given that the country is the biggest nickel reserve on earth, this study aims to accomplish three distinct objectives: to create a thematic map of (1) nickel mining locations in Indonesia by province; (2) mining locations for the top ten nickel companies and nickel industry hubs in Indonesia; and (3) the business performance of leading nickel issuers in the country. Thematic maps are created based on Geographic Information Systems (GIS). The results show that nickel reserves are available in seven provinces; two nickel industrial hubs and ten big mining companies operate in these provinces; and these companies have sound business performance following the ore nickel export ban. Our analysis offers a new perspective on the effect of the national nickel policy on the business viability of selected mining companies in Indonesia by applying the company's financial healthiness measurement in GIS.

1. Introduction

There has been a dramatic increase in the demand for nickel in the battery industry, particularly in the electronic vehicles (EVs) sector. As a nation with the biggest nickel reserves and nickel mine production in the world, Indonesia is well-positioned to entice investors into its battery supply chain. According to the data from Statista [1], in 2023, the global nickel reserves reached an estimated value of over 130 million metric tons. Indonesia accounted for the majority of the total, with the country holding 55 million metric tons. In terms of nickel mine production, Indonesia contributed approximately 1.8 million metric tons in 2023, which indicates that the country holds a significant position as the foremost global producer of nickel from mines [2]. Figures 1 and 2 depict the global nickel reserves by country and the global nickel mine producers by country, respectively.

In an effort to encourage domestic processing of the raw material and boost the country's nickel production, the Indonesian government strictly prohibited the trade in nickel ore starting in late April 2022. The government has mandated that nickel undergo domestic processing before it may be exported. This prohibition was the result of a series of policies imposed between 2009 and 2019 [3,4], with the initial export restrictions on nickel ore dating back to January 2014 [5]. Although certain concentrations of nickel ore below 1.7% remained permissible for export from January 2017 to December 2019, the practice ended entirely in January 2020. Hence, starting in January 2020, all exports of nickel ore will be prohibited. The specific objective of this policy is to enhance the capacity of national processing

facilities, reintegrate the valuable contributions of the nickel supply chain into the country's economy, and stimulate job generation and economic advancement inside the country [6].

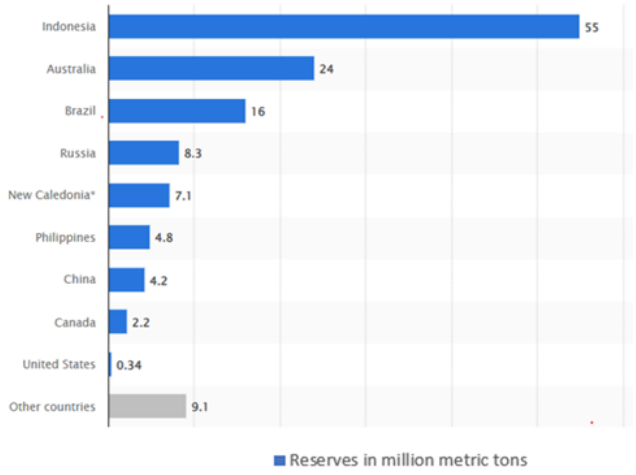

Figure 1. The global nickel reserves by country.

The European Union (EU) has filed a lawsuit against Indonesia, claiming that the country's regulations in question breach the General Agreement on Tariffs and Trade of 1994, to which Indonesia was a party [7]. The UE believes that nickel export limitations imposed by Indonesia have an impact on crucial EU industries, particularly those dealing with batteries and stainless steel [8]. The EU moved to have this matter heard by the World Trade Organization's (WTO) Dispute Settlement Body. The WTO declared Indonesia defeated based on the trial results, considering its downstream industry immature in October, 2022. International trade rules state that in order for a nation to ban the export of a certain good or service, that country must have an advanced manufacturing sector; however, Indonesia does not yet meet this threshold [9]. President Joko Widodo strongly urged to persist in the legal battle against the European Union's lawsuit against the nickel downstream strategy [10].

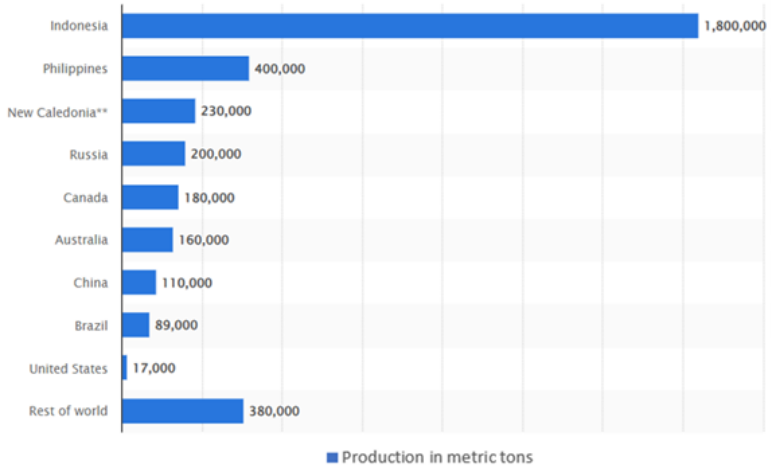

Figure 2. The global nickel mine production by country.

While the government has lost its WTO lawsuit with the EU, the president intends to implement similar regulations for other essential minerals. He asserted that Indonesia will not encounter any difficulties in resolving the issue, considering the well-established nature of the industry and the significant increase in nickel export revenue from $1 billion in 2014 to $20.9 billion in 2021. In a recent policy shift aimed at prioritizing the manufacturing of EV batteries, the government has proposed the potential prohibition of exports pertaining to bauxite, tin, gold, and processed nickel products [11,12].

Scholars have thoroughly studied the economic impact of the ore export ban. Lim et al. [13] examine whether the Indonesian government's export prohibition on nickel ore has led to a spike in the price of nickel. The results confirm that the London Metal Exchange (LME) nickel price index appeared to rise after Indonesia imposed export restrictions on nickel ore. The 2014 export prohibition in the country had a somewhat bigger impact than the 2019 ban. The 2014 shock to the LME nickel market persisted for some time following the ban's implementation. Some studies document the encouraging effect of the export prohibition on economic growth [14,15] and non-tax revenues [16]. Positive effects of the export prohibition include enhancing the monetary value of nickel goods for international trade, preserving the durability of nickel ore reserves, and strengthening human capital through the creation of employment opportunities [10,17].

Another study looks at the interconnections and effects of the export prohibition on nickel ore on several economic sectors [18]. The sectors of construction and manufacturing had the second-highest production multiplier values, behind the electricity and gas procurement sectors. The limitation on exporting nickel ore has led to an increase in the export of ferro-nickel, which has had a significant impact on the economy's domestic and import production, particularly in the manufacturing sector.

An examination of the existing literature, as previously said, indicates that the economic impact under investigation pertains to macroeconomic variables such economic growth, nickel price, non-tax revenues, and gross domestic growth. There is a scarcity of research that specifically examine the business performance of nickel mining businesses in the aftermath of the ore export prohibition. Therefore, this study aims to address this deficiency. This study will focus on whether the export ban will impact the business performance of the nickel mining industry. The primary aim of this study is threefold: firstly, to generate a thematic map illustrating the distribution of nickel mining sites across provinces in Indonesia; secondly, to identify the mining locations of the top ten nickel companies and nickel industry hubs in Indonesia; and thirdly, to assess the business performance of prominent nickel issuers in the country.

The following is a concise overview of the article: this study presents the methods in the subsequent section. The ensuing part will provide a review of the findings. The final section of the paper presents the conclusions, as well as an analysis of the limitations and recommendations for further research.

2. Material and method

2.1. Material

This study is descriptive-qualitative, with the data obtained from various sources, including research articles, newspapers and magazines, ministry reports, and the annual reports of nickel mining companies. This research uses the Altman Z-model of the financial distress calculation [19] to calculate the business performance based on information from the annual report. The article on Media Nikel Indonesia's (MNI) website [20] provides information about the top ten largest nickel mining companies. MNI is a company that operates in the media sector and specializes in reporting various topics about nickel from upstream to downstream and then from central to regional governments and associations. Meanwhile, data regarding nickel mining areas by province was obtained from DataIndonesia’s website [21].

2.2. Method

Consistent with previous research [22–25], the present article utilizes the Altman Z-rank of the business distress valuation model [19] to evaluate the business performance of nickel mining companies. How to calculate the Z-score is presented as follows:

$$Z = 1.2X1 + 1.4X2 + 3.3X3 + 0.6X4 + 1.0X5 \quad (1)$$

where, X1 = The ratio of working capital to total assets.
X2 = The ratio of retained earnings divided to total assets
X3 = The ratio of earnings before interests and taxes to total assets, and
X4 = The ratio of book value of equity divided by book value of debt

This study appraises the Z-score using the following standards: When the Z-number exceeds 2.99, it indicates that the organization is doing well or is in an area of safety. The company is in uncertainty or needs monitoring from management if the Z-score is between 2.99 and 1.81. There will be economic issues for the business if the Z-score is less than 1.81, the business will face economic difficulties.

For the data analysis, this current research calculates the Z-value of nickel mining firm that is traded on the Indonesia Stock Exchange. Only listed companies applied, as the non-listed annual report is unavailable. The years 2018 and 2019 represent the period of pre-nickel ore prohibition, while 2020 and 2021 represent the period of post-export ban.

The current study makes use of a Geographic Information System (GIS) program to create maps including mining site location map and the Z-score thematic maps. Data visualization in the form of maps is the primary use of GIS [26]. For the Z-score thematic maps, the location of head office is utilized.

3. Result and discussion

3.1. Nickel mining area by province

Indonesia has seven provinces—South Sulawesi, Papua, West Papua, North Maluku, and Southeast Sulawesi—with a combined nickel mining area of 520,877.07 hectares, according to the Ministry of Energy and Mineral Resources (Table 1). Of them, Sulawesi is the most important center for nickel resources, and the biggest nickel mining region in Indonesia is in Southeast Sulawesi, followed by North Maluku, Central Sulawesi, and West Papua. Hence, three main islands are the location of the biggest nickel deposit in Indonesia, namely Sulawesi, Maluku, and Papua. Table 1 outlines the nickel mining regions across all of Indonesia's provinces [21], while Figure 3 presents the map of nickel mining area by province in the country.

Table 1. Nickel mining area by province.

No	Province	Nickel mining areas in hectares
1	Southeast Sulawesi	198,624.66
2	North Maluku	156,197.04
3	Central Sulawesi	115,397.37
4	West Papua	22,636
5	Papua	16,470
6	South Sulawesi	7,163
7	Maluku	4,389
	Total	520,877.07

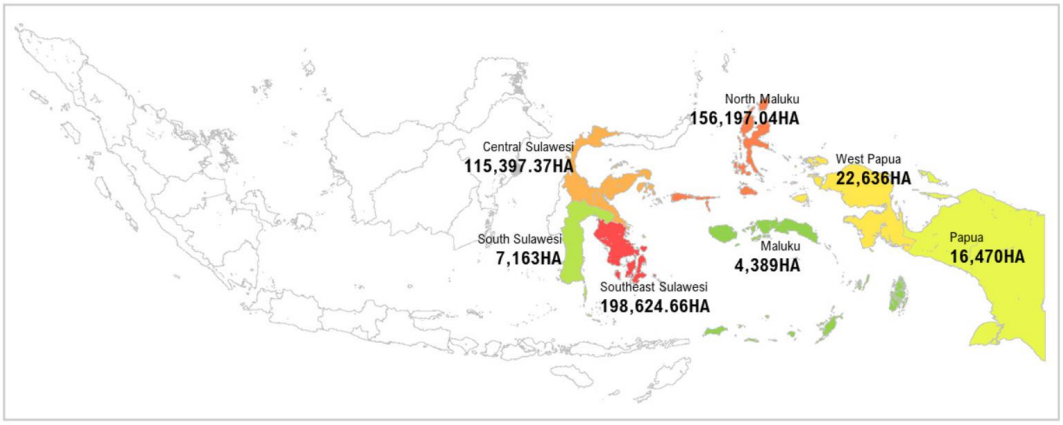

Figure 3. Maps of nickel mining area by province.

3.2. The mining locations of the top ten nickel companies and nickel industry hubs in Indonesia

Indonesia has two nickel industrial hubs, namely Indonesia Morowali Industrial Park (IMIP) and Indonesia Weda Bay Industrial Park (IWIP). IMIP, located in Bahadopi Block, Morowali Regency, Central Sulawesi, is a business organization whose primary goods are nickel, carbon steel, and stainless steel and which maintains a field of industry that is concentrated on nickel. Established in 2013, the company, a collaboration between PT Bintang Delapan Investama and Chinese investors, namely Shanghai Decent Investment (Group) Co., Ltd., IMIP, has become the largest producer of nickel-based products in Southeast Asia. Since 2018, IMIP has overtaken PT Vale Indonesia Tbk (INCO) and PT Aneka Tambang Tbk (Antam), which control the production of processed nickel in the country.

Seated at Lelilef Village, Weda District, Central Halmahera Regency, North Maluku Province, the IWIP is a nickel-based processing comprehensive business park. As stated in PERPRES No. 18, which pertains to the national medium-term development plan for the years 2020–2024, IWIP has been in operation since August 30, 2018, and it is a national priority project. In addition to being a National Vital Object, the corporation is also one of President Joko Widodo's National Strategic Projects, as confirmed by Presidential Regulation (PERPRES) of the Republic of Indonesia Number 109 of 2020. Table 2 shows the mining locations of the top ten nickel companies and two nickel industry hubs in Indonesia, while Figure 4 presents the maps from Table 2.

Table 2. the mining locations of the top ten nickel companies and nickel industry hubs in Indonesia.

No	Name	Code	Symbol	Location
1	Indonesia Morowali Industrial Park	IMIP		Fatufia Village, Morowali, Central Sulawesi
2	Indonesia Weda Bay Industrial Park	IWIP		Lelilef Village, Central Weda and Nort Weda, Central Halmahera Regency, North Maluku
3	PT Vale Indonesia Tbk	INCO		Sorowako block, Nuha, East Luwu, Central Sulawesi Bahodopi block, Morowali, Central Sulawesi Pomalaa block, Kolaka, Southeast Sulawesi Sua-sua block, North Kolaka, Southeast Sulawesi Sambalagi Village, Bungku Pesisir, Morowali, Central Sulawesi

No	Name	Code	Symbol	Location
4	PT Aneka Tambang Tbk through subsidiaries	ANTM		
	PT Gag Nickel	Gag		Gag island, Raja Ampat, West Papua
	PT Weda Bay Nickel	WBN		Centarl Weda Tengah & North Weda, Central Halmahera Tengah, North Maluku Maba District, East Halmahera, North Maluku Maniang Island, Wundulako, Kolaka, Southeast Sulawesi Pomalaa District, Kolaka, Southeast Sulawesi Lasolo District, North Konawe, Southeast Sulawesi Asera and Molawe District, North Konawe, Southeast Sulawesi
5	PT Trimegah Bangun Persada	NCKL		Obi Island, Kawasi Village, SouthHalmahera, North Maluku
6	PT Central Omega Resources Tbk	DKFT		Petasia, North Morowali, Central Sulawesi Sawa Village, Motui District, North Konawe, Southeast Sulawesi
7	PT Ifishdeco Tbk	IFSH		Tolala, North Kolaka, Southeast Sulawesi Tinanggea, South Konawe Southeast Sulawesi
8	PT Resource Alam Indonesia Tbk	KKGI		North Konawe Southeast Sulawesi
9	PT Bintang Delapan Mineral	BDM		Fatufia Village, Morowali, Central Sulawesi
10	PT Timah Tbk through subsidiary	TINS		
	PT Timah Investasi Mineral	TIM		Baliara Village, West Kabaena, Bombana, Southeast Sulawesi Rahampuu Village, Kabaena, Bombana, Southeast Sulawesi
11	PT PAM Mineral Tbk	NICL		Lameruru Village, Langgikima, North Konawe, Southeast Sulawesi Buleleng Village, Bungku Pesisir, Morowali, Central Sulawesi Laroenai Village, Bungku Pesisir, Morowali, Central Sulawesi
12	PT Harum Energy Tbk	HRUM		Weda Bay, Central Halmahera, North Maluku Fatufia Village, Morowali, Central Sulawesi

Source: author's compilation.

As portrayed in Figure 4, the mining locations of the top ten nickel companies are mostly located in Sulawesi and Maluku islands. In the West Papua region, PT Gag Nickel, a subsidiary of PT Aneka Tambang Tbk, operates the only mining site, Gag Island.

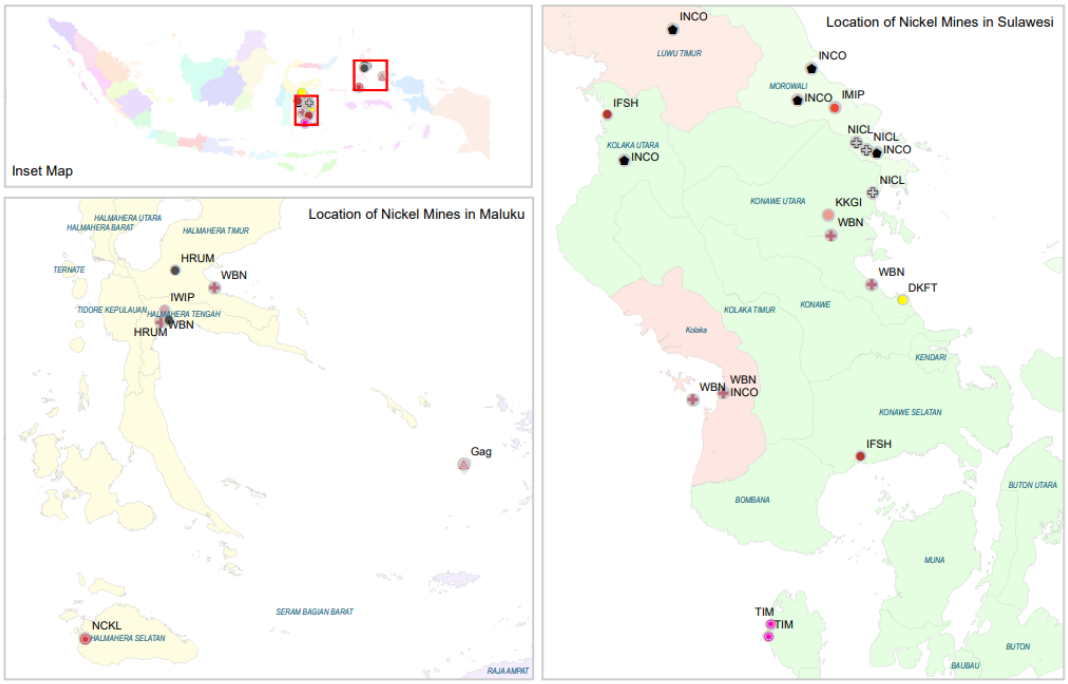

Figure 4. Map of mining locations of the top ten nickel companies and nickel industry hubs in Indonesia.

3.3. Comparing the business performance in periods pre- and post-nickel ore export prohibition

Figures 5 and 6 portray the business performance of listed mining companies in pre-ore export prohibition and post-ore export prohibition, respectively. We create the maps by indicating the state of each company's business viability, whether it's healthy, in the cautious zone, or experiencing distress at its head office. Table 3 provides the Altman Z-number of listed nickel mining companies in two different periods, i.e., before and after the ore export prohibition.

Table 3. Z-score of nickel companies in the pre- and post-ore nickel export prohibition.

No	Name	Before export ban		After export ban	
		Z-score	Remark	Z-score	Remark
1	PT Vale Indonesia Tbk	6.57	Well-performed	8.56	Well-performed
2	PT Aneka Tambang Tbk	2.4	Grey zone	4.21	Well-performed
3	PT Central Omega Resources Tbk	0.40	Distress	0.05	Distress
4	PT Ifishdeco Tbk	1.06	Distress	5.80	Well-performed
5	PT Resource Alam Indonesia Tbk	4.25	Well-performed	4.71	Well-performed
6	PT Timah Tbk	1.55	Distress	1.88	Grey zone
7	PT Harum Energy Tbk	6.35	Well-performed	4.39	Well-performed
8	PT PAM Mineral Tbk	NA		1.88	Grey zone
9	PT Trimegah Bangun Persada Tbk	NA		0.39	Distress

As exhibited in the table, most of the Z-values of nickel companies increased in the period after the ore nickel export ban as compared to those before the export ban. With the exception of PT Central Omega Resources Tbk (DKFT), almost all companies experience an increase in their Z-score. PT Central Omega Resources Tbk (DKFT) not only engages in nickel mining, but also coal mining. The fall in coal prices during the COVID-19 pandemic is a likely cause of the firm's financial downturn, which coincidentally coincides with the prohibition on nickel exports. PT Harum Energy Tbk (HRUM) also faces a decrease in the Z-score; however, both periods suggest that HRUM's Z-value is maintaining a healthy level of performance. Before the export ban, the Indonesian stock exchange did not list two companies, PT PAM Mineral Tbk and PT Trimegah Bangun Persada Tbk. That is why the Z-scores of the companies were unavailable (NA), since the annual report was also unavailable for the general public. One of the top ten nickel companies, PT Bintang Delapan, remains closely held, making it impossible to calculate the Z-score.

Figure 5. Map of business performance of listed mining companies pre-export prohibition.

As shown in Figures 5 and 6, almost all mining companies place their head offices in Jakarta. Only PT Timah Tbk has a central office in Bangka Belitung province. The figures also suggest that the number of mining firms in the healthy area is higher in the period after the ore nickel export ban as compared to those before the export prohibition, indicating that the government policy of prohibiting ore nickel encourages mining companies to add value in the nickel processing, which therefore increases their business viability.

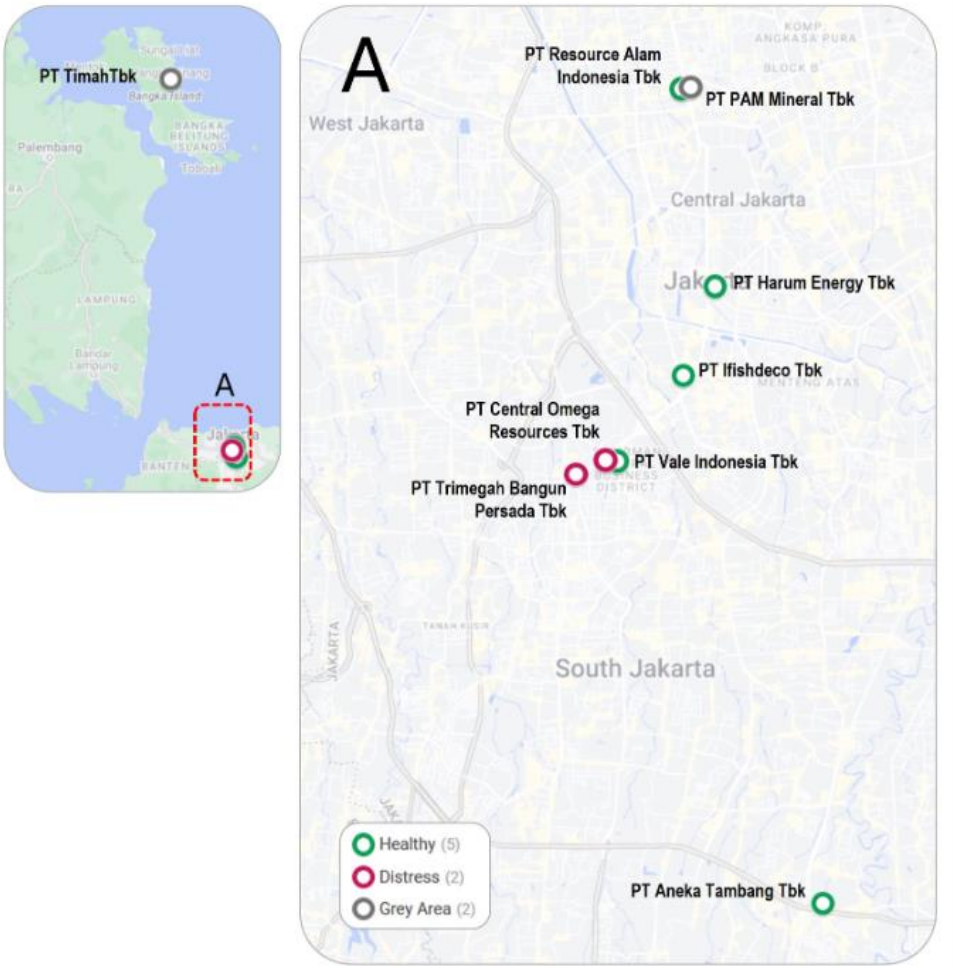

Figure 6. Map of business performance of listed mining companies post-export prohibition.

4. Conclusion

The primary aim of this study is threefold: firstly, to generate a thematic map illustrating the distribution of nickel mining sites across provinces in Indonesia; secondly, to identify the mining locations of the top ten nickel companies and nickel industry hubs in Indonesia; and thirdly, to assess the business performance of prominent nickel issuers within the country. This study utilizes GIS to generate thematic maps. The findings indicate the presence of nickel reserves in seven provinces. These provinces are home to two prominent nickel industrial hubs and 10 major mining enterprises. Notably, these companies have shown significant business success since the lifting of the ore nickel export prohibition. By utilizing the company's financial healthiness measurement in GIS, our analysis provides a fresh viewpoint on how the national nickel policy has affected the business performance of certain Indonesian mining businesses. As a drawback, this study focuses solely on the economic impact of the export ban and does not take into account the environmental impact in assessing business sustainability. Hence, future research may discuss the environmental impact following economic booms due to the globalized nickel industrial supply chain in Indonesia.

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